Michigan Department of Transportation
5100B (07/07)

CHECKLIST TO DESIGNATE AREAS OF EVALUATION FOR REQUESTS FOR PROPOSAL (RFP)

Exhibit B

MDOT PROJECT MANAGER	JOB NUMBER (JN)	CONTROL SECTION (CS)
Michele Mueller	105046A	82071

DESCRIPTION IF NO JN/CS
MITS Interior Fit Up Package

MDOT PROJECT MANAGER: Check all items to be included in RFP.

WHITE = REQUIRED
GRAY SHADING = OPTIONAL

Check the appropriate Tier in the box below

☐ **TIER I ($25,000-$99,999)**	☐ **TIER II ($100,000-$250,000)**	☒ **TIER III (>$250,000)**	**CONSULTANT:** Provide only checked items below in proposal.
☐	☐	☒	Understanding of Service
☐	☐	☒	*Innovations*
☐	☐	☒	*Safety Program*
N/A	☐	☒	Organization Chart
☐	☐	☒	Qualifications of Team
☐	☐	☒	Past Performance
Not required as part of official RFP	Not required as part of official RFP	☒	Quality Assurance/Quality Control
☐	☐	☒	**Location:** The percentage of work performed in Michigan will be used for all selections unless the project is for on-site inspection or survey activities, then location should be scored using the distance from the consultant office to the on-site inspection or survey activity.
N/A	N/A	☐	Presentation
N/A	N/A	☐	Technical Proposal (if Presentation is required)
3 pages (MDOT forms not counted) **(No Resumes)**	7 pages (MDOT forms not counted)	19 pages (MDOT forms not counted)	Total maximum pages for RFP **not including key personnel resumes**

REQUEST FOR PROPOSAL

The Michigan Department of Transportation (MDOT) is seeking professional services for the project contained in the attached scope of services.

If your firm is interested in providing services, please indicate your interest by submitting a Proposal, Proposal/Bid Sheet or Bid Sheet as indicated below. The documents must be submitted in accordance with the latest "Consultant/Vendor Selection Guidelines for Service Contracts" and "Guideline for Completing a Low Bid Sheet(s)", if a low bid is involved as part of the selection process. **Referenced Guidelines are available on MDOT's website under Doing Business > Vendor/Consultant Services >Vendor/Consultant Selections.**

RFP SPECIFIC INFORMATION

☑ BUREAU OF HIGHWAYS ☐ BUREAU OF TRANSPORTATION PLANNING ** ☐ OTHER

THE SERVICE WAS POSTED ON THE ANTICIPATED QUARTERLY REQUESTS FOR PROPOSALS

☑ NO ☐ YES DATED _____ THROUGH _____

☐ **Prequalified Services** – See page ___ of the attached Scope of Services for required Prequalification Classifications.

☑ **Non-Prequalified Services** - If selected, the vendor must make sure that current financial information, including labor rates, overhead computations, and financial statements, if overhead is not audited, is on file with MDOT's Office of Commission Audits. This information must be on file for the prime vendor and all sub vendors so that the contract will not be delayed. (**Form 5100J Required with Proposal**)

☐ **Qualifications Based Selection** – Use Consultant/Vendor Selection Guidelines

For all Qualifications Based Selections, the section team will review the information submitted and will select the firm considered most qualified to perform the services based on the proposals. The selected vendor will be contacted to confirm capacity. Upon confirmation, that firm will be asked to prepare a priced proposal. Negotiations will be conducted with the firm selected.

****For RFP's that originate in Bureau of Transportation Planning only**, a priced proposal must be submitted at the same time as, but separate from, the proposal. Submit directly to the Contract Administrator/Selection Specialist, Bureau of Transportation Planning **(see address list, page 2)**. The priced proposal must be submitted in a sealed envelope, clearly marked **"PRICE PROPOSAL."** The vendor's name and return address MUST be on the front of the envelope. The priced proposal will only be opened for the highest scoring proposal. Unopened priced proposals will be returned to the unselected vendor(s). Failure to comply with this procedure may result in your priced proposal being opened erroneously by the mail room.

For a cost plus fixed fee contract, the selected vendor must have a cost accounting system to support a cost plus fixed fee contract. This type of system has a job-order cost accounting system for the recording and accumulation of costs incurred under its contracts. Each project is assigned a job number so that costs may be segregated and accumulated in the vendor's job-order accounting system.

☐ **Qualifications Review / Low Bid** - Use Consultant/Vendor Selection Guidelines. See Bid Sheet Instructions for additional information.

For Qualification Review/Low Bid selections, the selection team will review the proposals submitted and post the date of the bid opening on the MDOT website. The notification will be posted at least two business days prior to the bid opening. Only bids from vendors that meet proposal requirements will be opened. The vendor with the lowest bid will be selected. The selected vendor may be contacted to confirm capacity.

☑ **Best Value** - Use Consultant/Vendor Selection Guidelines. See Bid Sheet Instructions below for additional information. The bid amount is a component of the total proposal score, not the determining factor of the selection.

☐ **Low Bid** (no qualifications review required - no proposal required.) See Bid Sheet Instructions below for additional instructions.

BID SHEET INSTRUCTIONS

A bid sheet(s) must be submitted in accordance with the "Guideline for Completing a Low Bid Sheet(s)" (available on MDOT's website). The Bid Sheet(s) is located at the end of the Scope of Services. Submit bid sheet(s) separate from the proposal, to the address indicated below. The bid sheet(s) must be submitted in a sealed manila envelope, clearly marked **"SEALED BID."** The vendor's name and return address MUST be on the front of the envelope. Failure to comply with this procedure may result in your bid being opened erroneously by the mail room and the bid being rejected from consideration.

PROPOSAL SUBMITTAL INFORMATION

REQUIRED NUMBER OF COPIES FOR PROJECT MANAGER	PROPOSAL/BID DUE DATE	TIME DUE
5	6/2/10	12:00pm

PROPOSAL AND BID SHEET MAILING ADDRESSES

Mail the multiple proposal bundle to the MDOT Project Manager or Other indicated below.

☑ MDOT Project Manager ☐ MDOT Other

MDOT/Metro Region office
Michele Mueller
18101 W Nine Mile Road
Southfield, MI 48075

Mail one additional stapled copy of the proposal to the Lansing Office indicated below.

	Lansing Regular Mail	OR	Lansing Overnight Mail
☑	Secretary, Contract Services Div - B470 Michigan Department of Transportation PO Box 30050 Lansing, MI 48909		Secretary, Contract Services Div - B470 Michigan Department of Transportation 425 W. Ottawa Lansing, MI 48933
☑	Contract Administrator/Selection Specialist Bureau of Transportation Planning B470 Michigan Department of Transportation PO Box 30050 Lansing, MI 48909		Contract Administrator/Selection Specialist Bureau of Transportation Planning B470 Michigan Department of Transportation 425 W. Ottawa Lansing, MI 48933

GENERAL INFORMATION

Any questions relative to the scope of services must be submitted by e-mail to the MDOT Project Manager. Questions must be received by the Project Manager at least four (4) working days prior to the due date and time specified above. All questions and answers will be placed on the MDOT website as soon as possible after receipt of the questions, and at least three (3) days prior to the RFP due date deadline. The names of vendors submitting questions will not be disclosed.

MDOT is an equal opportunity employer and MDOT DBE firms are encouraged to apply. The participating DBE firm, as currently certified by MDOT's Office of Equal Opportunity, shall be listed in the Proposal

MDOT FORMS REQUIRED AS PART OF PROPOSAL SUBMISSION

5100D – Request for Proposal Cover Sheet
5100G – Certification of Availability of Key Personnel
5100I – Conflict of Interest Statement
5100J - Consultant Data and Signature Sheet (Required only for Non-Prequalified Work)

(These forms are not included in the proposal maximum page count.)

Michigan Department of Transportation

SCOPE OF SERVICE
FOR
SPECIALTY SERVICES
TRANSPORTATION MANAGEMENT CENTER (TMC) INTERIOR FIT-OUT
AND
INTELLIGENT TRANSPORTATION SYSTEM (ITS) INTEGRATION

CONTROL SECTION: 82071

JOB NUMBER: 105046A

PROJECT LOCATION:
Michigan Intelligent Transportation System Center (MITSC) in Detroit, Michigan
Detroit Integrated Transportation Center (DITC) in Detroit, Michigan

PROJECT DESCRIPTION:
The TMC Interior Fit-Out and ITS System Integration project consists of the following major items:

- Install and Integrate ITS Communications Systems
- Install Control Room Furnishings
- Install and Integrate Audio/Video Systems
- Install Electrical Devices and Circuits
- Install Interior Wood/Fabric Paneling
- Install Suspended Ceiling
- Install Furnishings
- Install and Integrate Sound Masking System
-

***A mandatory pre-proposal meeting and site walk through will be held on Monday, May 10, 2010. Consultants must confirm attendance via email to the Project Manager by Thursday, May 6, 2010. A confirmation of attendance will be sent to consultant.**

ANTICIPATED SERVICE START DATE: June 2010

ANTICIPATED SERVICE COMPLETION DATE: June 2011

PRIMARY PREQUALIFICATION CLASSIFICATION:
None

SECONDARY PREQUALIFICATION CLASSIFICATION:
None

DBE REQUIREMENT: 0%

MDOT PROJECT MANAGER:

Michele Mueller
Metro Region Office
Michigan Department of Transportation
18101 W. Nine Mile Road
Southfield, MI 48075
Telephone: 248-483-5133
Fax: 248-569-3103
muellerm2@michigan.gov

GENERAL INFORMATION:

The State of Michigan Department of Transportation, hereinafter referred to as the "DEPARTMENT", is requesting Proposals that are comprised of a written Technical Proposal and Proposal Price, which will be used for project selection. **The Proposal Price shall not be included in the Technical Proposal; it shall be included in a separate sealed envelope.**

A Vendor can submit only one (1) Proposal as the Prime Vendor. This document refers to the Vendor who submits the Proposal for the award of the TMC INTERIOR FIT OUT AND ITS SYSTEM INTEGRATION project.

The Special Provisions are included in Attachment A and the Plan Set is included in Attachment B.

1.0 PROJECT OBJECTIVES

The Vendor shall be required to demonstrate good project management practices while working on this project. These practices include frequent and regular communication with the DEPARTMENT's project manager and others as necessary, management of time and resources, and documentation. The Vendor will set up and maintain throughout the design of the project a contract file in accordance with DEPARTMENT procedures. DEPARTMENT approval will be required prior to any changes required throughout the course of construction of this project. It is anticipated that the Vendor will develop a project specific approach and develop a list of potential issues to avoid unnecessary delays.

The DEPARTMENT will provide contract administration, management services, technical reviews, as necessary, of all work associated with the development and preparation of the contract plans and shop drawings, and installation and construction of the project. The DEPARTMENT will provide job specific information and/or functions as outlined in this contract.

2.0 PROJECT COMPONENTS

The following section is provided to give the Vendor an overview of the project components.

Communications Systems – This project will involve the integration of the existing communications infrastructure at the existing facility to the new facility utilizing a combination of new and existing conduits and hand/manholes. The DEPARTMENT is requiring that a minimum 30 day overlap of the operation of both TMC systems occur to ensure operational integrity prior to any decommissioning of the old center.

Installation and integration of the following items is anticipated as part of this project at a minimum:

- Directional bored conduits
- Air blown fiber optic cables
- 10Gb Ethernet Network Switch
- Wavelength Division Multiplexing Controller
- Communications Equipment Grounding and Bonding
- Integration and testing of communications infrastructure modifications
- Additional items as necessary to provide a fully functioning system

Control Room Furnishings – The main control room for the TMC will require the installation of several intensive use furniture items, including but not limited to the following items:

- Adjustable Operator Consoles
- Adjustable Operator Seating
- Mill Work
- Additional items as necessary to provide a fully functioning system

Audio/Visual (A/V) Systems – The TMC will have several audio visual systems incorporated within the facility. Currently, the A/V systems at the existing facility are being upgraded, and it is intended that these systems will be relocated to the new facility. Relocation of these systems will occur in such a way as to ensure the initial warranty remains intact for the devices and is modified/extended to be on the same warranty schedule as the new equipment. Additional A/V related equipment will also be installed at the new facility.

The following tasks and equipment is included in this project at a minimum:

- Mobilize and setup the existing Auxiliary Traffic Management Center at the existing MITS Center facility.
- Relocate the main operations video wall, including removing the existing equipment from the current control room and relocate to the new control room as part of this project at a minimum:
    - Sixteen (16) Mitsubishi 67” large screen video display cubes,
    - Barco Transform A system controller
    - Other associated hardware/software to provide a fully functioning system
- Deliver (from MDOT storage), install, and integrate eight (8) Mitsubishi 67” large screen video display cubes for installation with the 16 existing video display cubes and associated equipment as part of the final video display wall in the new facility.
- Additional items as necessary to provide a fully functioning system

Electrical – Installation of electrical devices and power to all systems included in this project. It is anticipated that the following major items of work will be part of this project at a minimum:

- Underground concrete encased conduits
- Lighting fixtures
- Lighting control and dimming devices
- Electrical power outlets
- Lighting fixture lowering devices
- Data cabling
- Additional items as necessary to provide a fully functioning system

Interior Construction and Furnishings – This project will be incorporating the installation of interior design elements in the following rooms of this facility at a minimum.

- Main operations floor
- 1st Floor and 2nd Floor Locker Room
- 2nd Floor Conference Room (Emergency Operations Room)
- 2nd Floor Intelligent Transportation Systems Technician Shop area

Interior components to be installed as part of this project are anticipated to be as follows at a minimum:

- Suspended ceilings
- Wall coverings (wood and fabric paneling)
- Cabinetry and millwork
- General Furnishings
    - Lockers
    - Shelves
    - Conference room seating and tables
- Additional items as necessary to provide a fully functioning system

Sound Masking System – Design and installation of an active sound masking system comprised of the following major components at a minimum:

- System Panel and PC based system control software
- IP addressable system components
- Above the ceiling mounted sound generators

  Additional items as necessary to provide a fully functioning system

3.0 TECHNICAL PROPOSAL FORMAT AND INFORMATION REQUESTED

Vendors are requested to follow the numeric format and organization of the information below when preparing the Technical Proposal and are required to follow the latest version of the Michigan Department of Transportation Consultant/Vendor Selection Guidelines for Service Contracts. For purposes of this response, the page limit does not include project profiles, resumes, proof of certifications and bonding documents which may be contained in the proposal Appendix. **Proposal Prices shall be in a sealed envelope and included in the submittal of the Technical Proposals.**

3.1. PROJECT APPROACH

- **Project Management Approach -** Describe your project management approach to this project.
- **Communication with Client and Subcontractors -** Describe how communications will be handled and documented with the client (MDOT), subcontractors, and others during this project.
- **Quality Assurance and Quality Control -** Describe how your firm maintains and ensures the quality of your work as well as the work performed by subcontractors.

3.2. VENDOR QUALIFICATIONS

At a minimum the Vendor must meet and provide proof of the following qualifications:

- Licensed General Contractor in the State of Michigan for at least five years
- **Proof of financial stability and standing**
- **Insurance**
- **Financial Bonding**
- **Bank References**
- **Pending Lawsuits or Claims**

Identify key staff assigned to the project for these roles:

- Project Manager
- Project Superintendent
- Quality Manager
- Master Electrician
- Lead System Integration Engineer

Project Manager must be a current employee of the Vendor's firm. A single key staff person may be assigned to no more than two roles, however the Quality Manager may not be assigned to any other role.

Include the following minimum requirements, and the following sections should be used in the response:

- **Overview of Firm** – Include the location of the firm, number of employees, annual revenue, and history of the firm (as currently named). Also provide the Vendor's licensing information, and evidence of the Vendor's ability to provide sufficient bonding and insurance in the state of Michigan for this project.
- **Roles and Responsibilities** – Describe your firm's role and the role of your key staff on this project, including any subcontractors. Descriptions should be related to your ability, capacity, and process to complete the tasks and primary components of the project as described in previous sections of this RFQ.
- **Key Staff and Resumes** – Resumes of key staff must show directly related project experience, education, certifications, and professional licensure for the following key areas of work as they relate to this project and the individuals role. **Maximum of three (3) pages per resume** for each key staff member**.**

- **Project Profiles** - Provide three (3) or more successfully completed projects over a total construction budget of $1 million that are similar to the scope of work described in this RFP. Please provide the following information at a minimum for each project:
  - Project name
  - Project location (state, city)
  - Project size (Square Footage and Contract Value)
  - Project description
  - Client reference contact information

3.2.1. COMMUNICATIONS SYSTEMS QUALIFICATIONS

Provide the qualifications of the staff and subcontractor's firm (if applicable) responsible for these services. Proposals should include sufficient information of any subcontractor's firm as those requested of the PROPROSER QUALIFICATIONS Section 3.2. The personnel responsible for COMMUNICATIONS SYSTEMS work must meet the following minimum requirements:

- Firm must have five (5) Years of Experience with Intelligent Transportation System Technology, Testing, and Integration projects
- Provide proof of a Registered Communications Distribution Designer (RCDD) to supervise all work on-site.
- Provide proof of Fiber Optic Certification
  - Building Industry Consulting Service International (BICSI)
  - Electronics Technicians Association (ETA)
- Provide proof of Grounding and Bonding Certification
  - NFPA 780 Master Label Certification
  - UL 96A and UL 96
- Provide proof of Networking Certification (ie CCNA)
- Factory certified technicians for network equipment configuration and support (Alcatel Lucent network equipment is preferred)

3.2.2. A / V QUALIFICATIONS

Provide the qualifications of the staff and subcontractor's firm (if applicable) responsible for these services. Proposals should include sufficient information of any subcontractor's firm as those requested of the VENDOR QUALIFICATIONS Section 3.2. At a minimum the staff responsible for A/V work must meet the following requirements:

- Five (5) Years of Experience with Audio Video Systems design, installation, integration, and testing projects
- Provide certification letters from the manufacturers of the following components stating the firm is certified to install, transfer, test, and integrate the following major existing video wall components:
  - Mitsubishi Video Wall Display Cubes
  - Barco TransForm A system controller
- Understanding of the existing and desired warranty requirements and commitments related to relocating the existing equipment from the current MITSC to the new TMC and procurement of new equipment. The DEPARTMENT'S preference is to have one final point of contact for the A/V warranty issues for the facility.

3.2.3. ELECTRICAL QUALIFICATIONS

Provide the qualifications of the staff and subcontractor's firm (if applicable) responsible for these services. Proposals should include sufficient information of any subcontractor's firm as those requested of the VENDOR QUALIFICATIONS Section 3.2. At a minimum the staff responsible for ELECTRICAL work must meet the following requirements:

- Provide proof of the corporation being in the electrical contracting business for the past continuous 5 years or more.
- 1:1 Ratio of Journeyman/Master to Apprentice Electrician while on the job.
- Provide proof of Grounding and Bonding Certification

3.3. PAST PERFORMANCE

Relevant performance evaluations for the past three (3) years will be evaluated for firms on the Vendor's team that meet the prequalification requirements. If references are provided because the firm has not previously worked for MDOT or they have only had a few service opportunities that have been evaluated, the references will be contacted.

3.4. LOCATION

Provide the estimated amount of labor to be provided by Michigan based employees.

VENDOR SELECTION SCORING CRITERIA

The following approach will be used in determining the best value proposal to MDOT. The selected proposal will be the one considered to represent the best value to MDOT based on the technical and price proposals, i.e., the highest combination of technical score and price.

	Maximum Points
Technical Proposal	
1. Project Approach	**30 pts**
▪ Project Management Approach	
▪ Project Communication	
▪ Quality Assurance / Quality Control	
2. Vendor Qualifications	**45 pts.**
▪ Project Manager	
▪ Communications Systems Qualifications	
▪ Audio / Video Qualifications	
▪ Electrical Qualifications	
3. Past Performance	**20 pts**
4. Location	**5 pts**
Proposal Price*	**40 pts***
Total	**140 pts**

*Points for the Proposal Price Score will be applied on a linear basis, calculated as follows. The lowest bidder will receive 40 points and the other bidders will receive a proportion of the point value based on their bid cost relative to the low bidder, using the following equation:

[Low Bid/Bid] x 40 = Proposal Price Score

** TMC INTERIOR FIT-OUT AND ITS SYSTEM INTEGRATION
SPECIFIC SCORING POINT ASSIGNMENT

1. PROJECT APPROACH (30 Points)

1.1. Project Management Approach.

15 pts: Thoroughly explained project specific management approach above expectations, custom tailored for this project.
10 pts: Adequately explained project management approach meets minimum expectations, well explained approach for all projects.
5 pts: Generic project management approach meets minimum expectations, not related to the project or subcontractors.

1.2. Project Communication.

10 pts: Thoroughly explained project communication plan tailored to the project, above expectations.
7 pts: Adequately explained project communication plan, meets minimum expectations.
5 pts: Generic project communication plan, meets minimum expectations.

1.3. Quality Assurance and Quality Control.

5 pts: Thoroughly explained QA/QC procedures relating to contractor and subcontractor deliverables/products, relates specifically to this project.
2 pts: Adequately explained QA/QC procedures relating to contractor and subcontractor deliverables/products, general approach for projects.
1 pts: Generic project QA/QC procedures, meets minimum expectations, not related to the project or subcontractors.

2. PROPOSER QUALIFICATIONS (45 points)

2.1. Project Manager

15 pts: Project Manager shows minimum of three (3) directly related service projects
8 pts: Project Manager shows minimum of one to two (1-2) directly related service projects
0 pts: Project Manager shows no directly related service projects.

2.1.1. Communications Systems Qualifications.

10 pts: Key Task Leader and Key Staff presented for this work exceeds the minimum requirements and exhibit solid experience in the areas of work to be performed.
5 pts: Key Task Leader and Key Staff presented for this work meets the minimum requirements and exhibit experience in the areas of work to be performed.
0 pts: Key Task Leader and Key Staff presented for this work do not met the minimum requirements

2.1.2. Audio / Video Qualifications.

10 pts: Key Task Leader and Key Staff presented for this work exceeds the minimum requirements and exhibit solid experience in the areas of work to be performed.
5 pts: Key Task Leader and Key Staff presented for this work meets the minimum requirements and exhibit experience in the areas of work to be performed.
0 pts: Key Task Leader and Key Staff presented for this work do not met the minimum requirements

2.1.3. Electrical Qualifications.

10 pts: Staff presented for this work exceeds the minimum requirements and exhibit solid experience in the areas of work to be performed.
5 pts: Staff presented for this work meets the minimum requirements and exhibit experience in the areas of work to be performed.
0 pts: Staff presented for this work do not met the minimum requirements

3. PAST PERFORMANCE (20 points)

20 pts: Designated five (5) or more successfully completed projects with a minimum value of $1 million dollars per project, that are relevant to the anticipated scope of work for this project.**
15 pts: Designated three to four (3-4) successfully completed projects with a minimum value of $1 million dollars per project, that are relevant to the anticipated scope of work for this project.**
10 pts: Designated one to two (1-2) successfully completed projects with a minimum value of $1 million dollars per project, that are relevant to the anticipated scope of work for this project.**

** Successfully completed projects will be defined through reference checks by review team.

4. LOCATION (5 points)

- 95-100% 5 points
- 80-94% 4 points
- 50-79% 3 points
- 25-49% 2 points
- 10-24% 1 point
- Less than 10% 0 points

Proposals that do not meet the requirements of the Michigan Department of Transportation Consultant/Vendor Selection Guidelines for Service Contracts will be considered non-responsive to this RFP.

4.0 PROPOSAL / BID DEVELOPMENT SCHEDULE

4.1. PLAN REVIEW

The most recent set of facility construction plans and specifications from the State of Michigan Department of Management and Budget (DMB) construction project will be available beginning on the day after the release of the RFQP package. Vendors will be able to review (**by appointment with the MDOT PROJECT MANAGER only**) these plans and specifications at the MDOT Metro Region Offices located at 18101 West Nine Mile Road, Southfield, MI 48075. Vendors are encouraged to review the DMB plans and specifications prior to the pre-proposal meeting and site walk through as the plans and specifications will not be reviewed during the pre-proposal meeting.

4.2. SITE WALK THROUGH

A mandatory site walk through will allow Vendors a chance to review the existing facility as well as the new facility. Vendors will be required to adorn appropriate Personal Protective Equipment for the site walk through, including hard hat, boots, vest, and safety glasses.

4.3. PRE-PROPOSAL MEETING

A mandatory pre-proposal meeting will be held on May 10, 2010. The purpose of this pre-proposal meeting is to allow the Vendor's to ask questions and/or request clarification regarding the plans and specifications. The plans and specifications will not be "walked through" at this meeting; it is the responsibility of the Vendor to make themselves familiar with the plans and specifications prior to this meeting.

4.4. APPROVED EQUAL SUBMISSIONS

Vendors will be able to submit their questions and requests for approved equal vendors and/or equipment to the DEPARTMENT up until one week following the pre-proposal meeting. The DEPARTMENT will provide answers to all Vendors that have attended the Site Walk Through and Pre-Proposal Meeting. Responses will be developed one week after the last day of submission to the DEPARTMENT

4.5. PROPOSAL SUBMISSIONS

Technical Proposal and Proposal Price submissions are due Wednesday, May 26, 2010 by 12:00 p.m.

5.0 CONSULTANT PAYMENT - Milestone:

Compensation for this project shall be on a **milestone** basis, not to exceed the Total Service amount. Compensation shall be divided into payments for the completion of a portion of the services (deliverables). An example of milestones for this project would be:

Installation of Rough Framing	**3 %**
Installation of Dry Wall	**3 %**
Interior Painting	**4 %**
Interior Wood Work and Paneling	**10 %**
Installation of Ceiling	**6 %**
Installation of Fire Suppression	**2 %**
Install Rough Electrical	**2 %**
Install Finish Electrical	**6 %**
Install Sound Masking System	**4 %**
Install Consoles and Furnishings	**20 %**
Install and Integrate Video Walls	**20 %**
Install workstations and network	**5 %**
ITS System Integration	**15 %**
Total Service	**100%**

The DEPARTMENT Project Manager may authorize payment if a milestone is delayed due to circumstances beyond the Consultant's control. The DEPARTMENT reserves the right to adjust the amounts associated with each milestone, if determined to be in the best interest of the DEPARTMENT.

All billings for services must be directed to the DEPARTMENT and follow the current guidelines. The latest copy of the "Professional Engineering Service Reimbursement Guidelines for Bureau of Highways" is available on MDOT's website. This document contains instructions and forms that must be followed and used for billing. Payment may be delayed or decreased if the instructions are not followed.

Payment to the successful Vendor for Services rendered shall not exceed
the maximum amount unless an increase is approved in accordance with the contract with the Consultant. Typically, billings must be submitted within 60 days after the completion of services for the current billing. The final billing must be received within 60 days of the completion of services. Specific terms will be included in the final contract terms of the successful Vendor.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
TMC INTERIOR FIT-OUT AND ITS SYSTEM INTEGRATION PROJECT OVERVIEW

DES:MM 1 of 9 C&T:APPR:XXX:YYY:00-00-00

a. Description. This special provision provides an overview of the project structure which describes the construction of the TMC Interior Fit-Out and ITS System Integration project. The Michigan Department of Transportation (MDOT) is in the process of constructing a new traffic management center (TMC) across Lafayette Boulevard from the existing TMC known as the MITS Center, which is located at 1050 Sixth Street, Detroit, MI 48226. All work shall be performed in accordance with the contract documents and the 2003 Standard Specifications for Construction. The project is divided into two primary work areas as described below.

1. General

A. ATMS Network. The existing TMC has several communication linkages (wired and wireless) which facilitate communication to/from communication Hubs, Nodes and field devices. The intent is to transition these communication linkages from the existing TMC to the new TMC while enabling access to the communications network, ATMS platforms and field devices from both TMCs. The new facility will be the primary TMC on the communication backbone while the existing TMC will be connected as a spur with full access to the communications network, ATMS systems and field devices allowing the Department the flexibility to transition operations as they deem necessary. A separate special provision ATMS Network Overview is provided to further indicate the delineation of this package.

B. TMC Interior Fit-Out. The existing TMC has several audio visual (A/V) systems which display various types of video and information which allow the TMC operators to perform their duties. The new TMC is being constructed to allow for the expansion of services and system enhancements. The new space which the TMC will be housed in is under construction and the intent is to provide the necessary relocation of existing equipment, procurement/installation of additional equipment and provide the necessary interior fit out construction to allow for the final relocation of the TMC operations to the new space. A separate special provision TMC Interior Fit-Out Overview is provided to further indicate the delineation of this package.

2. Summary

A. *Special Provision for Maintaining Traffic is hereby incorporated into this special provision.*

B. *Special Provision for Measurement and Payment is hereby incorporated into this special provision.*

C. *Special Provision for ATMS Network Overview is hereby incorporated into this special provision.*

D. *Special Provision for TMC Interior Fit-Out Overview is hereby incorporated into this special provision.*

E. *Special Provision for Coordination Clause is hereby incorporated into this special provision.*

3. Special Provision Structure

A. **Table 1** provides the table of contents for the Special Provisions associated with this project.

Table 1 - Special Provision Table of Contents

No.	Special Provision Name
1	TMC INTERIOR FIT-OUT AND ITS SYSTEM INTEGRATION PROJECT OVERVIEW
2	MAINTAINING TRAFFIC
3	MEASUREMENT AND PAYMENT
4	ATMS NETWORK OVERVIEW
4.1	BASIC METHODS AND MATERIALS FOR ITS WORK
4.2	PROTECT ITS INFRASTRUCTURE
4.3	ATMS INTEGRATION AND IMPLEMENTATION
4.4	STRUCTURED CABLING
4.5	COMMUNICATIONS GROUNDING AND BONDING
4.6	AIR-BLOWN FIBER-OPTIC (ABF) TUBE & CABLE INFRASTRUCTURE
4.7	10 GIGABIT ETHERNET NETWORK SWITCH
4.8	WDM COMMUNICATIONS CONTROLLER
4.9	CONDUIT, DIRECTIONAL BORE, (number), _ Inch
4.10	GROUNDING AND BONDING
4.11	ITS CONDUIT CONSTRUCTION
4.12	LIGHTNING PROTECTION
4.13	CONDUIT CLEANING AND TESTING
5	TMC INTERIOR FIT-OUT OVERVIEW
5.1	BASIC METHODS AND MATERIALS FOR INTERIOR FIT OUT
5.2	VIDEO WALL RELOCATION AND NEW INSTALLATION
5.3	CRYSTAL REPORTS SERVER
5.4	FLAT PANEL DISPLAYS
5.5	SERVER RACK(S)
5.6	VIDEO RECORDER
5.7	SOUND MASKING SYSTEM
5.8	METAL FABRICATIONS – SECTION 05 50 00
5.9	ROUGH CARPENTRY – SECTION 06 10 00
5.10	INTERIOR ARCHITECTURAL WOODWORK – SECTION 06 40 23
5.11	JOINT SEALANTS – SECTION 07 92 00
5.12	PENETRATION FIRESTOPPING - SECTION 07 84 13
5.13	FLUSH WOOD DOORS – SECTION 08 14 16
5.14	GLAZING – SECTION 08 80 00
5.15	NON-STRUCTURAL METAL FRAMING – SECTION 09 22 16
5.16	GYPSUM BOARD – SECTION 09 29 00
5.17	SPECIAL CEILING SYSTEMS – SECTION 09 54 00
5.18	FIXED SOUND-ABSORPTIVE PANELS – SECTION 09 84 13

5.19	INTERIOR PAINTING – SECTION 09 91 23
5.20	STAINING AND TRANSPARENT FINISHING – SECTION 09 93 00
5.21	VISUAL DISPLAY SURFACES – SECTION 10 11 00
5.22	METAL LOCKERS – SECTION 10 51 13
5.23	BASIC FURNISHINGS REQUIREMENTS – SECTION 12 00 00
5.24	SHADES – SECTION 12 20 00
5.25	FURNITURE AND ACCESSORIES – SECTION 12 40 00
5.26	SYSTEMS FURNITURE – SECTION 12 59 00
5.27	COMMON WORK RESULTS FOR ELECTRICAL WORK – SECTION 26 05 00
5.28	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES – SECTION 26 05 19
5.29	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS - SECTION 26 05 26
5.30	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS – SECTION 26 05 29
5.31	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS – SECTION 26 05 33
5.32	CABLE TRAYS FOR ELECTRICAL SYSTEMS – SECTION 26 05 36
5.33	VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS – SECTION 26 05 48
5.34	IDENTIFICATION FOR ELECTRICAL SYSTEMS - SECTION 26 05 53
5.35	MODULAR DIMMING CONTROLS – SECTION 26 09 36
5.36	WIRING DEVICES – SECTION 26 27 26
5.37	INTERIOR LIGHTING – SECTION 26 51 00
6	COORDINATION CLAUSE

4. Project Management

A. Scope Management

(1) Conduct all Work necessary to meet the requirements of scope management, including preparing, documenting, revising, and submitting information that details the Work and any changes to the Work that are approved by the Department.

(2) Following Notice to Proceed (NTP), incorporate any changes to the Work into its cost and progress management, schedule management, quality management, and human resources management for the Project.

B. Progress Management

(1) Conduct all Work necessary to meet the requirements of progress management, including the preparing, revising, and submitting of progress reports.

C. Schedule of Milestones

(1) Following Notice to Proceed (NTP), develop a Schedule of Milestones as described in the Special Provision for Measurement and Payment.

(2) During the course of the Project, incorporate any Approved changes to the Schedule of Milestones and document these changes in a Revised Schedule of Milestones.

D. Progress Report

(1) Include the following in a monthly progress report:

(a) Summary of work performed during the previous month.

(b) A certificate signed by its Construction Quality Control Manager certifying that all construction Work performed through the date of the Progress Report has been performed in a prudent manner and in compliance with the requirements of the Contract. This certificate must also certify that all necessary materials to perform such Work have been provided by Contractor or its Subcontractors or Vendors in accordance with the provisions of this Contract, and that the Contractor holds title to all such materials included in the invoices issued during the month.

(c) An updated CPM Schedule, a progress report outlining the activities of Work completed the previous month and anticipated Work for the next month, and an analysis of the critical path.

(d) Provide a website (such as Bricsnet) for purposes of maintaining an updated submittal log that tracks, at a minimum, when an item was submitted by the Contractor and when it was returned to the Contractor. The submittal log shall also show the status of the submittal (No exceptions taken, Make corrections noted, Resubmit, or Rejected). This webiste shall also provide a schedule for upcoming submittals in the coming month.

(e) A summary of items the Contractor or the Department needs or any outstanding issues that need to be resolved and who the responsible party is. This issue list shall carry over from month to month until resolution.

(f) Quality updates

(i) Summary of quality audits and quality control processes performed

(ii) Listing of non-conformances and resolutions

(g) Change Orders

(i) Summary of outstanding change orders

(ii) Summary of items where Contractor is aware of claim, dispute, circumstance, or fact that may give rise to a claim, if applicable

(2) Provide an electronic combined copy of the entire report in Adobe Acrobat (.pdf) format.

E. Schedule Management

(1) Complete and update a computerized Critical Path Method (CPM) Schedule as described herein. Whenever the term “Schedule” is used in the Contract Documents, it shall mean the CPM Schedule. The Work under this Contract shall be planned, reported and accomplished using the Critical Path Method (hereinafter referred to as CPM).

(2) Definitions

(a) CPM Schedule: The as-planned schedule that represent the Contractor's best judgment and intended plan for completion of the Work in compliance with Contract Documents. The CPM Schedule shall show all planned activities, including activities by any separate contractors, interface dates with Utility owners/municipalities/agencies, all submittal requirements, and submittal review periods.

(b) Critical Activity: An Activity with zero or negative Float.

(c) Critical Path(s): The chain of continuous activities controlling the last activity of the Schedule and/or Milestone(s).

(d) Milestone: A contractually obligated Project Start or deadline that shall be designated with an Activity Type of Milestone. Milestones are the only activities allowed a Start and Finish date constraint. The Contractor may use Activity Coding to designate other activities of interest.

(e) Float: Number of Days by which a part of the Work in the Schedule may be delayed without extending the Contract Time or Milestone.

(3) Software

(a) Use Microsoft Project or other software as Approved by the Engineer. The Department uses Microsoft Project and must be able to access the electronic schedule.

(4) Manage and work with each Subcontractor and Vendor to obtain information on activities for implementation and sequencing of the Work. The Schedules shall reflect Contract requirements and known limitations.

(5) Errors or omissions within Schedules shall not relieve the Contractor from finishing all Work within the time limit specified for completion of the Contract. If, after a Schedule has been accepted by the Department, and either the Contractor or the Department discovers that any aspect of the Schedule has an error or omission, the Schedule shall be corrected.

(6) At a minimum, update the CPM Schedule monthly to accurately reflect the status of Work completed and Work remaining. Meet with the Department to review each update. Schedule updates shall be made to the most recently Accepted CPM Schedule. Schedule updates shall be named to denote the date of submittal.

(7) The Department’s review and Acceptance of Schedules will not waive any Contract requirements and shall not relieve the Contractor of any obligation or responsibility for submitting complete and accurate information. By review and Acceptance of the Schedule, the Department does not endorse or otherwise certify the validity or accuracy of any part of the Schedules. The responsibility for validity and accuracy of all Schedules is the sole responsibility of the Contractor.

(8) All Float in the schedule is a shared commodity available to the Project and is not for the exclusive benefit of any party. Use of any Float-suppressing techniques will be cause for rejection of Schedule submittal.

(9) Level of Detail

(a) Each activity shall: (1) be expressed in Days; (2) be a duration of not more than 20 Working Days, unless otherwise authorized by the Department; (3) have a unique activity description; (4) have at least one predecessor and one successor activity, except for Project start and finish respectively.

(b) The activities of the Schedule shall have, at a minimum, the level of detail described below, as applicable to the type of Work being performed unless otherwise agreed to by the Department:

(i) General Activities

1) Schedule Milestones

2) Shop and working drawing preparation, submittal, and processing for all elements requiring shop or working drawings

3) Permit preparation and reviews

4) Substantial Completion

5) Punch List

6) Final Acceptance

(ii) ITS Acceptance

1) Review existing handhole/conduit condition

2) Prepare handholes and conduits

3) Conduit installation

4) Handhole installation

5) Prepare fiber optic cable

6) Install fiber optic cable

7) Perform fiber optic cable terminations

8) Perform Optical Time Domain Reflectometer (OTDR) testing & project documentation

(10) Submit to the Department for Acceptance the Original Schedule within 3 weeks of Award. The Schedule shall be submitted in PDF format. The Department

will have 15 working days to review this document. Submit to the Department an updated electronic version of the Schedule in PDF format with the Progress Report submittals. Provide an electronic version of the Schedule in native format upon the Department's request, including updates of the Schedule.

F. Quality Management

(1) Contractor Responsibility

(a) Provide all administration and construction Work in accordance with the Contract Documents. The Contractor shall not be relieved of its obligation to perform the Work in accordance with the Contract Documents, or any of its other obligations under the Contract Documents, by oversight, spot checks, audits, reviews, tests, inspections, acceptances, or approvals by any Persons, or by any failure of any Person to take such action.

G. Human Resource Management

(1) Conduct all Work necessary to meet the requirements of human resource management, including personnel, facilities, and equipment.

(2) All personnel performing Work on the Project shall have the experience, skill, and knowledge to perform the Work assigned to them. All personnel performing Work on the Project shall also have appropriate required professional licenses and certifications.

(3) Key Personnel for the Project shall include the following:

(a) Project Manager

(b) Project Superintendent

(c) Quality Manager

(d) Master Electrician

(e) Lead System Integration Engineer

(4) One of the contractor's key personnel shall be on-site at least 50% of the time during construction unless otherwise approved by the Engineer. One person may fill up to two key personnel roles, however the Quality Manager may not be assigned to any other role.

(5) The Department will have the right to Approve or reject the Contractor's Key Personnel prior to their participation on the Project. Such Approval will be based on the qualification requirements set forth above and elsewhere in the Contract Documents for all Key Personnel.

(6) Prepare a directory of Approved Key Personnel that includes the following information for each individual: name, Project title, Project office address, Project office location, e-mail address, telephone numbers (office, mobile, pager), and fax

number. The directory shall be kept current throughout the course of the Project. Identify a person and phone number that will be available at all times while Work is being performed.

(7) Submit to the Department the directory of Approved Key Personnel within 30 Days of Award and not less than five Days prior to the start of construction activities.

b. Materials.

None.

c. Construction.

1. General

A. Verify that all work performed under these Specifications is in accordance with the requirements and standards defined and referenced in these Specifications. Any work performed in deviation of these Specifications, any of the referenced material, or any applicable standards or requirements, shall immediately be corrected by the Contractor without additional charges to the Department, regardless of the stage of completion. Record all inspection observations. As a minimum, the record shall include the name(s) of personnel conducting the inspection, a brief description of the inspection and the observations. These records shall be available for the Department to review at any time. Also, these records shall be delivered to the Department before final acceptance.

B. In addition to the requirements outlined in equipment specific Special Provisions, Basic Methods and Materials for ITS Work and ATMS Integration and Implementation Special Provisions, the Contractor shall provide the following. Installation inspections shall be undertaken through the performance of pre-installation, in-progress, final, and corrective action inspections.

(1) Pre-Installation Inspection: Inspect all equipment and material to be used prior to installation. All items shall be verified for compliance with the requirements of these Specifications and all other applicable standards. All equipment, cable, and associated hardware identified for installation shall be inspected for damage and completeness utilizing standard practices to determine integrity and acceptability. Provide the Department with a video on DVD detailing the existing conditions of the spaces where work is to occur prior to beginning any work.

(2) In-Progress Inspection: At the Department's discretion, perform in-progress inspections that shall include visual inspections of equipment, wiring practices, cabling, placement of equipment, marking of cables and adherence to safety procedures. In addition, the Department, or its representative, may conduct additional inspections any time.

(3) Final Inspection: Participated in the final inspection conducted by the Department, or its representative which encompasses all portions of the installation. This inspection to be performed to ensure that all aspects of the installation have been performed in accordance with these Specifications, standard industry practices and the publications referenced herein. All non-compliance items shall be noted by

the Department and provided to the Contractor for review, comment, and corrective action.

(4) Corrective Action and Verification Inspection: Perform corrective action so that the Department, or its representative, can perform a verification inspection to ensure that all non-compliance items identified during the final inspection have been corrected.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION
FOR
MAINTAINING TRAFFIC

a. Description. This work shall consist of all labor, materials and equipment required to maintain traffic in accordance with the Special Provisions for Maintaining Traffic, and as specified herein. The Michigan Department of Transportation (MDOT) is in the process of constructing a new traffic management center (TMC) across the street from the existing TMC known as the MITS Center, which is located in downtown Detroit. The existing TMC has several communication linkages (wired and wireless) which facilitate communication to/from communication Hubs, Nodes and field devices. The intent of this project is to transition these communication linkages from the existing TMC to the new TMC while enabling access to the communications network, ATMS platforms and field devices from both TMC's. The new facility will be the primary TMC on the communication backbone while the existing TMC will be connected as a spur with full access to the communications network, ATMS systems and field devices allowing MDOT the flexibility to transition operations as they deem necessary.

b. General. Traffic shall be maintained according to Sections 103.05, 103.06 and 812 of the 2003 Standard Specifications for Construction, including any Supplemental Specifications, and as specified here.

1. The Contractor shall notify the Engineer a minimum of 72 hours prior to the implementation of any detours, road closures, or lane closures and major traffic shifts. All detours, road closures, lane closures and major traffic shifts require Engineer approval before being implemented.

2. The Contractor shall coordinate his operations with Contractors performing work on other projects within or adjacent to the Construction Influence Area (CIA).

3. City or MDOT maintenance crews and/or Contract Maintenance Agencies may perform maintenance work within or adjacent to the Construction Influence Area (CIA). The Maintenance Division of the City/MDOT and/or Contract Maintenance Agency shall coordinate their operations with the Engineer to minimize the interference to the Contractor.

The Contractor shall obtain permits "if necessary" from local governments prior to placing construction signing on surface streets.

c. Construction Influence Area (CIA). The CIA shall include the existing/proposed right-of-way of the following roadways, within the approximate limits described below:

1. From 5th to 6th St. on Lafayette St.
2. From 5th to 6th St. on Fort St.
3. From Fort St. to Howard St. on 5th St.
4. From Fort St. to Lafayette St. on 6th St.

d. Traffic Restrictions.

General

1. No work shall be performed or additional lane closures allowed during Freedom Festival Fireworks, Joe Louis Arena events, Cobo Hall events, Easter, Memorial Day, July 4th, Labor Day, Thanksgiving and all other city holiday periods, as defined by the Engineer.

2. There will be no reduction in speed limit in the construction influence area.

3. All work will be conducted during daytime hours only. Night work may be permitted, at the discretion of the Engineer. Work on weekends, if approved, shall be as directed by the Engineer. However, any additional cost for maintaining traffic will be borne by the Contractor.

4. Access to all business and residential drives shall be maintained within the construction zones at all times during construction as directed by the Engineer.

5. When work is being done within a lane or part of a lane, then it becomes a lane closure.

6. Once work is initiated that includes any lane restrictions, that work shall be continuous until completed. A lack of work activity for more than 1 week shall require the removal and replacement of lane restrictions at the Contractor's expense.

7. Access for construction vehicles between traveled lanes and work areas shall be restricted to specific locations. The number of access points and their locations will require the prior approval of the Engineer.

8. The Contractor shall obtain all necessary permits from appropriate agencies prior to placing construction signing on roads. The cost incurred to obtain these permits shall be considered to be included in the cost of other pay items.

9. The Contractor shall be responsible for sweeping roadways of debris and dirt that

has been tracked onto the pavement by the various work operations. This is to be done daily or more often as directed by the Engineer to keep the roadway clean and the work shall be included in the pay item, “Minor Traf Devices.” The Contractor shall also clean off the loose material on the haul trucks prior to entering any public roadways.

10. During non-working periods, any incomplete work shall have advance Plastic Drums at specific hazards, as directed by the Engineer.

e. Traffic Control Devices.

1. General

   A. All traffic control devices and their usage shall conform to revised Part 6 of the Michigan Manual of Uniform Traffic Control Devices (MMUTCD), 2005 edition, Standard Plan Series WZD-125-E and as specified herein.

   B. Sign covers shall be placed over existing regulatory, warning and construction signs that are not applicable during construction.

   C. During non-working periods, any work site with uncompleted work shall have plastic drums at specific locations, as directed by the Engineer, at no additional cost to the Department.

   D. The following traffic control typicals shall be used on this project: M0020a, M0040a, M0240a and M0520a.

2. Temporary Signs

   A. All diamond-shaped warning signs shall be 48 inch x 48 inch mounted at a 7 foot minimum bottom height. All temporary signs shall be mounted at a 5 foot minimum bottom height in uncurbed areas and 7 foot minimum bottom height in curbed or pedestrian areas.

   B. All signs shall be approved by the Engineer PRIOR to use.

   C. All temporary signs shall be constructed with legends and symbols flush to the signs face and not extending beyond the sign borders or edges.

   D. All temporary signs shall be faced with prismatic retroreflective sheeting.

   E. The work of maintaining, existing warning, regulatory and/or guide signs and of removing and salvaging non-applicable signs and supports, as specified in Subsection 812.04, shall be included in the pay item “Minor Traf Devices.”

   F. Signs and barricades, when required by the Engineer, are to be cleaned over the entire reflective surface. The unit price paid for a contract item

designated as “operated” and “sign, temporary,” of the type specified, is payment for the operation, inspection, maintenance (cleaning), re-positioning and removal of the item.

G. Temporary signs installed on portable supports shall either be removed or laid down with the feet off when no longer applicable to that operation. These signs shall not occupy the shoulder of the roadway when laid down nor shall they be placed against attenuators or guardrail when no longer applicable to that operation.

H. The portable sign supports for all diamond warning signs on this project shall be fabricated as per Standard Plan Series WZD-125-E.

3. Channelizing Devices

A. Required channelizing devices shall be plastic drums with high intensity sheeting. 20 additional plastic drums are included to be used at the discretion of the Engineer.

B. Spacing of channelizing devices in feet in the taper area should not exceed the posted speed in miles per hour and twice the posted speed in the parallel area.

4. Temporary Pavement Markings

A. Temporary pavement markings are not required on this project.

g. Measurement and Payment.

The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
MEASUREMENT AND PAYMENT

a. Description. This special provision provides details regarding the measurement and payment to the Contractor for Work performed.

1. General

A. Cost and Progress Management

(1) Perform all Work necessary to meet the requirements of cost management, including the preparing, processing, revising, and submitting of invoices.

(2) Compensation for this project shall be on a milestone basis not to exceed the Total Service amount. The Engineer may authorize partial payments as described in the Special Provision for Measurement and Payment, in the event that a delay is incurred due to circumstances beyond the Contractor's control. All billings for services must follow the current Department guidelines for Contractor payment.

(3) Payment to the Contractor for services rendered shall not exceed the maximum amount unless an increase is approved in accordance with the contract with the Contractor. Typically, billings must be submitted within 60 days after the completion of services.

B. Schedule of Milestones

(1) Following the Notice to Proceed (NTP), develop a Schedule of Milestones that is based on and similar to the **Form 1** of this special provision. Form 1 is provided as a sample Schedule of Milestones, and the Contractor is required to develop a final Schedule of Milestones. Submit the Schedule of Milestones within 15 Working Days of NTP to the Department for review and approval. The Department will respond with comments or acceptance within 15 Working Days of receipt of this Original Schedule of Milestones.

(2) Verify that all costs necessary to meet the particular requirements of each item are included in the Schedule of Milestones and that the costs total up to the Proposal Price.

(3) During the course of the Project, incorporate any Approved changes to the Schedule of Milestones and document these changes in a Revised Schedule of Milestones.

(4) Submit the Revised Schedule of Milestones for Department Acceptance of any change to the Original Schedule of Milestones. The Department will respond within 15 Working Days of receipt of the Revised Schedule of Milestones.

FORM 1 - SCHEDULE OF MILESTONES

This provides an example of how that schedule of milestones may be configured. This form is for information purposes only and should not be submitted with the Technical Proposal or the Proposal Price.

SCHEDULE OF MILESTONES

Proposer Name:_____

Item/Line No.	Description	Unit	Item Total
1	Installation of Rough Framing	Bid Amount	$
2	Installation of Dry Wall	Bid Amount	$
3	Interior Painting	Bid Amount	$
4	Interior Wood Work and Paneling	Bid Amount	$
5	Installation of Ceiling	Bid Amount	$
6	Installation of Fire Suppression	Bid Amount	$
7	Install Rough Electrical	Bid Amount	$
8	Install Rough Electrical	Bid Amount	$
9	Install Finish Electrical	Bid Amount	$
10	Install Sound Masking System	Bid Amount	$
11	Install Consoles and Furnishings	Bid Amount	$
12	Install and Integrate Video Walls	Bid Amount	$
13	Install workstations and network	Bid Amount	$
14	ITS System Integration	Bid Amount	$
15	**PROPOSAL PRICE (TOTAL SERVICE AMOUNT)** (Sum of Lines 1 thru 14)	**Bid Amount**	$

(5) The Department Project Manager may authorize payment if a milestone is delayed due to circumstances beyond the Consultant's control. The Department reserves the right to adjust the amounts associated with each milestone, if determined to be in the best interest of the Department.

C. Invoices

(1) The Department reserves the right to withhold processing of an invoice if the requirements of this section are not met.

(2) Structure the billing periods to start on the first day of the month and end on the last day of the month. Include the following on the invoice cover sheet:

(a) Project numbers (federal and State) and title

(b) Invoice number (numbered consecutively starting with “01”)

(c) Period covered by the invoice (specific Days)

(d) Total earned to date for the Project as a whole and for each Milestone (as shown in Approved Schedule of Milestones)

(e) Authorized signature and title of signatory

(f) Date that invoice was signed

(3) Include the Progress Report, for the period being billed, with the invoice.

(4) On a monthly basis, at a minimum, meet with the Department to review the following prior to submitting invoices, unless otherwise approved by the Engineer:

(a) Activity percent completes, which are based on physical percent complete estimated by the field personnel relating to a resource and cost loaded schedule activity

(b) Incorporation of approved Change Orders as individual activities with proper title, coding by Change Order number, associated logic, duration, as well as resource and cost loading

(c) Verification of any unit price items

(d) Status of outstanding Nonconforming Work and Warranties

(e) Backup documentation for cost reimbursable procurement and Change Order schedule activities

(5) Include with the monthly invoice an electronic copy of the billing spreadsheet, and an updated schedule. The invoices should be submitted as one hardcopy and one electronic pdf.

D. Invoice Calculations

(1) The Department will base payments on the Department’s estimate of physical percent complete of the Work and the Schedule of Milestones, not on measured quantities.

(2) The payment to the Contractor will be the amount shown on the Contractor's Approved invoice less deductions made by the Department.

(3) The following Project Management items (from Form 1 - Schedule of Milestones example or equal as approved by the Engineer) will be paid by prorating any unpaid balances by the amount of time remaining until Substantial Completion:

(a) Contract Management (includes Scope Management, Cost and Progress Management, and Schedule Management)

(b) Safety/Quality Management

(c) Warranty Bond

(d) Payment and Performance Bond

(e) Insurances

(f) Utility Management

b. Materials.

None.

c. Construction.

None.

d. Measurement and Payment. The completed Work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIFICATION
FOR
ATMS NETWORK OVERVIEW

a. Description. The Michigan Department of Transportation (MDOT) is in the process of constructing a new traffic management center (TMC) across the street from the existing TMC known as the MITS Center, which is located in downtown Detroit. The existing TMC has several communication linkages (wired and wireless) which facilitate communication to/from communication Hubs, Nodes and field devices. The intent of this project is to transition these communication linkages from the existing TMC to the new TMC while enabling access to the communications network, ATMS platforms and field devices from both TMCs. The new facility will be the primary TMC on the communication backbone while the existing TMC will be connected as a spur with full access to the communications network, ATMS systems and field devices allowing the Department the flexibility to transition operations as they deem necessary. This specification provides details of the work expected for the ATMS network and systems and the construction sequencing and phasing, as shown on the Plans and Special Provisions. All work shall be performed in accordance with the Standard Specifications for Construction.

1. General

A. Furnish, install, integrate, test, and warranty all equipment and required ancillary components necessary to provide a complete and fully functional system in all respects, without additional expense to the Department.

B. All equipment required for the installation, integration and testing of components and subsystems contains within this project must be supplied by the Contractor as an appurtenance to the electronic equipment included within the project and at no additional cost to the Department.

C. The ATMS network, systems and field devices are comprised of:

(1) Department

(a) Conduit – entry points into existing and new TMCs

(b) Conduit – connection between TMCs and to Verizon conduit

(c) Fiber into existing TMC from M-10 Lodge Freeway

(d) Wireless linkage on existing rooftop

(e) Existing communications infrastructure (OC-48 SONET)

(f) Existing ATMS platform (hardware and software)

(g) New Ethernet communications infrastructure (10 Gigabit Ethernet)

(h) Interim ATMS platform (hardware and software)

(i) Statewide ATMS platform (hardware and software)

(2) Verizon (formerly MCI)

(a) Leased backbone fiber to Hubs 2, 6, 9 and 10

(b) Verizon owned conduit – entry points into existing and new TMCs

D. Definitions, Acronyms and Abbreviations

(1) ABF - Air Blown Fiber

(2) ADM - Add/Drop Multiplexer

(3) ASTM - American Society for Testing and Materials

(4) ATM - Asynchronous Transfer Mode

(5) ATMS - Advanced Traffic Management System

(6) BCN - Backbone Communications Network (BCN)

(7) Bellcore - Bell Communication Research

(8) BER - Bit Error Rate

(9) CCTV - Closed Circuit Television

(10) CIF - Common Intermediate Format

(11) COADM - Coarse Optical Add/Drop Multiplexer

(12) CWDM - Coarse Wavelength Division Multiplexing

(13) dB - decibel

(14) dBm - decibel referenced to 1 mW

(15) DMS - Dynamic Message Sign

(16) E&M - Engineering and Maintenance

(17) EIA - Electronic Industries Association

(18) ERL - Echo Return Loss

(19)FDU - Fiber Distribution Unit

(20)FPS - Frames per Second

(21)FTU - Fiber Termination Unit

(22)GB - GigaByte (1 x 10 9 Bytes/Characters)

(23)Gbps - Gigabits per second

(24)GHz - Gigahertz

(25)GPS - Global Positioning System

(26)GRS - Galvanized Rigid Steel Conduit

(27)Hub - Communication transmission equipment site that provides wire termination or wireless link for aggregation of user devices to the Network

(28)ICEA - Insulated Cable Engineers Association

(29)IL - Individual Loop

(30)IP - Internet Protocol

(31)ITU-T - International Telecommunication Union –Telecommunication

(32)KB - KiloByte (1 x 10 3 Bytes/Characters)

(33)Kbps - Kilobits per second

(34)KHz - Kilohertz (1 x 10 3 cycles per second)

(35)LAN - Local Area Network

(36)LED - Light Emitting Diode

(37)LFC - Local Field Controller

(38)MB - Megabyte (1 x 10 6 Bytes/Characters)

(39)Mbps - Megabits per second

(40)DTMB - Michigan Department of Technology, Management and Budget

(41)MDOT - Michigan Department of Transportation

(42)MHz - Megahertz (1 x 10 6 cycles per second)

(43)mm - millimeter (1 x 10-3 meter)

(44)MM - Multimode

(45)MPEG-4 - Motion Pictures Expert Group version 4

(46)MTBF - Mean Time Between Failures

(47)MTTR - Mean Time To Repair, manufacturer support

(48)NEMA - National Electrical Manufacturers Association

(49)nm - nanometer (1 x 10-9 meter)

(50)NMS - Network Management System

(51)Node - Communication transmission equipment site that provides wire termination or wireless link for connecting user devices to the Network

(52)NTCIP - National Transportation Communications for ITS Protocol

(53)OADM - Optical Add Drop Multiplexer

(54)OC-192 Optical Channel 192 - 10 gigabits per seconds

(55)OC-48 - Optical Channel 48 - 2.5 gigabits per seconds

(56)OCC10 - 10Gbps Optical Channel Card

(57)OSHA - Occupational Safety & Health Administrations

(58)OTDR - Optical Time Domain Reflectometer

(59)Pps - packets per second

(60)RAM - Random Access Memory

(61)RFC - Request For Comment

(62)RGB - Red Green Blue

(63)RMS - Ramp Metering System

(64)RU - Rack Unit 1.75 in (44.45 mm) high

(65)RWIS - Roadway Weather Information System

(66)S/N - Serial Number

(67)SM - Single Mode

(68)SNMP - Simple Network Management Protocol

(69)SONET - Synchronous Optical Network

(70)SSI - Surface Systems Incorporated

(71)STS - Synchronous Transport Signal

(72)TCP - Transmission Control Protocol

(73)TCP/IP - Internet Protocol Suite (Transmission Control Protocol / Internet Protocol)

(74)TDM - Time Division Multiplexing

(75)TDU - Tube Distribution Unit

(76)TMS - Traffic Management System

(77)TRM - Traffic Responsive Metering

(78)TSC - Traffic Signal Controller

(79)TTL - Transistor Transistor Logic

(80)U - Rack Unit 1.75 in (44.45 mm) high

(81)UL - Underwriters Laboratory

(82)VDS - Vehicle Detection System; Vehicle Detector Station

(83)VS - Video Switch

(84)WAN - Wide Area Network

(85)WAP - Wireless Application Protocol

(86)WDM - Wavelength Division Multiplexing (WDM)

2. Summary

A. *Special Provision for Basic Methods and Materials for ITS Work* is hereby incorporated into this special provision.

B. *Special Provision for Communications Grounding and Bonding* is hereby incorporated into this special provision.

C. *Special Provision for Lightning Protection* is hereby incorporated into this special provision.

D. *Special Provision for ITS Conduit Construction* is hereby incorporated into this special provision.

E. *Special Provision for Protect ITS Infrastructure* is hereby incorporated into this special provision.

F. *Special Provision for Air-Blown Fiber-Optic (ABF) Tube & Cable Infrastructure* is hereby incorporated into this special provision.

G. *Special Provision for 10 Gigabit Ethernet Network Switch* is hereby incorporated into this special provision.

H. *Special Provision for WDM Communications Controller* is hereby incorporated into this special provision.

I. *Special Provision for ATMS Integration and Implementation* is hereby incorporated into this special provision.

J. *Special Provision for Structured Cabling* is hereby incorporated into this special provision.

K. *Special Provision for Conduit Cleaning and Testing* is hereby incorporated into this special provision.

3. Requirements of Regulatory Agencies and Standards. The compliance with the latest edition of the following codes, standards and guidelines is required:

A. American Association of State Highway and Transportation Officials (AASHTO), Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, 2001 or latest edition

B. American Institute of Steel Construction's (AISC)

C. American National Standards Institute Standard C2 (ANSI)

D. American Society for Testing Materials (ASTM)

E. American Society of Civil Engineers (ASCE)

F. American Society of Testing and Materials (ASTM)

G. Building Industry Consulting Services International (BICSI)

H. Electronic Temperature Sensor (ETS) including but not limited to ETS 300-019, Class 3.2 and 300-019, Class 1.2

I. Federal Communications Commission (FCC) Code of Federal Regulations including but not limited to Title 47 and Part 15.org compliant

J. Institute of Electrical and Electronic Engineers (IEEE) including but not limited to 142-1991, 802.1D, 802.1p, 802.1Q, 802.3, 802.3D, 802.3u, 802.3ae, 802.3z, and Internet Group Management Protocol v. 2 or higher (2236)

K. International Electrotechnical Commission (IEC)

L. International Organization for Standardization (ISO) 11801:2002

M. International Telecommunication Union - Telecommunication (ITU-T)

N. Lightning Protection Institute (L.P.I.) Standards including but not limited to 175, 176, and 177

O. Manual on Uniform Traffic Control Devices (MUTCD) for Temporary Traffic Control Devices, 2003 or Latest Edition

P. Motorola Standards and Guidelines for Communications Sites (R-56)

Q. Moving Picture Experts Group (MPEG), Video Compression Standards Publications

R. National Electric Code (NEC), 2005/2007 or Latest Edition (and local Electrical Installation Standards/Laws)

S. National Electrical Manufacturers Association (NEMA) Standards Publications including but not limited to 250, TS 2-2003, and TS 4-2005

T. National Fire Protection Association (NFPA) 70 - National Electrical Code

U. National Fire Protection Association (NFPA) 780 - Lightning Protection Code

V. National Television Standards Committee (NTSC), Video Standards Publications

W. National Transportation Communications for ITS Protocol (NTCIP)

X. Request for Comment (RFC) 2236 IGMP v.2; 2475 DiffServ; 768 UDP; 791 IP; 792 ICMP; 793 TCP; 783 TFTP; 826 ARP; 854 Telnet; 1157 SNMP v.1 and v.2; 1213 MIB II; 1493 Bridge MIB; 1643 Ethernet MIB; and RMON 4.

Y. Telecommunications Distribution Methods Manual (TDMM)

Z. Telecommunications Industry Association and Electronic Industry Alliance (TIA/EIA) Electronics Industries Association (EIA/TIA) including but not limited to 232-E, 310-C, 422-A, 455-46, 455-53(Ref B.1.39), 455-59, 455-61, 485, 568-B, 596-B, 598-B, 606-A, 607, and 758-A

AA. Traffic Engineering Handbook, Institute of Transportation Engineers

BB. Underwriters Laboratories Standards(UL)including but not limited to 94 V-O, 96, 96A, 467, 486A, 508, 910, 1666, 1703, and 60950

4. Qualifications

A. In addition to the requirements outlined in equipment specific Special Provisions and the RFP, the Contractor shall adhere to the following qualification requirements.

B. Work specified herein shall be the responsibility of a single communication systems integration contractor. Bidders must provide documentation showing a minimum of five years experience in the fabrication (equipment manufacturer), assembly, installation, integration and testing of systems of similar complexity as specified in the project documents. This requirement shall apply equally to suppliers and manufacturers of the communications subsystems and major components to be used on this Project. The documentation shall include the names, locations and points of contact for at least three installations of the type and complexity specified in the project documents. Bidders shall indicate the type of each referenced system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 24 months. Documentation must be provided to the Engineer for review.

C. All work shall be supervised on-site by a BICSI Registered Communications Distribution Designer (RCDD)

(1) RCDD shall demonstrate knowledge and compliance with all BICSI, TIA/EIA, UL, and NEC standards and codes.

(2) Contractor shall submit proof of RCDD designation at time of bidding.

D. Work performed directly by the Contractor shall be with factory-certified technicians. Contractor shall submit proof of factory certifications to the Engineer. Provide or engage an experienced and factory certified installer to install, configure and test project equipment such as

(1) Ethernet Backbone

(2) WDM equipment (including appropriate network interface modules).

(3) Fiber optic and Ethernet cables

(4) Manufacturer of each type of fiber optic product shall certify all personnel performing installation, splices fiber optic connector terminations and testing.

(5) The manufacturer of each type Ethernet cable product shall certify all personnel performing installation, connector terminations and testing.

E. Work specified herein shall be the completed by the integration contractor. If sub contractors will be used then the Contractor must submit the name of the subcontractor firm, qualification and what part of the project they will handle, and key staff to the Department for approval. Bidders must provide documentation showing a minimum of five years experience in the fabrication (equipment manufacturer), assembly and

installation of systems of similar complexity as specified herein. This requirement shall apply equally to suppliers and manufacturers of the communications subsystems and major components to be used on this Project. The documentation shall include the names, locations and points of contact for at least three installations of the type and complexity specified herein. Bidders shall indicate the type of each referenced system and certify that each system has performed satisfactorily in the manner intended for a period of not less than 24 months.

F. By submitting a Bid, the Contractor thereby certifies that it is qualified in all areas pertaining to, either directly or indirectly, the work. In the event the Contractor becomes unable to complete the work in accordance with the Contract documents, or to the satisfaction of the Engineer due to a lack of understanding of equipment, systems or services required by the Contract documents, it shall be the responsibility of the Contractor to retain the services of the applicable subcontractor or manufacturers' representatives to expeditiously complete the work in accordance with the Engineer's construction schedule with no additional cost to the Department.

G. Provide factory-certified technicians who have at least 5-10 years experience in network equipment configuration and support (Alcatel-Lucent network equipment experience is preferred).

(1) These certified employees shall supervise the installation, commission, and maintain the work.

(2) All installing personnel shall also be licensed as required by local and / or state jurisdictions.

5. Penalties

A. In the event of a conflict among these penalties and those set forth in the Standard Specifications for Construction the order of precedence shall be defined by the more stringent penalty.

B. By submitting a Bid, the Contractor thereby certifies that it is qualified in all areas pertaining to, either directly or indirectly, the work and all known industry standards. In the event the Contractor becomes unable to complete the work in accordance with the Contract documents, or to the satisfaction of the Engineer due to a lack of understanding of equipment, systems or services required by the Contract documents, it shall be the responsibility of the Contractor to retain the services of the applicable subcontractor or manufacturers' representatives to expeditiously complete the work in accordance with the Engineer's construction schedule with no additional cost to the Department.

C. If the Contractor is unable to meet the Contract obligations or to the satisfaction of the Engineer, the Department may give the Contractor written notice specifying the delay constituting default and the action required to be taken by them if the Contractor does any of the following:

(1) Fails to prosecute the work with the labor, equipment, or materials sufficient to complete the work within the contract time and according to the specifications.

(2) Performs the work improperly.

(3) Neglects or refuses to remove material and to reconstruct work that has been rejected as defective and unsuitable.

(4) Fails, for any reason, to carry on the work according to the contract.

D. If any of the following happens, the Department will have full power and authority to take the work out of the hands of the Contractor, including appropriation and use of any of the materials on the project, and use contract or any other method that the Department determines may be required to complete the work:

(1) The Contractor, within the time specified in this proposal, does not proceed satisfactorily.

(2) The Contractor commits any act of bankruptcy, becomes insolvent or is declared bankrupt.

(3) A final judgment against the Contractor is allowed to remain unsatisfied for five days.

(4) The Contractor makes an assignment for the benefit of the Contractor's creditors.

(5) The Contractor files or if there has been filed against the Contractor, proceedings for reorganization, under the Bankruptcy Act.

E. When the Department takes over uncompleted work, all additional costs and damages, and the costs and charges of completing the work, shall be deducted from monies due or to become due to the Contractor. If the total of the damages, costs and charges exceeds the balance of the contract price that would have been payable to the Contractor had the Contractor completed the work, then the Contractor shall, on demand, pay to the Department the amount of the overage.

F. The Contractor shall be charged liquidated damages for any delays or downtime not caused by natural causes (such as weather) in the amount of $1550.00 per day, in accordance to Section 108 of the 2003 Standard Specifications. Liquidated damages will continue to be incurred on a daily basis until final system acceptance is completed and approved by the Engineer.

6. Existing ATMS Network and System Overview

A. The existing ATMS network and system as-built diagrams are included in the Contract documents. Additional details are shown on the Plans.

B. The existing ATMS network, system and field devices at a minimum are comprised of:

(1) Leased backbone network fiber

(2) Department owned wired and wireless infrastructure

(3) Advanced Traffic Management System (hardware and software)

(4) OC-48 SONET/ATM

(5) M-JPEG A-D converters (en/decoders)

(6) Analog video matrix switchers, amplifiers and titlers

(7) Local Area Network (LAN) including IP Ethernet 10/100/1000/10 Gbps (10GbE) Switchs

(8) Dynamic Message Signs (DMS)

(9) Closed Circuit Television (CCTV) Surveillance Cameras

(10)Warning Flashers for Queue

(11)Vehicle Detector Stations (VDS)

(12)Inter-agency Communications / Video Sharing

(13)Loop Detectors

(14)Network communication Hubs and nodes

(15)Terminal Servers/Port Servers

(16)Optical Transceivers / Media Converters

(17)Communications media - fiber optic cable, wireless and microwave

(18)Wireless IEEE 802.11 communications standards

(19)Network communication Hubs

(20)Terminal Servers/Port Servers

C. As depicted on the Plans, the existing TMC is connected by a combination of Department and Verizon conduit and fiber. Conduit along Howard Street (belonging to Verizon) contains leased fiber to and from Hub 2. Nine 3-inch conduits along M-10 (belonging to the Department) contain Verizon leased fiber to and from Hub 9. The Department owned conduit is connected to Verizon owned conduit along Fort St.

D. Fiber leased from Verizon travels to/from the TMC to Hubs 2, 6, 9 and 10 to complete a ring topology. This topology provides failover of network signaling via multiple paths for data and network traffic. If one section of the ring is disconnected, there is not a disruption in communication (e.g. a failover in signal occurs).

E. Department wired and wireless infrastructure along these corridors is primarily used for ITS field device connectivity. Connectivity is provided with a Department owner wireless link on the rooftop of the existing MITS Center and fiber along M-10 (NB and SB).

7. New ATMS Network and System Overview

A. The new ATMS network and system details are shown on the Plans.

B. The new ATMS network, system and field devices at a minimum are comprised of:

(1) Leased backbone network fiber

(2) Department owned wired and wireless infrastructure

(3) Interim Advanced Traffic Management System (hardware and software) comprising of 360 Cameleon ITS

(a) Eventual transition to Statewide ATMS platform (hardware and software) comprising of Delcan's ATMS software

(4) WDM communications core

(5) 10 Gigabit Ethernet network backbone

(6) MPEG-4 A-D converters (en/decoders)

(7) Digital video wall(s), video amplifiers and titlers

(8) Wide Area Network (WAN)

C. The intent of the new ATMS network and system is to operate concurrently with the existing ATMS network and system.

D. Ethernet based network connectivity will be established to communication Hubs 2, 6, 9, 10 and Nodes 4, 5, 7 and 8 while the existing network connectivity will remain intact as-is.

E. The Interim ATMS platform will be Ethernet based.

b. Materials.

1. Not Applicable

c. Construction.

1. Installation

A. Requirements are outlined in equipment specific Special Provisions, Basic Methods and Materials for ITS Work and ATMS Integration and Implementation Special Provisions.

B. The communication system integration and implementation must be accomplished in such a manner which does not impede day-to-day system operational functions unless agreed upon in advance with the MDOT Engineer. Any expected downtime and system cutovers must be scheduled during off-peek travel times, nights or weekends with the MDOT Engineer. All durations must be approved by the MDOT Engineer prior to commencement.

C. Verizon Coordination: Coordinate the relocation of existing Verizon (MCI) leased fiber (and conduit as applicable) from the existing traffic management center (MITS) to the new traffic management center with Verizon. Coordinate amendments to the Department's contract(s) with Verizon, the Department reserves the right for all decision making.

(1) All associated costs for new conduit and fiber installation or relocation and contract modifications will not be measured or paid for separately.
(2) The Contractor is responsible for all costs incurred from Verizon and must be included with their bid. Fiber and conduit relocation or installation shall not disrupt any of the remaining systems operational status.
(3) All new fiber (including any modifications to existing) must be provided, installed and spliced (as applicable) by Verizon to maintain existing lease, warranty and maintenance contract requirements.

2. Construction Sequence and Phasing

A. General Overview. This project will establish a connection to the ATMS network backbone and enable operations to be seamlessly transitioned from the old TMC to the new TMC as the Department deems necessary. To mitigate downtime, a two phased approach is required for adding the new TMC on the leased fiber ring and eliminating the existing TMC's dependency. The high-level steps include establishing a fiber interconnection between TMCs, completing the new TMC turn-up, enabling access to both ATMS software platforms from both TMCs, removing the current TMC from the fiber ring and creating a spur connection back to the new TMC. Listed below are additional details of each phase.

(1) Phase I:

(a) Conduit Build Out: As shown on the Plans the new TMC building construction project will construct conduit and handholes on the new TMC property which will be used in the overall fiber/conduit design to establish a connection to Verizon's leased fiber network, connection to both TMCs and connection to M-10.

(b) All conduit shall be owned by the Department. The only expection is where connection into Verizon owned conduit is required. These connection types shall have a MDOT owned demarcation point (such as a handhole) between conduits.

(c) All new conduit must be constructed during Phase I, including the following locations:

(i) New conduit across 5th Street and Lafayette Boulevard to connect the conduit on the new TMC property to the existing Department conduit along M-10.

(ii) New conduit to connect the new TMC to the existing Verizon conduit along Fort Street (at 6th and 5th).

(d) ATMS Network Backbone Fiber Connection: The existing TMC has two parallel fiber connections coming into the center that are leased from Verizon, one to/from Hub 2 and the other to/from Hub 9 to complete a ring network.

(i) To minimize downtime, all new fiber must be installed in-ground prior to commencing cut-over.

(ii) Fiber connections as shown on the Plans need to be established from the new TMC to Verizon's leased fiber network and between TMCs to allow both TMCs onto the ATMS network simultaneously while completing the fiber ring for redundancy.

(iii) Coordinate with Verizon for construction build-out details, listed below are the minimum requirements:

1) Establish a new fiber connection between the new TMC and Verizon's CO for Hub 9.

2) Establish a center-to-center connection between TMCs to complete the leased backbone fiber network ring when each building is only connected to a single leg of the leased fiber.

3) Disconnect fiber between the existing TMC and Verizon's CO for Hub 9.

(e) Inter-building Fiber Connection: Between TMC's (new and existing)

(i) To minimize downtime, all new fiber must be installed in-ground prior to commencing cut-over.

(ii) Fiber connections as shown on the Plans will be installed between both TMCs for a Department owned connection, utilized to facilitate center-to-center connectivity during Phase II between 10 Gigabit Ethernet Network Switches

(f) Testing: The existing TMC will continue operating as normal, with access to both existing and interim ATMS platforms. The new TMC will be on the leased network backbone with network infrastructure in place to facilitate communication between the interim ATMS platform and field devices.

(i) Testing requirements are outlined in the equipment specific Special Provisions, Basic Methods and Materials for ITS Work and ATMS Integration and Implementation Special Provisions. Listed below are the minimum requirements:

(ii) Install, test and turn-up network infrastructure (WDM Communications Controller and 10 Gigabit Ethernet Network Switch) in new TMC.

(iii) Test, demonstrate and validate existing and interim ATMS platforms from existing TMC to ensure full operational functionality has not been impacted.

(iv) Test, demonstrate and validate interim ATMS platform from new TMC to ensure full operational functionality has been achieved

(2) Phase II:

(a) ATMS Network Backbone Fiber Connection: After successfully completing Phase I, each TMC will have a single leased Verizon fiber connection coming into the center and a leased Verizon inter-building connection which completes a fully redundant ring network.

(i) To minimize downtime, all new fiber must be installed in-ground prior to commencing cut-over.

(ii) Fiber connections as shown on the Plans need to be established from the new TMC to Verizon's leased fiber network completing the fiber ring for redundancy. Coordinate with Verizon for construction build-out details, listed below are the minimum requirements:

1) Establish a new fiber connection between the new TMC and Verizon's CO for Hub 2 to establish two lateral paths on the fiber ring for redundancy.

2) Disconnect fiber connection between the existing TMC and Verizon's CO for Hub 2.

3) Remove existing TMC from fiber ring and connect as a spur to new TMC via the Department owned fiber interconnection between buildings established during Phase I and center-to-center connectivity between 10 Gigabit Ethernet Network Switches.

4) Remove Verizon fiber interconnection between buildings established during Phase I to complete ATMS network backbone fiber ring.

5) Establish a fiber connection between the SONET/ATM interface in the existing TMC to the WDM Communications Controller in the new TMC.

6) Disconnect and salvage the WDM Communications Controller in the existing TMC. This must be provided to the MDOT Engineer.

(b) Testing: The existing TMC will continue operating as normal, with access to both existing and interim ATMS platforms. The new TMC will serve as a pass-through for the existing TMC to access ITS field devices from the existing and interim ATMS platforms. The new TMC will be on the leased network backbone with network infrastructure in place to facilitate communication between the existing and interim ATMS platform and field devices.

(i) Testing requirements are outlined in the equipment specific Special Provisions, Basic Methods and Materials for ITS Work and ATMS Integration and Implementation Special Provisions. Listed below are the minimum requirements:

(ii) Test, demonstrate and validate existing and interim ATMS platforms from existing TMC to ensure full operational functionality has not been impacted.

(iii) Test, demonstrate and validate existing and interim ATMS platforms from new TMC to ensure full operational functionality has been achieved.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIFICATION
FOR
BASIC METHODS AND MATERIALS FOR ITS WORK

a. Description.
This special provision describes the basic materials and methods for Intelligent Transportation Systems (ITS), required for this project. This work shall be done in accordance with the 2003 *Standard Specifications for Construction* except as modified herein, the contract documents, manufacturer's instructions, and shop drawings.

1. General.
   A. This special provision applies to all work to be completed in this project including but not limited to:
      (1) ITS communications network infrastructure for core communication backbone
      (2) ITS communications network infrastructure for field devices
      (3) System configuration and integration
      (4) System testing, validation and documentation
   B. The Contractor will furnish, install, test and integrate all equipment and components necessary to provide full and complete ITS functionality in all respects, without additional expense to the Department.

2. Permits and Licenses.
   A. Acquire the permits and necessary insurance riders for all required utility and inspection permits, including all costs associated with these permits and insurance riders.
   B. The Contractor is responsible for all overtime inspection costs by utility companies and other agencies required for work performed at the discretion of the Contractor outside the utility company's normal working hours.
   C. The Contractor is responsible for payment of all utility bills and charges prior to equipment acceptance by MDOT. All utility accounts will be transferred as designated by the Engineer within two weeks of equipment acceptance by the Engineer.
   D. Construction Phase Submittals.
      (1) General
         (a) Except for the project Close Out Documentation, all shop drawings, schematics, material lists, and details will be submitted to the Engineer within 90 days of Contractor's Notice to Proceed
         (b) No extension of time will be allowed due to Contractor's failure to complete and obtain acceptance of any submittal nor will delays to the project for completing this work be allowed as the basis of any claim. Seven copies of

each submittal shall be transmitted to the Engineer, unless otherwise specified

(c) Submittals not transmitted as specified will be returned without review, and must be resubmitted

(d) Review and acceptance of submittals by the Engineer does not relieve the Contractor of the responsibility for errors or conformance with the contract documents

(e) All submittals will be accompanied by a Letter of Transmittal that includes the following information:

(i) Date of submittal
(ii) Name of company making submittal
(iii) Name of the Contractor sending submittal
(iv) State Job Number and Control Section
(v) Federal aid project number
(vi) Itemized list of enclosures (e.g., five copies of Inside Wiring Submittals)
(vii) Recipient name and department (i.e. to the attention of …)
(viii) Action requested (e.g., please review submittals for approval)

(2) Required Submittals:

(a) Site Evaluation Report: Submit Site Evaluation Reports for all sites requiring assessment of construction site prior to equipment installations as detailed in the Plans

(b) Shop Drawings and Equipment Data

(i) Submit Shop Drawings and Equipment Data for all prefabricated ITS equipment and components if required by the contract documents.
(ii) Submit samples if required by the contract documents, or if requested by the Engineer.
(iii) Shop Drawings
(iv) Allow 10 working days for the Engineer to review detailed plans prior to authorization to commence installation
(v) Verify, in writing, final hardware and software installation configuration plans with the Engineer prior to any field installation
(vi) Equipment Data
(vii) Prior to ordering material, submit equipment data information. Equipment data sheets shall clearly state equipment compliance with equipment specifications
(viii) Submit five indexed and bound sets of equipment data including but not limited to the following items identified in individual specification and special provision sections (see Table 1 – next page).

Table 1: Individual Specification Provision Sections

4	ATMS NETWORK OVERVIEW
4.1	BASIC METHODS AND MATERIALS FOR ITS WORK
4.2	PROTECT ITS INFRASTRUCTURE
4.3	ATMS INTEGRATION AND IMPLEMENTATION
4.4	STRUCTURED CABLING
4.5	COMMUNICATIONS GROUNDING AND BONDING
4.6	AIR-BLOWN FIBER-OPTIC (ABF) TUBE & CABLE INFRASTRUCTURE
4.7	10 GIGABIT ETHERNET NETWORK SWITCH
4.8	WDM COMMUNICATIONS CONTROLLER
4.9	CONDUIT, DIRECTIONAL BORE, (number), _ Inch
4.10	GROUNDING AND BONDING
4.11	ITS CONDUIT CONSTRUCTION
4.12	LIGHTNING PROTECTION
4.13	CONDUIT CLEANING AND TESTING

(ix) List in the index equipment being submitted and the specification section references

(x) Equipment includes, but is not limited to, the following:

- A complete equipment list including manufacturers' names, model numbers, and quantities of each item; manufacturers' data sheets on all equipment items, including parts list and part numbers; performance characteristics and capacities; dimensions and clearances; wiring diagrams and controls; and other pertinent information
- Equipment racks and console layouts showing locations of all equipment items
- Construction details for any custom fabricated items, including interfaces, panels, removable control panels, and wall plates. These details shall show dimensions, materials, finishes, and color selection
- ITS schematics showing detailed connections to all equipment with wire/cable number, terminal block number, and color-coding. Distinct wire numbers shall be translated to label permanently affixed to each cable. Device connection and protocol information, and labeling schema shall also be provided
- Contractor or its subcontractors certificate by the manufacturer to install the equipment

(c) Work Plan:

(i) Submit Work Plan to the Engineer for review at the preconstruction meeting

(ii) The Work Plan will be discussed at the preconstruction meeting. Within two weeks of receipt, the Engineer will either accept the plan as

submitted or request revisions. First two weeks schedule will be reviewed at the preconstruction meeting and the Engineer will approve or request change to the first two weeks schedule as a part of the meeting

(iii) Work on this project will not begin until the Work Plan has been accepted by the Engineer

(iv) The Work Plan will include primary work tasks and schedule for each indicating start and completion dates with clear identification of long lead-time items and critical path tasks

(d) Material Handling and Storage Plan

(i) Thirty days prior to any equipment arriving at the site, submit 10 copies of a Material Handling and Storage Plan to the Engineer

(ii) The Material Handling and Storage Plan will give details of the equipment and facilities to be provided and the procedures to be adopted by the Contractor for the safe and efficient handling and storage of all equipment and material

(iii) The Engineer will review the plan and respond within 10 workings days of receipt indicating either acceptance or rejection with required changes of the plan

(iv) Address all comments and resubmit the plan within seven working days after receiving the rejection notice and comments

(v) Do not ship materials to the site until the Materials Handling and Storage Plan is accepted by the Engineer

(vi) The Department will not make provisions for temporary storage of equipment prior to deployment in specified locations. All costs incurred in storage, setup, handling, and transportation shall be included in bid

(vii) The Department assumes no responsibility for stored equipment. The ownership and title to equipment shall not be vested in the Department before the equipment has been delivered, tested, and accepted

(viii) All equipment shall be fully insured and maintained by the Contractor until final acceptance by the Engineer

(ix) The Contractor is encouraged to minimize the amount of time equipment is stored in an outside environment

(e) Equipment Installation Plan

(i) Thirty days prior to the first installation of equipment, submit 10 copies of the Equipment Installation Plan to the Engineer. Should the Equipment Installation Plan may be integrated into the Work Plan, the submittal time frame of the Work Plan applies

(ii) The Engineer will review the plan and respond within 10 working days of receipt indicating either acceptance or rejection with required changes of the plan

(iii) Address all comments and resubmit the plan within seven working days after receiving the rejection notice and comments. The approved plan shall be used for all subsequent installations of similar equipment

(iv) The Equipment Installation Plan includes, but is not limited to, the following:

- Details of equipment to be used for installation

- Name, contact information and details of relevant experience of Contractor's personnel to be involved
- Details and sequence of procedures to be employed for equipment installation
- Location, date and expected time of installation
- Details of precautionary measures to be adopted to avoid damage to the equipment
- Details of repair facilities/measures available to rectify any damage to the equipment during installation

(f) Test Plan:

(i) Submit a complete Test Plan to the Engineer for review and acceptance prior to commencing any testing. Allow sufficient time for this review such that it is accepted by the Engineer at least 14 days prior to the start any testing

(ii) Include details of the Pre-Construction Testing, Construction Phase Testing and Final Inspection and Acceptance Testing as specified in this special provision. In addition, address all material and equipment testing required by the contract documents

(iii) Include a schedule of each step of testing process; identification of all test equipment to be utilized; and identification of each independent testing subcontractor to be employed to conduct specified testing

(g) Close Out Documentation: provide the following items as part of the Close Out Documentation after construction has been completed

(h) Record Documents:

(i) Maintain a set of record "As-Built" documentation and plans during the course of installation

(ii) These documents will be updated weekly by the Contractor to reflect current approved design changes and as-built information

(iii) Completed record documents and plans will be turned over to the Engineer at the completion of work

(iv) Record Documents will indicate, but not be limited to, the following:

- All approved changes and/or deviations from the contract documents
- Equipment model, serial number, and location
- ITS diagrams labeling all connections to equipment
- Maintenance and operation information adequate to operate all required features of all equipment without other technical support
- Service entrance facilities
- Main cross-connects
- Telecommunications closets, equipment rooms, handholes and manholes
- Splices
- Hand holes and junction boxes with their associated identifying label
- Location of all devices with device identification and cable routing
- Other material and equipment as-built details required by the contract documents

(i) Application Software
  (i) Provide necessary application software (including any applicable licenses) to allow the Department to edit diagram(s) as needed. If the Department has current software for managing this information, use the Department's current standards in developing this information

(j) Other Documentation:
  (i) Provide a graphical diagram of equipment connections on CD-ROM, and 8.5 inch by 11 inch paper copies indicating the Department identification and locations, as well as details of interconnection to other devices including media types.
  (ii) Provide complete ITS configuration, including any default settings modified on the ITS in both Microstation (.dgn) and Portable Document Format (.pdf) formats
  (iii) Provide both bound and indexed paper medium and CD-ROM media documentation of all equipment and associated parts with manufacturer's nameplate, giving name of manufacturer, description, size, type, serial number, and other specifications per building, to facilitate maintenance or replacement. Nameplate of distributor or Subcontractor is not acceptable. These electronic file(s) will be in Microsoft Access database format (.mdb). Provide two sets of cable termination records for copper and fiber optic feed cables in a bound paper medium
  (iv) One set will be left on-site in each associated telecommunications closet or cabinet (in a water-tight resealable envelope), and the second set shall be provided to the Engineer upon project completion. Cross connect and patching information will be filled out in pencil, to facilitate future changes

b. Materials.

Furnish new materials and equipment. Where no specific kind or quality of material is specified, furnish industry standard materials, as approved by the Engineer.

1. Materials will be produced by a company that has been engaged in the manufacture of such types of materials for a period of at least five years. All equipment must be factory manufactured and come with a minimum three year manufacturer's warranty.

2. The Contractor is responsible for protecting materials before, during, and after installation, until maintenance of the material is officially transferred to the Department. In event of damage, the Contractor will make all repairs and/or replacement necessary to restore the material to its original state within the timeframe agreed upon with the Engineer and at no additional cost.

3. Supply the most recent version of all equipment hardware and software. A prior and/or old version of equipment, unless specifically identified as an exception to this requirement or approved by the Engineer, is not acceptable. In cases where a newer version of the equipment is available at the time of installation, the Contractor must request a clarification from the Engineer on which equipment is to be used.

4. Deliver all material to the job site in original unopened containers, where applicable, with all labels intact and legible at time of use. Store all materials in accordance with

manufacturer's recommendations and the accepted Materials Handling and Storage Plan.

5. The Contractor shall provide and install all available software upgrades through final acceptance. The exception shall be if such installation will compromise ITS functionality, subject to review and approval of the Engineer.

6. The Contractor shall furnish and install all patch cables to cross connect all available equipment. Patch cables shall be color-coded as follows in Table 2:

Table 2: Patch Cable Colors

	Patch Cable	Color
Telephone	Switch-to-Patch Panel	Gray
Telephone	Patch Panel-to-Patch Panel	Gray
Data	Server-to-Switch	Red
Data	Router/Switch/Other	Orange
Data	Hub-to-Switch	Yellow
Data	Hub-to-Hub	Green
Data	Hub-to-Patch Panel Workstation)	Blue
Data	Workstation-to-Wall	Blue/Gray/Beige

7. Transient voltages, surges, and sags shall not affect the equipment operations.

8. The equipment shall meet all the requirements in Section 2.1.4 - Power Interruption of the National Electrical Manufacturer's Association (NEMA) standard TSI for traffic control ITS and Section 2.1.6 - Transients, Power Service of the NEMA standard TSI.

9. The equipment shall be modular in design to allow major portions to be readily replaced in the field.

10. The equipment design and construction shall utilize the latest available techniques with a minimum number of different parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.

11. The equipment shall be designed for ease of maintenance. All equipment parts shall be readily accessible for inspection and maintenance. Test points shall be provided for checking essential voltages and waveforms.

12. All external screws, nuts, and locking washers shall be stainless steel. No self-tapping screws shall be used unless specifically approved by the Engineer. All parts shall be made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum, or brass. An inert dielectric material shall separate dissimilar metals.

13. Equipment Warranties.
    A. Provide a statement of warranty for all equipment and complete documentation of the procedures to initiate warranty service calls.

B. Except as noted, beginning with the date of notice to proceed and continuing for a period ending one year after the date of acceptance by the Engineer, the Contractor will provide the following services:
   (1) Furnish a warranty of all hardware, software, and related equipment.
   (2) Transfer ownership and warranties of all purchased hardware, equipment, and software to the Department
   (3) The Department will be the sole Owner of all equipment software or the registered licensee as appropriate
   (4) Pay for the cost of ownership or license of software during the warranty period.
C. The Manufacturer shall repair any failed equipment covered by warranty that can be repaired on-site within 48 hours of notification of failure.
   (1) Replace equipment requiring removal from site for repair or any equipment requiring replacement with a new unit within five days of notification of failure
   (2) New replacement equipment will continue the original warranty of the replaced unit except where the warranty provided by its supplier or manufacturer is longer. The cost of shipping of failed equipment is the responsibility of the Contractor
   (3) If equipment cannot be replaced with identical equipment, the Engineer will provide approval after review of the Contractor's provided options

c. Construction.

1. General Requirements:
   A. Optimize all hardware, firmware, and software settings to function, perform, and are managed via the communications network.
   B. Furnish, install, and properly configure software license programs as specified by manufacturer.
   C. Install, set in place, initialize, and configure all specified and/or included equipment for full and final operation.
   D. Provide full-featured operation of all ITS elements and demonstrate this operation to the Engineer by completion of all activities described in the accepted Test Plan.
   E. Comply with working clearances and dedicated spaces per NEC Articles 110, 384 and 800-5, as well as all current NEC articles, and Federal, State and Local regulations.
   F. Execute work in a manner which preserves and protects warranties of all equipment, whether or not the equipment is a part of this project.
   G. Ground and bond all equipment and materials as required by National and Local Standards, these Specifications, and as noted on the plans.
   H. Install all equipment such that the failure of any single equipment shall not cause the failure of any other equipment in the ITS.

2. Cutting and Patching:
   A. Complete all cutting and patching necessary for installation of work with approval of the Engineer.
   B. Use rotary type drilling tools and concrete cutting saws to cut concrete and masonry walls.
   C. Use rotary type drilling tools to cut cabinets where knock-outs are not available and cable access is required.
   D. Provide a firestop as required.

E. Ensure waterproof holes through exterior walls and ground floor.
F. The Contractor shall not impair strength or function of object being cut or patched, (e.g., do not weaken structural members).
G. Do not use a torch for cutting metal

3. Wiring Requirements:
   A. All wiring will meet the requirements of the National Electric Code. All wires will be cut to proper length before assembly.
   B. No wire will be doubled-back to take up slack.
   C. Neatly lace wires into cable with nylon lacing or plastic straps, and secure cables with clamps.
   D. Provide service loops at all connections.
   E. All DC relays, solenoids, and holding coils shall have diodes or other protective devices across the coils for transient suppression.
   F. The equipment shall contain readily accessible, manually resettable, or replaceable circuit protection devices (such as circuit breakers or fuses) for equipment and power source protection.
   G. Circuit breakers or fuses shall be provided and sizes such that no wire, equipment, connector, PC board, or assembly shall be subjected to sustained current in excess of their respective design limits upon the failure of any single circuit element or wiring.
   H. All external connections shall be made by means of connectors. The connectors shall be keyed to preclude improper hookups. All wires to and from the connectors shall be color-coded and appropriately labeled. In order to assure compatibility and performance compliance, the cables from the dome camera housing shall be assembled by the camera manufacturer.
   I. All pins and mating connectors shall be plated to provide good electrical connection and resist corrosion. Connectors utilizing solder type connections shall have each soldered connection covered by a piece of heat shrink tubing securely shrunk to insure that it protects the connection.
   J. Modules of unlike functions shall be mechanically keyed to prevent insertion into the wrong socket or connector.
   K. All modules and assemblies shall be clearly identified with name, model number, serial number, and any other pertinent information required to facilitate equipment maintenance.
   L. Each control panel shall be one integral unit with self-contained power supplies or shall draw its power from the camera controller.
   M. All external connections shall be made by means of connectors. The connectors shall be keyed to preclude improper hookups. All wires to and from the connectors shall be color-coded and/or appropriately marked. Pins and mating connectors shall be plated with a minimum of 20 microns of gold.
   N. Connecting harnesses of appropriate length and terminated with matching connectors shall be provided and installed for interconnection with the communications equipment interface.

4. Power Requirements:

A. The equipment operation shall not be affected by the transient voltages, surges, and sags normally experienced on commercial power lines. It is the Contractor's responsibility to check the local power service to determine if any special design is needed for the equipment. The extra cost associated with any special design of the equipment to operate with local power service, if required, shall be included in the bid price.
B. AC power cables shall be run separately from the communications signal cables.
C. The equipment used shall be designed to protect personnel from exposure to high voltage during equipment operation, adjustments, and maintenance.
D. All electrical equipment shall meet all of its specified requirements when it is supplied from:
   (1) 100 to 240 VAC, 50/60 Hz electricity for equipment with AC to DC switching power supplies.
   (2) 120 VAC plus or minus 20%, 60 Hz plus or minus 3 Hz electricity for equipment with AC to DC wall power adapter.
E. The equipment shall be powered from the output of an uninterruptible power supply (UPS). The maximum power required shall not exceed 300 watts.
F. The Contractor shall comply with the working clearances and dedicated spaces per NEC Articles 110, 384, and 800-5, as well as all current NEC Articles, and Federal, State and Local regulations.
G. The appropriate surge protector shall be installed to protect power conductor and control conductor (including return conductors).
H. The equipment shall meet all the requirements of Section 2.1.6 -Transients, Power Service of the NEMA standard TSI.
I. The ITS management software shall have the capability to detect when critical equipment experiences intermittent or permanent loss of power. The ITS management software shall identify the equipment that experienced the power loss.

5. Integration:
   A. The Contractor is responsible for the integration of all ITS devices, subsystems and systems included on this project. This integration task will include, but not limited to, field/central control verification of communications network interoperability with the existing ITS network, the verification of the interoperability of all ITS devices included on this project and existing to the ITS network, integration of all devices, subsystems and systems within the Advanced Traffic Management System (ATMS) - ITS central control software and the integration of equipment required for a fully functional ITS system contained with in the project limits. It is the responsibility of the Contractor to arrange for entrance into field cabinets, MITS Center or any other facility that is required for the completion of the work described herein.

6. Equipment Testing and Acceptance Requirements:
   A. The Contractor shall submit a complete Test Plan for the Engineer's review and acceptance prior to commencing any testing. If any modification to equipment is made, the Contractor shall repeat the testing according to the accepted Test Plan to ensure changes do not conflict with other equipment. Upon completion of any testing, written reports shall be submitted to the Engineer stating the results of the tests and any actions taken as a result of these tests.

B. Payment schedules shall be dependent on the successful completion of these testing benchmarks (refer to individual equipment special provisions contained in the contract documents).
C. All tests must be conducted in the presence of the Engineer.
D. The Contractor is responsible for furnishing all test equipment required to test the ITS in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the ITS. The Contractor shall furnish test equipment with greater accuracy than the parameters to be tested.
E. All major and minor failures that occur and the corrective actions taken shall be maintained in a Failure Log, and provided to the Engineer. A record of failed equipment serial numbers shall be included in this log.
   (1) A major failure shall be defined as having occurred if any one or more of the following occur: (Note: The 60-day test clock shall be reset to zero and restarted after major failures are corrected to the satisfaction of the Engineer.)
      (a) Less than 95 percent of any individual ITS equipment is operational at any moment.
      (b) Any failure that requires greater than 24 hours to correct.
      (c) Frequent occurrence of minor failures indicating a major ITS flaw as determined by the Engineer.
   (2) A minor failure is any other failure. The 60-day acceptance test period shall be stopped when a minor failure occurs and restarted without resetting to zero after the minor failure is corrected to the satisfaction of the Engineer.
F. Pre-Construction Testing –
   (1) Pre-Construction Testing shall provide the Engineer with a comprehensive proof of concept test demonstrating ITS equipment and components working interactively.
   (2) The Contractor shall perform a comprehensive pre-test of the configuration and assembly details in the presence of the Engineer prior to any field installation. The procedures shall be as stated in the accepted Test Plan.
G. Construction Phase Testing –
   (1) After the Pre-Construction Test has been completed and 30 days prior to the anticipated date of acceptance of Construction Phase Testing, Construction Phase Testing is expected to begin.
   (2) The Contractor shall verify in writing that the ITS equipment and components meet all of the requirements of the specifications and complies with all appropriate standards listed in these specifications.
   (3) This testing shall be designed to validate that the ITS equipment and components works together to provide full ITS functionality prior to the Final Inspection and Acceptance Testing.
H. Final Inspection and Acceptance Testing -
   (1) The earliest of two weeks prior to the final inspection or within sixty days of project completion, deliver to the Engineer four copies of a certificate by the authorized representative of the manufacturer that the ITS has been properly installed, adjusted and pre-tested.
   (2) At the Final Inspection, a representative of the equipment manufacturer shall demonstrate to the Engineer that the ITS functions as specified in the Plans and Special Provisions.

(3) There shall be an Acceptance Test period of 60 days after completion of the Final Inspection to identify, isolate, and correct any problems with the hardware, software, and interfaces. All problems discovered by the Contractor or Engineer shall be corrected to the satisfaction of the Engineer.

I. Final Acceptance -
(1) Final acceptance of the complete and operating ITS will be made by the Engineer only after all of the following have been achieved.
(2) Successful completion of Acceptance Testing per the Test Plan that was accepted by the Engineer.
(3) Engineer receipt, review, and approval of all Acceptance Test data and results.
(4) Successful completion and delivery of all contract deliverables including all project documentation referenced in this or other special provisions.
(5) Field equipment shall operate continuously for 24 hours per day, seven days a week for the duration of the 60 day acceptance test period, during which the equipment shall experience no major failures.

7. Equipment Identification:
A. Equipment shall be identified on each item with high quality, smear resistant, computer-generated labels, and established for logical identification in compliance with EIA/TIA 606, Specifications, or as directed by the Engineer. Labels shall be Brady or approved alternate and shall meet or exceed the legibility, defacement, and adhesion requirements specified in UL969, and meet or exceed the general exposure requirements in UL969 for indoor or outdoor use, whichever applies. Labeling identifiers shall be EIA/TIA 606 3.4. (Except jacks), followed by an identifying number or letter.
B. Each type of equipment, pathway, or space shall have a separate labeling scheme (e.g., there may be TC1, BC1, etc. within a building). Jacks shall be labeled with TC number, cabinet number, patch panel number, then port number unless noted otherwise (e.g., A-2-4-24 would be Closet A, Cabinet 2, patch panel 4, terminated on the 24th port; ensure all cabinets and patch panels are labeled accordingly).
C. Label plug-end of power cords identifying equipment powered.

8. Construction Site Cleanup:
A. The Contractor shall remove from the site all debris accumulating as a result of installation and properly dispose of all debris according to the standard specifications.
B. The Contractor shall leave all rooms, cabinets, and facilities in a clean condition.
C. The Contractor shall clean interiors of all cabinets, furniture, and equipment enclosures. The Contractor shall clean all equipment prior to acceptance testing. All equipment shall appear in new condition.

d. Measurement and Payment.

The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
CONDUIT CLEANING AND TESTING

DES:MM 1 of 1 C&T:APPR:XXX:YYY:00-00-00

a. Description. The work of consists of locating, clearing and testing existing conduit.

b. Materials. None specified.

c. Construction.

1. Clear existing conduit of all dirt, water, excess concrete, and other foreign materials with a dry swab and mandrel.

2. Test the suitability of the conduit for use by pulling a mandrel and swab through it in the presence of the Engineer. Use a mandrel 12 inches long (shorter in conduit runs with bends) and 1⁄2 inch smaller in diameter than the conduit.

3. If the test demonstrates that the conduit is suitable, install a pull rope in the conduit. If the conduit will not be used immediately, tie each end of the rope in the box or cabinet at the end of the conduit segment and seal each end of the segment in a manner that prevents the entry of water and rodents.

4. If the conduit is found to be damaged, present the engineer with a recommendation for repairing or bypassing the damage.

5. For ease of installation of trunkline fiber optic cables (96 strand and larger), couplings may be installed between conduit entry and exit in existing handholes. This would provide a “pass through” route for the cable to be pulled without needing to stop at every handhole. This should not be done for any bends in the conduit run of more than 5 degrees, and should only be added to subsequent handholes such that the continuous length of pull between hand holes is no more than 1500 feet for any single cable pull. This construction method is allowable, but not required. All materials must be approved by the Engineer before use, along with an installation plan. Any work associated with this will not be paid for separately.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIFICATION
FOR
ATMS INTEGRATION AND IMPLEMENTATION

a. Description.

System integration and implementation provides a consolidated communications infrastructure to be used by network systems for transmission of data and video signals between the traffic management center(s) and ITS field devices. This work includes but is not limited to coordination with other projects and contractors and modifying or fine-tuning equipment, software, system parameters and configurations to achieve a consolidated communications infrastructure that operates together properly. In addition testing, retesting and validating the systems after each change has been made.

1. General
   A. Furnish, install, integrate, test, and warranty all equipment and required ancillary components necessary to provide a complete and fully functional system in all respects, without additional expense to MDOT.
   B. All equipment required for the installation, integration and testing of components and subsystems contains within this project must be supplied by the Contractor as an appurtenance to the electronic equipment included within the project and at no additional cost to MDOT.
   C. All work shall be coordinated with the MDOT Engineer.

2. Summary
   A. Refer to ATMS Network Overview Document Section a.2.

3. Requirements of Regulatory Agencies and Standards
   A. Refer to ATMS Network Overview Document Section a.3.

4. Qualifications
   A. Refer to Network Overview Document Section a.4.

5. Submittals
   A. In addition to the requirements outlined in equipment specific Special Provisions and the Basic Methods and Materials for ITS Work Special Provision, the Contractor shall provide the following.
   B. Any modifications on materials that were given to the Contractor to support their work as part this contract will be turned over to MDOT at the time of acceptance test in both written and electronic document formats.
   C. A full set of as-built documents will be submitted to MDOT within 5 business days of the completion of acceptance testing, and before MDOT provides the sign-off on project completion.

6. Administration - Documentation & Equipment Identification

A. In addition to the requirements outlined in equipment specific Special Provisions and the Basic Methods and Materials for ITS Work Special Provision, the Contractor shall provide the following.
B. All documentation will submitted to MDOT in writing.
A. System wiring diagrams shall show all system components, wire numbers, color codes, pin numbers, component locations and connections, depicting the “as-built”, final configuration.
C. Rack elevation and wiring diagrams shall depict the front views of the equipment racks identifying all equipment installed within. Complete wiring diagrams of the racks shall also be included.
D. Documentation for any equipment installed as part of specification package will include Manufacturer, Make, Model, Serial Number, and date of install, warranty period by date.
E. The CONTRACTOR will assemble, maintain and track equipment user and administration guides for all equipment that is installed as part of this specification package.
   (1) All manuals will be labeled and turned-over to MDOT during or prior to acceptance test.
F. All equipment will be labeled with IP address and HOSTNAME and participating network information on the front panels (in the upper right corner) that is easily visible and accessible by any technician.
G. All SNMP data will be updated and inserted in the equipment configuration during initial installation and configuration.

7. Configuration/Installation & Testing
   A. Migrate existing network/devices from the existing TMC to the new TMC as shown on the Plans. This includes but is not limited to the rooftop wireless connections and home-run fiber based connections.
   B. Install, test and certify all required network and patch cables in accordance to the Structured Cabling Special Provision.
   C. Develop a network Plan which minimizes any impacts to the existing system and MDOT Operations.
   D. Install, power and configure the WDM equipment at the TMC (new facility).
   E. Using MDOT TCP/IP scheme – request a viable IP address from the MDOT Engineer.
   F. Assign IP address for the WDM equipment.
   G. Setup IP address, VLAN modifications, route changes and ACL for all network equipment in the ITS network.
   H. Test WDM equipment configuration and functional condition.
   I. Break one leg of the ITS network ring at the current MITS Center.
   J. Insert WDM equipment and test ITS network connectivity and functionality; ensure no disruption of services.
   K. Configure and apply new IP address for all ITS network equipment; verify functionality of the new equipment.
      (1) Ensure network continuity of service at all ITS network hubs and nodes.
      (2) Ensure no network downtime is allowed.
   L. Break second leg of the ITS network ring at the current MITS.
   M. Insert WDM equipment and test ITS network connectivity and functionality; ensure no disruption of services.

N. Configure and apply new IP address for all ITS network equipment; verify functionality of the new equipment.
   (1) Ensure network continuity of service at all ITS network hubs and nodes.
   (2) Ensure no network downtime is allowed.
O. Verify overlay services are configured properly within the MITS Center and TMC (both facilities) and all ITS network hubs and nodes.
P. Install, power and configure the 10GigE equipment at the TMC (new facility).
Q. Using MDOT TCP/IP scheme – request a viable IP address from the MDOT Engineer.
R. Assign IP address for the 10GigE equipment.
S. Setup IP address, VLAN modifications, route changes and ACL for all network equipment in the ITS network.
T. Configure and apply new IP address for all ITS network equipment; verify functionality of the new equipment.
   (1) Ensure network continuity of service at all ITS network hubs and nodes.
   (2) Ensure no network downtime is allowed.
U. Verify overlay services are configured properly within the TMC (new facilities) and all ITS network hubs and nodes.
V. Test network connectivity for SONET services and network traffic to each HUB location and NODE location
W. Test network connectivity for Ethernet/IP services and network traffic to each HUB location and NODE location
X. Test NMS functionality and alarms for the WDM and 10GigE installed as part of this project and existing.
Y. Test legacy ATMS platform software for functionality in the MITS Center and TMC (both facilities).
Z. Test interim ATMS platform software for functionality in the MITS Center and TMC (both facilities).
AA. Test device control from MITS Center and TMC (both facilities) to 6 devices (of each type) in each HUB/NODE in the ITS network.
BB. Upon successful completion of equipment installation and configuration provide all documentation and configuration parameters to the MDOT Engineer.

8. Maintenance, Support & Warranty
   A. In addition to the requirements outlined in equipment specific Special Provisions and the Basic Methods and Materials for ITS Work Special Provision, the Contractor shall provide the following. The Contractor shall provide maintenance, warranty and support for all components associated with this system at no additional charge to MDOT through final system acceptance, including but not limited to:
      (1) Preventive and routine maintenance services in accordance with the provisions of the maintenance manual/guideline for each component.
         (a) Preventative maintenance services at a minimum shall include inspection, testing, necessary adjustment, parts cleaning, and software upgrades.
         (b) Routine maintenance services at a minimum shall include scheduled overhauls as recommended by the equipment manufacturer.
      (2) Emergency repair conditions consist of any key components being inoperative to the extent the system cannot function in a normal manner. Emergency repair services shall at a minimum include inspections and necessary tests to determine the causes of equipment or software malfunction or failure. The

emergency services shall include furnishing and installing components, parts, or software changes required to replace malfunctioning system elements.

B. Maintenance services are not expected after final system acceptance for any project elements.
C. Support shall be supplied by the Contractor directly or by a Sub-Contractor approved by the MDOT Engineer.
D. Once the "system-side" work has commenced and through final system acceptance the Contractor shall provide telephone support twenty-four (24) hours a day, seven (7) days a week. For emergency repairs the Contractor shall provide support on-site within four (4) hours of any request. For all other issues/repairs the Contractor shall provide support on-site within twenty-four (24) hours of any request.
E. The Contractor shall supply a list of special tools, test equipment, and outside inventory required.
F. All documentation shall be provided to the MDOT Engineer after final system acceptance.
G. The warranty on the WDM Communications Controller and 10 Gigabit Ethernet Network Switch will be for 5 years and include:
   (1) Manufacturer provided telephone support services (24/7/365), not including any on-site services
   (2) Next day hardware replacement
   (3) Any warranty replaced items will be tracked and submitted to MDOT in writing for serial numbers, manufacturer, make, model and date of installation/repair.

9. System Acceptance
   A. In addition to the requirements outlined in equipment specific Special Provisions and the Basic Methods and Materials for ITS Work Special Provision, the Contractor shall provide the following.
   B. Develop a system acceptance test plan to demonstrate how the completed ITS system(s), network(s), and field devices will be tested to assure compliance with the Contract documents for project completion. The test plan must be submitted and approved by the MDOT Engineer prior to any testing. A minimum of 3 weeks (MDOT working days) must be allowed for MDOT review and approval. At a minimum the test plan should provide the following information:
      (1) Statements of purpose identifying the goals of the test
      (2) The methods and processes used for testing
      (3) Duration and schedule of tests
      (4) Examples of all graphs, tables, and charts necessary for display of testing results
      (5) Certifications and qualifications of all persons conducting the testing
      (6) Calibration certificate of test equipment
      (7) Inspection of wiring
      (8) Completing diagnostic routines provided by the manufacturer
      (9) Component, sub-system and system level testing, including successful demonstration of end-to-end network connectivity between the ATMS system(s), applications, field devices and the remaining communications network as defined in the specifications, Plans, or as directed by the MDOT Engineer.
      (10) A testing checklist/punchlist coinciding with the acceptance testing.
   C. Conduct the approved tests and report the results and checklist/punchlist in writing to the MDOT Engineer. The Contractor shall resolve any outstanding issues and perform all failed tests again and report results to the MDOT Engineer. This process shall be repeated until all tests are successful or approved by the MDOT Engineer.

D. MDOT, or its representative, shall witness all testing and approve validation of final acceptance.
E. Final system acceptance shall include successful system demonstration (including validation of systems operational status) and a 90 day burn-in period.
F. The Contractor will notify MDOT and MDOT'S Representative at least 10 days in advance of desiring witness and system acceptance testing. A completed acceptance testing checklist/punchlist shall be provided to the MDOT Engineer a minimum of 72 hours prior to any witness testing.
G. During the system acceptance test, the Contractor will demonstrate full network and application (ATMS platforms) functionality, management and data transfer on the ITS network from both Traffic Management Centers (existing and new). The following tests shall be included (but not limited to) in the full system acceptance testing:
   (1) Successful completion of test measures using 64, 512 and 1518 byte sized packets, to include but not limited to:
      (a) Packet Loss (data throughput)
      (b) Frame Loss
      (c) Latency
   (2) Failure test, (fiber removal) from both sides of the ring architecture into the WDM equipment installed as part of this specification package.
   (3) Failure recovery, (fiber re-install) from both sides of the ring architecture into the WDM equipment installed as part of this specification package.
   (4) Power failure event, (remove street power) validate and perform test to ensure the equipment is properly installed and running on both UPS and power generator.
   (5) Line card failure, (line card removal) from both sides of the ring architecture into the WDM equipment installed as part of this specification package. Ensure alerts and alarms are configured and operational in the NMS for the ITS network.
   (6) Line card recovery, (fiber re-install) from both sides of the ring architecture into the WDM equipment installed as part of this specification package. Ensure alerts and alarms are configured and operational (alarms do not trigger post recovery) in the NMS for the ITS network.
   (7) Performance test SONET network access and data transfer from and to every hub location on the ITS network.
   (8) Performance test TCP/IP network access and data transfer from and to every hub location on the ITS network.
   (9) Application test SONET network access and data transfer to legacy ATMS platform and device communications to at least 6 devices (of each type) in each HUB/NODE or directly connected to the TMC.
   (10) Application test TCP/IP network access and data transfer to interim ATMS platform and device communications to at least 6 devices (of each type) in each HUB/NODE or directly connected to the TMC.
   (11) TCP/IP route and ACL test, ARP cache verification, TRACE RT verification and PING test verification of every hub and node network device and 6 ITS devices (of each type) at each network location
   (12) Test network connectivity and cable integrity end-to-end to validate conformance with certified structured cable results.
   (13) Test network connectivity and cable integrity to video wall in new TMC, including complete functionality and operation from the ATMS platforms.
H. Upon successful completion of final system acceptance testing provide all documentation and test results to the MDOT Engineer.

b. Materials.

1. Not Applicable

c. Construction.

1. Requirements
   A. The communication system integration and implementation must be accomplished in such a manner which does not impede day-to-day system operational functions unless agreed upon in advance with the MDOT Engineer. Any expected downtime and system cutovers must be scheduled during off-peek travel times, nights or weekends with the MDOT Engineer. All durations must be approved by the MDOT Engineer prior to commencement.
   B. System integration and implementation includes but is not limited to the following:
      (1) Setup, configuration, installation and troubleshooting the network appliances provided in or modified as part of this project.
      (2) Working with MDOT and other projects to integrate into the communications backbone. Configuring and/or reconfiguring the communications network infrastructure to accommodate the modifications presented by this project such as modifying routing configurations to account for the new TMC and existing TMC on the same network and rerouting ITS field devices to the new TMC.
      (3) Optimizing the operation of each specific component and the system holistically.
      (4) Resolving all incompatibilities with system components (including software incompatibilities) introduced by the Contractor's actions performed under this project.
   C. As subsystems and systems are altered - test, retest and validate systems to verify that all aspects of the system remain fully operational using the detailed test plan (developed by the Contractor and approved by the MDOT Engineer).

d. Measurement and Payment.

The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIFICATION
FOR
STRUCTURED CABLING

a. Description.
Structured cabling provides a consolidated communications infrastructure to be used by network systems and is comprised of copper and fiber optic cables routed throughout facilities providing transmission media for voice, data, and video signals. The Contractor shall provide structured cabling transmission media, components, and testing as specified herein or shown on the plans and in conformance with manufacturers' requirements and recommendations. All work shall be performed in accordance with the Standard Specifications for Construction.

1. General
   A. The Contractor must furnish, install, integrate and test all equipment and required ancillary components necessary to provide a complete and fully functional system in all respects, without additional expense to MDOT.
   B. All equipment required for the installation, integration and testing of components and subsystems contains within this project must be supplied by the Contractor as an appurtenance to the electronic equipment included within the project and at no additional cost to MDOT.
   C. Structured cabling includes the racks, patch panels, connectors, patch cords, outlets, terminal blocks, etc. as required to provide a complete structured system. Specifically the following types of control and signal transmission media:
      (1) Copper: ANSI/TIA/EIA-568-B Compliant, Cat 6
      (2) Fiber Optic Cable: ISO/IEC 11801 Compliant
      (3) Customer-owned Outside Plant Telecommunications Infrastructure Standard: TIA-758-A
      (4) Radiating Antenna Cable ("Ported" or "Leaky" Coax)
      (5) Coaxial Cable (Hardline and Horizontal distribution)
   D. Cables shall be shielded twisted pair, with shielding on each pair and with overall shielding.
   E. Cables shall not produce any interference with existing infrastructure.
   F. Unless agreed to in writing, the system shall be documented as specified herein or shown on the drawings.

2. Summary
   A. *Refer to ATMS Network Overview Document Section a.2.*

3. Requirements of Regulatory Agencies and Standards
   The compliance with the latest edition of the following codes, standards and guidelines is required:
   A. Refer to ATMS Network Overview Document Section a.3.

4. Protocols

A. RS-232, RS-422, RS-485
B. SONET
C. ATM
D. Ethernet
E. FDDI
F. IPv4, IPv6

5. Qualifications and Submittals
   A. Refer to Basic Methods and Materials for ITS Work Document Section a.2.D.
   B. Refer to ATMS Network Overview Document Section a.4.
   C. Refer to ABF Fiber-Optic Tube & Cable Infrastructure Document Section a.10.C.(25).(o) where applicable.

b. Materials.

1. Category 6 Cable
   A. Shielded Twisted-Pair Cat 6 cable shall meet and/or exceed all requirements for ANSI/TIA/EIA-568-B and support high-speed communication network applications, including but not limited to 10 Gigabit Ethernet.
   B. UL-listed communications cable Type CMP for plenum applications, Type CMR for riser applications, Type CMG for general-purpose applications.
   C. Furnish a copy of the factory certified test report verifying that final production reels are tested to at least 200 MHz and conforms to all ANSI/TIA/EIA Cat 6 requirements.
   D. All cabling and connectors shall comply with and be tested to ANSI/TIA/EIA-568-B and as specified in testing requirements listed in the contract documents.
   E. Connectors/Jacks/Outlets
      (1) All outlets, jacks, and connectors shall exceed all requirements of proposed ANSI/TIA/EIA-568-B.
      (2) All locations shall utilize “RJ-45 style” 8-position, 8-conductor T568B data jacks.
      (3) Jacks shall be modular and identified by color or with a color icon or tab differentiating function (e.g. voice/data/miscellaneous).
      (4) Flush mount faceplates and boxes shall be provided at all locations unless otherwise noted. Exceptions to the specifications which request surface mounting in lieu of flush must be submitted and obtain approval prior to installation.
      (5) Coordination with the modular furniture provider shall be necessary to determine type and design of outlet configurations to be incorporated into the furniture.

2. Fiber Optic Cable
   A. The fiber optic cable construction shall consist of 62.5/125 µm single mode optical fibers. Size and routing of fiber optic cables shall be as indicated on the Plans. Fibers shall exceed all requirements for ANSI/TIA/EIA-568-B and support high-speed communication network applications, including 10 Gigabit Ethernet.
   B. UL-listed fiber optic cable Type OFNP for plenum applications, Type OFNR for riser applications, Type OFNG for general-purpose applications.
      (1) UL-listed fiber optic cable for use in ductbank and buried applications.
   C. Cable shall use loose tube construction for exterior applications and tight buffer construction for interior applications unless otherwise noted. All cable shall be dielectric.

(1) Loose tube construction: Optical fibers shall be surrounded by a tube buffer, be contained in a channel, or otherwise loosely packaged to provide clearance between the fibers and the inside of the container to allow for thermal expansion without constraining the conductor. Cable core shall contain water-blocking compound to prevent water migration into the cable.

(2) Tight buffer construction: The cable shall contain optical fibers that have a 245 μm mechanically strippable acrylate coating. Additionally, there shall be a 900 μm thermoplastic coating applied directly to the fiber. The fibers will be surrounded by aramid yarn and be contained in a flame resistant thermoplastic outer jacket.

D. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness; jackets extruded under high pressure are not acceptable.

E. For cables with more than two fibers, the cable jacket shall be designed for easy removal without damage to the optical fibers by incorporating a ripcord under each cable jacket.

F. The nominal thickness of the cable outer jacket shall be sufficient to provide adequate cable protection while meeting the mechanical, flammability, and environmental test requirements of this document over the life of the cable.

G. Each individual fiber shall be color coded for identification. The fiber optic color coding shall be in accordance with ANSI/TIA/EIA-598, "Color Coding of Fiber Optic Cables". The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded, buffered fibers shall not adhere to one another. When fibers are grouped into individual units, each unit shall be numbered on the unit jacket for identification. The number shall be repeated at regular intervals.

H. The outer jacket shall be marked with the manufacturer's name or UL file number, date of manufacture, fiber type, flame rating, UL symbol, and sequential length markings every two (2) feet (e.g. "COMPANY-01/98-62.5/125 MICRON-Type OFN - (UL) 00001 FEET"). The printing shall be permanent and legible for the life of the cable.

I. Furnish a copy of the factory certified optical test report verifying that final production reels comply with the attenuation requirements.

J. All cabling and connectors shall comply with and be tested to ANSI/TIA/EIA-568-B and as specified in testing requirements listed in the contract documents.

K. Fiber optic connectors

(1) All outlets, jacks, and connectors shall exceed all requirements of ANSI/TIA/EIA-568-B.

(2) Connectors shall be capable of terminating optical fiber glass cables with outside diameters ranging from one hundred twenty-five (125) through nine hundred (900) microns. Fabricate connectors with optical fiber, self-centering, axial alignment mechanisms. Connectors shall have an insertion loss of not greater than 0.3 dB.

L. Fiber optic splices

(1) Make no splices except at indicated splice points, or specifically approved by the MDOT Engineer. Splices shall be fusion type and shall be located within closures, distribution centers, or splice trays rated for the location. All splice locations must be clearly indicated on shop drawings and as-builts.

(2) Splices shall not exceed a maximum optical attenuation of 0.3 dB when measured in accordance with ANSI/TIA/EIA-455-59.

3. Patch Panels or Distribution Units
   A. Fiber optic wall or rack-mounted customer premises type cabinets serve as a consolidation or multi-user demarcation point for various outlets, networks, systems, servers and workstations located throughout the facility.
   B. Cabinets shall contain cable routing and strain relief supports for support of cable during and after installation.
   C. Cabinets shall allow for top and bottom cable entry.
   D. Cabinets shall be provided with loaded plates containing required quantity of FC-type adapters as shown on drawings.
   E. Cabinets shall be provided with locking hinged doors. The hinged door shall swing downward.

4. Innerduct
   A. Nonmetallic flexible optical fiber raceway (innerduct) shall be a flame-retardant corrugated flexible raceway for the protection and isolation of optical fiber cable. Raceways shall be rated for the environment installed, contain a pre-installed pull rope, and possess the following ratings:
      (1) Shall meet UL94 V-O flame test, orange in color for general purpose applications.
      (2) Shall meet UL 1666 standard for riser applications, white in color for riser applications.
      (3) Shall meet UL 910 standard for plenum applications, white in color for plenum applications.
      (4) Shall be rated for ductbank and/or direct burial applications as shown on the drawings, orange in color for outdoor applications.
   B. Nonmetallic raceway couplings, fittings, and conduit bodies shall be provided as required to connect raceways and be rated for use with the applicable installation environment.

c. Construction.

1. Installation
   A. All installation activities shall be performed in a neat and professional manner in accordance with all applicable local and national codes. Additionally, the Contractor and all subsequent Sub-Contractors employed to satisfy the requirements of these specifications shall obtain, or satisfy, the following prior to installation:
      (1) All licenses and permits.
      (2) All insurance and bonding as required.
      (3) All other standards or requirements specified in this document.
   B. The Contractor shall install and inspect all hardware required in this specification in accordance with the manufacturer's installation instructions.
   C. The Contractor shall adhere to the following during installation of the system:
      (1) Underwriter’s Laboratories (UL) listing for restricted access installations in business and customer premises applications. This listing is required by the National Electric Code for customer premise installations.

D. System installation and construction methods shall conform to the requirements of the Federal Communications Commission and local state, county, and city ordinances.
E. Where undefined by codes and standards, Contractor shall apply a safety factor of at least two (2) times the rated load to all fastenings and supports of system components.
F. The Contractor shall install all system components including furnished equipment, and appurtenances in accordance with the manufacturer's instructions, NFPA 70, ANSI-C2 and as shown, and shall furnish all cables, connectors, terminators, interconnections, services, and adjustments required for a complete and operable system at no additional cost to the MDOT.
G. All media shall be listed for the application, marked and protected as per the NEC. Articles 770 and 800 shall define the power source limitations, installation guidelines, insulation properties, applications and allowable cable substitution schedules. Solid conductor materials shall be substituted for the specified 7-strand conductor materials as required by the NEC. All media substitutions shall conform to the NEC and be approved by the Engineer.
H. Install all media in approved raceway, according to manufacturer's written instructions.
   (1) Install transmission media without damaging conductors, shield, or jacket.
   (2) Do not bend cable, in handling or installation, to smaller radii than minimum required or recommended by manufacturer.
   (3) 90-degree sweeps and field bends shall be used. Pre-manufactured elbows and factory bends shall not be used.
   (4) No more than two 90-degree bends in 100 feet of conduit without the addition of a pullbox shall be acceptable.
I. Grounding shall be installed as necessary to preclude ground loops, noise, and surges from adversely affecting system operation.
J. Rack Mounted Equipment:
   (1) As a general practice, the Contractor shall run power cables, control cables, and high level cables on the left side of an equipment rack as viewed from the rear.
   (2) Contractor shall run other cables on the right side of an equipment rack, as viewed from the rear.
K. All cable runs should be continuous. Splices both optical fiber and copper, shall be done only upon receipt of written approval from the MDOT Engineer. The MDOT Engineer reserves the right to reject any splicing request. If any un-approved splices are found before acceptance, the Contractor shall replace the entire spliced cable without any additional charges, regardless of the stage of completion. All splice locations shall be recorded on the “as built” drawings and provided to MDOT.
L. Pull cables without exceeding cable manufacturer's required or recommended pulling tensions.
   (1) Pull cables simultaneously where more than one is being installed in same raceway.
   (2) Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
   (3) Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage media or raceway.

M. Install exposed media in controlled Telecommunications Rooms parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.
N. Use splice and tap connectors that are compatible with cable material. Make no splices except at indicated splice points, or specifically approved by the MDOT Engineer.
O. Bond shields and drain conductors to ground at only one point in each circuit.
P. Connect components to wiring system and to ground as indicated and instructed by manufacturer and according to ANSI/TIA/EIA-607. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torque's specified in UL Standard 486A.
Q. For fiber optic backbone cabling provide 20 feet of slack located on each end of the cable. The excess fiber will be coiled up and supported by suitable means so that it is suspended above the ceiling or rack. Terminate fiber optic connectors in accordance with the manufacturer's instructions. Unless otherwise shown on the drawings, terminate strands from left to right, and top to bottom (front view)
R. Optical fiber cabling placed in cable tray and/or conduits larger than 2" shall be placed in nonmetallic flexible optical fiber raceway (innerduct).
S. For Cat 6 Cable, total cable length for each location shall not exceed 295 feet (90 meters). The contractor shall notify the engineer of any location that exceeds this limitation prior to cable installation.

2. Documentation, Equipment Identification, Quality Control, Testing, Maintenance/Support/Warranty and System Acceptance
   A. Outlined in the Basic Methods and Materials for ITS Work, ATMS Network Overview and equipment specific Special Provisions.
   B. Refer to ABF Fiber-Optic Tube & Cable Infrastructure Document Section a.10.C.

d. Measurement and Payment.

The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIFICATION
FOR
COMMUNICATIONS GROUNDING AND BONDING

a. Description.
Communications grounding and bonding provides solid grounding of electrical systems and equipment. It includes basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified herein are supplemented in other Special Provisions. This work is to be done in accordance with the Standard Specifications for Construction, sections 819 and 918 except as modified herein.

1. General
   A. The Contractor must furnish, install, integrate and test all equipment and required ancillary components necessary to provide a complete and fully functional system in all respects, without additional expense to MDOT.
   B. All equipment required for the installation, integration and testing of components and subsystems contains within this project must be supplied by the Contractor as an appurtenance to the electronic equipment included within the project and at no additional cost to MDOT.
   C. All ground wires installed beneath the surface of the earth shall be solid tinned copper. All ground wires installed above the surface shall be stranded copper.
   D. The Contractor shall design a ground system for each type of remote site and submit Plans in the form of a design drawing for approval by the Engineer. The design shall be certified by a Professional Engineer in the State of Michigan.
   E. Provide grounding and bonding as follows:
      (1) Grounding electrodes and conductors
      (2) Equipment grounding conductors
      (3) Bonding
      (4) Communication system grounding
      (5) Electrical equipment and raceway grounding and bonding
      (6) Control equipment grounding

2. Summary
   Refer to ATMS Network Overview Document Section a.2.
3. Requirements of Regulatory Agencies
   The compliance with the latest edition of the following codes, standards and guidelines is required:

   A. Refer to ATMS Network Overview Document Section a.3.

   Where conflicts exist between the above referenced documents and this document, the more stringent requirement shall prevail.
4. Qualifications and Submittals

A. Outlined in the ATMS Network Overview Special Provision.

b. Materials.

1. Equipment
   A. Communications Grounding Conductors
      (1) Insulated copper American Wire Gauge (AWG) wire following ASTM-B3, ASTM-B8 and ASTM-B33, of following sizes:
         (a) Main ground source feed from the building ground system to the Telecommunications Main Ground Busbar (TMGB): No. 3/0 AWG green insulated stranded copper ground wire.
         (b) Telecommunications Bonding Backbone (TBB), from the TMGB to the Telecommunications Ground Busbars (TGB): No. 3/0 AWG green insulated stranded copper ground wire.
         (c) TGB to equipment cabinets and racks, conduits, cable raceways, etc.: No. 6 AWG green insulated stranded copper ground wire.
   B. Grounding Connectors
      (1) Connectors shall be a copper alloy material and two-hole compression lug type at all connecting ends.
   C. Ground Rods
      (1) A minimum of ten feet long, 3/4-inch diameter, copper-clad steel.
   D. The TMGB, located in the main distribution facility (MDF), shall comply with the following:
      (1) The TMGB shall be a predrilled copper busbar with standard NEMA bolt hole sizing and spacing for the type of connectors to be used.
      (2) The TMGB shall be sized for the immediate requirements and allow for growth. The minimum dimensions shall be ¼ inch thick by 4 inches wide by 23 inches long.
      (3) The TMGB shall be electrotin plated for reduced contact resistance.
      (4) The TMGB shall have pre-drilled holes, which shall support a minimum of two tiers of eight No. 6 AWG copper two-hole compression lugs.
      (5) The TMGB shall comply with ANSI/EIA/TIA 607.
   E. Each TGB, located in the intermediate distribution facilities (IDFs), shall comply with the following:
      (1) The TGB shall be a predrilled copper busbar with standard NEMA bolthole sizing and spacing for the type of connectors to be used.
      (2) The TGB shall be sized for the immediate requirements and allow for growth. The minimum dimensions shall be ¼ inch thick by 4 inches wide by 23 inches long.
      (3) The busbar should be electrotin plated for reduced contact resistance.
      (4) The TMGB shall have pre-drilled holes, which shall support a minimum of two tiers of eight No. 6 AWG two-hole copper compression lugs.
      (5) The TMGB shall comply with ANSI/EIA/TIA 607.
   F. Equipment cabinet and rack ground busbar
      (1) Provide and install a ground busbar in all relay racks, frame racks and equipment cabinets to be used as an equipment grounding bus.
      (2) The busbar shall be for equal-flange (channel) 19-inch rack width and shall include ground bar, splice plate and #12-24 mounting hardware.
      (3) The minimum dimensions shall be ¾ inch in width by 3/16 inch in thickness.

(4) The busbar shall have pre-drilled holes, which shall support a minimum of eight No. 6 AWG two-hole copper compression lugs.
(5) The busbar shall comply with ANSI/EIA/TIA 607.

2. Requirements
   A. General
      (1) Grounding system shall following NEC Article No. 250 - Grounding, IEEE 142-1991 - Recommended Practice for Grounding of Industrial and Commercial Power Systems and BICSI TDMM.
      (2) All conductor wire, busbars and conduit shall be UL listed.
      (3) The communications ground system shall be separate and independent from all power grounding.
      (4) Power grounding and/or bonding shall not be allowed to interfere or provide any back feed or be a conductor to the separate communications ground system source or to any communications bonded materials or equipment.
   B. TMGB
      (1) The main ground source feed to the TMGB in the MDF shall be a separate and independent feed from the main building ground system.
      (2) The main ground source feed shall be a No. 3/0 AWG green insulated stranded copper ground wire from the building or counterpoise ground system to the TMGB in the MDF.
      (3) The No. 3/0 AWG green insulated stranded copper ground wire shall be installed in a two-inch metallic conduit.
      (4) The No. 3/0 AWG green insulated stranded copper ground wire connections shall be exothermically welded at connecting ends.
         (a) The first weld shall be at the main building electrical entrance facility grounding electrode conductor ground system end.
         (b) The second weld shall be at the TMGB.
   C. TBB and TGB
      (1) The TBB originates at the TMGB and shall be extended from the TMGB to each TGB within the MDF and throughout the building using the telecommunications backbone pathways, to the TGB(s) in each IDF. The minimum TBB conductor size shall be a No. 3/0 AWG green insulated stranded copper ground wire. The TBB shall be installed in a two-inch metallic conduit.
      (2) The communications ground system shall be a separate ground system and be completely independent and isolated from all power grounding.
      (3) The TBB No. 3/0 AWG green insulated stranded copper ground wire connections shall be exothermically welded at connecting ends.
         (a) The first weld shall be at the TMGB.
         (b) The second weld shall be at TGB.
   D. Equipment cabinets and racks
      (1) All cabinets and racks shall be provided with a separate communications ground, consisting of a No. 6 AWG green insulated stranded copper ground wire, from the nearest TGB in the room and home run to each cabinet or rack ground busbar. Unless otherwise noted in the drawings, do not loop ground wire.
      (2) All ground raceways within cabinets and racks shall be an insulated one-inch metallic flexible raceway and shall include the proper transition electrical metallic tubing (EMT) fittings.

(3) All ground raceways and fitting connections shall be bonded to the TGB and comply with all applicable codes and specifications.

c. Construction.

1. Preparation
   A. Contractor's on-site RCDD supervisor shall review and approve all shop drawings, coordination drawings and record drawings.
   B. Complete site preparation and soil compaction before trenching and driving ground rods for underground grid.
   C. Verify exact location of stub-up points for grounding of equipment, fences and building or steel structures.
   D. Copper and copper alloy connections should be cleaned prior to connection.

2. Installation
   A. General
      (1) Install work following drawings, manufacturer's instructions and approved submittal data.
      (2) Installation plans and requests for information (RFIs) shall be reviewed by contractor's on-site RCDD.
      (3) All work shall be supervised and reviewed by contractor's on-site RCDD.
      (4) Bonding conductors shall be routed with minimum bends or changes in direction and should be made directly to the points being bonded.
      (5) Bonding connections should be made by using:
         (a) Compression copper lugs. Use listed hardware that has been laboratory tested to eliminate most field problems.
         (b) Exothermic welding (see NEC Article 250) within the ground electrode system, for parts of a grounding system that are subject to corrosion or that must carry high currents reliably, or for locations that require minimum maintenance.
      (6) Drive rods vertically, leaving top 18 inches exposed above finished grade. Exothermic-weld below-grade grounding connections, except at ground rods. Install additional ground rods as required to pass resistance test.
      (7) Make connections to dry surfaces only. Remove paint, rust, oxides, scales, grease and dirt from surfaces before making connection. Sand clean a one square inch area, drill, tap, and bolt conductor and connector to sanded area. Ensure proper conductivity.
      (8) The No. 3/0 AWG insulated ground wire weld ends shall have a minimum amount of wire exposure from the conduit to each weld and a minimum amount of insulation removed at weld.
      (9) The No. 6 AWG insulated ground wire connecting ends shall have a minimum amount of insulation removed at ground lug.
      (10) Do not connect ground wire in power cable assemblies to the communications ground system.
   B. TMGB
      (1) TMGB should be located so that the bonding conductor is as short and straight as possible. Maintain clearances required by applicable electrical codes.
      (2) The TMGB shall be attached to the wall studs with tapping screws with the bottom of the busbar 84 inches above finished floor.

(3) The TMGB shall be offset from the wall two inches and shall include support brackets and insulators.
(4) Connect the TMGB to the main building electrical entrance facility ground system and telecommunications primary protectors.
(5) TMGB Weld Requirements:
(a) The No. 3/0 AWG ground wire weld from the main source shall not exceed one inch from one end of the TMGB busbar.
(b) One additional weld shall not exceed one inch from the opposite end of the TMGB busbar.
(c) Two or more additional welds shall not exceed the one-inch spacing from the welds toward the center of the busbar.
(d) The No. 3/0 AWG insulated ground wire weld ends shall have a minimum amount of wire exposure from the conduit to the weld and a minimum amount of insulation removed at weld.

C. TGB
(1) The TGB should also be located so that the bonding conductor is as short and straight as possible. Maintain clearances required by applicable electrical codes.
(2) The TGB shall be attached to the wall studs with tapping screws with the bottom of the busbar 84 inches above finished floor (AFF).
(3) The TGB shall be offset from the wall two inches and shall include support brackets and insulators.
(4) TGB Weld Requirements:
(a) The No. 3/0 AWG ground wire weld from the TMGB shall not exceed one inch from one end of the TGB busbar.
(b) One additional weld shall not exceed one inch from the opposite end of the TGB busbar.
(c) Two or more additional welds shall not exceed the one-inch spacing from the end welds toward the center of the busbar.
(d) The No. 3/0 AWG insulated ground wire weld ends shall have a minimum amount of wire exposure from the conduit to the weld and a minimum amount of insulation removed at weld.

D. Equipment cabinets and racks
(1) The busbar shall be installed at the base and back of each cabinet and rack.
(2) Each cabinet and rack shall be provided with a No. 6 AWG insulated ground wire home run to the TGB, except as noted:
(a) In a cabinet or rack bay, provide a home run ground wire to the first cabinet or rack from the wall.
(b) From the first cabinet or rack, the No. 6 AWG insulated ground wire may be looped from cabinet frame to cabinet frame (or rack to rack, where applicable), connecting to each cabinet frame (or rack) ground busbar, not to exceed four adjacent cabinets (or racks).
(c) Do not loop from rack to cabinet.
(3) Each cabinet or rack bay against the wall shall be bottom/side ground feeds from the wall.
(a) Wall ground feeds/raceways to racks shall not be exposed on the walls.
(b) Exception: Some cabinet or rack bays may require the ground to be fed from the ceiling raceway.
(4) All ground raceways within each cabinet (or on each rack, where applicable) or cabinet base and adjacent ganged cabinet base shall be an insulated metallic

flex type raceway and shall not interfere with equipment mounting framing or equipment mounting brackets.

(5) Each ground feed shall provide proper installation allowances and penetration depths to provide conversion fittings from solid metallic to insulated metallic flex conduit raceways.

(6) To bond each cabinet and rack to ground, sand clean a one square inch area, drill, tap, and bolt conductor and connector to sanded area.

E. Cable Tray/Runway, Cable Raceway and Support Systems Grounding

(1) Provide communications cable tray and cable runway systems with a communications isolated ground from the nearest TGB.

(2) Provide and install No. 6 AWG insulated ground wire to one end of each cable tray/runway system and home run to nearest TGB.

(3) Communications cable tray/runway that is located in the same room as the TMGB shall be connected to the TMGB.

(4) For electrically non-continuous conduits which contain only a grounding conductor, bond the conduit and conductor together at both ends to ground.

(5) Bond conduit ends to nearest TGB with grounding bushings or ground clamps.

F. Floor Tile

(1) Floor tile in the MDF and IDF shall be static-free.

(2) Floor tile shall match existing floor tile (if applicable).

(3) Floor tile grounding strips shall not be exposed.

G. Other: Provide and install No. 6 AWG green insulated stranded copper ground wire home run to nearest TGB from each of the following:

(1) All conductive ducts.

(2) All communications conductive equipment.

(3) All communications conductive hardware.

(4) All communications conductive materials.

H. Testing

(1) Test grounding system before grid trenches are backfilled. Test for ground resistance after installation of underground grid and grounding connections.

(2) Install test wells at locations as required for testing, using a pipe surrounding the rod and connections with a cover placed on top at grade level.

(3) Test system resistance at each test well using "fall of potential" method: Maximum resistance of five ohms.

(4) Upon completion of the electrical system, including all grounding, the Electrical Contractor shall test the system for stray currents, ground shorts, etc. Approved instruments, apparatus, services, and qualified personnel shall be utilized. If stray currents, shorts, etc., are detected, eliminate or correct as required. The test procedure shall be as follows:

(a) Open all main disconnects for the system being tested.

(b) Disconnect the system neutral from the service entrance or step-down transformer neutral connection.

(c) Connect a DC ohmmeter across the system neutral and equipment ground.

(d) An ohmmeter reading in excess of 100 ohms shall indicate that the system neutral and equipment ground are properly isolated.

(e) An ohmmeter reading less than 100 ohms shall indicate that the system contains ground shorts (stray currents) at some point along the system neutral.

(f) Grounded neutrals may be identified by disconnecting individual neutral conductors from the system, one at a time, while monitoring the ohmmeter.
(g) The systems shall be re-tested after correction of all ground shorts is complete.

3. Documentation, Equipment Identification, Quality Control, Testing, Maintenance/Support/Warranty and System Acceptance
   A. Outlined in the Basic Methods and Materials for ITS Work, ATMS Network Overview and equipment specific Special Provisions.

d. Measurement and Payment.

The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
AIR-BLOWN FIBER-OPTIC (ABF)
TUBE & CABLE INFRASTRUCTURE

DES: MM 1 of 17 C&T:APPR:XXX:YYY:00-00-00

a. Description.

The Air-Blown Fiber Optic (ABF) Tube and Cable Infrastructure consists of the installation and termination of ABF tubes, fiber termination units (FTU), tube distribution units (TDU), splice enclosure assembles, and fiber bundles within the stated project limits, as depicted in the Plans. This work is to be done in accordance with the 2003 Standard Specifications for Construction, except as modified herein.

1. General
   - A. The Contractor will furnish, install, integrate and test all equipment and required components necessary to provide full and complete ITS functionality in all respects, without additional expense to MDOT.
   - B. All equipment required for the testing of devices and subsystems contained within this project must be supplied by the Integrator as an appurtenance to the electronic equipment included within the project and at no additional cost to MDOT.
   - C. Prior to the start of systems installation, the CONTRACTOR shall meet at the project site with the MDOT ENGINEER and or their representative to coordinate efforts.
   - D. The CONTRACTOR shall review areas of potential interference and resolve conflicts before proceeding with and work. The areas and conditions shall be examined under which the system is to be installed, not to proceed with work until satisfactory conditions have been achieved.
   - E. Exact location of ABF tube and Fiber cable terminations shall be field verified.
   - F. All fiber and conduit installations shall be installed to meet or exceed the following standards:
   - G. NEC 2005/2007 (and local Electrical Installation Standards/Laws)
   - H. Institute of Electrical and Electronic Engineers (IEEE).
   - I. American National Standards Institute Standard C2 (ANSI).
   - J. American Society of Testing and Materials' (ASTM).
   - K. Lightning Protection Institute (L.P.I.) Standards 175, 176, and 177.
   - L. Underwriters' Laboratories Standards 96 and 96A (UL).
   - M. TIA/EIA standards regarding outside plant installations, single mode fiber and test/measurement, loss budgeting including (but not limited to the following):
     - (1) TIA/EIA 598-B
     - (2) TIA/EIA 606-A
     - (3) TIA/EIA 568-B
     - (4) TIA 758-A

2. Summary
   - A. Refer to ATMS Network Overview Document Section a.2.
   - B. Requirements of Regulatory Agencies and Standards

C. The compliance with the latest edition of the following codes, standards and guidelines is required:
D. Refer to ATMS Network Overview Document Section a.3.
E. Functional and Performance Requirements
F. Furnish, assemble and install materials that are new, corrosion resistant, and capable of operating in all weather conditions.
G. Use equipment designed to protect personnel from exposure to high voltage during equipment operation, adjustments, and maintenance.
H. Use identical and completely interchangeable equipment at each field locations, where applicable.

b. Materials.

1. Air Blown Fiber (ABF) - Tube Infrastructure
   A. Unless otherwise specified, tube cables shall provide at least two times the number of tubes needed to complete the initial fiber bundle installation requirements.
   B. ABF tubes may be composed of dielectric and metallic materials and shall be suitable for underground, buried, and/or aerial applications.
   C. ABF tubes for direct buried applications shall be steel armored for rodent protection.
   D. Conductive material(s) shall be bonded and grounded per ANSI/TIA/EIA-J Std-607.
   E. During installation, ABF tube ends are to be completely sealed per manufacturer's recommended procedures to prevent ingress of contaminants, including water.
   F. The minimum bend radius of ABF tubes shall be 20 times the tube diameter during installation and 10 times the tube diameter after installation.
   G. Upon completion of ABF tube installation, all tubes shall pass the standard 150 psi pressure test and 5 mm bead obstruction test per the ABF tube manufacturer's recommended procedures.
   H. All unoccupied ABF tubes shall be plugged on both ends per manufacturer's specifications.

2. Fiber Termination Units (FTUs)
   A. A suitable FTU shall be provided at all locations where fiber is to be terminated.
   B. FTUs shall provide for strain relief of incoming tube cables as well as providing connector panels and connector couplings adequate to accommodate the number of fibers to be terminated.
   C. All FTUs shall incorporate radius control mechanisms to limit bending of the fibers to the manufacturer's recommended minimums or 3", whichever is larger.
   D. FTUs shall be wall or rack-mounted as appropriate for site location.
   E. All terminated fibers shall be mated to appropriate couplings mounted on patch panels.
   F. Couplers shall be mounted on a panel that, in turn, snaps into the housing assembly.
   G. Panels shall be available to accommodate a changing variety of connector types.
   H. FTUs shall be installed as shown in the Plans.
   I. The size of each FTU shall be based on the fiber bundle to enter the enclosure.
   J. At each site location a minimum 24-port FTU shall be used, unless otherwise noted on the Plans.
   K. At the head-end site location a standard 19" rack-mountable version shall be used, as applicable.

3. Tube Distribution Units (TDUs)

A. A suitable TDU for the site environmental conditions for tube distribution, routing, and termination shall be used.
B. TDUs shall be installed as shown in the Plans and wherever several tube cables enter the same location or where tube cable type transitions take place.
C. The size of each TDU shall be based on the number of ABF tubes to enter the enclosure.
D. At each site location a minimum two (2) seven (7) ABF tubes shall be accommodated, unless otherwise noted on the Plans.
E. TDUs shall be wall-, floor-, rack-, or ceiling-mounted to provide better protection and geometry for distribution.
F. All TDU's shall be installed per manufacturer's recommendations.

4. Splice Enclosure Assembly
A. An outdoor rated splice enclosure, suitable for the site environmental conditions shall be used.
B. Splice enclosures shall be installed as shown in the Plans.
C. The size of each enclosure shall be based on the fiber bundle to enter the enclosure.
D. At each site location a minimum 24-port splice enclosures shall be used, unless otherwise noted on the Plans.
E. At the head-end and each cabinet site location a standard 19" rack-mountable version shall be used, as applicable.
F. At the tunnel field device site locations a wall-, shelf-mountable version shall be used.
G. Kellems Grips shall be used to secure tube/cables to enclosures.

5. Single-Mode Fiber/ABF bundles (PEF Jacketed), Patch Cables and Connectors
A. The fiber bundles shall be appropriate connectors (FC, SC, ST, LC, etc.), as determined by the equipment and or MDOT preference.
B. All single mode fiber optic cabling shall be in PEF (polyethylene extruded foam) jacketed, bundled fibers available in 6, 12 and 18-fiber bundles.
C. Fiber bundles shall be provided based on immediate needs only.
D. All fiber bundles shall be installed within the properly rated tube cable infrastructure.
E. The CONTRACTOR shall furnish and install optical fiber bundles as identified on the drawings.
F. Fiber bundles shall not be spliced or patched at transition points from indoor to outdoor environments.
G. Fiber bundles shall be installed end to end or "home run" from work area outlet whenever possible to minimize splicing and patching.
H. Zero tensile stress shall be placed upon the fiber bundles during installation to eliminate micro-fractures within the glass.
I. The optical fiber, with fiber counts as indicated on drawings, shall have the following specifications:
J. Dual window, 1310 nm and 1550 nm.
K. Maximum attenuation – 0.40 dB/km at 1310 nm, 0.30 dB/km at 1550 nm.
L. Dispersion unshifted, matched-clad, zero water peak.

6. Optical Fiber Patch Cables
A. Optical fiber jumpers shall incorporate the appropriate connectors (FC, SC, ST, LC, etc.), as determined by the equipment and or MDOT preference.

B. The connector body shall be of materials similar to that used in the proposed couplings.
C. Channels shall be of equal length.
D. The optical fiber patch cables shall be single mode fiber utilizing tight buffer construction.
E. The optical fiber patch cables shall be a minimum of 9 feet long.

7. Connectors
A. The connector type(s) shall be appropriate FC, SC, ST, LC, etc., as determined by the equipment and or MDOT preference.
B. The attenuation per mated pair shall not exceed 0.75 dB (individual) and 0.5 dB (average).
C. Connectors shall sustain a minimum of 200 mating cycles per EIA/TIA-455-21 without violating specifications.
D. Connectors shall meet the following performance criteria:

Test	Procedure	Maximum Attenuation (dB)
Cable Retention	FOTP-6	0.2 dB
Durability	FOTP-21	0.2 dB
Impact	FOTP-2	0.2 dB
Thermal Shock	FOTP-3	0.2 dB
Humidity	FOTP-5	0.2 dB

c. Construction.

1. Installation Requirements
A. Tube Cable Installation
(1) Prior to pulling tube cable, the conduits shall be thoroughly swabbed to remove foreign material before pulling cables.

(2) The CONTRACTOR shall furnish all required installation tools to facilitate the Tube Cable installation without damage to the cable jacket. All equipment shall be of substantial construction to allow steady progress once pulling has begun. Makeshift devices that may move or wear in a manner to pose a hazard to the cable shall not be used. Such equipment is to include, but not be limited to:
(a). Sheaves
(b). Winches
(c). cable reels
(d). cable reel jackets
(e). duct entrance funnels
(f). pulling tension gauges
(g). and similar devices

(3) Tube Cable pulling shall be done in accordance with cable manufacturer's recommended procedures and ANSI/IEEE C2 standards.

(4) Manufacturer's recommendations shall be a part of the cable submittal.

(5) Recommended pulling tensions and minimum bending radii shall not be exceeded.

(6) Any tube cable bent or kinked to a radius more than recommended shall not be installed.

(7) During tube cable pulling operation, an adequate number of personnel shall be present to allow cable observation at all points of duct entry and exit as well as to feed cable and operate pulling machinery.

(8) Pulling lubricant shall be used to ease pulling tensions.

(9) Lubricant shall be of a type that is non-injurious to the cable material used.

(10) Lubricant shall not harden or become adhesive with age.

(11) The CONTRACTOR shall avoid abrasion and other damage to cables during installation.

(12) Tube Cable slack is required for thermal expansion/contraction per manufacturer's recommendations.

(13) All exposed tube cable shall be labeled at 35-foot (maximum) intervals with tags indicating ownership, cable type, and fiber type installed.

(14) Tube cable shall be riser or plenum-rated if required by the installation environment.

(15) Where not installed in a continuous length, tube cable segments shall be spliced using couplings designed for that purpose and housed within a properly rated TDU (tube distribution unit), splice case, or cold shrink wrap per manufacturer's specifications.

(16) The CONTRACTOR shall provide link level schematic (as-builts) – to include manholes, offsets, survey locations, depth of installation, full plan & profile of each cable and conduit location throughout the project area.

B. Fiber Bundle Installation, Termination and Splices

(1) Reusable/ABF, PEF jacketed (Polyethylene Extruded Foam) fiber bundles shall be installed according to manufacturer's recommended procedures.

(2) PEF jacketed optical fiber cable bundles shall be continuously inserted and propelled or blown into the individual tubes utilizing compressed nitrogen as the propellant per the manufacturer's instructions.

(3) The blowing installation process and the fiber bundles shall also be designed to allow removal, replacement, and reuse of the fiber bundles at any time in the future as deemed necessary by MDOT.

(4) Slack in each PEF jacketed fiber bundle shall be provided as to allow for future re-termination in the event of connector or fiber end-face damage.

(5) Adequate slack shall be retained to allow termination at a 30" high workbench positioned adjacent to the termination enclosure(s).

(6) A minimum of 1 meter (39”) of slack shall be retained at the work area.

(7) A minimum of 3 meters (approximately 10’) of slack shall be retained in equipment rooms and telecommunications closets.

(8) Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all optical fiber terminations.

(9) Fiber optic connectors can be field installed or pigtails can be fusion spliced to the fibers.

(10) All fiber optic cable connectors, both field, pigtails, or other, shall be the same type.

(11) All fiber optic cable splices shall be made in fiber optic splice enclosures that provide a moisture tight, re-enterable enclosure that places no stress on the finished splices in the tray and is compatible with the fusion splicer.

(12) Extreme care shall be given to not bending the fiber optic cable tighter than the minimum recommended bend radius.

(13) Splices are only allowed at locations specified in the applicable drawings. No repair splices will be made during cable installation.

(14) All splices and field terminations shall be made by factory trained and certified technicians, SCTE certification is an acceptable alternative to factory trained and certified technicians.

C. Testing, Identification and Administration of Fiber Infrastructure

(1) General

(a). Work Included

(b). Provide all labor, materials, tools, field-test instruments and equipment required for the complete testing, identification and administration of the work called for in the Contract Documents.

(c). In order to conform to the overall project event schedule, the cabling contractor shall survey the work areas and coordinate cabling testing with other applicable trades.

(d). In addition to the tests detailed in this document, the contractor shall notify MDOT or MDOT ENGINEER of any additional tests that are deemed necessary to guarantee a fully functional system. The contractor shall carry out and record any additional measurement results at no additional charge.

(2) Scope

(a). This Section includes the minimum requirements for the test certification, identification and administration of backbone and horizontal optical fiber cabling.

(b). This Section includes minimum requirements for:

(i). Fiber optic test instruments

(ii). Fiber optic testing

(iii). Identification
(iv). Labels and labeling

(3) Administration

(4) Test results documentation
(a). As-built drawings
(b). Testing shall be carried out in accordance with this document. This includes testing the attenuation and polarity of the installed cable plant with an optical loss test set (OLTS) and the installed condition of the cabling system and its components with an optical time domain reflectometer (OTDR). The condition of the fiber endfaces shall also be verified.
(c). Testing shall be performed on each cabling link (connector to connector).
(d). Testing shall be performed on each cabling channel (equipment to equipment) that is identified by MDOT.
(e). Testing shall not include any active devices or passive devices within the link or channel other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.
(f). All tests shall be documented including OLTS dual wavelength attenuation measurements for multimode and singlemode links and channels and OTDR traces and event tables for multimode and singlemode links and channels.
(g). Documentation shall also include optical length measurements and pictures of the connector endface.

(5) Quality Assurance
(a). All testing procedures and field-test instruments shall comply with applicable requirements of:
(i). ANSI Z136.2, ANS For Safe Use Of Optical Fiber Communication Systems Utilizing Laser Diode And LED Sources
(ii). ANSI/EIA/TIA-455-50B, Light Launch Conditions For Long-Length Graded-Index Optical Fiber Spectral Attenuation Measurements
(iii). ANSI/TIA/EIA-455-59A, Measurement of Fiber Point Discontinuities Using an OTDR.
(iv). ANSI/TIA/EIA-455-60A, Measurement of Fiber or Cable Length Using an OTDR.
(v). ANSI/TIA/EIA-455-61A, Measurement of Fiber or Cable Attenuation Using an OTDR.
(vi). ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Singlemode Fiber Cable Plant.
(vii). ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
(viii). ANSI/TIA/EIA-568-B.1, Commercial Building Telecommunications Cabling Standard, Part 1, General Requirements.
(ix). ANSI/TIA/EIA-568-B.3, Optical Fiber Cabling Components Standard.
(x). TIA/EIA TSB-140, Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.

(xi). ANSI/TIA/EIA-606-A, Administration Standard for Commercial Telecommunications Infrastructure, including the requirements specified by the customer, unless the customer specifies their own labeling requirements.

(6) Documentation signed by the manufacturer of the Air Blown Fiber with the bid that states the CONTRACTOR is authorized and certified by the manufacturer to provide the Air Blown Fiber cable products, installation and warranty certification is required.

(7) Documentation shall be submitted with the bid listing the names of employees that will be used on this project indicating their experience, level of expertise, and certificates of training signed by the manufacturer.

(8) Bids from non-compliant firms will be rejected.

(9) The CONTRACTOR shall complete Quality Assurance requirements.

(10) Trained technicians who have successfully attended an appropriate training program, which includes testing with an OLTS and an OTDR and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:
(a). Manufacturer of the fiber optic cable and/or the fiber optic connectors.
(b). Manufacturer of the test equipment used for the field certification.
(c). Training organizations (e.g., BICSI, A Telecommunications Association headquarters in Tampa, Florida; ACP [Association of Cabling Professionals™] Cabling Business Institute located in Dallas, Texas)
(d). MDOT or MDOT ENGINEER shall be invited to witness and/or review field-testing.
(e). MDOT or MDOT ENGINEER shall be notified of the start date of the testing phase five (5) business days before testing commences.
(f). MDOT or MDOT ENGINEER will select a random sample of 5% of the installed links. MDOT or MDOT ENGINEER shall test these randomly selected links and the results are to be stored in accordance with Part 3 of this document. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the representative shall repeat 100% testing at no cost to MDOT.

(11) Submittals
(a). Manufacturers catalog sheets and specifications for fiber optic field-test instruments including optical loss test sets (OLTS; power meter and source), optical time domain reflectometer (OTDR) and inspection scope.
(b). A schedule (list) of all optical fibers to be tested.

(12) Sample test reports

(13) Acceptance of test results

(a). Unless otherwise specified by MDOT or MDOTs representative, each cabling link shall be in compliance with the following test limits:
(i). Optical loss testing
(ii). Backbone (multimode and singlemode) link
(iii). The link attenuation shall be calculated by the following formulas as specified in ANSI/TIA/EIA-568-B.1:
(iv). Link Attenuation (dB) = Cable_Attn (dB) + Connector_Attn (dB) + Splice_Attn (dB)
(v). Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)
(vi). Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)
(vii). Maximum allowable connector_loss = 0.75 dB
(viii). Splice_Attn (dB) = number_of_splices * splice_loss (dB)
(ix). Maximum allowable splice_loss = 0.3 dB
(x). The values for the Attenuation_Coefficient (dB/km) are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation coefficient (dB/km)	Wavelength (nm)	Attenuation coefficient (dB/km)
Multimode 62.5/125 µm	850	3.5	1300	1.5
Multimode 50/125 µm	850	3.5	1300	1.5
Single-mode (Inside plant)	1310	1.0	1550	1.0
Single-mode (Outside plant)	1310	0.5	1550	0.5

(14) Horizontal (multimode) link
(a). The acceptable link attenuation for a multimode horizontal optical fiber cabling system is based on the maximum 90 m (295 ft) distance.
(b). The horizontal link may be tested using a fixed upper limit for attenuation of 2.0 dB. This value is based on the loss of two (2) connector pairs, one pair at the telecommunications outlet/connector and one pair at the horizontal cross-connect, plus 90 m (295 ft) of optical fiber cable.
(c). A horizontal link in an Open Office Cabling network with a consolidation point may be tested using a fixed upper limit for attenuation of 2.75 dB.

(15) Centralized (multimode) link
(a). The acceptable link attenuation for a multimode centralized optical fiber cabling system is based on the maximum 300 m (984 ft) distance.
(b). The centralized link may be tested using a fixed upper limit for attenuation of 3.3 dB. This value is based on the loss of three (3) connector pairs, one pair at the telecommunications outlet/connector, one pair at the consolidation point and one pair at the horizontal cross-connect, plus 300 m (984 ft) of optical fiber cable.
(c). A horizontal link in an Open Office Cabling network with a consolidation point may be tested using a fixed upper limit for attenuation of 4.1 dB.

(16) OTDR testing
(a). Reflective events (connections) shall not exceed 0.75 dB.
(b). Non-reflective events (splices) shall not exceed 0.3 dB.

(c). Magnified endface inspection
(d). Fiber connections shall be visually inspected for endface quality.
(e). Scratched, pitted or dirty connectors shall be diagnosed and corrected.
(f). All installed cabling links and channels shall be field-tested and pass the test requirements and analysis as described in Part 3. Any link or channel that fails these requirements shall be diagnosed and corrected. Any corrective action that must take place shall be documented and followed with a new test to prove that the corrected link or channel meets performance requirements. The final and passing result of the tests for all links and channels shall be provided in the test results documentation in accordance with Part 3.
(g). Acceptance of the test results shall be given in writing after the project is fully completed and tested in accordance with Contract Documents and to the satisfaction of MDOT.

Note: High Bandwidth applications such as 1000BASE-SX, 10GBASE-S, and FC1200 impose stringent channel loss limits. Where practical, certification should consider loss length limits that meet maximum channel (transmitter to receiver) loss.

(h). Performance specification for MM fiber at 850 nm in table below:

Fiber Type		Bandwidth	1000BASE-SX		10GBASE-SR		FibreChannel 1200-MX-SN-I	
	µm	(MHz• Km)	Length (m)	Loss (dB)	Length (m)	Loss (dB)	Length (m)	Loss (dB)
OM1	62.	220	275	2.38	26	2.6	33	2.4
OM2	50	500	550	3.56	82	2.3	82	2.2
OM3	50	2000	1000	3.56	300	2.6	300	2.6

(17) PRODUCTS
(a). OPTICAL FIBER CABLE Testers
(i). The field-test instrument shall be within the calibration period recommended by the manufacturer.
(b). Optical loss test set (OLTS)
(i). Multimode optical fiber light source
(ii). Provide dual LED light sources with central wavelengths of 850 nm (±30 nm) and 1300 nm (±20 nm)
(iii). Output power of –20 dBm minimum.
(iv). The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-B.1) with a Category 1 light source.
(v). Singlemode optical fiber light source
(vi). Provide dual laser light sources with central wavelengths of 1310 nm (±20 nm) and 1550 nm (±20 nm).
(vii). Output power of –10 dBm minimum.
(c). Power Meter

(i). Provide 850 nm, 1300/1310 nm, and 1550 nm wavelength test capability.
(ii). Power measurement uncertainty of ± 0.25 dB.
(iii). Store reference power measurement.
(iv). Save at least 100 results in internal memory.
(v). PC interface (serial or USB).
(vi). Length measurement
(vii). It is preferable to use an OLTS that is capable of measuring the optical length of the fiber using time-of-flight techniques.

(d). Optical Time Domain Reflectometer (OTDR)
(i). Shall have a bright, color transmissive LCD display with backlight.
(ii). Shall have rechargeable Li-Ion battery for 8 hours of normal operation.
(iii). Weight with battery and module of not more than 4.5 lb and volume of not more 200 in^3.
(iv). Internal non-volatile memory and removable memory device with at least 16 MB capacity for results storage.
(v). Serial and USB ports to transfer data to a PC.
(vi). Multimode OTDR
(vii). Wavelengths of 850 nm (± 20 nm) and 1300 nm (± 20 nm).
(viii). Event deadzones of 3.7 m maximum at 850 nm and 1300 nm.
(ix). Attenuation deadzones of 10 m maximum at 850 nm and 13 m maximum at 1300 nm.
(x). Distance range not less than 2000 m.
(xi). Dynamic range at least 10 dB at 850 nm and 1300 nm
(xii). Singlemode OTDR
(xiii). Wavelengths of 1310 nm (± 20 nm) and 1550 nm (± 20 nm).
(xiv). Event deadzones of 3.5 m maximum at 1310 nm and 1550 nm.
(xv). Attenuation deadzones of 10 m maximum at 1310 nm and 12 m maximum at 1550 nm.
(xvi). Distance range not less than 10000 m.
(xvii). Dynamic range at least 10 dB at 1310 nm and 1550 nm

(e). Fiber Microscope
(i). Magnification of 200X or 400X for endface inspection
(ii). Requirements
(iii). Video camera systems are preferred.
(iv). Camera probe tips that permit inspection through adapters are preferred.
(v). It is preferable to use test equipment capable of saving and reporting the endface image.
(vi). Integrated OLTS, OTDR and fiber microscope
(vii). Test equipment that combines into one instrument an OLTS, an OTDR and a fiber microscope may be used.

(18) Identification
(a). Labels
(i). All labeling shall be in accordance with ANSI/TIA/EIA-606 unless otherwise noted
(ii). Shall meet the legibility, defacement, exposure and adhesion requirements of UL 969.

(iii). Shall be preprinted using a mechanical means of printing (e.g., laser printer).
(iv). Where used for cable marking, provide vinyl substrate with a white printing area and a clear “tail” that self laminates the printed area when wrapped around the cable. If cable jacket is white, provide cable label with printing area that is any other color than white, preferably orange or yellow – so that the labels are easily distinguishable.
(v). Where insert type labels are used provide clear plastic cover over label.
(vi). Provide plastic warning tape 6 inches wide continuously printed and bright colored 18” above all direct buried services, underground conduits and duct-banks.

(19) Administration
(a). Administration of the documentation shall include test results of each fiber link and channel.
(b). The test result information for each link shall be recorded in the memory of the field-test instrument upon completion of the test.
(c). The test result records saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records.

(20) EXECUTION
General
(a). All tests performed on optical fiber cabling that use a laser or LED in a test set shall be carried out with safety precautions in accordance with ANSI Z136.2.
(b). All outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.

(21) OPTICAL FIBER CABLE TESTING
(a). Field-test instruments shall have the latest software and firmware installed.
(b). Link and channel test results from the OLTS and OTDR shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.
(c). Fiber endfaces shall be inspected at 200X or 400X magnification. 200X magnification is suitable for inspecting multimode and singlemode fibers. 400X magnification may be used for detailed examination of singlemode fibers. Scratched, pitted or dirty connectors shall be diagnosed and corrected.
(d). It is preferable that the endface images be recorded in the memory of the test instrument for subsequent uploading to a PC and reporting.
(e). Testing shall be performed on each cabling segment (connector to connector).
(f). Testing shall be performed on each cabling channel (equipment to equipment) that is planned for use per MDOT’s instructions.

(g). Testing of the cabling shall be performed using high-quality test cords of the same fiber type as the cabling under test. The test cords for OLTS testing shall be between 1 m and 5 m in length. The test cords for OTDR testing shall be approximately 100 m for the launch cable and at least 25 m for the receive cable.

(22) TUBE CABLE TESTING

(a). Obstruction and pressure test data for each tube installed shall be provided to MDOT personnel.
(b). Both pressure and obstruction tests shall be completed prior to installing fiber bundle(s)
(c). Pressure testing shall be required for testing end-to-end tube spans after completion of tube cable installation and tube inter-connection.
(d). Tube pressure testing shall be completed before proceeding with end-to-end tube obstruction testing.
(e). Obstruction testing shall be performed on all tubes upon completion of tube cable installation and prior to fiber bundle installation.

(23) FIBER OPTIC BUNDLE TESTING

(a). The CONTRACTOR shall provide to MDOT personnel, the cable manufacturer's test report for each reel of fiber bundle provided. These test reports shall include manufacturer's on-reel:
(b). Attenuation test results at both 1310 nm and 1550 nm (single-mode) to include signal loss, distance to impedance(s), and full OTDR measurement results by strand and by termination link.
(c). For each optical fiber of each reel prior to shipment from the manufacturer.
(d). The CONTRACTOR shall perform an attenuation test with an OTDR of each optical fiber of each fiber bundle reel prior to installation and supply the test data to the MDOT Engineer prior to installation.
(e). The fibers utilized in the installation shall be traceable to the manufacturer. On-the-reel bandwidth performance as tested at the factory shall be provided upon request.
(f). Optical fiber bundle shall be tested before utilization as follows:
(g). Perform all tests and provide copies of all test results to MDOT representatives.
(h). Responsible for supplying all equipment and personnel necessary to conduct the acceptance tests. The CONTRACTOR shall detail the proposed test plan for each cable type including equipment to use, test frequencies, and wavelengths, etc.
(i). Conduct acceptance testing according to a schedule coordinated with MDOT. Representatives of MDOT may be in attendance to witness the test procedures.
(j). Offer adequate advance notice (at least one week) to MDOT personnel as to allow for such participation.
(k). Describe how they will conduct the tests and provide copies of all test results to the MDOT ENGINEER and or their representative.
(l). All fibers shall be initially tested with a light source and OTDR utilizing procedures as stated in ANSI/TIA/EIA-526-14A:
(m). OFSTP-7 Measurement of Optical Power Loss of Installed Single-mode Fiber Cable Plant.

(n). Measured results shall be plus/minus 1 dB of the submitted loss budget calculations. If loss figures are outside this range, the cable shall be tested with an optical time domain reflectometer (OTDR) to determine cause of variation.
(o). The CONTRACTOR shall correct improper splices and replace damaged fiber at no charge to MDOT.
(p). Fibers shall be tested at 1310 nm and 1550 nm for single-mode optical fiber bundles.
(q). Testing procedures shall utilize “Method B” – One jumper reference.
(r). Bi-directional testing of optical fibers shall be required.
(s). Test results shall include a record of wavelength, fiber type, fiber and bundle number, test equipment and model number, date reference setup, and operator (personnel).
(t). Provide written reports of all test data in written form to MDOT, at such time the CONTRACTOR turns over test data to MDOT personnel.
(u). In the event that test results are not satisfactory, the CONTRACTOR shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation method, and shall perform additional tests as MDOT personnel deems necessary at no additional cost to MDOT.
(v). Tests related to connected equipment of others shall only be done with the permission and presence of the CONTRACTOR involved. The CONTRACTOR shall perform only that testing as required to prove the fiber connections are correct.
(w). Three (3) record copies of all test data shall be submitted to MDOT for approval. The MDOT personnel may be present.

(24) OPTICAL LOSS TESTING
(a). Backbone link
(i). Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper or the equivalent method.
(ii). Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper or the equivalent method.
(iii). Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.
(iv). Use the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1 or the equivalent method. The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.
(b). Horizontal (multimode) link
(i). The horizontal optical fiber cabling link segments need to be tested at only one wavelength. Because of the short length of cabling, attenuation deltas due to wavelength are insignificant. The horizontal link should be tested at 850 nm or 1300 nm in one

direction in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper method or the equivalent method.

(c). Centralized (multimode) link

(i). The centralized optical fiber cabling link segments need to be tested at only one wavelength. Because of the short length of cabling, attenuation deltas due to wavelength are insignificant. The horizontal link should be tested at 850 nm or 1300 nm in one direction in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper method or the equivalent method. Testing at 850 nm is recommended unless otherwise specified by MDOT.

(25) OTDR TESTING

(a). Backbone, horizontal and centralized links shall be tested at the appropriate operating wavelengths for anomalies and to ensure uniformity of cable attenuation and connector insertion loss.

(b). Backbone multimode: 850 nm and 1300 nm

(c). Backbone singlemode: 1310 nm and 1550 nm

(d). Horizontal multimode: 850 nm or 1300 nm

(e). Centralized multimode: 850 nm or 1300 nm (850 nm recommended unless otherwise specified by the end user)

(f). Each fiber link and channel shall be tested in one direction.

(g). A launch cable shall be installed between the OTDR and the first link connection.

(h). A receive cable shall be installed after the last link connection.

(i). Magnified Endface Inspection

(i). Fibers shall be inspected at 250X or 400X magnification. 250X magnification is suitable for inspecting multimode and singlemode fibers. 400X magnification may be used for detailed examination of singlemode fibers.

(j). Length Measurement

(i). The length of each fiber shall be recorded.

(ii). It is preferable that the optical length be measured using an OLTS or OTDR.

(k). Polarity Testing

(i). Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with subclause 10.3 of ANSI/TIA/EIA-568-B.1. The polarity of the paired duplex fibers shall be verified using an OLTS.

(l). Identification

(m). Labeling

(i). Labeling shall conform to the requirements specified within ANSI/TIA/EIA-606-A or to the requirements specified by MDOT or MDOT ENGINEER.

(n). Administration

(o). Test results documentation

(i). Test results saved within the field-test instrument shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of the test records. These test records shall be uploaded to the PC unaltered, i.e., “as saved in the field-test instrument”. The file

format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.

(ii). The test results documentation shall be available for inspection by MDOT or MDOT ENGINEER during the installation period and shall be passed to MDOT's representative within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling. The installer shall retain a copy to aid preparation of as-built information.

(iii). The database for the complete project, including twisted-pair copper cabling links, if applicable, shall be stored and delivered on CD-ROM prior to MDOT acceptance of the building. This CD-ROM shall include the software tools required to view, inspect, and print any selection of the test reports.

(iv). Circuit IDs reported by the test instrument should match the specified label ID (see (l) of this Section).

(v). The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information

(vi). The identification of the customer site as specified by the end-user

(vii). The name of the test limit selected to execute the stored test results

(viii). The name of the personnel performing the test

(ix). The date and time the test results were saved in the memory of the tester

(x). The manufacturer, model and serial number of the field-test instrument

(xi). The version of the test software and the version of the test limit database held within the test instrument

(xii). The fiber identification number

(xiii). The length for each optical fiber

(xiv). The index of refraction used for length calculation when using a length capable OLTS

(xv). Test results to include OLTS attenuation link and channel measurements at the appropriate wavelength(s) and the margin (difference between the measured attenuation and the test limit value).

(xvi). Test results to include OTDR link and channel traces and event tables at the appropriate wavelength(s).

(xvii). The length for each optical fiber as calculated by the OTDR.

(xviii). The overall Pass/Fail evaluation of the link-under-test for OLTS and OTDR measurements

(xix). A picture or image of each fiber end-face

(xx). A pass/fail status of the end-face based upon visual inspection.

(xxi). Record copy and as-built drawings

(xxii). Record copy of drawings both periodically throughout the project and at end of the project shall be provided to MDOT on CD-ROM. Record copy of drawings at the end of the project and utilizing software that is acceptable to MDOT and include notations reflecting the as built conditions of any additions to or

variation from the drawings provided such as, but not limited to cable paths and termination point. Drawings are to incorporate test data imported from the test instruments.

(xxiii). The as-built drawings shall include, but are not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts and frame installation details. The as-builts shall include all field changes made up to construction completion:

(xxiv). Field directed changes to pull schedule.

(xxv). Field directed changes to cross connect and patching schedule.

(xxvi). Horizontal cable routing changes.

(xxvii). Backbone cable routing or location changes.

(xxviii). Associated detail drawings.

(xxix). OTDR analysis, loss budget and connectivity and associated certification reports that meet or exceed EIA/TIA standards.

(xxx). The CONTRACTOR shall deliver the digital media to MDOT within six (6) weeks of completion of the project.

(xxxi). The CONTRACTOR shall deliver three (3) sets of as-built drawings to the MDOT representative within four (4) weeks of completion of the project.

(xxxii). Test/Certification results in bounded printed form and electronic document submission.

2. DELIVERY, STORAGE, AND HANDLING

A. The CONTRACTOR shall comply with Master Format Division 1 requirements.

B. The equipment shall be protected during transit, storage, and handling to prevent damage, theft, soiling, and misalignment.

C. The CONTRACTOR shall coordinate for secure storage of equipment and materials.

D. Equipment shall not be stored in conditions outside of the manufacturer's recommendations for environmental conditions.

E. The manufacturer's recommended procedures for storage of materials & equipment shall be followed.

F. Damaged equipment shall not be installed nor removed from site or replaced with new equipment.

d. Measurement and Payment.

The completed work includes all materials, labor, tools, equipment and incidentals necessary to complete the work, including but not limited to fiber distribution units (FDU's), tube distribution units (TDU's), splice enclosures assemblies, tube couplers, innerduct, bends, fittings, expansion couplings, terminations plugs, caps, and sealing fittings, pull ropes, conduit spacers as required by the manufacturer of the conduit, bonding systems, locator tape, locator wire, testing, and protective metal shields.

The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
10 GIGABIT ETHERNET NETWORK SWITCH

DES: MM 1 of 5 C&T:APPR:XXX:YYY:00-00-00

a. Description.

This work consists of the furnishing, configuring, installing, integrating and testing of a 10 gigabit Ethernet (10 GigE) network switch at locations designated on the Plans. All 10 GigE equipment shall enable the existing MDOT network and support interconnection to Wave Division Multiplexing (WDM) equipment (which is transporting both 10GBE and SONET OC-48 Ring traffic). This network infrastructure is to provide high- speed, low latency and scalable network supporting MDOTs Intelligent Transportation System (ITS) devices and operation software. The 10 GigE equipment shall consist of links that can be configurable for direct point-to-point to the proposed WDM network equipment (existing and/or provided by others). This work is to be done in accordance with the 2003 Standard Specifications for Construction, except as modified herein.

1. General
   A. The Contractor must furnish, install, integrate and test all equipment and required components necessary to provide a complete and fully functional system in all respects, without additional expense to MDOT.
   B. All equipment required for the installation, integration and testing of devices and subsystems contained within this project must be supplied by the Contractor as an appurtenance to the electronic equipment included within the project and at no additional cost to MDOT.

2. Summary
   A. Refer to ATMS Network Overview Document Section a.2.

3. Requirements of Regulatory Agencies and Standards

The compliance with the latest edition of the following codes, standards and guidelines is required:
   A. Refer to ATMS Network Overview Document Section a.3.

4. Qualifications
   A. Refer to ATMS Network Overview Document Section a.4.

5. Submittals
   A. Refer to Basic Methods and Materials for ITS Work and ATMS Network Overview.

5. Functional Requirements
   A. Furnish, assemble and install materials that are new and capable of operating in indoor conditions.
   B. Use identical and completely interchangeable equipment.
   C. Use equipment designed to protect personnel from exposure to high voltage during equipment operation, adjustments, and maintenance.

D. Compliance with all current NEC articles, Federal, State and Local regulations are required of the Contractor.
E. The 10 GigE equipment pay item consists of a fully functional, installed, configured, and tested 10 GigE network switch into existing WDM and 10GigE network.
F. The 10 GigE equipment must not impede or degrade the existing network infrastructure or systems.
G. Includes the configuration and/or reconfiguration of existing infrastructure to ensure seamless interoperability.
H. Configure and integrate with existing Network Management Software (password protected) allowing configuration and management of software/firmware upgrades and full software/hardware functionality.
I. Must meet or exceed the following ETS specifications for Operation and Storage conditions. Refer to ATMS Network Overview Document Section a.3.H
J. The 10 GigE equipment must be fully interoperable with the existing communications infrastructure, ITS devices and ATMS systems.
K. Support a minimum time between failure (MTBF) rate of at least 150,000 hours.
L. All small form factor pluggable (SPF) and 10 Gigabit small form factor pluggable (XFP) interface modules must be included (including attenuators). The interconnection between TMC's shall be 10 Gigabit.
M. Rack-mountable in a standard EIA/TIS 19" rack. Refer to ATMS Network Overview Document Section a.3.B
N. At a minimum, provide the following diagnostic LED's:
   (1) Power
   (2) Redundant power supply (RPS)
   (3) Transceiver status
   (4) Link integrity
   (5) Link activity
   (6) Link status
   (7) Link duplex indications (full/half)
   (8) Link speed (10/100/1000/10000 Mbps)
   (9) Link disabled
O. Must meet or exceed functional equipment requirements and configuration of the existing equipment at the MITS Center, outlined below:

Alcatel-Lucent OS9700 10 Gigabit Ethernet Backbone Switch

Part Number	Description	QTY
OS9700-RCB-A	[ECCN 5A992] OS9700 Redundant Bundle (Dual CMMs) for AC power, w/SSL (DES, 3DES, RC2, RC4). AC redundant chassis bundle includes 1 OS9700 chassis, 3 OS9-PS-0600A, 2 OS9700-CMM and AOS w/ advanced IP routing	1
OS9-GNI-C24	24-10/100/1000BaseT/TX RJ45 ports. Gigabit Ethernet network interface with RJ-45 connector supports 10/100/1000 Mbps transmission speed. Supports Cat5 or Cat5e UTP Cabling. (Requires minimum of 4 pairs to support 1000BaseTX.)	4
OS9-XNI-U2	2-unpopulated 10,000BaseX ports. 10 Gigabit Ethernet network interface with XFP (XFP MSA) connectors supports 2 XFP transceivers.	2
XFP-10G-SR*	10 Gigabit Ethernet optical transceiver (XFP MSA). Supports multimode fiber over 850nm wavelength (nominal) with an LC	2

Part Number	Description	QTY
	connector. Typical reach of 300m on 50/125 µm MMF. *Note: Validate part and wavelength at time of procurement and prior to installation / configuration.	

**Note: This is the configuration of the existing equipment based on current conditions. The total distance between end-points (TMC's) may require the use of different XFP's, specifically based on the Phases as shown on the Plans.*

b. Materials.

1. Equipment
   A. Must meet or exceed functional equipment requirements and configuration of the existing equipment at the MITS Center.
   B. Provide and install all available software and firmware upgrades through final acceptance.
   C. 10 GigE equipment consists of at least:
      (1) Optical Transmitter(s)
      (2) Optical Receiver(s)
      (3) Optical Cabling
      (4) Optical Patch Cords
      (5) SNMP management system
      (6) Power Cords
      (7) At least one spare of each component (if utilizing equipment not currently within network).
   D. General Minimum Technical Requirements:
      (1) Chassis Configuration: minimum 10 slots
      (2) Full Redundancy (CPU, power, fan, etc.): Yes
      (3) Hot Swappable Modules and Sub-Components: Yes
      (4) Network Connection Types: 10/100/1000/10000 BASE-T
      (5) SNMP Compliance: MIB I, MIB II
      (6) Data Interface: IEEE 802.3, 802.3D, 802.3u, 802.3ae, 802.3z
      (7) IEEE Configuration Standards: 802.1D Bridging Mode, 802.1Q VLAN
      (8) FCC Certified and Part 15.org compliant
      (9) Internet Group Management Protocol v. 2 or higher (2236)
      (10) Remote Configuration: Wired LAN Station Telnet, FTP, SNMP, HTML, or TFTP
      (11) Packet Routing: Store and Forward Capable
      (12) Error Checking: CRC32 Bit and Package Protocol Acknowledgment
      (13) Security Configurations: Authentication, IP/MAC Filtering.
      (14) Use a Forwarding/Filtering Rate of
         (a) 14,800 pps (packets per second) for 10Mbps; and
         (b) 148,800 pps for 100 Mbps.
         (c) 1,488,000 pps for 1000 Mbps (as applicable)
         (d) 14,880,000 pps for 10000 Mbps (as applicable)
      (15) Utilize a minimum of 4K MAC address table.
      (16) Provide, at a minimum, the following Ethernet and management ports.
         (a) 10/100/1000 Mbps BASE-T ports:
            (1) Ninety-six (96) copper ports
            (2) Connector Type: RJ-45
            (3) Auto negotiate for speed (10/100/1000 Mbps) and duplexity (full/half) for each port
         (b) Fiber Based Ports

(1) One – 24 Port 1000BaseX network interface module
(2) SPF Transceivers - as required to complete migration of existing fiber-based network/devices migrated from the old TMC to the new TMC (under this project by the Contractor).

(c) 10 GigE BASE-X ports:
(1) Two – two (2) port network interface modules
(2) Two small form factor pluggable (XFP) transceivers
(a) Must account for network configurations as shown on the Plans for Phase I and II.
(3) Wavelength: must match existing configuration and be confirmed prior to any procurement.
(4) Connector Type: must match existing configuration and be confirmed prior to any procurement.

(d) Management port
(1) Type RJ-45 or DB-9
(2) Manufacturer management cable must be provided

E. Each device must be uniquely addressable on the network.
F. Power Requirements
(1) Power input voltage range of 100-115 AC 60Hz
(2) Max power consumption 150 Watts

c. Construction

1. Coordination

A. Following the bid award, contact the MDOT Engineer and submit and coordinate the configuration of all IP address with the MDOT Engineer and/or their representative.

2. Installation

A. Grounding & bonding and surge suppression shall be in accordance with the Communications Grounding & Bonding, Grounding & Bonding and Lighting Protection special provisions.
B. Use an OTDR and optical loss test set (OLTS) to test and measure the fiber cables to ensure they are within EIA/TIA specifications up to 10 gigabit Ethernet. Also refer to ABF Fiber-Optic Tube & Cable Infrastructure Document Section a.10.A-B.
C. Rack mounting shall adhere to minimum OSHA and ASTM mounting standards.
D. Provide all hardware needed to properly mount the 10 GigE equipment and any ancillary pieces.
E. Provide a cable management system to be installed in appropriate locations in and around the rack area.
F. All cable and patch cord installations shall meet or exceed the bend radius as outlined in the EIA/TIA specifications.
G. Complete connections to existing network/devices migrated (under this project by the Contractor) from the old TMC to the new TMC. This includes relocation and termination of all fiber based connections as shown on the Plans.
H. Fiber connections to the existing and proposed network/devices will be made via proper length Single Mode (SM) LC to LC patch cables.
I. Configuration of all hardware and software/firmware will be scheduled as not to disrupt any operation of the MDOT network unless MDOT has allowed for a special exception.
J. After all installations and configurations are complete a test and acceptance phase will be preformed. Upon MDOT accepting the test as successful final scheduling for system cutover will need to be coordinated with the MDOT Engineer.

3. Testing

In addition to the testing and system acceptance requirements outlined in the Basic Methods and Materials for ITS Work and ATMS Network Overview Special Provisions the following test plan items are required:

A. Refer to ABF Fiber-Optic Tube & Cable Infrastructure Document Section a.10.C
B. Execution of all diagnostic routines provided by the manufacturer.
C. Unit testing of all chassis, cards, interconnections, and software/firmware for proper operation with results.
D. Fiber testing all cables and connections with OTDR and optical loss test set (OLTS) and providing results.
E. Packet throughput analysis & testing with results.
F. Existing ATMS client test from new facility to existing facility
   (1) Repair and re-test as necessary
G. Interim ATMS client test from new facility to existing facility
   (1) Repair and re-test as necessary
H. Conduct the approved tests and report the results in writing to the MDOT Engineer.
I. After successful completion of all tests in the test plan a 90-day observation period shall begin. To be accepted, the system must operate continuously for 90 days with no loss of communication attributable to work performed in this project. If any device experiences such a loss in communication correct the defect and begin the 90 observation period again. Continuation, extension or restart criterion and requirements must be outlined in the test plan which will be reviewed and approved by the MDOT Engineer. MDOT reserves the right to determine any network/system outage occurrence as major and request a restart under any and all circumstances.
J. Maintain a log of all communication failures, whether caused by work performed in this project or not, listing date, time, affected equipment, nature of the failure (no communication, intermittent communication, garbled communication, device/component failure, etc.), cause, corrective action taken, and date of correction. Allow the MDOT Engineer (or their representative) to inspect this log at any time and deliver the log to the MDOT Engineer at the end of the project.

d. Measurement and Payment.

The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
WDM COMMUNICATIONS CONTROLLER

DES: MM 1 of 5 C&T:APPR:XXX:YYY:00-00-00

a. Description.

This work consists of the furnishing, configuring, installing, integrating and testing of Wavelength Division Multiplexing (WDM) controller at locations designated on the Plans. WDM controller shall enable the existing OC-48 SONET network and the proposed 10 Gigabit Ethernet backbone network to communicate though links that provide seamless connectivity with scheduled minimal disruption or degradation of the network traffic. The WDM controller shall consist of links that can be configurable for direct SONET insertion/overlay and point-to-point to the proposed backbone core network equipment (existing and/or provided by others). This work is to be done in accordance with the 2003 Standard Specifications for Construction, except as modified herein.

1. General
   A. The Contractor must furnish, install, integrate and test all equipment and required components necessary to provide a complete and fully functional system in all respects, without additional expense to MDOT.
   B. All equipment required for the installation, integration and testing of devices and subsystems contained within this project must be supplied by the Contractor as an appurtenance to the electronic equipment included within the project and at no additional cost to MDOT.

2. Requirements of Regulatory Agencies and Standards
   The compliance with the latest edition of the following codes or standards is required:
   A. Refer to ATMS Network Overview Document Section a.3.

3. Qualifications
   A. Refer to ATMS Network Overview Document Section a.4.

4. Submittals
   A. Refer to Basic Methods and Materials for ITS Work and ATMS Network Overview.

5. Functional Requirements
   A. Furnish, assemble and install materials that are new and capable of operating in indoor conditions.
   B. Use identical and completely interchangeable equipment.
   C. Use equipment designed to protect personnel from exposure to high voltage during equipment operation, adjustments, and maintenance.
   D. Compliance with all current NEC articles, Federal, State and Local regulations are required of the Contractor.
   E. The WDM equipment pay item consists of a fully functional WDM to SONET/ATM and WDM to IP Ethernet 10 Gbps communications link passing data and verified

and accepted by MDOT; including testing of the ATMS client system (interim and existing) functionally in both project phases.

F. The WDM equipment must not impede or degrade the existing network infrastructure or systems.
G. Includes the configuration and/or reconfiguration of existing infrastructure to ensure seamless interoperability.
H. Configure and integrate with existing Network Management Software (password protected) allowing configuration and management of software/firmware upgrades and full software/hardware functionality.
I. Must meet or exceed the following ETS specifications for Operation and Storage conditions:
   (1) Operating conditions: ETS 300 019, Class 3.2
   (2) Storage conditions: ETS 300 019, Class 1.2
J. The WDM equipment must be fully interoperable with the existing communications infrastructure, ITS devices and ATMS systems.
K. Support a minimum time between failure (MTBF) rate of at least 150,000 hours.
L. All small form factor pluggable (SPF) and 10 Gigabit small form factor pluggable (XFP) interface modules must be included (including attenuators). The interconnection between TMC's shall be 10 Gigabit.
M. Rack-mountable in a standard EIA/TIS 19" rack.
N. At a minimum, provide the following diagnostic LED's:
   (1) Power
   (2) Redundant power supply (RPS)
   (3) Transceiver status
   (4) Link integrity
   (5) Link activity
   (6) Link status
   (7) Link duplex indications (full/half)
   (8) Link speed (10/100/1000/10000 Mbps)
   (9) Link disabled
O. Must meet or exceed functional equipment requirements and configuration of the existing equipment at the MITS Center, outlined below:

Alcatel-Lucent 1692 Metrospan Edge (MSE)

Part Number	DESCRIPTION	QTY
1692 MSE SUBRACK		
3AL97679AA	LOW COST METRO SPAN COMPACT SHELF	1
3AL97682AA	COMPACT FAN	1
3AN51151AA	COMPACT DUST FILTER	1
1692 MSE MULTIPLEXERS		
3AL97772AA	2F 8CH MDX2E W/ 1310 FILTER	2
1692 MSE EL/OPT MODULES		
1AB194670005	OPTO TRX SFP L-1.1 DDM EXTEMP	2
1AB196370007	OPTO TRX SFP S-16.1 ANYRATE DDM	2
1AB214540002	XFP 10GBE BASE S	2
1692 MSE TRIBUTARIES		
3AL97529BA	LOW COST DUAL WLA MODULE - 3R	1

8DG81002AA*	OCC-10 XFP CWDM 1610NM *Note: Validate part and wavelength at time of procurement and prior to installation / configuration.	2
1692 MSE TRIBUTARY SUBSYSTEM		
1AB196340009*	CWDM 1470NM PIN SFP DDM *Note: Validate part and wavelength at time of procurement and prior to installation / configuration.	2
1692 MSE POWER SUPPLY		
3AL86888AA	PSC_C	2
1692 MSE CONTROLLER		
8DG22852AE	RLII-AMERICA 1692MSE R3.4 FLASH CARD	1
3AL81728AA	SFP MODULE PLUGIN TOOL	1
3AL86653AA	LAC (LAN ACCESS CARD)	1
3AL86668AA	HOUSEKEEPING	1
3AL87009AA	ALARM CARD	1
3AL97540AA	OSC (OPTICAL SUPERVISORY CHANNEL)	1
3AL97690AA	LOW COST ESC	1
1692 MSE EQUIPMENT ACCESSORIES		
1AB195500001	JUMPER SFM MU/UPC-MU/PC 350MM	4
1AB195530001	JUMPER SFM MU/UPC-LC/UPC 390MM	4
1AB195530002	JUMPER SFM MU/UPC-LC/PC 320MM	4
3AL86750AA	ALARM CHAIN CABLE	1
3AL86751AA	HK USER CABLE	1
3EM17962AJ	KEYED SHLF PWR CA ASSY 10FT	2
3EM14633AA	BRACKET, MTG, CPE (23")	2
1AD000770237	.563 IN .216-24 UNC-2A PAN CROSS-RE	8
1692 MSE DOCUMENTATION		
3AL97925AE	DCP-1692MSEDGE 3.4 CD-ROM EN	1
1692 MSE SOFTWARE PACKAGES		
3AL97929AA	SWP-1692MSPAN EDGE R3.4	1
1692 MSE SW LICENCES		
3AL97618AA	SWL-RCT-1692MSEDGE LIC.FEE	1

**Note: This is the configuration of the existing equipment based on current conditions. The total distance between end-points (TMC's) may require the use of different XFP's.*

b. Materials.

1. Equipment
   A. Must meet or exceed functional equipment requirements and configuration of the existing equipment at the MITS Center.
   B. Provide and install all available software and firmware upgrades through final acceptance.
   C. WDM equipment consists of at least:
      (1) Optical Transmitter(s)
      (2) Optical Receiver(s)
      (3) Optical Cabling
      (4) Optical Patch Cords

(5) SNMP management system
(6) Power Cords
(7) At least one spare of each component (if utilizing equipment not currently within network).
(8) General Minimum Technical Requirements:
(a) Network Connection Types: 10/100/1000/10000 BASE-T
(b) SNMP Compliance: MIB I, MIB II
(c) Data Interface: IEEE 802.3, 802.3D, 802.3u, 802.3ae, 802.3z
(d) IEEE Configuration Standards: 802.1D Bridging Mode, 802.1Q VLAN
(e) FCC Certified and Part 15.org compliant
(f) Internet Group Management Protocol v. 2 or higher (2236)
(g) Remote Configuration: Wired LAN Station Telnet, FTP, SNMP, HTML, or TFTP
(h) Packet Routing: Store and Forward Capable
(i) Error Checking: CRC32 Bit and Package Protocol Acknowledgment
(j) Security Configurations: Authentication, IP/MAC Filtering.
(k) Use a Forwarding/Filtering Rate of
(1) 14,800 pps (packets per second) for 10Mbps; and
(2) 148,800 pps for 100 Mbps.
(3) 1,488,000 pps for 1000 Mbps (as applicable)
(4) 14,880,000 pps for 10000 Mbps (as applicable)
(l) Utilize a minimum of 4K MAC address table.
(9) Provide, at a minimum, the following line cards/interfaces and management ports.
(a) C-WLA: module to provide interface to existing SONET equipment
(b) OCC10-EC: module to provide interface to 10 Gigabit Ethernet equipment
(c) 2F 8CH MDX2E: module to provide wavelength multiplexing (MUX/DeMUX) onto the fiber optic cable
(d) LAN/SNMP interfaces

D. Each device must be uniquely addressable on the network.
E. Power Requirements
(1) Power input voltage range of 100-115 AC 60Hz
(2) Max power consumption 150 Watts

c. Construction

1. Coordination

A. Following the bid award, contact the MDOT Engineer and submit and coordinate the configuration of all IP address with the MDOT Engineer and/or their representative.

2. Installation

A. Grounding & bonding and surge suppression shall be in accordance with the Communications Grounding & Bonding, Grounding & Bonding and Lighting Protection special provisions.
B. Use an OTDR and optical loss test set (OLTS) to test and measure the fiber cables to ensure they are within EIA/TIA specifications up to 10 gigabit Ethernet. Also refer to ABF Fiber-Optic Tube & Cable Infrastructure Document Section a.10.A-B.
C. Rack mounting shall adhere to minimum OSHA and ASTM mounting standards.
D. Provide all hardware needed to properly mount the WDM equipment and any ancillary pieces.
E. Provide a cable management system to be installed in appropriate locations in and around the rack area.

F. All cable and patch cord installations shall meet or exceed the bend radius as outlined in the EIA/TIA specifications.
G. Fiber connections to the existing and proposed network/devices will be made via proper length Single Mode (SM) patch cables.
H. Configuration of all hardware and software/firmware will be scheduled as not to disrupt any operation of the MDOT network unless MDOT has allowed for a special exception.
I. After all installations and configurations are complete a test and acceptance phase will be preformed. Upon MDOT accepting the test as successful final scheduling for system cutover will need to be coordinated with the MDOT Engineer.

3. Testing

In addition to the testing and system acceptance requirements outlined in the Basic Methods and Materials for ITS Work and ATMS Network Overview Special Provisions the following test plan items are required:

A. Refer to ABF Fiber-Optic Tube & Cable Infrastructure Document Section a.10.C.
B. Execution of all diagnostic routines provided by the manufacturer.
C. Unit testing of all chassis, cards, interconnections, and software/firmware for proper operation with results.
D. Fiber testing all cables and connections with OTDR and optical loss test set (OLTS) and providing results.
E. Packet throughput analysis & testing with results.
F. Existing ATMS client test from new facility to existing facility
(1)Repair and re-test as necessary
G. Interim ATMS client test from new facility to existing facility
(1)Repair and re-test as necessary
H. Conduct the approved tests and report the results in writing to the MDOT Engineer.
I. After successful completion of all tests in the test plan a 90-day observation period shall begin. To be accepted, the system must operate continuously for 90 days with no loss of communication attributable to work performed in this project. If any device experiences such a loss in communication correct the defect and begin the 90 observation period again. Continuation, extension or restart criterion and requirements must be outlined in the test plan which will be reviewed and approved by the MDOT Engineer. MDOT reserves the right to determine any network/system outage occurrence as major and request a restart under any and all circumstances.
J. Maintain a log of all communication failures, whether caused by work performed in this project or not, listing date, time, affected equipment, nature of the failure (no communication, intermittent communication, garbled communication, device/component failure, etc.), cause, corrective action taken, and date of correction. Allow the MDOT Engineer (or their representative) to inspect this log at any time and deliver the log to the MDOT Engineer at the end of the project.

d. Measurement and Payment.

The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
CONDUIT, DIRECTIONAL BORE, (number), _ Inch

DES:MM 1 of 1 C&T:APPR:XXX:YYY:00-00-00

a. Description. Furnish all labor, equipment, and materials necessary for Directional Bore Conduit installation to complete the work as indicated on the plans.

b. Materials. Materials shall meet the following sections of the Standard Specifications for Construction:

Conduit……918
Backfill ……....206
Granular Material……...902
Turf and Landscape Material……...917

c. Construction. Construction shall be governed by Sections 206, 816, and 819 of the Standard Specifications for Construction and MDOT "typical" signal construction detail ST-22A. The number and size of conduits shall be as shown on the plans or as directed by the Engineer.

1. Ground Water Control.

   A. Drainage, bailing, pumping, or other control of ground water entering the excavation from seepage layers/lenses or pockets of saturated material of a routine and minor nature can be effectively controlled from inside the excavation. This shall be accomplished in such a manner that adjacent soil shall not be removed with the ground water drained and, thus, weaken or undermine the structure or its support(s) or any existing structure(s).

   B. If ordinary methods of drainage such as bailing, pumping, etc. prove unsatisfactory, the Special Provision for Dewatering shall apply.4. Vacuum clean rack(s), and dust all exposed surfaces upon completion of installation.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
TMC INTERIOR FIT-OUT OVERVIEW

a. Description. The Michigan Department of Transportation (MDOT) is in the process of constructing a new traffic management center (TMC) across the street from the existing TMC known as the MITS Center, which is located in downtown Detroit. The existing TMC has several audio visual (A/V) systems which display various types of video and information which allow the TMC operators to perform their duties. The new TMC is being constructed to allow for the expansion of services and system enhancements. The new space which the TMC will be housed in is under construction and the intent of this project to provide the necessary relocation of existing equipment, procurement/installation of additional equipment and provide the necessary interior fit out construction to allow for the final relocation of the TMC operations to the new space. This specification provides details of the work expected for the interior fit out package as shown on the Plans and Special Provisions. All work shall be performed in accordance with the Standard Specifications for Construction, where applicable.

1. General

A. Furnish, install, integrate, test, and warranty all equipment and required ancillary components necessary to provide a complete and fully functional system in all respects, without additional expense to the Department.

B. All equipment required for the installation, integration and testing of components and subsystems contains within this project must be supplied by the Contractor as an appurtenance to the electronic equipment included within the project and at no additional cost to the Department.

2. Summary

A. *Special Provision for Basic Methods and Materials for Interior Fit-Out is hereby incorporated into this special provision.*

B. *Special Provision for Video Wall Relocation and New Installation is hereby incorporated into this special provision.*

C. *Special Provision for Crystal Reports Server is hereby incorporated into this special provision.*

D. *Special Provision for Flat Panel Displays is hereby incorporated into this special provision.*

E. *Special Provision for Server Rack(s) is hereby incorporated into this special provision.*

F. *Special Provision for Video Recorder is hereby incorporated into this special provision.*

G. *Special Provision for Sound Masking System is hereby incorporated into this special provision.*

H. *Special Provision for Metal Fabrication – Section 05 50 00 is hereby incorporated into this special provision.*

I. *Special Provision for Rough Carpentry – Section 06 10 00 is hereby incorporated into this special provision.*

J. *Special Provision for Interior Architectural Woodwork – Section 06 40 23 is hereby incorporated into this special provision.*

K. *Special Provision for Joint Sealants – Section 07 92 00 is hereby incorporated into this special provision.*

L. *Special Provision for Penetration Firestopping – Section 07 84 13 is hereby incorporated into this special provision.*

M. *Special Provision for Flush Wood Doors – Section 08 14 16 is hereby incorporated into this special provision.*

N. *Special Provision for Glazing – Section 08 80 00 is hereby incorporated into this special provision.*

O. *Special Provision for Non-Structural Metal Framing – Section 09 22 16 is hereby incorporated into this special provision.*

P. *Special Provision for Gypsum Board – Section 09 29 00 is hereby incorporated into this special provision.*

Q. *Special Provision for Special Ceiling System – Section 09 54 00 is hereby incorporated into this special provision.*

R. *Special Provision for Special Provision for Fixed-Sound Absorptive Panels – Section 09 84 13 is hereby incorporated into this special provision.*

S. *Special Provision for Interior Painting – Section 09 91 23 is hereby incorporated into this special provision.*

T. *Special Provision for Staining and Transparent Finishing – Section 09 93 00 is hereby incorporated into this special provision.*

U. *Special Provision for Visual Display Surfaces – Section 10 11 00 is hereby incorporated into this special provision.*

V. *Special Provision for Metal Lockers – Section 10 51 13 is hereby incorporated into this special provision.*

W. *Special Provision for Basic Furnishing Requirements – Section 12 00 00 is hereby incorporated into this special provision.*

X. *Special Provision for Shades – Section 12 20 00 is hereby incorporated into this special provision.*

Y. *Special Provision for Furniture and Accessories – Section 12 40 00 is hereby incorporated into this special provision.*

Z. *Special Provision for Systems Furniture – 12 59 00 is hereby incorporated into this special provision.*

AA. *Special Provision for Common Work Results for Electrical Work – Section 26 05 00 is hereby incorporated into this special provision.*

BB. *Special Provision for Low-Voltage Electrical Power Conductors and Cables – Section 26 05 19 is hereby incorporated into this special provision.*

CC. *Special Provision for Grounding and Bonding for Electrical Systems – Section 26 05 26 is hereby incorporated into this special provision.*

DD. *Special Provision for Hangers and Supports for Electrical System – Section 26 05 29 is hereby incorporated into this special provision.*

EE. *Special Provision for Raceway and Boxes for Electrical Systems – Section 26 05 33 is hereby incorporated into this special provision.*

FF. *Special Provision for Cable Trays for Electrical Systems – Section 26 05 36 is hereby incorporated into this special provision.*

GG. *Special Provision for Vibration and Seismic Controls for Electrical Systems – Section 26 05 48 is hereby incorporated into this special provision.*

HH. *Special Provision for Identification for Electrical Systems – Section 26 05 53 is hereby incorporated into this special provision.*

II. *Special Provision for Modular Dimming Controls – Section 26 09 36 is hereby incorporated into this special provision.*

JJ. *Special Provision for Wiring Devices – Section 26 27 26 is hereby incorporated into this special provision.*

KK. *Special Provision for Interior Lighting – Section 26 51 00 is hereby incorporated into this special provision.*

3. Requirements of Regulatory Agencies and Standards. The compliance with the latest edition of the following codes, standards and guidelines is required:

A. American Institute of Steel Construction's (AISC)

B. American National Standards Institute Standard C2 (ANSI)

C. American Society for Testing Materials (ASTM)

D. American Society of Civil Engineers (ASCE)

E. American Society of Testing and Materials (ASTM)

F. Building Industry Consulting Services International (BICSI)

G. Federal Communications Commission (FCC) Code of Federal Regulations including but not limited to Title 47 and Part 15.org compliant

H. Institute of Electrical and Electronic Engineers (IEEE) including but not limited to 142-1991, 802.1D, 802.1p, 802.1Q, 802.3, 802.3D, 802.3u, 802.3ae, 802.3z, and Internet Group Management Protocol v. 2 or higher (2236)

I. International Electrotechnical Commission (IEC)

J. International Organization for Standardization (ISO) 11801:2002

K. International Telecommunication Union - Telecommunication (ITU-T)

L. Lightning Protection Institute (L.P.I.) Standards including but not limited to 175, 176, and 177

M. Motorola Standards and Guidelines for Communications Sites (R-56)

N. Moving Picture Experts Group (MPEG), Video Compression Standards Publications

O. National Electric Code (NEC), 2005/2007 or Latest Edition (and local Electrical Installation Standards/Laws)

P. National Electrical Manufacturers Association (NEMA) Standards Publications including but not limited to 250, TS 2-2003, and TS 4-2005

Q. National Fire Protection Association (NFPA) 70 - National Electrical Code

R. National Fire Protection Association (NFPA) 780 - Lightning Protection Code

S. National Television Standards Committee (NTSC), Video Standards Publications

T. National Transportation Communications for ITS Protocol (NTCIP)

U. Request for Comment (RFC) 2236 IGMP v.2; 2475 DiffServ; 768 UDP; 791 IP; 792 ICMP; 793 TCP; 783 TFTP; 826 ARP; 854 Telnet; 1157 SNMP v.1 and v.2; 1213 MIB II; 1493 Bridge MIB; 1643 Ethernet MIB; and RMON 4.

V. Telecommunications Distribution Methods Manual (TDMM)

W. Telecommunications Industry Association and Electronic Industry Alliance (TIA/EIA) Electronics Industries Association (EIA/TIA) including but not limited to 232-E, 310-C, 422-A, 455-46, 455-53(Ref B.1.39), 455-59, 455-61, 485, 568-B, 596-B, 598-B, 606-A, 607, and 758-A

X. Underwriters Laboratories Standards(UL)including but not limited to 94 V-O, 96, 96A, 467, 486A, 508, 910, 1666, 1703, and 60950

4. Qualifications

A. In addition to the requirements outlined in equipment specific Special Provisions the Contractor and RFP, bidders shall adhere to the following qualification requirements and present these qualifications at the time of bidding unless otherwise specified.

(1) Work specified herein shall be the responsibility of a single contractor.

(2) Use of additional qualified subcontractors is acceptable however subcontractors must be indicated in the bid documentation.

(3) Bidders as well as subcontractors must provide the following documentation at the time of bidding indicating a minimum of five years experience in the execution of projects similar in complexity as specified in the project documents.

(a) Provide the following information for at least three successfully completed projects similar in nature to this project as well as the bidder or subcontractors role within this project.

(i) Project Name and Description

(ii) Client Name and Primary Client Contact Information

(iii) Project Budget

(iv) Project Location

(4) These requirements shall apply equally to suppliers and manufacturers of the subsystems and major components to be used on this Project as described below:

(a) Video Wall Systems

(b) Sound Masking Systems

(c) Interior Architectural Woodwork

(d) Special Ceiling Systems

(e) Systems Furniture

B. Provide or engage an experienced and factory certified installer to install, configure and test the following equipment.

(1) Operator consoles

(2) Video Wall Systems

(a) Mitsubishi Video Wall Display Cubes

(b) Barco TransForm A system controller

C. Submit proof of factory certifications to the Engineer at the time of bidding.

5. New TMC Overview

A. The plans and specifications for the new DITC facility are available for review upon request and by appointment.

B. DITSC facility is currently under contract and construction is anticipated to be completed by July 2010.

6. New TMC Interior Fit Out Overview

A. The new TMC and details are shown on the Plans.

B. The new TMC Interior Fit Out at a minimum is comprised of:

(1) Control Room Furnishings

(a) Operator Consoles

(b) Operator Seating

(2) Custom Mill Work

(3) A/V Systems

(a) Main Operations Room Video Wall System

(b) Flat Panel Displays

(4) Electrical

(a) Decorative Lighting Fixtures

(b) Decorative Lighting Fixtures Lowering Devices

(c) Fluorescent Lighting Control and Dimming Devices

(d) Data Cabling

(5) Interior Construction

(a) Rough Carpentry

(b) Interior Architectural Woodwork

(c) Special Ceiling Systems

(d) Fixed-Sound Absorptive Panels

(6) Interior Furnishings

(a) Systems Furniture

(b) Shades

(7) Sound Masking System

b. Materials.

1. None

c. Construction.

1. Installation

A. Requirements are outlined in specific Special Provisions.

2. Construction Sequence and Phasing

A. General Overview. This project will finish the space allocated in the DITC facility for the new TMC. In coordination with the ATMS network connections the operations are to be seamlessly transitioned from the old TMC to the new TMC as the Department deems necessary. To mitigate downtime, a phased approach is required for the relocation of the A/V systems from the old TMC to the new TMC to ensure the transfer of operations allows for continual operation of the major TMC services including the use of at least one large screen video display system. The high-level steps include the construction of the operations area, emergency operations area, and relocation/installation of the A/V equipment in the new facility.

B. Requirements. Coordinate the relocation of the ATMS network with this work.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
BASIC METHODS AND MATERIALS FOR INTERIOR FIT-OUT

a. Description. This special provision describes the basic materials and methods required for this project. This work shall be done in accordance with the 2003 *Standard Specifications for Construction* except as modified herein, the contract documents, manufacturer's instructions, and shop drawings.

1. General.

A. This special provision applies to all work to be completed in this project including but not limited to:

(1) Video Wall Systems

(2) Sound Masking Systems

(3) Interior Architectural Woodwork

(4) Interior Finishes

(5) Electrical Work

(6) Special Ceiling Systems

(7) Systems Furniture

B. The Contractor will furnish, install, test and integrate all equipment and components necessary to provide full and complete functionality in all respects, without additional expense to the Department.

C. Prepare and distribute minutes from all project related meetings to attendees for review, comments, and approval by OWNER.

2. Permits and Licenses.

A. Acquire the permits and necessary insurance riders for all required city, state, utility and inspection permits, including all costs associated with these permits and insurance riders.

B. The Contractor is responsible for all overtime inspection costs by city, state, utility companies and other agencies required for work performed at the discretion of the Contractor outside the city, state, utility company's normal working hours.

C. The Contractor is responsible for payment of all city, state, utility bills and charges prior to equipment acceptance by the Department.

3. Construction Phase Submittals.

(1) General

(a) Except for the project Close Out Documentation, all shop drawings, schematics, material lists, and details will be submitted to the Engineer within 90 days of Contractor's Notice to Proceed

(b) No extension of time will be allowed due to Contractor's failure to complete and obtain acceptance of any submittal nor will delays to the project for completing this work be allowed as the basis of any claim. Seven copies of each submittal shall be transmitted to the Engineer, unless otherwise specified

(c) Submittals not transmitted as specified will be returned without review, and must be resubmitted

(d) Review and acceptance of submittals by the Engineer does not relieve the Contractor of the responsibility for errors or conformance with the contract documents

(e) All submittals will be accompanied by a Letter of Transmittal that includes the following information:

(i). Date of submittal

(ii). Name of company making submittal

(iii). Name of the Contractor sending submittal

(iv). State Job Number and Control Section

(v). Federal aid project number

(vi). Itemized list of enclosures (e.g., five copies of Inside Wiring Submittals)

(vii). Recipient name and department (i.e. to the attention of …)

(viii). Action requested (e.g., please review submittals for approval)

(2) Required Submittals:

(a) Site Evaluation Report: Submit Site Evaluation Reports for all sites requiring assessment of construction site prior to equipment installations as detailed in the Plans

(b) Shop Drawings and Equipment Data

(i). Submit Shop Drawings and Equipment Data for all prefabricated equipment and components if required by the contract documents.

(ii). Submit samples if required by the contract documents, or if requested by the Engineer.

(iii). Shop Drawings

(iv). Allow 10 working days for the Engineer to review detailed plans prior to authorization to commence installation

(v). Verify, in writing, final hardware and software installation configuration plans with the Engineer prior to any field installation

(vi). Equipment Data

(vii). Prior to ordering material, submit equipment data information. Equipment data sheets shall clearly state equipment compliance with equipment specifications

(viii). Submit five indexed and bound sets of equipment data including but not limited to the following items identified in individual specification and special provision sections (see Table 1 – next page).

Table 1: Individual Specification Provision Sections

TMC INTERIOR FIT-OUT OVERVIEW
BASIC METHODS AND MATERIALS FOR INTERIOR FIT-OUT
VIDEO WALL RELOCATION AND NEW INSTALLATION
CRYSTAL REPORTS SERVER
FLAT PANEL DISPLAYS
SERVER RACK(S)
VIDEO RECORDER
SOUND MASKING SYSTEM
METAL FABRICATIONS – SECTION 05 50 00
ROUGH CARPENTRY – SECTION 06 10 00
INTERIOR ARCHITECTURAL WOODWORK – SECTION 06 40 23
JOINT SEALANTS – SECTION 07 92 00
PENETRATION FIRESTOPPING - SECTION 07 84 13
FLUSH WOOD DOORS – SECTION 08 14 16
GLAZING – SECTION 08 80 00
NON-STRUCTURAL METAL FRAMING – SECTION 09 22 16
GYPSUM BOARD – SECTION 09 29 00
SPECIAL CEILING SYSTEMS – SECTION 09 54 00
FIXED SOUND-ABSORPTIVE PANELS – SECTION 09 84 13
INTERIOR PAINTING – SECTION 09 91 23
STAINING AND TRANSPARENT FINISHING – SECTION 09 93 00
VISUAL DISPLAY SURFACES – SECTION 10 11 00
METAL LOCKERS – SECTION 10 51 13
BASIC FURNISHINGS REQUIREMENTS – SECTION 12 00 00
SHADES – SECTION 12 20 00
FURNITURE AND ACCESSORIES – SECTION 12 40 00
SYSTEMS FURNITURE – SECTION 12 59 00
COMMON WORK RESULTS FOR ELECTRICAL WORK – SECTION 26 05 00
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES – SECTION 26 05 19
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS - SECTION 26 05 26
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS – SECTION 26 05 29
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS – SECTION 26 05 33
CABLE TRAYS FOR ELECTRICAL SYSTEMS – SECTION 26 05 36
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS – SECTION 26 05 48
IDENTIFICATION FOR ELECTRICAL SYSTEMS - SECTION 26 05 53
MODULAR DIMMING CONTROLS – SECTION 26 09 36
INTERIOR LIGHTING – SECTION 26 51 00

(ix). List in the index equipment being submitted and the specification section references

(x). Equipment includes, but is not limited to, the following:

1) A complete equipment list including manufacturers' names, model numbers, and quantities of each item; manufacturers' data sheets on all equipment items, including parts list and part numbers; performance characteristics and capacities; dimensions and clearances; wiring diagrams and controls; and other pertinent information

2) Equipment racks and console layouts showing locations of all equipment items

3) Construction details for any custom fabricated items, including interfaces, panels, removable control panels, and wall plates. These details shall show dimensions, materials, finishes, and color selection

4) Schematics showing detailed connections to all equipment with wire/cable number, terminal block number, and color-coding. Distinct wire numbers shall be translated to label permanently affixed to each cable. Device connection and protocol information, and labeling schema shall also be provided

5) Contractor or its subcontractors certificate by the manufacturer to install the equipment

(c) Work Plan:

(i). Submit Work Plan to the Engineer for review at the preconstruction meeting

(ii). The Work Plan will be discussed at the preconstruction meeting. Within two weeks of receipt, the Engineer will either accept the plan as submitted or request revisions. First two weeks schedule will be reviewed at the preconstruction meeting and the Engineer will approve or request change to the first two weeks schedule as a part of the meeting

(iii). Work on this project will not begin until the Work Plan has been accepted by the Engineer

(iv). The Work Plan will include primary work tasks and schedule for each indicating start and completion dates with clear identification of long lead-time items and critical path tasks

(d) Material Handling and Storage Plan

(i). Thirty days prior to any equipment arriving at the site, submit 10 copies of a Material Handling and Storage Plan to the Engineer

(ii). The Material Handling and Storage Plan will give details of the equipment and facilities to be provided and the procedures to be adopted by the Contractor for the safe and efficient handling and storage of all equipment and material

(iii). The Engineer will review the plan and respond within 10 workings days of receipt indicating either acceptance or rejection with required changes of the plan

(iv). Address all comments and resubmit the plan within seven working days after receiving the rejection notice and comments

(v). Do not ship materials to the site until the Materials Handling and Storage Plan is accepted by the Engineer

(vi). The Department will not make provisions for temporary storage of equipment prior to deployment in specified locations. All costs incurred in storage, setup, handling, and transportation shall be included in bid

(vii). The Department assumes no responsibility for stored equipment. The ownership and title to equipment shall not be vested in the Department before the equipment has been delivered, tested, and accepted

(viii). All equipment shall be fully insured and maintained by the Contractor until final acceptance by the Engineer

(ix). The Contractor is encouraged to minimize the amount of time equipment is stored in an outside environment

(e) Equipment Installation Plan

(i). Thirty days prior to the first installation of equipment, submit 10 copies of the Equipment Installation Plan to the Engineer. Should the Equipment Installation Plan may be integrated into the Work Plan, the submittal time frame of the Work Plan applies

(ii). The Engineer will review the plan and respond within 10 working days of receipt indicating either acceptance or rejection with required changes of the plan

(iii). Address all comments and resubmit the plan within seven working days after receiving the rejection notice and comments. The approved plan shall be used for all subsequent installations of similar equipment

(iv). The Equipment Installation Plan includes, but is not limited to, the following:

1) Details of equipment to be used for installation

2) Name, contact information and details of relevant experience of Contractor's personnel to be involved

3) Details and sequence of procedures to be employed for equipment installation

4) Location, date and expected time of installation

5) Details of precautionary measures to be adopted to avoid damage to the equipment

6) Details of repair facilities/measures available to rectify any damage to the equipment during installation

(f) Test Plan:

(i). Submit a complete Test Plan to the Engineer for review and acceptance prior to commencing any testing. Allow sufficient time for this review such that it is accepted by the Engineer at least 14 days prior to the start any testing

(ii). Include details of the Pre-Construction Testing, Construction Phase Testing and Final Inspection and Acceptance Testing as specified in this special provision. In addition, address all material and equipment testing required by the contract documents

(iii). Include a schedule of each step of testing process; identification of all test equipment to be utilized; and identification of each independent testing subcontractor to be employed to conduct specified testing

(g) Close Out Documentation: provide the following items as part of the Close Out Documentation after construction has been completed

(h) Record Documents:

(i). Maintain a set of record “As-Built” documentation and plans during the course of installation

(ii). These documents will be updated weekly by the Contractor to reflect current approved design changes and as-built information

(iii). Completed record documents and plans will be turned over to the Engineer at the completion of work

(iv). Record Documents will indicate, but not be limited to, the following:

1) All approved changes and/or deviations from the contract documents

2) Equipment model, serial number, and location

3) Diagrams labeling all connections to equipment

4) Maintenance and operation information adequate to operate all required features of all equipment without other technical support

5) Service entrance facilities

6) Main cross-connects

7) Telecommunications closets, equipment rooms, handholes and manholes

8) Splices

9) Hand holes and junction boxes with their associated identifying label

10) Location of all devices with device identification and cable routing

11) Other material and equipment as-built details required by the contract documents

(i) Application Software

(i). Provide necessary application software (including any applicable licenses) to allow the Department to edit diagram(s) as needed. If the Department has current software for managing this information, use the Department's current standards in developing this information

(j) Other Documentation:

(i). Provide a graphical diagram of equipment connections on CD-ROM, and 8.5 inch by 11 inch paper copies indicating the Department identification and locations, as well as details of interconnection to other devices including media types.

(ii). Provide complete ITS configuration, including any default settings modified on the ITS in both Microstation (.dgn) and Portable Document Format (.pdf) formats

(iii). Provide both bound and indexed paper medium and CD-ROM media documentation of all equipment and associated parts with manufacturer's nameplate, giving name of manufacturer, description, size, type, serial number, and other specifications per building, to facilitate maintenance or replacement. Nameplate of distributor or Subcontractor is not acceptable. These electronic file(s) will be in Microsoft Access database format (.mdb). Provide two sets of cable termination records for copper and fiber optic feed cables in a bound paper medium

(iv). One set will be left on-site in each associated telecommunications closet or cabinet (in a water-tight resealable envelope), and the second set shall be provided to the Engineer upon project completion. Cross connect and patching information will be filled out in pencil, to facilitate future changes

b. Materials. Furnish new materials and equipment. Where no specific kind or quality of material is specified, furnish industry standard materials, as approved by the Engineer.

1. Materials will be produced by a company that has been engaged in the manufacture of such types of materials for a period of at least five years. All equipment must be factory manufactured and come with a minimum three year manufacturer's warranty.

2. The Contractor is responsible for protecting materials before, during, and after installation, until maintenance of the material is officially transferred to the Department. In event of damage, the Contractor will make all repairs and/or replacement necessary to

restore the material to its original state within the timeframe agreed upon with the Engineer and at no additional cost.

3. Supply the most recent version of all equipment hardware and software. A prior and/or old version of equipment, unless specifically identified as an exception to this requirement or approved by the Engineer, is not acceptable. In cases where a newer version of the equipment is available at the time of installation, the Contractor must request a clarification from the Engineer on which equipment is to be used.

4. Deliver all material to the job site in original unopened containers, where applicable, with all labels intact and legible at time of use. Store all materials in accordance with manufacturer's recommendations and the accepted Materials Handling and Storage Plan.

5. The Contractor shall furnish and install all available software upgrades through final acceptance. The exception shall be if such installation will compromise functionality, subject to review and approval of the Engineer.

6. Transient voltages, surges, and sags shall not affect the equipment operations.

7. The equipment shall meet all the requirements in Section 2.1.4 - Power Interruption of the National Electrical Manufacturer's Association (NEMA) standard TSI for traffic control ITS and Section 2.1.6 - Transients, Power Service of the NEMA standard TSI.

8. The equipment design and construction shall utilize the latest available techniques with a minimum number of different parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality.

9. The equipment shall be designed for ease of maintenance. All equipment parts shall be readily accessible for inspection and maintenance. Test points shall be provided for checking essential voltages and waveforms.

10. Equipment Warranties.

A. Provide a statement of warranty for all equipment and complete documentation of the procedures to initiate warranty service calls.

B. Except as noted, beginning with the date of notice to proceed and continuing for a period ending one year after the date of acceptance by the Engineer, the Contractor will provide the following services:

(1) Furnish a warranty of all hardware, software, and related equipment.

(2) Transfer ownership and warranties of all purchased hardware, equipment, and software to the Department

(3) The Department will be the sole Owner of all equipment software or the registered licensee as appropriate

(4) Pay for the cost of ownership or license of software during the warranty period.

C. The Manufacturer shall repair any failed equipment covered by warranty that can be repaired on-site within 48 hours of notification of failure.

(1) Replace equipment requiring removal from site for repair or any equipment requiring replacement with a new unit within five days of notification of failure

(2) New replacement equipment will continue the original warranty of the replaced unit except where the warranty provided by its supplier or manufacturer is longer. The cost of shipping of failed equipment is the responsibility of the Contractor

(3) If equipment cannot be replaced with identical equipment, the Engineer will provide approval after review of the Contractor's provided options

c. Construction.

1. General Requirements:

A. Optimize all hardware, firmware, and software settings to function, perform, and are managed via the communications network.

B. Furnish, install, and properly configure software license programs as specified by manufacturer.

C. Install, set in place, initialize, and configure all specified and/or included equipment for full and final operation.

D. Provide full-featured operation of all elements and demonstrate this operation to the Engineer by completion of all activities described in the accepted Test Plan.

E. Comply with working clearances and dedicated spaces per NEC Articles 110, 384 and 800-5, as well as all current NEC articles, and Federal, State and Local regulations.

F. Execute work in a manner which preserves and protects warranties of all equipment, whether or not the equipment is a part of this project.

G. Ground and bond all equipment and materials as required by National and Local Standards, these Specifications, and as noted on the plans.

2. Cutting and Patching:

A. Complete all cutting and patching necessary for installation of work with approval of the Engineer.

B. Use rotary type drilling tools and concrete cutting saws to cut concrete and masonry walls.

C. Use rotary type drilling tools to cut cabinets where knock-outs are not available and cable access is required.

D. Provide a firestop as required.

E. Ensure waterproof holes through exterior walls and ground floor.

F. The Contractor shall not impair strength or function of object being cut or patched, (e.g., do not weaken structural members).

G. Do not use a torch for cutting metal

3. Wiring Requirements:

A. All wiring will meet the requirements of the National Electric Code. All wires will be cut to proper length before assembly.

B. No wire will be doubled-back to take up slack.

C. Neatly lace wires into cable with nylon lacing or plastic straps, and secure cables with clamps.

D. Provide service loops at all connections.

E. All DC relays, solenoids, and holding coils shall have diodes or other protective devices across the coils for transient suppression.

F. The equipment shall contain readily accessible, manually resettable, or replaceable circuit protection devices (such as circuit breakers or fuses) for equipment and power source protection.

G. Circuit breakers or fuses shall be provided and sizes such that no wire, equipment, connector, PC board, or assembly shall be subjected to sustained current in excess of their respective design limits upon the failure of any single circuit element or wiring.

H. All external connections shall be made by means of connectors. The connectors shall be keyed to preclude improper hookups. All wires to and from the connectors shall be color-coded and appropriately labeled. In order to assure compatibility and performance compliance, the cables from the dome camera housing shall be assembled by the camera manufacturer.

I. All pins and mating connectors shall be plated to provide good electrical connection and resist corrosion. Connectors utilizing solder type connections shall have each soldered connection covered by a piece of heat shrink tubing securely shrunk to insure that it protects the connection.

J. Modules of unlike functions shall be mechanically keyed to prevent insertion into the wrong socket or connector.

K. All modules and assemblies shall be clearly identified with name, model number, serial number, and any other pertinent information required to facilitate equipment maintenance.

L. Each control panel shall be one integral unit with self-contained power supplies or shall draw its power from the camera controller.

M. All external connections shall be made by means of connectors. The connectors shall be keyed to preclude improper hookups. All wires to and from the connectors shall be color-coded and/or appropriately marked. Pins and mating connectors shall be plated with a minimum of 20 microns of gold.

N. Connecting harnesses of appropriate length and terminated with matching connectors shall be furnished and installed for interconnection with the communications equipment interface.

4. Equipment Testing and Acceptance Requirements:

A. The Contractor shall submit a complete Test Plan for the Engineer's review and acceptance prior to commencing any testing. If any modification to equipment is made, the Contractor shall repeat the testing according to the accepted Test Plan to ensure changes do not conflict with other equipment. Upon completion of any testing, written reports shall be submitted to the Engineer stating the results of the tests and any actions taken as a result of these tests.

B. Payment schedules shall be dependent on the successful completion of these testing benchmarks (refer to individual equipment special provisions contained in the contract documents).

C. All tests must be conducted in the presence of the Engineer.

D. The Contractor is responsible for furnishing all test equipment required to test the systems in accordance with the parameters specified. Unless otherwise stated, the test equipment shall not be considered part of the system. The Contractor shall furnish test equipment with greater accuracy than the parameters to be tested.

E. All major and minor failures that occur and the corrective actions taken shall be maintained in a Failure Log, and provided to the Engineer. A record of failed equipment serial numbers shall be included in this log.

(1) A major failure shall be defined as having occurred if any one or more of the following occur: (Note: The 60-day test clock shall be reset to zero and restarted after major failures are corrected to the satisfaction of the Engineer.)

(a) Less than 95 percent of any individual piece of equipment is operational at any moment.

(b) Any failure that requires greater than 24 hours to correct.

(c) Frequent occurrence of minor failures indicating a major system flaw as determined by the Engineer.

(2) A minor failure is any other failure. The 60-day acceptance test period shall be stopped when a minor failure occurs and restarted without resetting to zero after the minor failure is corrected to the satisfaction of the Engineer.

F. Pre-Construction Testing

(1) Pre-Construction Testing shall provide the Engineer with a comprehensive proof of concept test demonstrating the system and components working interactively.

(2) The Contractor shall perform a comprehensive pre-test of the configuration and assembly details in the presence of the Engineer prior to any field installation. The procedures shall be as stated in the accepted Test Plan.

G. Construction Phase Testing

(1) After the Pre-Construction Test has been completed and 30 days prior to the anticipated date of acceptance of Construction Phase Testing, Construction Phase Testing is expected to begin.

(2) The Contractor shall verify in writing that the system and components meet all of the requirements of the specifications and complies with all appropriate standards listed in these specifications.

(3) This testing shall be designed to validate that the system and components works together to provide full system functionality prior to the Final Inspection and Acceptance Testing.

H. Final Inspection and Acceptance Testing

(1) The earliest of two weeks prior to the final inspection or within sixty days of project completion, deliver to the Engineer four copies of a certificate by the authorized representative of the manufacturer that the system has been properly installed, adjusted and pre-tested.

(2) At the Final Inspection, a representative of the equipment manufacturer shall demonstrate to the Engineer that the system functions as specified in the Plans and Special Provisions.

(3) There shall be an Acceptance Test period of 60 days after completion of the Final Inspection to identify, isolate, and correct any problems with the hardware, software, and interfaces. All problems discovered by the Contractor or Engineer shall be corrected to the satisfaction of the Engineer.

I. Final Acceptance

(1) Final acceptance of the complete and operating system will be made by the Engineer only after all of the following have been achieved.

(2) Successful completion of Acceptance Testing per the Test Plan that was accepted by the Engineer.

(3) Engineer receipt, review, and approval of all Acceptance Test data and results.

(4) Successful completion and delivery of all contract deliverables including all project documentation referenced in this or other special provisions.

(5) Field equipment shall operate continuously for 24 hours per day, seven days a week for the duration of the 60 day acceptance test period, during which the equipment shall experience no major failures.

5. Equipment Identification:

A. Equipment shall be identified on each item with high quality, smear resistant, computer-generated labels, and established for logical identification in compliance with EIA/TIA 606, Specifications, or as directed by the Engineer. Labels shall be Brady or approved alternate and shall meet or exceed the legibility, defacement, and adhesion requirements specified in UL969, and meet or exceed the general exposure requirements in UL969 for indoor or outdoor use, whichever applies. Labeling identifiers shall be EIA/TIA 606 3.4. (Except jacks), followed by an identifying number or letter.

B. Each type of equipment, pathway, or space shall have a separate labeling scheme (e.g., there may be TC1, BC1, etc. within a building). Jacks shall be labeled with TC number, cabinet number, patch panel number, then port number unless noted otherwise (e.g., A-2-4-24 would be Closet A, Cabinet 2, patch panel 4, terminated on the 24th port; ensure all cabinets and patch panels are labeled accordingly).

C. Label plug-end of power cords identifying equipment powered.

6. Construction Site Cleanup:

A. The Contractor shall remove from the site all debris accumulating as a result of installation and properly dispose of all debris according to the standard specifications.

B. The Contractor shall leave all rooms, cabinets, and facilities in a clean condition.

C. The Contractor shall clean interiors of all cabinets, furniture, and equipment enclosures. The Contractor shall clean all equipment prior to acceptance testing. All equipment shall appear in new condition.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
INTERIOR ARCHITECTURAL WOODWORK – SECTION 06 40 23

a. Description.

1. General

A. Summary

(1) This Special Provision includes the following:

(a) Interior standing and running trim.

(b) Interior frames and jambs.

(c) Plastic-laminate cabinets.

(d) Plastic-laminate countertops.

(e) Closet and utility shelving.

(f) Shop finishing of interior woodwork.

(2) Related Special Provisions include the following:

(a) Rough Carpentry - Section 06 10 00 for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

(b) Fixed Sound-Absorptive Panels - Section 09 84 13

B. Definitions

(1) Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

C. Submittals

(1) Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

(a) Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

(b) Show locations and sizes of cutouts and holes for items installed in architectural woodwork.

(2) Samples for Initial Selection:

(a) Shop-applied transparent finishes.

(b) Plastic laminates.

(3) Woodwork Quality Standard Compliance Certificates: WI-certified compliance certificates.

(4) Qualification Data: For Installer and fabricator.

D. Quality Assurance

(1) Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program.

(2) Installer Qualifications: Fabricator of products.

(3) Quality Standard: Unless otherwise indicated, comply with WI's "Manual of Millwork" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

(a) Provide WI-certified compliance certificates indicating that woodwork, including installation, complies with requirements of grades specified.

(4) Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

(a) Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Delivery, Storage, And Handling

(1) Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas.

F. Project Conditions

(1) Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

(2) Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

(a) Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

G. Coordination

(1) Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

(2) Hardware Coordination: Distribute copies of approved hardware schedule to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

b. Materials.

1. Products

A. Materials

(1) General: Provide materials that comply with requirements of WI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

(2) Wood Species and Cut for Transparent Finish: Clear maple, plain sawn or sliced.

(3) Wood Species for Opaque Finish: Any closed-grain hardwood.

(4) Wood Products: Comply with the following:

(a) Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.

(b) Particleboard: ANSI A208.1, Grade M-2.

(c) Softwood Plywood: DOC PS 1, Medium Density Overlay.

(d) Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

(5) Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

(a) Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.

(6) High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

(a) Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:

(i) Formica Corporation.

(ii) Lamin-Art, Inc.

(iii) Nevamar Company, LLC; Decorative Products Div.

(iv) Wilsonart International; Div. of Premark International, Inc.

B. Cabinet Hardware And Accessories

(1) General: Provide cabinet hardware and accessory materials associated with architectural cabinets.

(2) Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening.

(3) Back-Mounted Pulls: BHMA A156.9, B02011.

(4) Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

(5) Shelf Rests: BHMA A156.9, B04013; metal.

(6) Drawer Slides: BHMA A156.9, B05091.

(a) File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.

(7) Door Locks: BHMA A156.11, E07121.

(8) Drawer Locks: BHMA A156.11, E07041.

(9) Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

(a) Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

(10) For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

C. Miscellaneous Materials

(1) Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

(2) Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

(3) Adhesives, General: Do not use adhesives that contain urea formaldehyde.

(4) Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

(a) Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

D. Fabrication, General

(1) Interior Woodwork Grade: Unless otherwise indicated, provide Custom-grade interior woodwork complying with referenced quality standard.

(2) Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

(3) Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

(a) Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).

(b) Edges of Rails and Similar Members More Than 3/4 Inch (19 mm) Thick: 1/8 inch (3 mm).

(c) Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).

(4) Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

(a) Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

(5) Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

(a) Seal edges of openings in countertops with a coat of varnish.

(6) Install glass to comply with applicable requirements in Special Provision for Glazing - Section 08 80 00 and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

E. Interior Standing And Running Trim For Transparent Finish

(1) Grade: Custom.

(2) Wood Species and Cut: Clear maple, plain sawn or sliced.

(3) For trim items wider than available lumber, use veneered construction. Do not glue for width.

(4) Assemble casings in plant except where limitations of access to place of installation require field assembly.

(5) Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.

F. Interior Frames And Jambs For Transparent Finish

(1) Grade: Custom.

(2) Wood Species and Cut: Clear maple, plain sawn or sliced.

(3) For frames or jambs wider than available lumber, use veneered construction. Do not glue for width.

G. Plastic-Laminate Cabinets

(1) Grade: Custom.

(2) AWI Type of Cabinet Construction: Flush overlay.

(3) WI Construction Style: Style A, Frameless.

(4) WI Construction Type: Type I, multiple self-supporting units rigidly joined together.

(5) WI Door and Drawer Front Style: Flush overlay.

(6) Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

(a) Horizontal Surfaces Other Than Tops: Grade HGS.

(b) Postformed Surfaces: Grade HGP.

(c) Vertical Surfaces: Grade HGS.

(d) Edges: Grade HGS.

(7) Materials for Semiexposed Surfaces:

(a) Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.

(i) Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch (0.460-mm) minimum thickness, matching laminate in color, pattern, and finish.

(ii) For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade CLS.

(b) Drawer Sides and Backs: Solid-hardwood lumber.

(c) Drawer Bottoms: Hardwood plywood.

(8) Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

(9) Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

(a) As indicated by laminate manufacturer's designations.

H. Plastic-Laminate Countertops

(1) Grade: Custom.

(2) High-Pressure Decorative Laminate Grade: HGS.

(3) Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

(a) As indicated by manufacturer's designations.

(4) Grain Direction: Parallel to cabinet fronts.

(5) Edge Treatment: Same as laminate cladding on horizontal surfaces.

(6) Core Material: Particleboard or medium-density fiberboard.

(7) Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

I. Closet And Utility Shelving

(1) Grade: Custom.

(2) Shelf Material: 3/4-inch (19-mm) veneer-faced panel product with veneer edge banding.

(3) Cleats: 3/4-inch (19-mm) solid lumber.

(4) Wood Species: Match species indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated Match species indicated for door to closet where shelving is located.

J. Shop Finishing

(1) Grade: Provide finishes of same grades as items to be finished.

(2) General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

(3) Transparent Finish:

(a) Staining: Match approved sample for color.

(b) Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.

(c) Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.

(d) Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

c. Construction.

1. Execution

A. Preparation

(1) Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

(2) Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

B. Installation

(1) Grade: Install woodwork to comply with requirements for the same grade specified in **b. Materials** for fabrication of type of woodwork involved.

(2) Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in **b. Materials**, to extent that it was not completed in the shop.

(3) Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

(4) Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

(5) Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

(6) Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 96 inches (2400 mm) long, except where shorter single-length pieces are necessary.

(a) Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.

(b) Install wall railings on indicated metal brackets securely fastened to wall framing.

(c) Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches (3 mm in 2400 mm).

(7) Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

(a) Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.

(b) Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

(8) Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

(a) Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to

match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

(b) Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.

(c) Secure backsplashes to walls with adhesive.

(d) Caulk space between backsplash and wall with sealant specified in Special Provision for Joint Sealants - Section 07 92 00

(9) Touch up finishing work specified in this Special Provision after installation of woodwork. Fill nail holes with matching filler where exposed.

C. Adjusting And Cleaning

(1) Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

(2) Clean, lubricate, and adjust hardware.

(3) Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
JOINT SEALANTS – SECTION 07 92 00

a. Description.

1. General

A. Submittals

(1) Product Data: For each joint-sealant product indicated.

(2) Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

(3) Warranties: Sample of special warranties.

B. Quality Assurance

(1) Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

(2) Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Project Conditions

(1) Do not proceed with installation of joint sealants under the following conditions:

(a) When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.

(b) When joint substrates are wet.

(c) Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

(d) Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

D. Warranty

(1) Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Special Provision within specified warranty period.

(a) Warranty Period: Two years from date of Substantial Completion.

b. Materials.

1. Products

A. Materials, General

(1) Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

(2) Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

(3) Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

(4) Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

B. Latex Joint Sealants

(1) Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

(a) Products: Subject to compliance with requirements, provide one of the following:

(i) BASF Building Systems; Sonolac.

(ii) Pecora Corporation; AC-20+.

(iii) Tremco Incorporated; Tremflex 834.

C. Joint Sealant Backing

(1) General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

(2) Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

(3) Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

D. Miscellaneous Materials

(1) Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

(2) Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

(3) Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

c. Construction.

1. Execution

A. Examination

(1) Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

(2) Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

(1) Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

(a) Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

(b) Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

(i) Concrete.

(ii) Masonry.

(iii) Unglazed surfaces of ceramic tile.

(iv) Exterior insulation and finish systems.

(c) Remove laitance and form-release agents from concrete.

(d) Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

(i) Metal.

(ii) Glass.

(iii) Porcelain enamel.

(iv) Glazed surfaces of ceramic tile.

(2) Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

(3) Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

C. Installation Of Joint Sealants

(1) General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

(2) Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

(3) Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of

installed sealants relative to joint widths that allow optimum sealant movement capability.

(a) Do not leave gaps between ends of sealant backings.

(b) Do not stretch, twist, puncture, or tear sealant backings.

(c) Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

(4) Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

(5) Install sealants using proven techniques that comply with the following and at the same time backings are installed:

(a) Place sealants so they directly contact and fully wet joint substrates.

(b) Completely fill recesses in each joint configuration.

(c) Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

(6) Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

(a) Remove excess sealant from surfaces adjacent to joints.

(b) Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

(c) Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

(d) Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.

(e) Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

(i) Use masking tape to protect surfaces adjacent to recessed tooled joints.

D. Cleaning

(1) Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

E. Protection

(1) Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

F. Joint-Sealant Schedule

(1) Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces JS-1.

(a) Joint Locations:

(i) Control and expansion joints on exposed interior surfaces of exterior walls.

(ii) Vertical joints on exposed surfaces of walls and partitions.

(iii) Perimeter joints between interior wall surfaces and frames of interior doors and windows.

(iv) Other joints as indicated.

(b) Joint Sealant: Latex.

(c) Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
PENETRATION FIRESTOPPING - SECTION 07 84 13

a. Description.

1. General

A. Summary

(1) This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

(2) Related Special Provisions include the following:

(a) Common Work Results for Electrical Work – Section 26 05 00

(b) Low-Voltage Electrical Power Conductors and Cables – Section 26 05 19

(c) Grounding and Bonding for Electrical Systems – Section 26 05 26

(d) Hangers and Support for Electrical Systems – Section 26 05 29

(e) Raceway and Boxes for Electrical Systems – Section 26 05 33

(f) Cable Trays for Electrical Systems – Section 26 05 36

(g) Vibration and Seismic Controls for Electrical Systems – Section 26 05 48

(h) Identification for Electrical Systems – Section 26 05 53

(i) Modular Dimming Controls – Section 26 09 36

(j) Wiring Devices – Section 26 27 26

(k) Interior Lighting - Section 26 51 00

B. Performance Requirements

(1) General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

(a) Fire-resistance-rated walls including fire partitions, fire barriers and smoke barriers.

(b) Fire-resistance-rated horizontal assemblies including floors.

(2) Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814:

(a) F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

(b) L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings 3.0 cfm/sq. ft (0.01524cu. m/s x sq. m) at both ambient temperatures and 400 deg F (204 deg C).

(3) For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

(a) For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

(b) For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

(c) For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

(4) For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

C. Submittals

(1) Product Data: For each type of product indicated.

(2) Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

(a) Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.

(3) Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

(a) Types of penetrating items.

(b) Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.

(c) Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

(4) Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

D. Quality Assurance

(1) Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

(2) Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

(3) Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in section a.1.B. "Performance Requirements" of this special provision:

(a) Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.

(b) Through-penetration firestop systems are identical to those tested per testing standard referenced in section a.1.B. "Performance Requirements" of this special provision. Provide rated systems complying with the following requirements:

(i) Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.

(ii) Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

1) UL in its "Fire Resistance Directory."

E. Delivery, Storage, And Handling

(1) Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers'

labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

(2) Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

F. Project Conditions

(1) Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

(2) Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

G. Coordination

(1) Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

(2) Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

(3) Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.

b. Materials.

1. Products

A. Manufacturers

(1) Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated in the Through-Penetration Firestop System Schedule at the end of section c. Construction of this special provision.

(a) A/D Fire Protection Systems Inc.

(b) Grace, W. R. & Co. - Conn.

(c) Hilti, Inc.

(d) Johns Manville.

(e) Nelson Firestop Products.

(f) NUCO Inc.

(g) RectorSeal Corporation (The).

(h) Specified Technologies Inc.

(i) 3M; Fire Protection Products Division.

(j) Tremco; Sealant/Weatherproofing Division.

(k) USG Corporation.

B. Firestopping, General

(1) Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

(2) Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

(a) Permanent forming/damming/backing materials, including the following:

(i) Slag-/rock-wool-fiber insulation.

(ii) Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.

(iii) Fire-rated form board.

(iv) Fillers for sealants.

(b) Temporary forming materials.

(c) Substrate primers.

(d) Collars.

(e) Steel sleeves.

C. Fill Materials

(1) General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of section c. Construction of this special provision by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

(2) Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

(3) Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

(4) Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

(5) Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

(6) Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

(7) Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

(8) Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

(9) Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

(10) Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

(11) Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

(a) Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.

(b) Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

D. Mixing

(1) For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

c. Construction.

1. Examination

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

(1) Proceed with installation only after unsatisfactory conditions have been corrected.

2. Preparation

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

(1) Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.

(2) Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.

(3) Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3. Through-Penetration Firestop System Installation

A. General: Install through-penetration firestop systems to comply with section a. "Performance Requirements" Article of this special provision and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

(1) Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.

(2) Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

(3) For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

4. Identification

A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

(1) The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."

(2) Contractor's name, address, and phone number.

(3) Through-penetration firestop system designation of applicable testing and inspecting agency.

(4) Date of installation.

(5) Through-penetration firestop system manufacturer's name.

(6) Installer's name.

5. Field Quality Control

A. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

6. Cleaning And Protecting

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

7. Through-Penetration Firestop System Schedule

A. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Firestop Systems with No Penetrating Items:

(1) UL-Classified Systems: C-AJ, C-BJ, F-A, W-J orW-L.

(2) Type of Fill Materials: One or more of the following:

(a) Latex sealant.

(b) Silicone sealant.

(c) Intumescent putty.

(d) Mortar.

C. Firestop Systems for Metallic Pipes, Conduit, or Tubing:

(1) UL-Classified Systems: C-AJ, C-BJ, C-BK, F-A, F-B, F-C, W-J, W-K or W-L..

(2) Type of Fill Materials: One or more of the following:

(a) Latex sealant.

(b) Silicone sealant.

(c) Intumescent putty.

(d) Mortar.

D. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing:

(1) UL-Classified Systems: C-AJ, C-BJ, F-A, F-B, F-C, W-J or W-L.

(2) Type of Fill Materials: One or more of the following:

(a) Latex sealant.

(b) Silicone sealant.

(c) Intumescent putty.

(d) Intumescent wrap strips.

(e) Firestop device.

E. Firestop Systems for Electrical Cables:

(1) UL-Classified Systems: C-AJ, C-BJ, F-A, F-B, F-C, W-J or W-L.

(2) Type of Fill Materials: One or more of the following:

(a) Latex sealant.

(b) Silicone sealant.

(c) Intumescent putty.

(d) Silicone foam.

(e) Pillows/bags.

F. Firestop Systems for Cable Trays:

(1) UL-Classified Systems: C-AJ, C-BJ, F-A, F-B, F-C, W-J, W-K or W-L.

(2) Type of Fill Materials: One or more of the following:

(a) Latex sealant.

(b) Intumescent putty.

(c) Silicone foam.

(d) Pillows/bags.

(e) Mortar.

G. Firestop Systems for Insulated Pipes:

(1) UL-Classified Systems: C-AJ, C-BJ, F-A, F-C, W-J or W-L.

(2) Type of Fill Materials: One or more of the following:

(a) Latex sealant.

(b) Intumescent putty.

(c) Silicone foam.

(d) Intumescent wrap strips.

H. Firestop Systems for Miscellaneous Electrical Penetrants:

(1) UL-Classified Systems: C-AJ, F-A or W-L.

(2) Type of Fill Materials: One or more of the following:

(a) Latex sealant.

(b) Intumescent putty.

(c) Mortar.

I. Firestop Systems for Miscellaneous Mechanical Penetrants:

(1) UL-Classified Systems: C-AJ, F-C, W-J or W-L.

(2) Type of Fill Materials: One or both of the following:

(a) Latex sealant.

(b) Mortar.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
FLUSH WOOD DOORS – SECTION 08 14 16

a. Description.

1. General

A. Summary

(1) This Special Provision Includes:

(a) Solid-core doors with wood-veneer faces.

(b) Factory finishing flush wood doors.

(2) Related Special Provisions:

(a) Interior Architectural Woodwork - Section 06 40 23 for wood door frames.

B. Submittals

(1) Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

(2) Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

(a) Indicate dimensions and locations of mortises and holes for hardware.

(b) Indicate dimensions and locations of cutouts.

(c) Indicate doors to be factory finished and finish requirements.

(3) Samples for Initial Selection: For factory-finished doors.

(4) Samples for Verification:

(a) Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish.

(5) Warranty: Sample of special warranty.

C. Quality Assurance

(1) Source Limitations: Obtain flush wood doors from single manufacturer.

D. Delivery, Storage, And Handling

(1) Comply with requirements of referenced standard and manufacturer's written instructions.

(2) Package doors individually in plastic bags or cardboard cartons.

(3) Mark each door on bottom rail with opening number used on Shop Drawings.

E. Project Conditions

(1) Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

F. Warranty

(1) Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

(a) Failures include, but are not limited to, the following:

(i) Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.

(ii) Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

(b) Warranty Period for Solid-Core Interior Doors: Life of installation.

b. Materials.

1. Products

A. Manufacturers

(1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

(a) Algoma Hardwoods, Inc.

(b) Eggers Industries.

(c) Graham; an Assa Abloy Group company.

(d) Marshfield Door Systems, Inc.

(e) Mohawk Flush Doors, Inc.; a Masonite company.

(f) Oshkosh Architectural Door Company.

(g) VT Industries Inc.

B. Door Construction, General

(1) Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

(2) Particleboard-Core Doors:

(a) Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2.

C. Veneered-Faced Doors For Transparent Finish

(1) Interior Solid-Core Doors:

(a) Grade: Premium, with Grade AA faces.

(b) Species: Select white maple.

(c) Cut: Rotary cut.

(d) Match between Veneer Leaves: Slip match.

(e) Assembly of Veneer Leaves on Door Faces: Running match.

(f) Exposed Vertical and Top Edges: Same species as faces.

(g) Core: Particleboard.

(h) Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.

(i) Thickness: 1-3/8 inch (37 mm).

D. Fabrication

(1) Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

E. Factory Finishing

(1) General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

(a) Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

(2) Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

(3) Transparent Finish:

(a) Grade: Premium.

(b) Finish: AWI conversion varnish or catalyzed polyurethane system.

(c) Staining: As selected by Architect from manufacturer's full range.

(d) Effect: Open-grain finish.

(e) Sheen: Satin.

c. Construction.

1. Execution

A. Examination

(1) Examine doors and installed door frames before hanging doors.

(a) Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.

(b) Reject doors with defects.

(2) Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

(1) Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

(2) Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

(a) Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

(b) Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.

(3) Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

C. Adjusting

(1) Operation: Rehang or replace doors that do not swing or operate freely.

(2) Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
GLAZING – SECTION 08 80 00

a. Description.

1. General

A. Summary

(1) This Special Provision includes glazing for the following products and applications, including those specified in other Special Provisions where glazing requirements are specified by reference to this Special Provision:

(a) Interior glass partition.

B. Definitions

(1) Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

(2) Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Performance Requirements

(1) General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

D. Submittals

(1) Product Data: For each glass product and glazing material indicated.

E. Delivery, Storage, And Handling

(1) Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

b. Materials.

1. Products

A. Glass Products

(1) Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

(a) Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.

(b) Provide Kind FT (fully tempered) float glass.

B. Glazing Sealants

(1) General: Provide products of type indicated, complying with the following requirements:

(a) Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

(b) Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

(c) Colors of Exposed Glazing Sealants: Clear.

(2) Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

(a) Single-Component Neutral-Curing Silicone Glazing Sealants.

(i) Available Products:

(b) Dow Corning Corporation; 790.

(c) GE Silicones; SilPruf LM SCS2700.

(i) Type and Grade: S (single component) and NS (nonsag).

(ii) Class: 100/50.

(iii) Use Related to Exposure: NT (nontraffic).

(iv) Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

(v) Applications: Glass partition wall.

C. Miscellaneous Glazing Materials

(1) General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

(2) Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

(3) Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

(4) Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

(5) Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

D. Fabrication Of Glazing Units

(1) Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

(2) Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

(3) Grind smooth and polish exposed glass edges and corners.

E. Monolithic Float-Glass Units

(1) Uncoated Clear Float-Glass Units: Class 1 Kind FT (fully tempered) float glass.

(a) Thickness: 13 mm.

(b) Visible Light Transmittance: 90 percent minimum.

c. Construction.

1. Execution

A. Examination

(1) Examine framing glazing, with Installer present, for compliance with the following:

(a) Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

(b) Minimum required face or edge clearances.

(c) Effective sealing between joints of glass-framing members.

(2) Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

(1) Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

C. Glazing, General

(1) Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

(2) Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

(3) Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

(4) Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

(5) Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

(6) Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

(7) Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:

(a) Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated

ability to maintain required face clearances and to comply with system performance requirements.

(b) Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

D. Sealant Glazing (Wet)

(1) Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

(2) Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

(3) Tool exposed surfaces of sealants to provide a substantial wash away from glass.

E. Cleaning And Protection

(1) Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

(2) Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

(3) Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
NON-STRUCTURAL METAL FRAMING – SECTION 09 22 16

a. Description.

1. General

A. Summary

(1) This Special Provision includes non-load-bearing steel framing members for the following applications:

(a) Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).

B. Submittals

(1) Product Data: For each type of product indicated.

b. Materials.

1. Products

A. Non-Load-Bearing Steel Framing, General

(1) Framing Members, General: Comply with ASTM C 754 for conditions indicated.

(a) Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

(b) Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized, unless otherwise indicated.

B. Steel Framing For Framed Assemblies

(1) Steel Studs and Runners: ASTM C 645.

(a) Minimum Base-Metal Thickness: 0.0179 inch (0.45 mm).

(b) Depth: As indicated on Drawings.

(2) Slip-Type Head Joints: Where indicated, provide one of the following:

(a) Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-(50.8-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.

(b) Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

C. Auxiliary Materials

(1) General: Provide auxiliary materials that comply with referenced installation standards.

(a) Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

c. Construction.

1. Execution

A. Examination

(1) Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

(a) Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation, General

(1) Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

(a) Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

(2) Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

(3) Install bracing at terminations in assemblies.

C. Installing Framed Assemblies

(1) Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

(2) Install studs so flanges within framing system point in same direction.

(a) Space studs as follows:

(i) Single-Layer Application: 16 inches (406 mm) o.c., unless otherwise indicated.

(ii) Multilayer Application: 16 inches (406 mm) o.c., unless otherwise indicated.

(3) Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

(a) Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

(b) Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

(i) Install two studs at each jamb, unless otherwise indicated.

(ii) Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.

(iii) Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

(c) Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

(4) Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
GYPSUM BOARD – SECTION 09 29 00

a. Description.

1. General

A. Summary

(1) This Special Provision includes the following:

(a) Interior gypsum board.

(2) Related Special Provisions include the following:

(a) Rough Carpentry - Section 06 10 00 for wood framing and furring that supports gypsum board.

(b) Non-Structural Metal Framing - Section 09 22 16 for non-structural framing and suspension systems that support gypsum board.

(c) Interior Painting - Section 09 91 23 for primers applied to gypsum board surfaces.

B. Submittals

(1) Product Data: For each type of product indicated.

(2) Samples: For the following products:

(a) Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

C. Storage And Handling

(1) Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

D. Project Conditions

(1) Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

(2) Do not install interior products until installation areas are enclosed and conditioned.

(3) Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

(a) Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

(b) Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

b. Materials.

1. Products

A. Panels, General

(1) Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Interior Gypsum Board

(1) General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

(a) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

(i) G-P Gypsum.

(ii) Lafarge North America Inc.

(iii) National Gypsum Company.

(iv) USG Corporation.

(2) Type X:

(a) Thickness: 5/8 inch (15.9 mm).

(b) Long Edges: Tapered.

C. Trim Accessories

(1) Interior Trim: ASTM C 1047.

(a) Material: Galvanized or aluminum-coated steel sheet or rolled zinc.

(b) Shapes:

(i) Cornerbead.

(ii) Bullnose bead.

(iii) LC-Bead: J-shaped; exposed long flange receives joint compound.

(iv) L-Bead: L-shaped; exposed long flange receives joint compound.

(v) U-Bead: J-shaped; exposed short flange does not receive joint compound.

(vi) Curved-Edge Cornerbead: With notched or flexible flanges.

(2) Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

(a) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

(i) Fry Reglet Corp.

(ii) Gordon, Inc.

(iii) Pittcon Industries.

(b) Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.

(c) Finish: Clear annodized.

D. Joint Treatment Materials

(1) General: Comply with ASTM C 475/C 475M.

(2) Joint Tape:

(a) Interior Gypsum Wallboard: Paper.

(3) Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

(a) Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.

(b) Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

(i) Use setting-type compound for installing paper-faced metal trim accessories.

(c) Fill Coat: For second coat, use drying-type, all-purpose compound.

(d) Finish Coat: For third coat, use setting-type, sandable topping compound.

(e) Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

E. Auxiliary Materials

(1) General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

(2) Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

(a) Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.

(b) For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

c. Construction.

1. Execution

A. Examination

(1) Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

(2) Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

(3) Proceed with installation only after unsatisfactory conditions have been corrected.

B. Applying And Finishing Panels, General

(1) Comply with ASTM C 840.

(2) Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

(3) Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints

on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

(4) Form control and expansion joints with space between edges of adjoining gypsum panels.

(5) Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

(a) Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.

(b) Fit gypsum panels around ducts, pipes, and conduits.

(c) Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

(6) Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

(7) Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

C. Applying Interior Gypsum Board

(1) Install interior gypsum board in the following locations:

(a) Type X: Vertical surfaces, unless otherwise indicated.

(2) Single-Layer Application:

(a) On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

(i) Stagger abutting end joints not less than one framing member in alternate courses of panels.

(ii) At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

(b) Fastening Methods: Apply gypsum panels to supports with steel drill screws.

D. Installing Trim Accessories

(1) General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

(2) Control Joints: Install control joints at locations indicated on Drawings.

(3) Interior Trim: Install in the following locations:

(a) Cornerbead: Use at outside corners, unless otherwise indicated.

(b) LC-Bead: Use at exposed panel edges.

(c) L-Bead: Use where indicated.

(d) U-Bead: Use where indicated.

(4) Aluminum Trim: Install in locations indicated on Drawings.

E. Finishing Gypsum Board

(1) General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

(2) Prefill open joints, rounded or beveled edges, and damaged surface areas.

(3) Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

(4) Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

(a) Level 4: All interior walls exposed to view.

(i) Primer and its application to surfaces are specified in other Special Provisions.

F. Protection

(1) Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

(2) Remove and replace panels that are wet, moisture damaged, and mold damaged.

(a) Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

(b) Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SPECIAL CEILING SYSTEMS – SECTION 09 54 00

a. Description.

1. General

A. Related Work

(1) Related work specified elsewhere:

(a) Common Work Results for Electrical Work - Section 26 05 00

(b) Grounding and Bonding for Electrical Systems - Section 26 05 26

(c) Hangers and Supports for Electrical Systems - Section 26 05 29

(d) Identification for Electrical Systems - Section 26 05 53

(e) Interior Lighting - Section 26 51 00

(f) Low-Voltage Electrical Power Conductors and Cables - Section 26 05 19

(g) Modular Dimming Controls - Section 26 09 36

(h) Raceway and Boxes for Electrical Systems - Section 26 05 33

(i) Wiring Devices - Section 26 27 26

(j) Vibration and Seismic Controls for Electrical Systems - Section 26 05 48

B. System Description

(1) Pre-formed, pre-finished, vertically curved suspension system and infill material as designated, consisting of curved and straight main tees, as well as straight cross tees snapped together to form two-directional 2' x 2' modules that curve up (vaults), down (valleys), or undulated (waves).

C. Quality Assurance

(1) Subcontractor qualifications: Install shall have successful experience installing ceiling suspension systems.

(2) Requirements of regulatory agencies: Codes and regulations of authorities having jurisdiction.

D. References

(1) ASTM C635, Standard Specifications for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.

(2) ASTM C636, Recommended Practice for Installation of Metal Suspension System for Acoustical Tile and Lay-In Panels.

(3) CISCA Ceiling Systems Installation Handbook.

E. Submittal

(1) Samples: Submit data for suspension system main tees and cross tees, infill panels and if specified optional trim for review of finish color and appearance.

(2) Shop Drawings

(a) Contractor shall provide reflected ceiling plan and section through elevations: Submit ceiling suspension system layout to indicated ceiling modules.

(b) Assembly drawings: Indicate module dimensions, accessory attachments, and installation of related components.

(3) Manufacturer's Data

(a) System details: Submit manufacturer's descriptive literature or standard drawings showing details of system with project conditions clearly identified, and manufacturer's recommended installation instructions.

(b) Color chart: Submit manufacturer's standard color chart sample or match of color choice for approval.

(4) Maintenance materials: Provide 5 percent of amount of curvatura components.

F. Delivery, Storage And Handling

(1) Delivery of materials: Deliver materials in original, unopened packages clearly labeled with manufacturer's name, item description, part number, type and class, as applicable.

(2) Inspection: Promptly inspect delivered materials, file freight claims for damage during shipment, and order replacement materials, as required.

(3) Storage: Store in manner that will prevent warpage, scratches, or damage of any kind. Prevent interference to/by other trades and any other adverse job conditions due to storage locations or methods.

(4) Handling: Handle in such manner to ensure against racking, distortion or physical damage of any kind.

G. Project Conditions

(1) Coordination with other work

(a) General: Coordinate with other work supported by or penetrating through the system.

(b) Mechanical work: Ductwork above suspension system shall be complete, and permanent heating and cooling systems operating.

(c) Electrical work: Installation of conduit above the curvatura system shall be complete before installation of suspension system.

(2) Protection

(a) Personnel: Follow good safety and industrial hygiene practices during handling and installing of all products and systems, with personnel to take necessary precautions and wear appropriate personal protective equipment as needed. Read material safety data sheets and related literature for important information on products before installation. Contractor to be solely responsible for all personal safety issued during and subsequent to installation; Architect, Specifier, Owner and manufacturer will rely on Contractor's performance in such regard.

(b) Existing Complete Work: Protect completed work above suspension system from damage during installation of curvatura system components.

b. Materials.

1. Products

A. Manufacturer

(1) Curvatura 3-Dimensional Curved System as manufactured by USG Interiors, Inc., Chicago, Illinois U.S.A.

B. Materials

(1) General ASTM C635, commercial quality, cold-rolled steel; all exposed surfaces post painted in manufacturer's standard enamel paint finish for 360 coverage, color (as selected from manufacturer's standard colors).

(2) Suspension system components

(a) General: Suspension system shall be curvatura (Standard) color for the suspension shall be selected from manufacturer's standard colors.

(b) Cross Tees 2' on center for two-directional system or stabilizer bars 4' on center with 2' cross tees at row ends when using on directional system.

(c) Hanger Wire: Because the curvatura system is decorative and often incorporates “see through” panels see **Construction c**.1.C.(4) for hanger wire options and consult with local building officials.

(d) Curvatura main tee curved segments

(i) Vault tees (length of face of grid concave) 1-1/2" high x 15/16" face with ½" x 1/4" bulb, or cross tee holes at 24" o.c., integral panel hold-down tabs and main tee splice plate.

(ii) Valley tees (length of face of grid convex) 1-1/2" high x 15/16" face with ½" x 1/4" bulb, cross tee holes at 24" o.c., integral panel hold-down tabs and main tee splice plate.

(3) Flexible infill options

(a) To be selected by Architect from manufacturer’s standard infill options.

(4) Accessories

(5) Curvatura trim option 1-1/4" high steel trim sections to match each main tee segment to provide a finished perimeter. The Genetic code for the curvatura trim is to match each main tee segment to provide a finished perimeter. Trim color selected is as selected by Architect.

C. Fabrication

(1) Manufacturing: Suspension members to conform to ASTM C635, designed to support infill panels and trim.

(2) Main tees: Roll-formed, splice clip connection, cross tee holes and hanger wire holes at 12" from ends and 24" o.c.

(3) Cross tees: Roll-formed, butt cut ends, high tensile steel end clinches to web section, double-locking and self indexing design.

(4) Finish: Manufacturer’s standard metal cleaning and finishing process to attain color selected.

c. Construction.

1. Execution

A. Inspection

(1) Examine areas to receive materials for conditions which will adversely affect installation. Provide written report of unacceptable surfaces.

(2) Do not start work until unsatisfactory conditions are corrected.

(3) Work to be concealed: Verify work above ceiling suspension system is complete and installed in manner which will not affect layout and installation of suspension system components.

(4) Beginning of installation shall signify acceptance of conditions in areas to receive the curvatura system.

B. Preparation

(1) Field dimensions must be verified prior to installation.

C. Installation

(1) Standard reference: Install in accordance with ASTM C636, CISCA installation standards, and other applicable code requirements.

(2) Manufacturer's reference: Install in accordance with manufacturer's current printed recommendations.

(3) Drawing reference: install in accordance with approved shop drawings and locate ceiling in accordance with main tee dimensions relative to elevations.

(4) Hanger wires

(a) Spacing: Space hanger wires on main tees at the alternate cross tee holes (maximum of 48" o.c.). Attach hangers directly to structure above as needed. Wires to hang plumb.

(b) Limitations: Do not support wires from mechanical and/or electrical equipment, piping, or other equipment occurring above ceiling.

(c) Quality of Workmanship: Because curvatura system is decorative and often incorporates "see through" panels, care should be taken to ensure that all hanger wires are straight and plumb, that wire wraps are neat and tight and that hanger wires are free of kinks, with local approval, consideration cab be given for using #18 black annealed wire or #18 stainless steel wire for a more sleek appearance.

(5) Accessories: Install accessories as applicable to meet the project requirements.

D. Cleaning

(1) Suspension: Remove infill material and perform any necessary cleaning maintenance with nonsolvent-based commercial cleaner.

(2) Immediately remove any corrosive substances or chemicals that would attack painted finishes (i.e., wallpaper adhesives).

(3) Touch up all minor scratches and spots, as acceptable, or replace damaged sections when touch up is not permitted.

(4) Painting: Repainting of suspension members shall be a high-quality, solvent-based paint and applied as recommended by paint manufacturer.

(5) Removal of debris: Remove all debris resulting from work of this special provision.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
FIXED SOUND-ABSORPTIVE PANELS – SECTION 09 84 13

a. Description.

1. General

A. Summary

(1) This Special Provision includes back-mounted acoustical wall panels.

(2) Related Special Provisions include the following:

(a) Special Ceiling Systems - Section 09 54 00 for acoustical ceiling panels supported by exposed suspension system and tested for noise reduction.

B. Definitions

(1) NRC: Noise reduction coefficient.

C. Submittals

(1) Product Data: For each type of panel edge, core material, and mounting indicated.

(2) Shop Drawings: For acoustical wall panels. Include mounting devices and details. Include elevations showing panel sizes and direction of fabric weave and pattern matching. Indicate panel edge and core materials.

(3) Samples for Verification: For the following products. Prepare Samples from same material to be used for the Work.

(a) Fabric: 12 inch by 12 inch sample from dye lot to be used for the Work.

(i) With specified treatments applied.

(b) Sample Panels: No larger than 12 by 12 inches (300 by 300 mm).

(4) Product Certificates: For each type of acoustical wall panel, signed by product manufacturer.

(5) Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of acoustical wall panel.

(6) Maintenance Data: For acoustical wall panels to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal recommendations.

(7) Warranty: Special warranty specified in this Special Provision.

D. Quality Assurance

(1) Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

(2) Source Limitations: Obtain acoustical wall panels through one source from a single manufacturer.

(3) Fire-Test-Response Characteristics: Provide acoustical wall panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

(a) Flame-Spread Index: 25 or less.

(b) Smoke-Developed Index: 450 or less.

E. Delivery, Storage, And Handling

(1) Comply with fabric and acoustical wall panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

(2) Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

(3) Protect panel edges from crushing and impact.

F. Project Conditions

(1) Environmental Limitations: Do not install acoustical wall panels until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

(2) Air-Quality Limitations: Protect acoustical wall panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

(3) Field Measurements: Verify locations of acoustical wall panels by field measurements before fabrication and indicate measurements on Shop Drawings.

G. Warranty

(1) Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of acoustical wall panels that fail in performance, materials, or workmanship within specified warranty period.

(a) Failure in performance includes, but is not limited to, acoustical performance.

(b) Failures in materials include, but are not limited to, fabric sagging, distorting, or releasing from panel edge; or warping of core.

(c) Warranty Period: Two years from date of Substantial Completion.

b. Materials.

1. Products

A. Core Materials

(1) Glass-Fiber Board: ASTM C 612, Type IA or Types IA and IB; density as specified, unfaced, dimensionally stable, molded rigid board, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

(2) Tackable, Impact-Resistant, High-Density Face Layer: 1/8-inch- (3.2-mm-) thick layer of compressed molded glass-fiber board with a minimum nominal density of 16 to 18 lb/cu. ft. (256 to 288 kg/cu. m) laminated to face of core.

(3) Wood: Clear, vertical grain, straight, kiln-dried hardwood of manufacturer's standard species, AWPA C20, Interior Type A, fire-retardant treated, low-hygroscopic-type formulation. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Kiln-dry material after treatment to 5 to 10 percent moisture content.

B. Back-Mounted, Edge-Framed Acoustical Wall Panels With Glass-Fiber Board Core

(1) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

(a) Sound Concepts.

(b) Conweb.

(c) Wenger.

(d) Kinetics Noise Control.

(e) Accentus, Inc.

(f) Sound Seal.

(g) Equal as approved by the Engineer.

(2) Panel Construction: Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed, dimensionally stable, rigid glass-fiber board core and bonded or attached to edges and back of frame.

(3) Nominal Core Density: 6 to 7 lb/cu. ft. (96 to 112 kg/cu. m).

(4) Core-Face Layer: Tackable, impact-resistant, high-density board.

(5) Facing Material: Fabric from same dye lot; color and pattern as indicated on Drawings in Material Selection Schedule.

(a) Applied Treatments: Stain resistance.

(6) Nominal Core Thickness and Overall System NRC: 2 inches (51 mm) and not less than NRC 0.90, for Type A mounting per ASTM E 795.

(7) Panel Width: As indicated on Drawings.

(8) Panel Height: Fabricated height as indicated on Drawings; mounting height as indicated on Drawings.

(9) Panel Edge and Frame: Hardened Edge.

(a) Panel Edge Detail: Square.

C. Fabrication

(1) Sound-Absorption Performance: Provide acoustical wall panels with minimum NRCs indicated, as determined by testing per ASTM C 423 for mounting type specified.

(2) Acoustical Wall Panels: Panel construction consisting of facing material adhered to face, edges and back border of dimensionally stable core; with rigid edges to reinforce panel perimeter against warpage and damage.

(a) Glass-Fiber Board: Resin harden areas of core for attachment of mounting devices.

(3) Fabric Facing: Stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other foreign matter. Applied with visible surfaces fully covered.

(a) Where square corners are indicated, tailor corners.

(b) Where radius or other nonsquare corners are indicated, attach facing material so there are no seams or gathering of material.

(c) Where fabrics with directional or repeating patterns or directional weave are indicated, mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.

(4) Core-Face Layer: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, sags.

(5) Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch (1.6 mm) for the following:

(a) Thickness.

(b) Edge straightness.

(c) Overall length and width.

(d) Squareness from corner to corner.

(6) Back-Mounting Devices: Concealed on backside of panel, recommended to support weight of panel, and as follows:

(a) Metal "Z" Clips: Two-part panel clips, with one part of each clip mechanically attached to back of panel and the other part to wall substrate, designed to allow for panel removal.

c. Construction.

1. Execution

A. Examination

(1) Examine fabric, substrates, and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of acoustical wall panels.

(a) Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

(1) Install acoustical wall panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

(2) Comply with acoustical wall panel manufacturer's written instructions for installation of panels using type of concealed mounting accessories indicated or, if not indicated, as recommended by manufacturer. Anchor panels securely to supporting substrate.

(3) Match and level fabric pattern and grain among adjacent panels.

(4) Installation Tolerances: As follows:

(a) Variation from Level and Plumb: Plus or minus 1/16 inch (1.6 mm).

C. Cleaning

(1) Clip loose threads; remove pills and extraneous materials.

(2) Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

D. Protection

(1) Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that acoustical wall panels are without damage or deterioration at time of Substantial Completion.

(2) Replace acoustical wall panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

d. Measurements and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
INTERIOR PAINTING – SECTION 09 91 23

a. Description.

1. General

A. Summary

(1) This Special Provision includes surface preparation and the application of paint systems on the following interior substrates:

(a) Steel.

(b) Galvanized metal.

(c) Wood.

(d) Gypsum board.

(e) Interior metal that does not have a factory final finish.

(f) Piping and ductwork, hangers and supports, electrical conduit and fixture supports which occur in rooms or areas where walls and/or ceilings are painted.

B. Submittals

(1) Product Data: For each type of product indicated.

(2) Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.

(a) Submit Samples on rigid backing, 8 inches (200 mm) square.

(b) Step coats on Samples to show each coat required for system.

(c) Label each coat of each Sample.

(d) Label each Sample for location and application area.

(3) Product List: For each product indicated, include the following:

(a) Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

(b) Printout of current "MPI Approved Products List" for each product category specified in **b. Materials**, with the proposed product highlighted.

C. Quality Assurance

(1) MPI Standards:

(a) Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

(b) Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

D. Delivery, Storage, And Handling

(1) Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

(a) Maintain containers in clean condition, free of foreign materials and residue.

(b) Remove rags and waste from storage areas daily.

E. Project Conditions

(1) Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

(2) Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

F. Extra Materials

(1) Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

(a) Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

b. Materials.

1. Products

A. Manufacturers

(1) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

(2) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

(a) Benjamin Moore & Co.

(b) ICI Paints.

(c) PPG Architectural Finishes, Inc.

(d) Sherwin-Williams Company (The).

(e) Repcolite.

B. Paint, General

(1) Material Compatibility:

(a) Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

(b) For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

(2) Colors: Match Architect's samples.

C. Primers/Sealers

(1) Interior Latex Primer/Sealer: MPI #50.

D. Metal Primers

(1) Quick-Drying Alkyd Metal Primer: MPI #76.

E. Latex Paints

(1) Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).

F. Dry Fog/Fall Coatings

(1) Interior Alkyd Dry Fog/Fall: MPI #55.

c. Construction.

1. Execution

A. Examination

(1) Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

(2) Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

(a) Gypsum Board: 12 percent.

(3) Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

(4) Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

(a) Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

B. Preparation

(1) Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

(2) Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

(a) After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

(b) Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

(3) Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

(a) Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

(4) Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

(5) Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

(6) Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

C. Application

(1) Apply paints according to manufacturer's written instructions.

(a) Use applicators and techniques suited for paint and substrate indicated.

(b) Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

(c) Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

(2) Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

(3) If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

(4) Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

(5) Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

(a) Mechanical Work:

(i) Uninsulated metal piping.

(ii) Uninsulated plastic piping.

(iii) Pipe hangers and supports.

(iv) Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

D. Cleaning And Protection

(1) At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

(2) After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

(3) Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

(4) At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

E. Interior Painting Schedule

(1) Steel Substrates:

(a) Alkyd Dry-Fall System: MPI INT 5.1D.

(i) Prime Coat: Quick-drying alkyd metal primer.

(ii) Topcoat: Interior alkyd dry fog/fall.

(2) Galvanized-Metal Substrates:

(a) Alkyd Dry-Fall System: MPI INT 5.3F.

(i) Prime Coat: Cementitious galvanized-metal primer.

(ii) Topcoat: Interior alkyd dry fog/fall.

(3) Gypsum Board Substrates:

(a) Latex System: MPI INT 9.2A.

(i) Prime Coat: Interior latex primer/sealer.

(ii) Intermediate Coat: Interior latex matching topcoat.

(iii) Topcoat: Interior latex (low sheen).

(4) Cotton or Canvas Insulation-Covering Substrates: Including pipe and duct coverings.

(a) Latex System: MPI INT 10.1A.

(i) Prime Coat: Interior latex primer/sealer.

(ii) Intermediate Coat: Interior latex matching topcoat.

(iii) Topcoat: Interior latex (low sheen).

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
VIDEO WALL RELOCATION AND NEW INSTALLATION

a. Description. This special provision provides the requirements for the de-install, packaging, transferring, furnishing, installing, testing, accepting, and warranting of the audiovisual (AV) systems for the new TMC. The existing facility is located at 1050 Sixth Street, Detroit, MI 48226. The new facility, the Raymond & Rosa L. Parks Detroit Integrated Transportation Campus (DITC), will be located one block southeast of the existing facility. The new building's layout and details are provided in the Plans. Integrate the existing AV systems into the new facility and provide any additional equipment required to meet the requirements of this special provision.

At the new facility, the TMC operators will utilize CCTV traffic monitoring cameras viewed on various video and computer output devices to assist with traffic incident detection, verification, response, management and clearance, as well as for traveler information. Furnish, install and integrate video display sub-systems to support these functions within the TMC. The requirements for the Video Wall Display System shall adhere to the Department Standard Specification unless otherwise specified or elaborated herein.

1. Provide the following services in response to the minimum technical requirements in this RFP:

A. Provide project management and coordination with other TMC activities including any other contractors or Vendors working in the building. It is probable that installation of the new software and/or the system upgrade will be underway at the same time as the work included in this RFP. Contractor will be responsible for the coordination of work associated with the various construction tasks underway at the facility, including coordination with other contractors working within the facility. Additional compensation will not be made for coordination of work within the facility related to this contract.

B. Furnish, install, integrate, and warranty a fully functional and operational video wall display system and ancillary hardware, software, wiring, workstations and remote displays within the new TMC control room and other rooms in the TMC.

C. Prepare final design plans and specifications for all elements of the video display systems and submit these to the OWNER for review and approval.

D. Mobilize and setup the existing Auxiliary Traffic Management Center at the existing MITS Center facility.

E. Develop a schedule depicting the relocation of the Video Wall Display System and the impacts to the existing operations. Coordination with OWNER to determine the schedule and duration of anticipated interruptions to the existing operations.

F. Develop a video display test and acceptance plan and submit the plan to the OWNER for review and approval.

G. Implement the system test and acceptance plan; to verify that all elements of the video display systems perform as described in these minimum technical requirements.

H. Train TMC Operators and OWNER in use and configuration of video wall and ancillary displays.

I. Maintain all elements of the video display systems for a period of five (5) years after final testing and acceptance.

2. The work covered under this special provision consists of furnishing all labor, material and services to install a complete AV system as indicated on the drawings and in these special provisions. The Scope includes but is not limited to:

A. Existing and new equipment and installation labor, for a fully functional system.

B. Miscellaneous components, hardware, interconnections and terminations required for proper operation of all systems.

C. All components required to provide the systems described in these specifications.

D. Creation of equipment lists dimensions, mounting details, and equipment compatibility.

E. Creation of one-line shop drawings depicting the connectivity of all the AV systems described in these specifications.

F. Accurate documentation of the equipment and installation.

G. Five-year warranty of the relocated existing and new equipment and installation, all equipment to be on one warranty schedule beginning from date of final acceptance of this system.

H. Five-year support consisting of two (2) visits per year at six month intervals to test and check AV systems and perform warranty work beginning from date of final acceptance of this system.

I. Test equipment, tools, ladders, lifts and scaffolding required for installation and the routine general maintenance that is to be performed.

J. Daily and final cleanup of debris caused by installation.

K. Preliminary and Final Acceptance.

L. Training.

3. System Description. This special provision provides the requirements for the de-install, packaging, transferring, furnishing, installing, testing, and accepting the AV for the new TMC at the DITC. Dedicated AV systems shall be provided for the spaces in the facility listed below. Capabilities shall vary, but may include sound reinforcement/audio playback systems; projection of video, computers, and documents. The AV and console furniture systems designed for the facility shall utilize the latest equipment and capabilities that are determined to best meet the functional requirements.

AV equipment shall be permanently installed on ceilings, walls, within cabinets, and/or within portable lecterns in each room to minimize system setup time and enable ease of operation. Equipment locations and mounting details shall take into account ease of installation, ease of servicing, proper separation by security classification, and maintenance. Where possible, spaces in the facility will use identical AV system equipment and/or controls to provide a common platform for users moving between rooms. All equipment shall be commercial or professional grade equipment. The AV shall accommodate both analog and digital video and audio signals as well as standard definition and high definition video signals. All matrices and switchers shall be multi-format card file type to allow for expansion and changing signal technologies.

A. New TMCControl Room Requirements. Furnish and install a fully functional and integrated video wall system meeting the Minimum Technical Requirements described in the special provision. The requirements are for the installation and integration of all equipment and software comprising the Video Wall Display System at the new TMC.
The Video Wall Display system shall be furnished and installed to demonstrate graphics and video images from field encoders.
The Video Wall Display (VWD) system shall be comprised of one video display assembly (VDA) and a video display controller (VDC). The VDA shall consist of an array of rear projection cubes utilizing Digital Light Processing ^{TM} (DLP) technology connected to a VDC with the latest up-to-date advances in rear projection and screen management technology to provide a completely integrated and fully functional video wall display system. The VWD shall also consist of, at a minimum, the following additional control equipment:

(1) Media Processor Controller (MPC);

(2) Hardwired Touch Panel (HTP);

(3) Wireless Touch Panel Remote Control System (WTP);

(4) RGBHV Switch Matrix (RSM);

(5) Distributed Audio System (DAS);

(6) All cables; coax, data cables, video cables and power cables; and

(7) Any and all ancillary items required for a fully operational video display system.

Furnish and install one (1) VDA consisting of sixteen (16 existing and eight (8) new 67-inch diagonal digital rear XGA projection color video cubes arranged in a eight (8) across by three (3) high video matrix. The eight (8) new video cubes should be arranged in one complete row of the 8x3 matrix either the top row or the bottom row; as recommended and confirmed by the manufacturer as the ideal placement. The VWC multiple screen control applications software shall treat the 24 cube matrix as one single high-resolution display. Design, furnish, and install borders, kick-plates, knee walls, headers, valances, sidewalls and all other finishing material needed to provide a seamless installation into the existing wall opening. All materials shall have acoustical properties matching that of the finished control room. All materials shall match in quality and color to the finished control room.

b. Materials. Develop a comprehensive list of existing equipment to include a description and part and model number of all equipment. As a part of the inventory process, then identify whether the part is suitable for re-use in the new TMC (yes or no). If not suitable provide description of why it is not re-usable. Using this Inventory as a basis, develop a second list in similar detail of the components required, identifying if they are replacements for existing components or if they are needed in the new configuration, but were not necessary in the existing installation. These two lists must then be reviewed with and approved by the Engineer. If revision is required, the revision shall be mutually acceptable to both Engineer and Contractor. At the time of the mutual acceptance of the lists described above, the Contractor has possession and therefore responsibility for the condition of the components listed as existing and suitable for re-use. If additional parts or components are subsequently required for the final installation (either due to omission, damage, or inaccurate assessment at the time the inventory was conducted, those parts or components shall be provided by the Contractor at no additional cost to the Department. All components and the final assembly must meet the required warranty provisions described elsewhere in these documents.

1. Existing Equipment – Control Room

A. The existing MITS Center Operations Room has the following AV System:

(1) Video Display Assembly (VDA)

(2) Sixteen 67” DLP Cubes & Base with Faux Wall and acoustical panels

(3) Video Display Controller (VDC)

(4) Video Wall Processor with Video Wall Expansion Chassis, Input/Output Cards

(5) Media Processor Control (MPC)

(6) Hardwired Touch Panel (HTP)

(7) Wireless Touch Panel Remote Control System (WTP)

(8) Rack Mounted DVRs

(9) Rack mount keyboard and monitor

(10) RGBHV Switch matrix (RSM)

(11) TV Tuner

(12) Dish Television Service

(13) Distributed Audio System (DAS)

(14) Ancillary Display System (ADS)

2. Existing Equipment – MDOT Maintenance Garage in Detroit

A. The following components are in storage with MDOT:

(15) Eight 67” DLP Cubes & Base with Faux Wall and acoustical panels

The System includes all associated cables, accessories, and required software necessary to display software application packages of video, RGB, and network-based application windows. The stored “layouts” can be launched via a touch panel or keyboard/mouse set of controls.

The existing video display assembly (VDA) consists of sixteen (16) XGA rear projection Mitsubishi cubes with 67” diagonal screens in an eight (8) wide by two (2) high array coupled with a custom base pedestal. The custom base pedestal features extruded aluminum posts with special clips to hold the custom acoustic bottom & top front panels designed to match the existing environment in the TMC. Each cube has a width of 53.5” and a height of 40.17” creating an 8x2 matrix with an overall display area with a width of 428.8 inches and height of 80.4 inches.

B. The TMC Video Wall Display displays the following types of sources:

(1) (48) Simultaneous MPEG-2 encoded Video from Field Devices

(2) (32) Composite Video/S-Video

(3) Multiple Client data/graphics Applications

(4) (7) RGBHV Video Capture

A BARCO Transform “A” Processor VDC currently is configured to support sixteen (16) cubes and allow for the displaying of forty-eight (48) concurrent streaming video, client applications running directly on the processor, thirty-two (32) composite, and seven (7) RGBHV capture windows.

Operators in the TMC will be capable of launching (changing) layouts and content of these layouts through the wireless touch panel, a custom web application, and the BARCO Apollo VWC client software installed on their workstations. The Engineer will designate one of the user’s workstations or a separate PC within this room as the supervisory (primary) control point to allow overriding other user’s requests (i.e., user authorization based control). The wireless touch panel is the main interface to the system for source selection, layout

selection audio source selection, volume control and the ability to change channels on the TV tuners.

An ultra-wide bandwidth matrix switch is currently configured to support all the existing inputs and outputs identified with the AV system within the TMC. The VDA is controlled via a color touch panel. The custom control page allows a single point from which system operation can be assessed and changed. Audio and video selection as well as display layout kickoff. The audio system provides all users with consistent, clear, crisp sound at all times from the sources associated with the space at all times. The rack system provides proper ventilation of equipment, and a power conditioner/UPS system protects the AV equipment.

2. New Equipment – Control Room

Deliver eight (8) new video display cubes from MDOT storage and provide ancillary equipment of identical specification and model number as the existing sixteen (16) cubes to provide a new array of eight (8) by three (3) display cubes.

(1) Design, Furnish, and Install a custom VDA support structure according to the placement as shown on the plans.

c. Construction.

1. Existing Video Wall Equipment Acceptance. The Contractor shall review and test to its satisfaction to assure the full functioning of the existing video wall equipment identified herein to be relocated. Prior to beginning any work related to packing and relocating the video wall equipment, the Contractor shall provide a statement to the Engineer of any equipment which has an operational deficiency. Beginning the packing and relocating of the existing equipment shall constitute acceptance by the Contractor of the condition of the existing video wall equipment. It is the Contractor's responsibility to protect all video wall components during the process of relocation, reinstallation, and testing. From the beginning of the work of this special provision until final acceptance of the work by the Engineer, the Contractor is responsible to protect and maintain all components of the video wall. The Department does not again become responsible for the physical protection of the video wall components until after final acceptance. Upon final acceptance, the Contractor has responsibilities to provide the required warranty and support for the video wall systems and their constituent components.

2. New Control Room Video Wall - Work Required. This AV system shall be relocated to the new TMC Control Room, at DITC, and additional equipment will be delivered, furnished and installed as required to meet the requirements listed herein. The Scope of Work (SOW) for this portion of the project includes at a minimum all the services related to the decommissioning, packing, relocating, and installation of the AV System as follows:

A. De-install and pack AV system, Video Display Assembly and associated AV equipment

B. Relocate all equipment to new facility and install all equipment associated with the Video Display Assembly and subsystems

C. Furnish and install all new equipment associated with the Video Display Assembly and subsystems required to expand the Video Display Assembly from 16 to 24 cubes

D. Install and level the Video Display Wall cubes with associated pedestal

E. Install the Video Display Controller and make required connections

F. Install the MPC, HTP, WTP, RSM, DAS, and ADS systems (see next page)

G. Install all cabling associated with the VDA and subsystems (see next page)

H. Perform all system interconnectivity

I. Configure media processor controller and test system

J. Perform System Training

K. This system shall be integrated to share information (camera feeds, analog video, RGBHV, etc…) with the Emergency Operations Center Conference Room.

L. Ensure that existing warranties remain intact for the existing equipment

M. Coordinate with the Department to ensure a fully functional system.

N. Review the building plans of the DITC/TMC and complete all installations to make a fully functional system described in the RFP.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
STAINING AND TRANSPARENT FINISHING – SECTION 09 93 00

a. Description.

1. General

(1) Summary

(a) This Special Provision includes surface preparation and the application of wood finishes on the following substrates:

(i) Interior Substrates:

1) Dressed lumber (finish carpentry).

(b) Related Sections include the following:

(i) Interior Painting - Section 09 91 23 for surface preparation and application of standard paint systems on interior substrates.

(2) Submittals

(a) Product Data: For each type of product indicated.

(b) Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.

(i) Submit Samples on representative samples of actual wood substrates, 8 inches (200 mm) square.

(ii) Label each Sample for location and application area.

(c) Product List: For each product indicated, include the following:

(i) Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules.

(ii) Printout of MPI's current "MPI Approved Products List" for each product category specified in **b. Materials**, with the product proposed for use highlighted.

(3) Quality Assurance

(a) MPI Standards:

(i) Products: Complying with MPI standards indicated and listed in its "MPI Approved Products List."

(ii) Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and finish systems indicated.

(4) Delivery, Storage, And Handling

(a) Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

(i) Maintain containers in clean condition, free of foreign materials and residue.

(ii) Remove rags and waste from storage areas daily.

(5) Project Conditions

(a) Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

(b) Do not apply exterior finishes in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

(6) Extra Materials

(a) Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

(i) Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

b. Materials.

1. Products

(1) Manufacturers

(a) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

(i) Benjamin Moore & Co.

(ii) ICI Paints.

(iii) PPG Architectural Finishes, Inc.

(iv) Sherwin-Williams Company (The)

(v) Repcolite.

(2) Materials, General

(a) Material Compatibility:

(i) Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

(ii) For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.

(b) Stain Colors: As selected by Architect.

(3) Stains

(a) Interior Wood Stain (Semi-Transparent): MPI #90.

c. Construction.

1. Execution

(1) Examination

(a) Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

(i) Maximum Moisture Content of Wood Substrates: 15 percent when measured with an electronic moisture meter.

(ii) Verify compatibility with and suitability of substrates, including compatibility with existing finishes.

(iii) Begin finish application only after unsatisfactory conditions have been corrected and surfaces are dry.

(iv) Beginning application of finish system constitutes Contractor's acceptance of substrate and conditions.

(2) Preparation

(a) Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

(b) Remove plates, machined surfaces, and similar items already in place that are not to be finished. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

(i) After completing finishing operations, reinstall items that were removed; use workers skilled in the trades involved. Remove surface-applied protection if any.

(c) Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.

(i) Remove surface dirt, oil, or grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.

(ii) Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

(iii) Countersink steel nails, if used, and fill with putty tinted to final color to eliminate rust leach stains.

(d) Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.

(3) Application

(a) Apply finishes according to manufacturer's written instructions.

(i) Use applicators and techniques suited for finish and substrate indicated.

(ii) Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.

(b) Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

(4) Field Quality Control

(a) Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when finishes are being applied:

(i) Owner will engage the services of a qualified testing agency to sample finish materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.

(ii) Testing agency will perform tests for compliance with product requirements.

(iii) Owner may direct Contractor to stop applying finishes if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying materials from Project site, pay for testing, and refinish surfaces finished with rejected materials. Contractor will be required to remove rejected materials from previously finished surfaces if, on refinishing with complying materials, the two finishes are incompatible.

(5) Cleaning And Protection

(a) At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

(b) After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

(c) Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

(d) At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

(6) Interior Wood-Finish-System Schedule

(a) Finish Carpentry Substrates:

(i) Waterborne Clear Acrylic Over Stain System: MPI INT 6.3W.

1) Stain Coat: Interior wood stain (semitransparent).

2) Three Finish Coats: Waterborne clear acrylic (satin).

(b) Exposed Wood Panel-Product Substrates:

(i) Waterborne Clear Acrylic Over Stain System: MPI INT 6.4U.

1) Stain Coat: Interior wood stain (semitransparent).

2) Three Finish Coats: Waterborne clear acrylic (satin).

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
VISUAL DISPLAY SURFACES – SECTION 10 11 00

a. Description.

1. General

A. Summary

(1) This Special Provision Includes:

(a) Markerboards.

B. Definitions

(1) Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes chalkboards, markerboards, and tackboards.

(2) Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of chalkboards, markerboards, tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

C. Submittals

(1) Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.

(2) Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.

(a) Show locations of panel joints.

(b) Include sections of typical trim members.

D. Quality Assurance

(1) Source Limitations: Obtain visual display surfaces from single source from single manufacturer.

(2) Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

(a) Flame-Spread Index: 25 or less.

(b) Smoke-Developed Index: 450 or less.

E. Delivery, Storage, And Handling

(1) Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

(2) Store visual display surfaces vertically with packing materials between each unit.

F. Project Conditions

(1) Environmental Limitations: Do not deliver or install visual display surfaces until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

(2) Field Measurements: Verify actual dimensions of construction contiguous with visual display surfaces by field measurements before fabrication.

(a) Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

G. Warranty

(1) Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

(a) Failures include, but are not limited to, the following:

(i) Surfaces lose original writing and erasing qualities.

(ii) Surfaces exhibit crazing, cracking, or flaking.

(b) Warranty Period: Life of the building.

b. Materials.

1. Products

A. Materials, General

(1) Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.

(a) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

(i) Claridge Products and Equipment, Inc.

(ii) PolyVision Corporation; a Steelcase company.

(b) Gloss Finish: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser.

(2) High-Pressure Plastic Laminate: NEMA LD 3.

(3) Hardboard: ANSI A135.4, tempered.

(4) Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063.

B. Markerboard Assemblies

(1) Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and 0.021-inch- (0.53-mm-) thick, porcelain-enamel face sheet with low-gloss finish.

(a) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

(i) Claridge Products and Equipment, Inc.

(ii) PolyVision Corporation; a Steelcase company.

(b) Manufacturer's Standard Core: Minimum 1/4 inch (6 mm) thick, with manufacturer's standard moisture-barrier backing.

(c) Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

C. Markerboard Accessories

(1) Aluminum Frames: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; standard size and shape.

(a) Factory-Applied Trim: Manufacturer's standard.

D. Fabrication

(1) Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

(a) Length: Furnish panels approximately equal in length with permissible variation not more than 3 inches (75 mm) in either direction of equal spacing. Allow 1/4-inch (6-mm) clearance at trim in length and width for fitting. Provide lengths of panels in each space as follows:

(i) More than 5 feet (1.5 m) but less than 9 feet (2.7 m); two panels.

(2) Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.

(a) Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

(3) Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.

(a) Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

(b) Provide manufacturer's standard vertical-joint spline system between abutting sections of markerboards.

(4) Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

(a) Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

E. General Finish Requirements

(1) Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

(2) Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

(3) Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

F. Aluminum Finishes

(1) Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

c. Construction.

1. Execution

A. Examination

(1) Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

(2) Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.

(3) Examine walls and partitions for proper preparation and backing for visual display surfaces.

(4) Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

(5) Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

(1) Comply with manufacturer's written instructions for surface preparation.

(2) Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.

(3) Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

C. Installation, General

(1) General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

D. Installation Of Factory-Fabricated Visual Display Boards And Assemblies

(1) Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches (400 mm) o.c. Secure both top and bottom of boards to walls.

(a) Field-Applied Aluminum Trim: Attach trim over edges of visual display boards and conceal grounds and clips. Attach trim to boards with fasteners at not more than 24 inches (610 mm) o.c.

E. Cleaning And Protection

(1) Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.

(2) Touch up factory-applied finishes to restore damaged or soiled areas.

(3) Cover and protect visual display surfaces after installation and cleaning.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
METAL LOCKERS – SECTION 10 51 13

a. Description.

1. General

A. Summary

(1) This Special Provision Includes:

(a) Standard metal lockers.

B. Submittals

(1) Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

(2) Shop Drawings: For metal lockers. Include plans, elevations, sections, details, and attachments to other work.

(a) Show locker trim and accessories.

(b) Include locker identification system and numbering sequence.

C. Quality Assurance

(1) Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

(2) Source Limitations: Obtain metal lockers and accessories from single source from single manufacturer.

(3) Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.

D. Delivery, Storage, And Handling

(1) Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

(2) Deliver master and control keys to Owner by registered mail or overnight package service.

E. Project Conditions

(1) Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

F. Coordination

(1) Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

G. Warranty

(1) Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

(a) Failures include, but are not limited to, the following:

(i) Structural failures.

(ii) Faulty operation of latches and other door hardware.

(b) Damage from deliberate destruction and vandalism is excluded.

(c) Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

H. Extra Materials

(1) Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

(a) Full-size units of the following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:

(i) Locks.

b. Materials.

1. Products

A. Materials

(1) Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

(2) Steel Tube: ASTM A 500, cold rolled.

(3) Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

(4) Anchors: Material, type, and size required for secure anchorage to each substrate.

(a) Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.

(b) Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

B. Standard Metal Lockers

(1) Products: Subject to compliance with requirements, provide one of the following:

(a) Lyon Workspace Products, LLC; Standard Lockers.

(b) Penco Products, Inc.; Guardian Lockers.

(c) Republic Storage Systems Company; Quiet Lockers.

(2) Locker Arrangement: Double tier.

(3) Locker Size: 12 inch wide by 12 inch deep by 30 inch tall.

(4) Material: Cold-rolled steel sheet.

(5) Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet as follows:

(a) Tops, Bottoms, and Intermediate Dividers: 0.024-inch (0.61-mm) nominal thickness, with single bend at sides.

(b) Backs and Sides: 0.024-inch (0.61-mm) nominal thickness, with full-height, double-flanged connections.

(c) Shelves: 0.024-inch (0.61-mm) nominal thickness, with double bend at front and single bend at sides and back.

(6) Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

(a) Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.

(b) Frame Vents: Fabricate face frames with vents.

(7) Doors: One piece; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

(a) Doors less than 12 inches (305 mm) wide may be fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.

(b) Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet; welded to inner face of doors.

(c) Door Style: Vented panel as follows:

(i) Louvered Vents: No fewer than three louver openings at top and bottom for double-tier lockers.

(8) Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

(a) Continuous Hinges: Manufacturer's standard, steel, full height.

(9) Recessed Door Handle and Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry and vandal resistant.

(a) Multipoint Latching: Finger-lift latch control designed for use with built-in combination locks, built-in key locks, or padlocks; positive automatic latching and prelocking.

(i) Latch Hooks: Equip doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.

(ii) Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated with vinyl or nylon to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

(10) Combination Padlocks: Key-controlled, three-number dialing combination locks; capable of five combination changes.

(11) Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:

(a) Double-Tier Units: One double-prong ceiling hook and two single-prong wall hooks.

(12) Accessories:

(a) Legs: 6 inches (152 mm) high; formed by extending vertical frame members, or fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to bottom of locker.

(i) Closed Front and End Bases: Fabricated from 0.036-inch (0.91-mm) nominal-thickness steel sheet.

(b) Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.

(13) Finish: Baked enamel or powder coat.

(a) Color(s): As selected by Architect from manufacturer's full range.

C. Fabrication

(1) Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

(a) Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.

(b) Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

(2) Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

(3) Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for preassembly at plant prior to shipping.

(4) Accessible Lockers: Fabricate as follows:

(a) Locate bottom shelf no lower than 15 inches (381 mm) above the floor.

(b) Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.

(5) Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

(6) Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.

(7) Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.

(8) Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

(a) Provide one-piece panels for double-row (back-to-back) locker ends.

D. Steel Sheet Finishes

(1) Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.

(2) Baked-Enamel Finish: Immediately after cleaning, pretreating, and phosphatizing, apply manufacturer's standard thermosetting baked-enamel finish. Comply with paint manufacturer's written instructions for application, baking, and minimum dry film thickness.

(3) Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

c. Construction.

1. Execution

A. Examination

(1) Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

(2) Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

(3) Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation

(1) General: Install level, plumb, and true; shim as required, using concealed shims.

(a) Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.

(b) Anchor single rows of metal lockers to walls near top of lockers and to floor.

(2) Knocked-Down Metal Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.

(3) Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

(a) Attach hooks with at least two fasteners.

(b) Attach door locks on doors using security-type fasteners.

(c) Identification Plates: Identify metal lockers with identification indicated on Drawings.

(i) Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

(d) Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

C. Adjusting, Cleaning, And Protection

(1) Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

(2) Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

(3) Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
BASIC FURNISHINGS REQUIREMENTS – SECTION 12 00 00

a. Description. This special provision describes general requirements to furnish and install window shades, furniture and accessories for this project.

1. General

A. Description

(1) "Furnishings" items described in the individual special provisions for Shades – Section 12 20 00, Furniture and Accessories – Section 12 40 00, and Systems Furniture – Section 12 59 00 are generally prefabricated in the manufacturer's plant in accordance with the specifications and delivered either complete or as components, for installation into the Project. Furnish required fastening devices that are compatible with the surfaces to which each "Furnishings" item is secured. Provide exposed accessories that are either chrome plated, stainless steel, bronze, brass, or aluminum, as required so that the exposed accessories are compatible with the associated "Furnishings" item and with the space in which they occur.

B. Quality Assurance

(1) General

(a) "Furnishings" items as delivered and installed shall conform to manufacturer's printed descriptive literature, and with Contract Document requirements.

(2) Installer's Qualifications

(a) Engage an experienced Installer who has specialized in "Furnishings" work similar to that required for the Project.

(3) Catalog Standards

(a) Manufacturer's catalog numbers are shown in the Contract Documents for convenience in identifying "Furnishings" items. Unless modified by notations in the Contract Documents, the manufacturer's catalog description for indicated "Furnishings" item constitutes requirements for each such item.

(i) Use of catalog numbers and other requirements set forth in the Contract Documents are not intended to preclude use of any other approved manufacturers' products or procedures which may be equivalent, solely as

determined by Architect, but are given for purposes of establishing standards of design, function and quality of materials, constructions, and workmanship.

(ii) Where modifications to standard "Furnishings" items are indicated in the Contact Documents, the manufacturer shall make the indicated modifications to his standard products as required to comply with the indicated modifications.

C. Delivery, Storage, And Handling

(1) Deliver each "Furnishings" item in original, unopened cartons or packaging, complete with all fasteners and accessories required for a proper and complete installation.

(2) Store "Furnishings" items in enclosed, weathertight spaces protected from damage and loss in accordance with manufacturer's recommendations.

(3) Furnishings Contractor shall in no circumstance be allowed to use the elevators for the purpose of moving or installing "Furnishing" items on any adjoining floors.

D. Conformance With Rules, Regulations, And Codes

(1) Give to authorities having jurisdiction, all notices required by law, obtain all official permits, licenses, etc., and pay any and all proper and legal fees as may be necessary for the due and faithful performance of the Work and which may arise incidental to the fulfilling of Contract Document requirements.

(2) Where applicable standards have been set, "Furnishings" items and accessories installed under the Contract shall be manufactured, fabricated, and installed in strict compliance with applicable rules, regulations, codes, and interpretations of authorities having jurisdiction.

b. Materials.

1. Products

A. Provide "Furnishings" items as described under the individual special provisions for Shades – Section 12 20 00, Furniture and Accessories – Section 12 40 00, and Systems Furniture – Section 12 59 00.

c. Construction.

1. Execution

A. Examination

(1) Examine substrate, supports, and conditions under which work of the individual special provisions for Shades – Section 12 20 00, Furniture and Accessories – Section 12 40 00, and Systems Furniture – Section 12 59 00 is to be installed, and verify locations of rough-ins for mechanical and electrical services.

Notify the Contractor, in writing, of unsatisfactory substrates, supports, and conditions, including improper locations of rough-in services, and other unsatisfactory conditions that will result in improper installation of work required under the individual special provisions for Shades – Section 12 20 00, Furniture and Accessories – Section 12 40 00, and Systems Furniture – Section 12 59 00. Do not proceed with installation until unsatisfactory conditions have been corrected.

(2) Verify that clearances are adequate for proper installation and functioning of each "Furnishings" item.

B. Preparation

(1) Cutting, Fitting, and Drilling

(a) Do cutting and patching of other materials required for proper installation of work required in the individual special provisions for Shades – Section 12 20 00, Furniture and Accessories – Section 12 40 00, and Systems Furniture – Section 12 59 00. Do not cut structural work, except as authorized by the Architect.

(b) Do necessary drilling and tapping of supporting materials required for proper installation of work required in the individual special provisions for Shades – Section 12 20 00, Furniture and Accessories – Section 12 40 00, and Systems Furniture – Section 12 59 00. Burning of holes is prohibited.

(2) Reinforcement of supporting construction required to secure and to support "Furnishings" items will be accomplished during installation of supporting construction by the applicable trades involved; however, indicating the type of reinforcement materials required, their accurate location and sizing is the responsibility of the "Furnishings" item Installer requiring such reinforcement.

(a) Where specialized supportive reinforcement is required or is standard with the "Furnishings" item manufacturer, deliver the reinforcement to the appropriate trades at such times and in such quantities as required so as not to delay the progress of the Work.

C. Installation

(1) Install "Furnishings" items as described under the individual special provisions for Shades – Section 12 20 00, Furniture and Accessories – Section 12 40 00, and Systems Furniture – Section 12 59 00 in strict accordance with manufacturer's written instructions and recommendations and with approved Shop Drawings (if any). Verify that all items are installed.

(2) Anchor stationary and built-in "Furnishings" items securely to floors, walls, structure, as applicable, with appropriate fasteners.

(3) Utilities

(a) Make final connections to roughed-in utilities required to make "Furnishings" items operational at locations where final connections are not

specified in other special provisions. Comply with applicable codes governing type of utility being installed and connected to.

(b) Where only plug-in electrical service is required, plug items into electric outlets as required to make units operational.

(c) Install miscellaneous fittings as required for a proper, final connection.

(4) Install "Furnishings" items after painting and applied finishes are completed in each area scheduled to receive each item.

D. Cleaning And Protection

(1) Clean and properly protect the work after installation and leave same in perfect condition, ready for its intended use.

(2) Repair or remove and replace defective or damaged "Furnishings" items, as directed by the Architect. Comply with manufacturer's instructions for touch-up of minor finish damage.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SHADES – SECTION 12 20 00

a. Description. This special provision describes the work required to furnish and install perimeter and interior window coverings, including motor operated translucent roll shades.

1. General

A. Refer to special provision Basic Furnishing Requirements – Section 12 00 00 for additional “General” requirements.

B. Related Special Provisions

(1) For wood grounds and blocking required in substrate construction for anchoring shades.

(a) Rough Carpentry – Section 06 10 00,

(2) For electrical service and connections to motor operated shades.

(a) Common Work Results for Electrical Work - Section 26 05 00

(b) Grounding and Bonding for Electrical Systems - Section 26 05 26

(c) Hangers and Supports for Electrical Systems - Section 26 05 29

(d) Identification for Electrical Systems - Section 26 05 53

(e) Interior Lighting - Section 26 51 00

(f) Low-Voltage Electrical Power Conductors and Cables - Section 26 05 19

(g) Modular Dimming Controls - Section 26 09 36

(h) Raceway and Boxes for Electrical Systems - Section 26 05 33

(i) Wiring Devices - Section 26 27 26

(j) Vibration and Seismic Controls for Electrical Systems - Section 26 05 48

C. Submittals

(1) Shop Drawings and Product Data

(a) Submit manufacturer's technical data and installation instructions for each type of shade, hardware, and accessory required.

(b) Include plans showing extent and locations of shades and shade controls. Include elevations where multiple shade units are required in continuous runs to show locations of divisions between shade units. Show installation details at and relationships to adjacent building components.

(i) Indicate locations of control panels, wall switches, motors, access to motors, and mounting details. Include wiring diagrams.

(ii) Include rough-in requirements for electrical services.

(2) Samples

(a) Submit manufacturer's color charts consisting of actual materials, showing full range of colors, textures, and patterns available for each type of shade material indicated.

D. Quality Assurance

(1) Installer Qualifications

(a) Engage an experienced Installer who has specialized in installing shades similar to type and scope required for the Project that have resulted in installations with a record of successful in-service performance.

(2) Fire-Test-Response Characteristics

(a) Provide shades identical to products that pass NFPA 701 Small Scale Test for flame propagation resistance performed by a testing and inspecting agency acceptable to authorities having jurisdiction.

(3) Single Source Responsibility

(a) Provide each shade unit as a complete assembly, including hardware, accessories, mounting brackets, and fasteners. Obtain shades required for the entire Project through one (1) source from a single manufacturer.

E. Project Conditions

(1) Field Measurements

(a) Before fabrication, verify actual dimensions of openings indicated to receive shades by taking accurate field measurements. Show recorded field measurements on Shop Drawings.

b. Materials.

1. Products

A. Refer to the special provision for Basic Furnishings Requirements – Section 12 00 00 for additional "Product" requirements.

B. Manufacturers

(1) Subject to compliance with requirements, provide products of one of the following:

(a) Draper Shade & Screen Co.

(b) Levelor Corp.

(c) MechoShade Systems, Inc.

(d) Lutron.

C. Materials And Components

(1) Shade Roller

(a) Manufacturer's standard metal roller, of material, diameter, and length required to support shades of sizes required to fill full openings indicated to receive shades.

(i) Incorporate into shade roller, manufacturer's standard UL approved, 24 volt DC end mounted, in-the-roller motor, with thermal overload switch, designed to raise and lower shades from remotely located switches. Provide manufacturer's standard remotely located switch assembly for each shade, including associated wiring required between switches and motors.

(ii) Incorporate RS-232 connection for control of roller motor operations.

(2) Shade Material

(a) Provide type materials indicated in Shade Schedule listed at the end of this Section.

(3) Shade Fabric Slat Bar

(a) Manufacturer's standard aluminum bar, with rounded edges, of length required to match shade width.

(4) Shade Pulls

(a) None.

(5) Installation Brackets

(a) Manufacturer's standard end brackets of material, size, and type required to suit type shade roller provided and designed for type mounting applications indicated.

(i) Provide either an integral flange on installation brackets or separate mounting brackets for securement of fascia panels.

(6) Fascia

(a) 0.062" minimum thickness extruded aluminum angle shaped fascia panel designed for snap-in-place securement to mounting brackets, concealing roller tube and mounting hardware; height of fascia per manufacturer's standards to suit type installation. Finish fascia with manufacturer's standard baked enamel finish system of colors selected by the Architect.

(7) Installation Fasteners

(a) Fabricated from metal that is noncorrosive to shade hardware and adjoining construction, and are designed to support shades as required by manufacturer's written instructions.

D. Fabrication

(1) Fabricate shades to dimensions and shapes indicated.

(2) Fabricate individual shade units to completely fill the openings, from head-to-sill and from jamb-to-jamb.

(a) For shade units installed between (inside) jambs, fabricate to fill opening, with not more than 1/4" (6 mm) clearance at jambs and 3/8" (9.5 mm) clearance at sill.

(b) For shade units installed outside jambs, fabricate width and lengths as indicted, with terminations between shade units of end-to-end installations occurring at centerline of mullions or at other defined vertical separations between openings, solely as defined by the Architect.

c. Construction.

1. Execution

A. Refer to the special provision for Basic Furnishings Requirements – Section 12 00 00 for additional "Execution" requirements.

B. Installation

(1) Install shades in compliance with manufacturer's instructions for type mountings and operations required and with approved Shop Drawings. Install shades plumb and level, securely anchored with type fasteners recommended by manufacturer to suit substrates secured to.

(a) Install shades located so that shade fabric is not closer than 1" to the interior face of glass lites, gaps between edges of shade fabric and jambs do not exceed 1/4" plus or minus 1/8", and bottom rail in the fully lowered position is within 1/2" of bottom of window or other opening defining element.

(b) Install remote located switches at locations indicated, into recessed outlet boxes.

(2) Adjust shades as required to provide smooth, easy operation.

C. Cleaning And Protection

(1) Remove shipping cartons, packing materials, and other debris resulting from work of this Section, from the Project site and legally dispose of. Clean area of construction debris resulting from work of this Section.

(2) Repair or remove and replace defective or damaged work, as directed by the Architect.

(3) Clean surfaces of shade fabric and housing just prior to Substantial Completion according to manufacturer's written instructions.

(4) Protect installed work from damage by work of other trades until Substantial Completion. Remove protection when no longer required.

D. Shade Schedule

(1) Shade SH-1

(a) General: Provide for all locations where this designation is indicated.

(b) Products: Subject to compliance with requirements, provide one (1) of the following:

(i) Lutron.

(c) Shade Material: Vinyl coated polyester complying with ASTM D 1925.

(i) Pattern: Lutron Basket Weave.

(ii) Color: Chalk PPO6-48-1.

(d) Openness Factory: 1 percent.

(e) Mounting: Ceiling.

(f) Direction of Roll: Regular.

(g) Operation

(i) Motorized Operations: Operated by motor activated with [infrared remote] [wall switch] [timer] [sun sensor] with [static to stop and hold shade at any position] [dynamic to stop and hold shade at predetermined positions] operating mode.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
FURNITURE AND ACCESSORIES – SECTION 12 40 00

a. Description. This special provision provides the requirements, delivery, installation, adjustment, and cleaning of furniture and accessories to be installed as part of this project. Furniture and accessories included in this special provision include Chairs, tables, seating units, credenza, and other movable furniture, furnishings, and accessories of types indicated on the Drawings and listed in schedules.

1. Submittals

A. Product Data

(1) Submit manufacturer's product data for each item of furniture and accessories required.

B. Samples

(1) For initial selection purposes, submit samples in manufacturer's standard sizes. For verification purposes, submit samples from the same materials to be used for each item of furniture, of the following sizes:

(a) 6" square samples of each upholstery and fabric finish required.

(b) 12" square samples of each paint finish required.

(c) 12" square samples of each wood specie, cut, and finish required.

(d) 12" square samples for each high pressure decorative laminate (HPDL) required.

C. Close-Out Documents

(1) Submit material test reports from qualified independent testing laboratories indicating and interpreting test results relative to compliance of materials with specified requirements.

(2) Submit schedules to the Owner at time of delivery of furniture and accessories to the Owner's designated receipt area. Include in each schedule the ID number of each delivered container and it's contents, using the ["ITEM"] ["TAG"] designation used in the schedules. Also indicate where each item is to be located within the building using room/area name and number designations used on the Drawings.

(3) Submit manufacturer's standard written warranty for each item of furniture and accessories required. Warranty periods shall be for not less than five (5) years staring on the date of Substantial Completion.

2. Quality Assurance

A. Physical Properties

(1) Provide furniture that is identical to that tested for the following physical properties, according to test method indicated by BIFMA, ANSI, or other testing and inspection agency acceptable to authorities having jurisdiction:

(a) Tests for General Office Chairs

(i) Test Method: ANSI/BIFMA X5.1 - 1993 - American National Standard for Office Furnishings - General Purpose Office Chairs - Tests.

(ii) Rating: Certified as complying.

(b) Tests for Lateral Files

(i) Test Method: ANSI/BIFMA X5.2 - 1989 - American National Standard for Office Furnishings - Lateral Files - Tests.

(ii) Rating: Certified as complying.

(c) Tests for Vertical Files

(i) Test Method: ANSI/BIFMA X5.3 - 1989 - American National Standard for Office Furnishings - Vertical Files - Tests.

(ii) Rating: Certified as complying.

(d) Standards for Lounge Seating

(i) Test Method: ANSI/BIFMA X5.4 - 1990 - American National Standard for Office Furnishings - Lounge Seating - Tests.

(ii) Rating: Certified as complying.

(e) Standards for Desks

(i) Test Method: ANSI/BIFMA X5.5 - 1989 - American National Standard for Office Furnishings - Desk Products - Tests.

(ii) Rating: Certified as complying.

B. Fire Performance Characteristics

(1) Provide furniture that is identical to that tested for the following fire performance requirements, according to test method indicated, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction:

(a) Surface Burning Characteristics

(i) Flame Spread: Not more than 25.

(ii) Smoke Developed: Not more than 50.

(iii) Test Method: ASTM E 84, UL 723, or NFPA 255, per authorities having jurisdiction.

(b) Fire Performance Characteristics of Padding

(i) Test Method: Federal Test Method Standard 191.

(ii) Rating: Average burn length not exceed 8". Average flame time not exceed 15 seconds after removal from source.

(c) Flammability: Upholstered Furniture

(i) Test Method: X5.7 - 1991 (F-1) BIFMA Voluntary Upholstery Furniture X5.7 - 1991 Flammability Standards for Business and Institutional Markets.

(ii) Rating: Certified as complying with requirements for Class A fabric.

C. Regulatory Requirements and Standards

(1) Electric Code: Comply with NFPA 70/ANSI C1 "National Electrical Code" for electrical components incorporated into furniture and accessories.

3. Delivery, Storage, And Handling

A. Tag each item of furniture and accessory separately with ["ITEM"] ["TAG"] designation used in schedules. Package items separately or together in containers, each clearly marked with an identification (ID) number on securely attached waterproof tags.

B. Do not deliver furniture and accessories until building is enclosed, heated, and ready for their installation.

C. Store furniture and accessories in enclosed, weathertight, heated, and ventilated areas with environmental criteria recommended by manufacturer.

D. Handle furniture and accessories in accordance with manufacturer's instructions and as required to prevent damage during delivery, storage, handling, and installation operations.

E. Protect finished surfaces from damage and soiling during installation. Comply with furniture and accessories manufacturer's recommendations.

b. Materials.

1. Products

A. Upholstery fabrics to be provided with the fabric manufacturer’s maximum performing stain proofing system.

B. Refer to the special provision for Basic Furnishing Requirements – Section 12 00 00 for additional "Products" requirements.

C. Furniture And Accessories

(1) See Drawings and schedules for type, quantity, model number, manufacturer, and location of each item of furniture and accessory.

c. Construction.

1. Execution

A. Refer to the special provision for Basic Furnishing Requirements – Section 12 00 00 for additional "Execution" requirements.

B. Examination And Preparation

(1) Examine condition and locations of rough-in mechanical and electrical services and conditions under which work of this Section to be installed. Notify [Owner] [Contractor], in writing, of unsatisfactory conditions and locations of rough-in services and other unsatisfactory conditions for proper installer of work under this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

(2) Examine conditions and verify dimensions where new furniture or equipment is to be installed.

(3) Provide surface applied protection for floors, doors, door frames, walls and other surfaces as required to protect in-place finished materials and surfaces from damage and soiling which may result from work of this Section.

C. Installation

(1) Comply with printed instructions and recommendations of manufacturer for each item of furniture and accessory. Verify that required and specified accessories for each item of furniture have been installed, or where indicated as loose or extra accessories, delivered to Owner.

(2) Do not install furniture and accessories in a scheduled area until all finishes have been completed in that area, including, but not necessarily limited to, carpeting, resilient flooring, ceiling, and painting.

(3) Place furniture and accessories in their final locations as indicated, or if not indicated, as directed by Architect.

(4) Where only plug-in electrical service connections are required to energize any item of furniture, perform same.

D. Adjusting And Repairing

(1) Adjust operable or moveable components and accessories of furniture and accessories as required to ensure smooth operation. Install plumb, level, true and straight with no distortions.

(2) Repair or remove and replace defective or damaged furniture and accessories, as directed by Architect, to eliminate evidence of damage. Comply with manufacturer's instructions for touch-up of minor finish damage.

E. Cleaning

(1) Clean and polish exposed components and surfaces of furniture and accessories immediately upon completion of installation.

(2) Remove packing materials, shipping cartons, and other debris resulting from work of this special provision and remove surface applied protection when no longer required. Remove form the site and legally dispose of.

(3) Clean area of construction debris resulting from work of this special provision.

F. Schedules

(1) Furniture and Accessories Schedules.

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Freestanding Desk	D1L D1R

Basis of Design:

Mfr/Series:	Steelcase Kick
Other mfg:	Knoll
Other mfg:	Allsteel

Photo		Location	Qty
	Photo indicates style; Configuration as specified		
		A205	(1) D1R
			(1) D1L

Description

Metal/plastic laminate desk; refer to Sheet F1.0 for component description
clear access supports; grommet each worksurface, center back
partial ht modesty panels (12");
PVC, vinyl or plastic worksurface edge at user edges.

base: 5-star; casters for resilient floor
22"d file/file pedestal; steel, with lock; letter-width
Lock all components; key alike
Note: S1, S2, S3, S5, must all be from the same mfg/series
10 year warranty

Edge trim:	selected from manufacturer's standard trim colors	
Metal	selected from manufacturer's standard base grade paint colors	
Tackbd Fabric:	Grade 1	
Pulls:	handle style pull; black	

Cost

	Quantity:	1 ea
	Total Cost D1L:	2
	Total Cost D1R:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Task Chair	CH1

Basis of Design:

Mfr/Series:	Steelcase Amia
Other mfg:	Steelcase Leap
Other mfg:	ErgoGenesis BodyBilt J2507

Photo	Location	Qty
		
	A138	16
	A225	16

Description

frame/mechanisms: welded steel
seat ht: 16"-21"h; pneumatic cylinder; seat width: min 19"; seat depth adjusts between min 16"-18"; seat cushion urethane foam (3#/CF);
seat back ht from seat: 25" min; width: 18" min; provide full tilt and locking mechanism and tension adjustment; recline range of 20 degrees; molded plastic or polypropolene outer back shell
visible controls, labled, reached from a seated poeition
arms: two independantly adj arms; 4" ht adj; min 2" width adj; min 30 degree pivot; depth adj 3"; arm caps soft reinforced urethane foam
base: 5-star; casters for resilient floor
product/parts guaranteed available for a minimum of 10 years after order entry date
provide wriiten user instructions
meets ANSI/BIFMA X5.1-2002
10 year warranty; warrantied up tp 300 lbs

Finishes

Seat Upholstery:	selected from manufacturer's standard mid-grade fabrics
Cleaning Code:	WS
Arms:	black
Frame:	black
Base:	black

Cost

Unit cost:	
Quantity:	32
Total Cost CH1:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Task Chair	CH1a

Basis of Design:

Mfr/Series:	Steelcase Amia
Other mfg:	Steelcase Leap
Other mfg:	ErgoGenesis BodyBilt J2507

Photo	Location	Qty
		
	A205	2

Description

frame/mechanisms: welded steel
seat ht: 16"-21"h; pneumatic cylinder; seat width: min 19"; seat depth adjusts between min 16"-18"; seat cushion urethane foam (3#/CF);
seat back ht from seat: 25" min; width: 18" min; provide full tilt and locking mechanism and tension adjustment; recline range of 20 degrees; molded plastic or polypropolene outer back shell
visible controls, labled, reached from a seated poeition
arms: two independantly adj arms; 4" ht adj; min 2" width adj; min 30 degree pivot; depth adj 3"; arm caps soft reinforced urethane foam
base: 5-star; casters for resilient floor
product/parts guaranteed available for a minimum of 10 years after order entry date
provide wriiten user instructions
meets ANSI/BIFMA X5.1-2002
10 year warranty; warrantied up tp 300 lbs

Finishes

Seat Upholstery:	selected from manufacturer's standard mid-grade fabrics
Cleaning Code:	WS
Arms:	black
Frame:	black
Base:	black

Cost

Unit cost:	
Quantity:	2
Total Cost CH1a:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Stack Chair	CH2

Basis of Design:

Mfr/Series:	Vecta Kart 1262115C
Other mfg:	Herman Caper
Other mfg:	KI Rapture RAPWAUSC

Photo	Location	Qty
		
	A138	2
	A225	12

Description

4-leg stack chair on casters, with arms
separate contoured seat and back; textured high impact polypropolene
arms: black textured non-upholstered armsrest
seat: upholstered
frame: min 16ga powder costed steel
carpet casters

width: 22" min; depth: 22" min; height: 32" min

Finishes

Seat Upholstery:	selected from manufacturer's standard mid-grade fabrics
Cleaning Code:	WS
Arms:	black
Frame:	black
Base:	black
Back:	black

Cost

Unit cost:	
Quantity:	14
Total Cost CH2:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	File	F1

Basis of Design:	
Mfr/Series:	Steelcase Universal Files
Other mfg:	
Other mfg:	

Photo	Location	Qty
Photo indicates style, not size		
		
	A138	5

Description
2-drawer metal lateral file with hanging file folder rails
42" wide
locks; key all differently
4 adj leveling glides
integral pull, full width
Note: F1, F2, S1, S2, S3, S5, must all be from the same mfg/series

Finishes		
Paint:	selected from manufacturer's standard base grade paint colors	

Cost		
	Unit cost:	
	Quantity:	5
	Total Cost F1:	

URS File No.		Project Name	Furniture Type	Code
12940906		TMC Interior Fit-Out	File	F2

Basis of Design:		
Mfr/Series:		Steelcase Universal Lateral File
Other mfg:		
Other mfg:		

Photo	Location	Qty
Photo indicates style, not size		
	A205	4

Description
4-drawer metal lateral file with hanging file folder rails
42" wide
with counterweight
locks; key all differently
4 adj leveling glides
integral pull, full width
Note: F1, F2, S1, S2, S3, S5, must all be from the same mfg/series

Finishes		
Paint:	selected from manufacturer's standard base grade paint colors	

Cost		
	Unit cost:	
	Quantity:	4
	Total Cost F2:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	File	F3

Basis of Design:

Mfr/Series:	Steelcase RPM2421CF
Other mfg:	
Other mfg:	

Photo	Location	Qty
 Photo similar to style		
	A205	2

Description

2-drawer metal mobile file ped with seat cushion top and separate retractable handle for pulling hanging file folder rails

locks; key all differently

Finishes

Pulls:	Black	
Seat Fabric:	selected from manufacturer's standard mid-grade fabrics	

Cost

	Unit cost:	
	Quantity:	2
	Total Cost F3:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Storage cabinet	S1

Basis of Design:

Mfr/Series:	Steelcase Universal Storage Cabinets; RSC18362AF
Other mfg:	
Other mfg:	

Photo	Location	Qty
 Photo indicates style; size as specified below		
	A138	2

Description

2-door metal storage cabinet; 1 adjustable shelf
36"w x 18"d x 28"h; height must match F1
locks; key all differently
flush steel front; integral pulls

Note: F1, F2, S1, S2, S3, S5, must all be from the same mfg/series

Finishes

Paint:	selected from manufacturer's standard base grade paint colors	

Cost

Unit cost:	
Quantity:	2
Total Cost S1:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Storage cabinet	S2

Basis of Design:

Mfr/Series:	Steelcase Universal Storage Cabinets; RSC24366QF
Other mfg:	
Other mfg:	

Photo	Location	Qty
		
	A205	9

Description

2-door metal storage cabinet; 5 adjustable shelves, minimum
36"w x 23"d x 84"h
locks; key all differently
flush steel front; integral pulls

Note: F1, F2, S1, S2, S3, S5, must all be from the same mfg/series

Finishes

Paint:	selected from manufacturer's standard base grade paint colors	

Cost

	Unit cost:	
	Quantity:	9
	Total Cost S2:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Wardrobe cabinet	S3

Basis of Design:

Mfr/Series:	Steelcase Universal Storage Cabinets; RWC24366DF
Other mfg:	
Other mfg:	

Photo	Location	Qty
		
	A205	1

Description

2-door metal storage cabinet; 1 shelf and coat rod
36" w x 23" d x 84" h; height must match S2
flush steel front; integral pulls

Note: F1, F2, S1, S2, S3, S5, must all be from the same mfg/series

Finishes

Paint:	selected from manufacturer's standard base grade paint colors	

Cost

	Unit cost:	
	Quantity:	1
	Total Cost S3:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Open shelving	S4

Basis of Design:

Mfr/Series:	Penco Clipper
Other mfg:	Acme Visible Ezrect medium duty shelving
Other mfg:	Tennsco

Photo	Location	Qty
 Open Configuration Photo shows 4 units		
	A205	4

Description

Open utility shelving; continuous 14 ga front and back steel shelf support, interlock with keyslots without use of nuts and bolts.
Uprights: minimum 19 ga cold rolled steel; keyslots on 1 1/2" centers, inside face only
Shelves: minimum 18 ga cold rolled steel; minimum 3/4" return flange all sides; adj vertically on 1 1/2" centers; provide minimum of 5 shelves + top each unit
provide continuous 13 ga steel intermediate supports designed to engage front and rear shelf support members
48"w x 24provide continuous 13 ga steel intermediate supports designed to engage front and rear shelf support membersd x 84"h; height to match S2

Finishes

Paint:	match S2	

Cost

	Unit cost:	
	Quantity:	4
	Total Cost S4:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Storage cabinet	S5

Basis of Design:

Mfr/Series:	
Other mfg:	
Other mfg:	

Photo	Location	Qty
		
	A205	1

Description

2-door metal storage cabinet; 8 adjustable shelves, minimum
36"w x 23"d x 84"h
locks; key all differently
flush steel front; integral pulls

Note: F1, F2, S1, S2, S3, S5, must all be from the same mfg/series

Finishes

Paint:	selected from manufacturer's standard base grade paint colors	

Cost

Unit cost:	
Quantity:	1
Total Cost S5:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Storage cabinet	S6

Basis of Design:

Mfr/Series:	Steelcase
Other mfg:	Penco
Other mfg:	Tennsco

Photo	Location	Qty
		
	A205	1

Description

4-door metal storage cabinet; 5 adjustable shelves, minimum
36"w x 23"d x 84"h
vented with perforated or louvered doors
flush steel front

Finishes

Paint:	selected from manufacturer's standard base grade paint colors	

Cost

Unit cost:	
Quantity:	1
Total Cost S6:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Mail Sorter	S7

Basis of Design:

Mfr/Series:	Charnstrom P710
Other mfg:	US Mail Supply PLY10
Other mfg:	Hamilton Sorter

Photo	Location	Qty
		
	A138	3

Description

metal mail slot cabinet; minimum 16 slots each cabinet
48"w x 13"d (maximum) x 16"h (maximum)
minimum 16 adjustable sorting pockets; adjustable in 1/2" increments
minimum 20 ga steel welded construction
powder coated or baked enamel finish

Finishes

Paint:	selected from manufacturer's standard base grade paint colors	

Cost

Unit cost:	
Quantity:	3
Total Cost S7:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Table	T1

Basis of Design:

Mfr/Series:	Steelcase Groupwork
Other mfg:	Vecta Akira
Other mfg:	KI Trek

Photo	Location	Qty
		
	A225	14

Description

30" x 72" tilt-top table nesting table
plastic laminate top with vinyl or PVC T-mold edge; minimum top thickness: 1.25"
modesty panel full width; must remain on table when tilted for nesting
casters on all legs

Finishes

Laminate top:	Nevamar Edenwood	
Edge:	selected from manufacturer's standard edge colors	
Base:	selected from manufactruer's standard paint colors	
Modesty panel:	Nevamar Edenwood	

Cost

	Unit cost:	
	Quantity:	14
	Total Cost T1:	

URS File No.	Project Name	Furniture Type	Code
12940906	TMC Interior Fit-Out	Anti-static table top and floor mat kit	ASM1 ASM2

Basis of Design:

Mfr/Series:	AntiStatic Mat
Other mfg:	All Mats
Other mfg:	Botron Company, Inc

Photo	Location	Qty
		
	A205	4 ASM1
		4 ASM2

Description

2059-2x4KT

.06" x 2' x 4' rubber table top kit w/15' ground cord and wrist strap

Static Dissipative top rubber layer laminated to a conductive rubber bottom layer.
Surface resistivity of top layer is 106 - 108 and bottom layer is 103 - 105. Meets ESD-D-412 standards.

blue color

WITH

AF-3X4KT

3' x 4' floor mat kit with ground cord

Rubberized mat with Vinyl and Nitrile construction.
Surface Resistivity is $10^{6} - 10^{9}$.

grey color

Finishes

Cost

Unit cost:	
Quantity:	4
Total Cost ASM1:	

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SYSTEMS FURNITURE – SECTION 12 59 00

a. Description. This special provision provides the requirements for the console furnishing for the MTISC Center Control Room. The TMC Control Room is a 24/7 operations and control room consoles designed for this intensive use will be provided for sixteen (16) control room operators. Layout of consoles within the room should not only provide for a comfortable view of the video display wall and meet ADA clearances for walkways and accessibility. Office grade systems furniture will not be an acceptable solution for the console furnishings required for this project.

1. General

A. Features and capabilities

(1) Sit/stand type console comprised of two (2) height-adjustable surface.

(a) Lifts components UL listed.

(b) Lifts components CSA and FCC certified.

(2) Two (2) height-adjustable sections/work surface space will be a minimum of 2800 square-inches and accommodate computer, communication, display, environmental controls and operator interface devices.

(3) Provide full wire management system; allowing cables to go from the top of the work surfaces, to the innards of the console, into the raised floor in an organized and professional-looking manner.

(4) Anthropologically and ergonomically designed accommodating the operators daily functions. Viewing angles and sight lines to video wall will not be compromised when the console is in the full stand position.

(5) Designed to fit into a layout approved by the client (Michigan Department of Transportation).

(a) The consoles may stand alone or be paired so that the multiple consoles can be grouped together.

(b) In addition to aesthetics, pieces connecting two or more (2+) consoles together will have a useable worksurface/partition for purposes such as enclosable and lockable storage, open storage space and additional worksurface, layout table, etc.

(c) Console layout designed to meet ADA requirements.

(d) Layout to accommodate the optimal viewing angle of the video wall by the greatest number of operators in the room. Console layouts to attempt to align the natural gaze of all operators to the center of the video display wall.

(e) Designed to be slightly U-shaped or concave.

B. Guidelines and requirements

(1) Meets ANSI-BIFMA guidelines and requirements.

(2) Meets BSR/HFES 100 guidelines and requirements.

(3) Meets ADA guidelines and requirements.

(4) Meets ISO guidelines and requirements for ergonomic standards.

(5) Meets CSA guidelines and requirements for ergonomic standards.

C. Structural Frame Stability as a result of Function

(1) Frame to accommodate sit/stand functionality with the option of fully adjustable and separately controlled input surfaces.

(2) Installed on top of finished flooring without penetrating the finished floor and without the use of floor fasteners.

(3) Modular design intended to accommodate future reconfigurations and/or upgrading options.

(4) Accommodate the installation of acoustical partition systems.

(5) The console will provide a fully integrated, both lateral and vertical, raceway for power supply, electrical, and data cable management throughout the entire layout of the console to allow uninterrupted cable management.

(6) The console will have levelers to overcome slight unevenness in the floor.

(7) Without disrupting structural stability, horizontal frame members will allow for horizontal passage of cabling without additional drilling. The base of the console (area of console parallel to flooring) and the top of the console will have multiple cable portals to permit vertical cable management passage. Any enclosed area of the console will have multiple cable portals to permit cable passage.

D. Monitor Surface

(1) Raise and lower on two columns at a minimum.

(2) Lower to allow for appropriate viewing angles of monitors so that the gaze angle to the center of the screens ranges between -15° and -20° from the horizontal eye level of the 5th percentile seated female.

(3) Rise to allow for appropriate viewing angels of monitors so that the gaze angle to the center of the screens ranges between -15° and -20° from the horizontal eye level of the 95th percentile male.

(4) Accommodate a maximum load of 1,000 pounds on the work surface. The work surface must be able to accommodate differential load from side to side up to the maximum load requirement without damaging the structure.

(5) Provide multiple cable drop areas (grommets) for equipment on the monitor surface. These areas must work in conjunction with the cable management system. Coverings for the grommets shall also be provided.

(6) Monitor surface to support a three (3) monitor mount. Each monitor will be individually adjustable (left, right, tilt forward, tilt back) finger-tip tilt adjustment. Mount to be securely fixed to the work surface and follow the contour of the work surface.

(7) Monitor surface will have a minimum of one surface mounted duplex power outlet, universal data ports, and voice port accessible to the user.

E. Input/keyboard Surface

(1) Lower to accommodate the ergonomic keyboard typing position of the 5th percentile seated female.

(2) Rise to accommodate the ergonomic keyboard typing position of the 95th percentile standing male.

(3) Electronically adjustable independent from the monitor surface.

(4) Wrap around design with a minimum space requirement of 80 square inches for placement of the following at a minimum:

(a) (1) keyboard

(b) (1) pointer/mouse

(c) (1) 8.5”x11” notepad

(5) Travel simultaneously with monitor surface to retain relative positioning between both surfaces.

(6) Provide unobstructed knee clearance in the seated operating position in accordance with ANSI standards.

(7) Provide adequate load-carrying capabilities as to the typical load during its lifetime.

F. Surface Control

(1) Input/keyboard surface and monitor surface controlled by an one (1) integrated touch-controlled interface

(2) Surface control to be done without the use of software.

(3) Movement of the surfaces will be controlled and designed in such a way that does not inflict personal or property damage when in use.

(4) Minimum safety clearances will be provided between the moving surfaces so that pinch points are eliminated.

(5) Adjustment will occur at low speeds.

(6) ADA compliant placement and design of console adjustment controls.

G. Computer Storage areas

(1) Provide adequate space for two (2) CPU towers at a minimum.

(2) Passive ventilation of CPU enclosures (optional active ventilation).

(3) CPU trays to be either fixed shelf, pull-out, swing-out, or elbow-hinged mechanisms, constructed of suitable material as to handle the CPU load and movement.

(4) Hinged and lockable access doors/panels.

(5) Access doors/panels may be able to be configured (swing out left, swing out right)

(6) Access doors/panels will be rear (back of console) accessible at a minimum. Only if physical layout dictates no other option, access doors will be accessible from the front (front of console).

(7) Cable management system incorporated into the computer storage area.

(8) Does not inhibit leg room and leg swing of the 95th percentile male.

H. Materials

(1) Edge Material

(a) Any external work surface exposed edge facing the operator to have a PVC or Vinyl nosing that is ergonomically sloped/shaped, Nosing leading edge thickness at least 0.5 inches.

(b) All other exposed edges of the console will not be rough anywhere around the entire perimeter of the console.

(2) Paint

(a) All painted surfaces to be epoxy powder-coat paint with a uniform application over all surfaces.

I. Environmental Controls

(1) Entire system controlled by single point interface for heat/cool by the touch of buttons with no computer software involved.

(2) Minimum of two (2) circulating filtered air outlets independently placed by the operator anywhere on any work surface.

(3) Filter to be extractable, replaced, and washed by operator without the use of tools.

(4) Include lightweight, mountable radiant heat panel integrated under side/ back side of the console. No forced heat will be allowed.

J. Console Lighting

(1) System will provide a minimum of two (2) LED task lights, each task light to be:

(a) Dimmable by operator.

(b) Selected on/off by operator.

(c) Fully adjustable (left, right, up, down, forward, back)

K. Side/back Panels

(1) Provide enclosing panels on the back and sides of the console from a height that is equal to the desktop height in its raised position downward to the floor.

(2) Panels to be attached and removed from the frame with concealed fasteners and without the use of tools.

(3) Panels may consist of variety of finishes as determined by the client to be interchangeable of material type.

(a) Fabric covered and recoverable in the field. Fabrics utilized to meet ASTM and State of CA Tech. Bulletin flammability ratings (E-84, Class 1 or CS-191-53, respectively).

(b) Acoustical panels have minimum performance values for NRC of 80, STC of 24, NIC (Flanking) of 18, and NIC (Barrier) of 21, per ASTM C 423, supported by certified test data. Acoustical panels will be covered in fabric to match interior of the room as approved by the owner.

(4) Panels tested in accordance with ASTM E 84 and conform to NFPA 101, Class A requirements.

L. Work Surfaces

(1) Minimum 45 pound density 1" nominal thickness wood core material (wheat chaff not acceptable).

(2) Factory engineered/constructed for vertical passage of electrical and communication cables as necessary at location indicated.

(3) GP50 (0.050" thick) High pressure decorative laminate (HPDL) minimum on the topside and user side of the work surfaces.

(a) Laminates must meet ANSI/NEMA publications and comply with the National Sanitation Foundation #35 Specification and the U.S. Federal Specification L-P 508H.

(b) Low-pressure laminate will not be accepted.

(4) Finished surfaces not adversely affected by ordinary household solvents, acids, alcohol, and salt solutions.

M. Pedestal

(1) Three (3) drawer system integrated into the console or provide sufficient space for placement of all steel file pedestal under console surfaces.

(a) If not integrated into the console, the pedestals will be on dual-wheeled lockable castors

(2) Available in pencil, box, and file types. File type must provide for hanging files.

(3) Pedestal and drawers constructed of steel and capable of being installed and removed at the Project site.

(4) Recessed drawer pulls.

(5) Lockable, option of being keyed alike or different locks.

N. Electrical

(1) Each console assembly shall include a minimum of eight (8) 20A duplex receptacles mounted within a horizontal base mounted panel raceway. (The consoles shall be fed via two 120 volt, 20 amp dedicated circuits.) The receptacles shall be equally spaced within the horizontal raceway, pre-wired within the raceway and shall alternate circuits.

(2) The console assembly power shall be factory prewired, U.L. labeled.

(3) The console assembly shall have provisions for mounting of a contractor provided ground bus. Grounding shall meet the intent of the Motorola r56 standard.

(4) The horizontal base mounted raceway system shall also be equipped with an additional independent wire management cable raceway providing horizontal panel to panel containment for a minimum of eight 25-pair 3/8" diameter cables.

(5) Electrical outlet receptacles will be built into and integral to the panel. No extension cord devices, wire way, or other devices mounted to the exterior of the panel are acceptable.

(6) Panels to provide a method of feeding electrical and communication lines through panels from panel-to-panel.

(7) The panel system will have the ability to connect with the building electrical and communications systems via flush to floor boxes connecting to the panel base raceway.

(8) Panels will be capable of being retro-fitted with electrical energy and communications capabilities and outlet/receptacles at a later date, providing identical capacity and performance to the factory wired panel.

O. Submittals

(1) Shop Drawings and Product Data

(a) Before final selection, the console supplier shall provide a detailed floor plan to scale showing each proposed console and location within room.

(b) Submit manufacturer's technical data and installation instructions for each panel, component and accessory of console required.

(c) Include plans, elevations, sections, locations, and types of service fixtures, and anchorage details to floors and walls. Show relationships to surrounding walls, doors, windows, and other building components.

(i) Include rough-in requirements for mechanical and electrical services, computer, and for other equipment and services, as indicated.

(d) List of components necessary to install the console in accordance with the requirements of the Contract Documents.

(e) Include layouts showing the complete layout for the entire Project, including dimensions indicating total outside dimensions of each workstation or cluster of components, actual dimensions widths of corridors, aisles, and entries.

(f) Include electrical designs indicating locations and method of connecting to building electrical system, including number and types of circuits required at each connection point location and type of electrical receptacles and

location of systems lighting. Include pathway from building electrical source to access points in the console.

(2) Close-Out Documents

(a) Submit written warranty and acceptance documents for console required.

(i) Console will be warranted to be free from defects in materials and workmanship for five (5) years based on 24/7 usage, beginning from the date of final acceptance by the Department..

(ii) Warranty will cover 100% of the product for the entire five (5) year period. This includes, but is not limited to:

1) All product, shipping, and installation.

2) Structural components.

3) All electrical components.

4) All accessories.

(iii) Under no circumstances will the buyer be responsible for any costs derived from defect(s) over the entire five (5) year period.

(iv) Console supplier will guarantee a response time of not more than one (1) business day for any inquiry received to the time that contact is made with the Department.

P. Quality Assurance

(1) Single Source Responsibility

(a) Provide panels, components, free-standing units and other scheduled items either manufactured by, or furnished by the same console company for single responsibility.

(i) Provide scheduled and indicated panels and components, both modular (manufacturer's standard) components and custom fabricated components, by a single manufacturer for the entire Project.

(b) The console supplier will have a minimum of fifteen (15) years experience specializing in console design and fabrication.

(2) Regulatory Requirements

(a) Electric Code: Comply with NFPA 70/ANSI C1 "National Electrical Code" for electrical components incorporated into the console.

(b) Flame-Resistant Fabric: All fabrics and textiles used in console components will comply with NFPA 701.

Q. Delivery, Storage, And Handling

(1) Contractor/supplier will be responsible for replacement of any damaged equipment which occurs as a result of actions by the contractor or supplier during the transport, handling, and installation of the equipment.

(2) The console supplier will pack the console components responsibly that will not damage console components through the entire trip from factory to desired destination.

(3) Deliver console components after building is fully enclosed, heated/cooled and ready for their installation. Deliver console components in manufacturer's original, unopened cartons or packaging to be able to fit into standard-sized door, complete with fasteners and accessories required for installation.

(4) Store console components in enclosed, weather tight, heated, ventilated areas with relative humidity in storage area not greater than 50 percent and with minimum temperature 55°F or in accordance with environmental criteria if different than specified environmental criteria.

(5) Handle console components as required to prevent damage during delivery, storage, handling and installation operations.

(6) Protect finished surfaces from damage and soiling during handling and installation.

(7) The console supplier will install the consoles within the finished space and will provide labor and site supervision.

R. Project Conditions

(1) Field Measurements

(a) Verify locations of power feeds, positions of exits and aisles, and overall dimensions of spaces and installation.

(b) Verify consoles are installed according to plans (see section below regarding installation).

b. Materials.

1. Products

A. Manufacturers

(1) Products

(a) Subject to compliance with requirements, provide one of the following:

(i) Evans Consoles Corporation.

(ii) Wright Line, LLC.

(iii) Watson Furniture Group, Inc.

(b) Or Equal as approved by the Engineer, approved equals to meet requirements as stated in this special provision. Requests to use an approved equal product/manufacturer to be submitted a minimum of 2 week prior to submission of bids. Requests should in writing using a line by line comparison of the requirements contained in this special provision.

c. Construction.

1. Execution

A. Preparation

(1) Examine conditions and verify dimensions where consoles are indicated to be installed.

(2) Provide surface applied protection for floors, doors, door frames, walls, and other surfaces as required to protect in-place finished materials and surfaces from damage and soiling which may result from work of this Section.

B. Installation

(1) Furnish and install necessary hardware, fasteners, accessories required to complete the installation of console. Verify that specified accessories have been installed, or where indicated as loose or extra accessories, delivered to Owner.

(2) Do not install console components in a scheduled area until all finishes have been completed in that area, including carpeting, resilient flooring, ceilings, painting, etc.

(3) Place console components in their final locations as indicated or if not indicated, as directed by Architect.

(4) Where only plug-in electrical service connections are required to energize any console component, perform same.

C. Adjusting And Repairing

(1) Adjust and lubricate hardware and other operable (moving) components and accessories as required to ensure smooth operation.

(2) Adjust leveling devices as required to ensure panels are plumb, level, of one height in any connected group and that work surfaces are level. Align panels to run continuous, straight, and true.

D. Cleaning

(1) Clean and polish exposed components and surfaces of consoles immediately upon completion of installation.

(2) Remove packing materials, shipping cartons, and other debris resulting from work of this Section and remove surface applied protection when no longer required. Remove from the site and legally dispose of.

(3) Clean area of construction debris resulting form work of this Section daily and upon final completion of project.

(4) Replace or repair as directed by Architect any defective or damaged product.

E. Testing

(1) Test each electrical component to verify that it is properly energized.

(2) Correct deficiencies and retest.

F. Console Schedule

(1) The Schedule identifies the major components required for the console. It is the console manufacturer and the Installer's responsibilities to identify and include additional components required to complete the installation and to comply with the manufacturer's recommendations for function, performance, safe installation, and use of the console.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment e.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
COMMON WORK RESULTS FOR ELECTRICAL WORK – SECTION 26 05 00

a. Description.

1. General

A. Summary

(1) Section Includes:

(a) Electrical equipment coordination and installation.

(b) Sleeves for raceways and cables.

(c) Sleeve seals.

(d) Grout.

(e) Common electrical installation requirements.

(f) Firestopping of electrical installation

B. Definitions

(1) EPDM: Ethylene-propylene-diene terpolymer rubber.

(2) NBR: Acrylonitrile-butadiene rubber.

C. Submittals

(1) General

(a) Make all submittals in accordance with the contract, herein, and individual sections in Special Provisions.

(b) Clearly identify all submittals with project name and location, and manufacturer's name. Review and approve all submittals prior to submitting to Architect. Mark each submittal with company name, reviewer's initials and date of review. Submittals not so approved and marked will be rejected, and resubmittal will be required.

(c) Clearly mark product data copies to identify pertinent products, models, or part numbers. Show performance characteristics and capacities, dimensions and clearances required, and wiring diagrams and controls.

(d) Submit indexed and bound sets of shop drawings and/or product data sheets for items listed in Special Provisions prior to ordering material and starting construction.

(e) Submit a minimum of two (2) copies of bound and indexed operation and maintenance instruction manuals, parts lists, shop drawings and product data sheets, and record drawings for items listed in Special Provisions as part of close-out documents.

D. Quality Assurance

(1) Furnish only new, first-class quality, materials and equipment, delivered, erected, connected and finished in every detail, selected and arranged to fit properly into building spaces. Where no specific kind or quality of material is specified, furnish first-class standard article, approved by Architect.

(2) Furnish services of one or more experienced superintendents, to be in charge of installation of work, and all skilled workmen, electricians and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

(3) Provide all component parts of each item of equipment or device with manufacturer's nameplate, giving name of manufacturer, description, size, type, serial number, electrical characteristics, etc., to facilitate maintenance or replacement. Nameplate of Subcontractor or distributor is not acceptable.

(4) Job conditions, which govern when and how products shall be installed, are generally covered in the contract and specifically covered in individual paragraphs of individual Special Provisions.

(5) Do NOT install any product where it might be exposed to environment that is extremely different to that in which it was intended to be normally used.

(6) Perform all work in close cooperation with other trades and utility companies.

(7) Comply with latest edition or revision of each standard or code mentioned in these specifications and as follows:

(a) American National Standard Institute (ANSI)

(b) American Society for Testing Materials (ASTM)

(c) National Electrical Manufacturer's Association (NEMA)

(d) Underwriters' Laboratories (UL)

(e) National Fire Protection Association (NFPA)

(f) National Electrical Code (NEC) - NFPA 70

(g) State and Local Municipality Building and Electrical Codes and Ordinances.

(8) Execute all work in conformity with best standards of practice. Lay out and install work in accordance with drawings, manufacturer's instructions, shop drawings, and field layouts of other trades.

(9) Drawings are diagrammatic and indicate the general arrangement and intent of systems and work included in these documents.

(10) Furnish all labor, material and equipment to install and successfully test electrical systems and work, complete and in place, as herein specified and as shown on drawings.

E. Alternates And Allowances

(1) Refer to the contract for General Requirements on Alternates and Allowances.

F. Product Delivery, Storage And Handling

(1) Refer to the contract for general requirements pertaining to delivery, storage and handling.

(2) Protect materials before, during and after installation.

(3) In event of damage, immediately make all repairs and replacements necessary at no additional cost.

(4) Deliver all materials to job-site in original unopened containers, where applicable, with all labels intact and legible at time of use. Store in strict accordance with manufacturer's recommendations.

(5) Examine all equipment and material delivered to jobsite prior to installation to ensure all specification requirements and shop drawing notes and comments have been incorporated by manufacturer. Installation of equipment or material signifies Contractor’s acceptance and approval of equipment or material from manufacturer.

G. Coordination

(1) Coordinate arrangement, mounting, and support of electrical equipment:

(a) To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

(b) To provide for ease of disconnecting the equipment with minimum interference to other installations.

(c) To allow right of way for piping and conduit installed at required slope.

(d) So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

(2) In cases of interferences between various items of equipment and building features, or if simplified construction is made possible by relocation of certain equipment, bring such conditions to attention of Architect. Changes in arrangements may be made only if authorized by Architect.

(3) Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

(4) Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

(5) Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

b. Materials.

1. Products

A. Materials

(1) Material shall be produced by company which has been engaged in manufacture of such types of materials for period of at least five (5) years.

(2) Provide electrical products as described under specific paragraphs in this division. Refer to various paragraphs for correct product identification.

B. Spare Material

(1) Refer to individual sections for spare material requirements.

C. Sleeves For Raceways And Cables

(1) Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

(2) Sleeves for Rectangular Openings: Galvanized sheet steel.

(a) Minimum Metal Thickness:

(i) For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).

(ii) For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

(3) Coordinate sleeve selection and application with selection and application of firestoping specified in Division 07 Section “Penetration Firestopping”.

D. Grout

(1) Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

c. Construction.

1. Execution

A. Preparation

(1) Drawings constituting part of these documents are diagrammatic and indicate general arrangement of systems and work included in documents.

(2) Coordinate necessary preparation required for electrical equipment installation with all trades.

(3) Carefully check and coordinate location and level of all lighting fixtures, conduits, junction boxes, cable tray, etc., located above suspended ceilings. If conflicts occur, follow space preference below (in order of first to last):

(a) Recessed lighting fixtures.

(b) Air terminal units.

(c) Low pressure ductwork.

(d) Soil, waste, vent, and storm piping.

(e) Sprinkler piping.

(f) Liquid heat transfer and refrigerant piping.

(g) Domestic water piping.

(h) Electrical conduit.

(4) Locate conduits, junction boxes, etc., to allow access to air terminal units, piping, control valves, etc., for maintenance and repair.

(5) Verify locations of outlets and types of connections required for equipment installed by others.

(6) Relocate any improperly located outlet, and replace any incorrect connection caused by lack of preparation or coordination. Also, repair to the Architect's/Owner's satisfaction any hole, etc., caused by these relocations/replacements.

B. Adjustments And Cleaning

(1) Cutting and Patching

(a) Do all cutting and patching necessary for installation of electrical work with approval, and under supervision of, Architect.

(b) Do not impair strength or function of work being cut or patched, i.e., do not weaken structural members and waterproof holes through exterior walls and ground floor. Use rotary type drilling tools and concrete cutting saws to cut concrete and masonry walls. Do not use torches for cutting steel.

(2) Wall, Floor and Ceiling Openings

(a) Place all sleeves necessary for electrical installation and advise other Contractors of all openings necessary for installation of electrical work.

(b) Provide sleeves necessary for installation of fire alarm, clock/program, telephone, video, data, sound, nurse call, etc., system cables. If system wiring has not been installed at time of building official's inspection, seal all sleeves. Subsequent penetrations and sealing will be done by System Contractor.

(c) Repair and finish all holes placed for conduit if such holes are placed after general construction is completed.

(d) For fire-rated stud wall or partitions, provide 24 inch minimum horizontal separation between boxes on opposite sides of same wall or partition.

(3) Painting

(a) Paint surface mounted conduits to match adjacent wall or ceiling finish.

(4) Protection

(a) Provide final protection of all electrical conduit, wiring, enclosures, equipment and panels, and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of substantial completion.

(b) Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

(c) Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

(5) Housekeeping and Clean-up

(a) Remove from site all debris and rubbish accumulating as result of electrical installation. Dispose of all debris and rubbish. Leave all electrical equipment rooms broom clean.

(b) Clean interiors of all cabinets, pull boxes, and equipment enclosures. Clean all electrical equipment, including lighting fixtures, at time of Substantial Completion.

(c) Refer to the contact for additional requirements.

C. Common Requirements For Electrical Installation

(1) Comply with NECA 1.

(2) Install all equipment and systems according to manufacturer's recommendations, and as outlined in individual paragraphs of these documents, to provide complete and totally operational systems.

(3) Comply with working clearances and dedicated spaces per NEC Article 110.

(4) Mount all equipment on exterior walls and in damp and wet locations on steel channel support providing separation between equipment and mounting surface(s).

(5) Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

(6) Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

(7) Right of Way: Give to piping systems installed at a required slope.

D. Sleeve Installation For Electrical Penetrations

(1) Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

(2) Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

(3) Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

(4) Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

(5) Cut sleeves to length for mounting flush with both surfaces of walls.

(6) Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

(7) Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

(8) Seal space outside of sleeves with grout for penetrations of concrete and masonry

(a) Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

(9) Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Special Provision for Joint Sealants - Section 07 92 00.

(10) Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Special Provision for Penetration Firestopping – Section 07 84 13.

(11) Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

(12) Aboveground, Exterior-Wall Penetrations: Seal penetrations using [**steel**] [**cast-iron**] pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

(13) Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

E. Sleeve-Seal Installation

(1) Install to seal exterior wall penetrations.

(2) Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

F. Firestopping

(1) Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Verify locations of smoke and fire barriers from Architectural floor plans. Firestopping materials and installation requirements are specified in Special Provision for Penetration Firestopping – Section 07 84 13.

G. Field Quality Control

(1) Conduct following tests on electrical installation during the course of construction:

(a) Test conductors for grounds and shorts.

(b) Test ground system.

(c) Operationally test diming systems.

(d) Operate lighting fixture lowering systems through complete cycle of operation.

(e) Test other systems as recommended by system manufacturer and as specified elsewhere.

(2) Upon completion of the project:

(a) Adjust voltage taps on all transformers for an optimum operating level.

(b) Aim all adjustable lighting fixtures.

(c) Adjust all auxiliary systems for optimum performance.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES – SECTION 26 05 19

a. Description.

1. General

A. Summary

(1) This Special Provision includes the following:

(a) Building wires and cables rated 600 V and less.

(b) Connectors, splices, and terminations rated 600 V and less.

B. Definitions

(1) EPDM: Ethylene-propylene-diene terpolymer rubber.

(2) NBR: Acrylonitrile-butadiene rubber.

C. Submittals

(1) No submittals required.

(2) Field quality-control test reports.

(3) Close-out Documents.

D. Quality Assurance

(1) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

(2) Comply with NFPA 70.

b. Materials.

1. Products

A. Conductors And Cables

(1) Copper Conductors: Comply with NEMA WC 70.

(2) Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

B. Connectors And Splices

(1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

(a) AFC Cable Systems, Inc.

(b) FCI - Burndy Products.

(c) Hubbell Power Systems, Inc.

(d) Ideal Industries, Inc.

(e) Ilsco Corp.

(f) O-Z/Gedney; EGS Electrical Group LLC.

(g) 3M; Electrical Products Division.

(h) Thomas & Betts Corp.

(i) Tyco Electronics Corp.; Raychem, AMP.

(2) Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

c. Construction.

1. Execution

A. Conductor Material Applications

(1) Feeders: Stranded Copper.

(2) Branch Circuits: Stranded Copper.

B. Conductor Insulation And Multiconductor Cable Applications And Wiring Methods

(1) Exposed Feeders: Type THHN-THWN, single conductors in raceway.

(2) Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

(3) Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

(4) Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

(5) Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

(6) Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway.

(7) Class 1 Control Circuits: Type THHN-THWN, in raceway.

(8) Class 2 Control Circuits: Type THHN-THWN, in raceway.

C. Installation Of Conductors And Cables

(1) Do not use conductors smaller than No. 12 AWG for branch circuit wiring.

(2) Make conductor lengths for parallel feeders identical.

(3) Install wiring in code conforming raceway after concrete and masonry work is complete and after moisture is swabbed from conduits.

(4) Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

(5) Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

(6) Lace or clip groups of feeder conductors at distribution centers, pullboxes and wireways.

Identify and color-code conductors and cables according to Special Provision Identification for Electrical Systems - Section 26 05 53.

(7) Use No. 10 AWG minimum wire size from panelboard to first outlet for any 277 volt branch circuit exceeding 125 feet between branch circuit panel and first outlet, and for any 120 volt branch circuit exceeding 75 feet between branch circuit panel and first outlet.

(8) Use an individual neutral conductor for each phase conductor of branch circuits. Common neutral conductors are NOT allowed.

(9) Install only switch legs in conduits to switch boxes. Do NOT route power supply conductors through lighting switch boxes.

(10) Install emergency system wiring in separate raceways from all other systems.

(11) Do not route emergency system wiring through normal power electrical rooms, unless room contains both normal and emergency distribution equipment, and emergency system wiring is connected to equipment in that room.

(12) Visually inspect, then test all feeders for grounds and short circuits prior to energizing the cable. Replace defective runs, or repair them at Architect's option.

D. Installation Of Cables Not Enclosed In Raceway Or Cable Tray

(1) Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

(2) Install cables per manufacturer’s recommendations without damaging conductors, shields, or jackets.

(3) Install exposed cables parallel and perpendicular to building lines and surfaces of exposed structural members. Follow surface contours where possible.

(4) Support cables according to Special Provision for Hangers and Supports for Electrical Systems - Section 26 05 29. Secure cables at not more than 30 inch (760 mm) intervals nor more than 6 inches (150 mm) from boxes, cabinets, racks, outlets, etc.

(5) Do not bend cables at less than 1.5 times manufacturer’s recommended minimum bending radii.

(6) Do not exceed manufacturer’s recommended maximum pulling tensions.

(7) Do not splice, tap, or terminate cables other than in outlets, terminals, or panels or cabinets.

(8) Protect cables passing through metal studs, walls, etc., with suitable rubber grommets or conduit sleeves.

E. Connections

(1) Use screw on wire connector for copper conductor sizes No. 10 gauge and smaller except at motor connections. Use tool applied compression or split bolt type for all motor connections and for conductors larger than #10. Protect compression and split bolt type splices with suitable electrical tape.

(2) Size all connectors to match cable size.

(3) Use tools recommended by vendor for applying pressure connectors.

(4) Suitable terminal lugs that are factory installed on equipment may be used for terminating cables.

(5) Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

(6) Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

(7) Splice only in accessible junction or outlet boxes.

(8) Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

F. Field Quality Control

(1) Perform tests and inspections and prepare test reports.

(2) Tests and Inspections:

(a) After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements. Test conductors for continuity.

(3) Remove and replace malfunctioning units and retest.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS - SECTION 26 05 26

a. Description. This work consists of furnishing and installing the grounding and bonding systems as specified herein and on the plans. This work shall be done to meet the intent of the National Electrical Code's requirements, all other applicable codes, as well as the Motorola r56 standard.

1. General

A. Summary

(1) This Special Provision includes methods and materials for grounding systems and equipment.

B. Submittals

(1) Product Data: For each type of product indicated.

(2) Certified field quality-control test reports.

(3) Close-out documents.

C. Quality Assurance

(1) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

(2) Comply with UL 467 for grounding and bonding materials and equipment.

b. Materials.

1. Products

A. Conductors

(1) Insulated Conductors

(a) Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

(2) Bare Copper Conductors:

(a) Stranded Conductors: ASTM B 8.

(3) Grounding Bus:

(1) Rectangular bars of tin plated annealed copper, ¼ by 4 inches (6 by 100 mm) in cross section, 12 inches minimum length, unless otherwise indicated; with wall mounted steel mounting brackets, insulators and holes and slots for NEMA 2-hole connectors and insulators.

(a) Harger Series T-GBI-M for power grounding applications.

(b) Harger Series GBI-TMGB for telecommunications grounding applications, with 12-inch or 24-inch length as indicated. Meet BICSI and EIA/TIA 607 Standards.

B. Connectors

(1) Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

(2) Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

(a) Pipe Connectors: Clamp type, sized for pipe.

c. Construction.

1. Execution.

A. Applications.

(1) Conductors. Install stranded conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

(2) Conductor Terminations and Connections:

(a) Pipe and Equipment Grounding Conductor Terminations:

(i) Bolted connectors.

(b) Underground Connections:

(i) Welded or irreversible compression type connectors, except as otherwise indicated.

(c) Connections to Structural Steel:

(i) Welded connectors.

B. Equipment Grounding

(1) Install insulated equipment grounding conductors with all feeders and branch circuits.

(2) Air-Duct Equipment Circuits:

(a) Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Installation

(1) Grounding Conductors:

(a) Route along Shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Field Quality Control

(1) Perform the following tests and inspections and prepare test reports:

(a) After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

(b) Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

(i) Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

(ii) Perform tests by fall-of-potential method according to IEEE 81.

(2) Measured ground resistances shall not exceed the following values:

(a) Power and Lighting Equipment or System with Capacity 500 kVA and Less: 5 ohms.

(3) Excessive Ground Resistance:

(a) If resistance to ground exceeds specified values, install additional ground rods and conductors as required. Remeasure grid resistance to ground until acceptable values are achieved.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
CRYSTAL REPORTS SERVER

DES:MM 1 of 1 C&T:APPR:XXX:YYY:00-00-00

a. Description. This work shall consist of providing and installing rack mount server, accessories, and mounting hardware to a powered up state of installation.

b. Materials. Rack mount server, included accessories and mounting hardware.

1. Intel Core 2 Duo E8400 processor or better.

2. Equipped with 4 GB of PC2-6400 (DDR2-800) unbuffered DDR2 ECC SDRAM memory, and supports up to 8 GB or RAM.

3. Two Port Serial ATA Controller with RAID 0/1 support with two 3.5" (large form factor) Serial ATA hot plug hard drives for an internal storage capacity of 640 GB (2 x 320GB Serial ATA hard drives).

4. DVD-RW drive.

5. Embedded Dual Port Gigabit Server Adapter.

6. One full-length and one half-length, low-profile PCI Express x1 slot (x8 connector).

7. Four USB 2.0 Ports.

8. Four dual rotor internal fans for N+1 redundancy.

9. Two 350 Watt 100 to 240 VAC input power supplies for 1+1 redundancy.

10. Front Panel status LEDs including system health and UID.

11. 1U (1.70" / 4.32 cm) Rack Mount Chassis and mounting hardware.

c. Construction. Install server in accordance to manufacturer's recommendations using supplied mounting hardware in designated server rack location as indicated on the plan sheet(s) or as directed by the Engineer. Run system diagnostics to assure server functionality.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS – SECTION 26 05 29

a. Description. This work consists of furnishing and installing the hangers, supports, and mounting hardware for the electrical work installed. The work shall be done to meet the intent of the National Electrical Code's requirements, industry standards, all other applicable codes, and to the manufacturer's requirements.

1. General

A. Summary

(1) This Special Provision includes the following:

(a) Hangers and supports for electrical equipment and systems.

(2) Related Special Provisions include the following:

(a) Vibration And Seismic Controls For Electrical Systems - Section 26 05 48 for products and installation requirements necessary for compliance with seismic criteria.

B. Definitions

(1) EMT: Electrical metallic tubing.

(2) RMC: Rigid metal conduit.

C. Performance Requirements

(1) Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

(2) Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

(3) Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

D. Quality Assurance

(1) Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

(2) Comply with NFPA 70.

b. Materials.

1. Products

A. Support, Anchorage, And Attachment Components

(1) Steel Slotted Support Systems: Comply with Metal Framing Manufacturers Association Standard MFMA-4, factory-fabricated components for field assembly.

(a) Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

(b) Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

(c) Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

(d) Channel Dimensions: Selected for applicable load criteria.

(2) Raceway and Cable Supports: As described in NECA 1 and NECA 101.

(3) Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

(4) Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

(5) Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

(6) Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

(a) Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

(b) Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

(c) Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

(d) Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

(e) Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

(f) Toggle Bolts: All-steel springhead type.

(g) Hanger Rods: Threaded steel.

B. Fabricated Metal Equipment Support Assemblies

(1) Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

(2) Materials: Comply with requirements in Special Provision for Metal Fabrications – Section 05 50 00 for steel shapes and plates.

2. Execution

A. Application

(1) Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Special Provision are stricter.

(2) Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

(3) Support overhead electrical systems from building structural framing. Do NOT support electrical systems from roof decks, floor slabs, pipes, ducts, mechanical equipment, or other conduit, except as noted.

(a) Electrical system support hanger loads less than 70 pounds may be suspended from floor slabs with preset inserts or approved anchors.

(b) For concrete frame construction, electrical system support hanger loads less than 200 pounds may be suspended from floor or roof slabs with preset inserts or approved anchors.

(c) If necessary, install appropriately sized steel support members spanning structural framing members to support electrical systems.

(4) Do NOT support conduits or cables from suspended ceilings unless they are 1/2 inch or smaller trade size branch circuit conduits or cables that conform to NEC 300.11 and feed only equipment mounted in or on suspended ceiling.

(5) Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

(a) Secure raceways and cables to these supports with single-bolt conduit clamps.

B. Support Installation

(1) Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Special Provision.

(2) Raceway Support Methods: Use methods described in NECA 1.

(3) Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

(4) Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

(a) To Wood: Fasten with lag screws or through bolts.

(b) To New Concrete: Bolt to concrete inserts.

(c) To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

(d) To Existing Concrete: Expansion anchor fasteners.

(e) Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.

(f) To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.

(g) To Light Steel: Sheet metal screws.

(h) Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

(5) Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

C. Installation Of Fabricated Metal Supports

(1) Comply with installation requirements in Special Provision for Metal Fabrications – Section 05 50 00 for site-fabricated metal supports.

(2) Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

(3) Field Welding: Comply with AWS D1.1/D1.1M.

D. Painting

(1) Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

(a) Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

(2) Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

c. Construction. None.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS – SECTION 26 05 33

a. Description.

1. General

A. Summary

(1) This Section includes raceways, fittings, boxes, floor boxes, service poles, enclosures, and cabinets for the following:

(a) Electrical power wiring.

(b) Communications systems, including telephone and data.

B. Definitions

(1) EMT: Electrical metallic tubing.

(2) FMC: Flexible metal conduit.

(3) LFMC: Liquidtight flexible metal conduit.

(4) NBR: Acrylonitrile-butadiene rubber.

(5) RNC: Rigid nonmetallic conduit.

C. Submittals

(1) Product Data: For wireways and fittings, hinged-cover enclosures, and cabinets.

(2) Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

(a) Structural members in the paths of conduit groups with common supports.

(b) HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

(3) Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Special Provision for Vibration and Seismic Controls for Electrical Systems - Section 26 05 48. Include the following:

(a) Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

(i) The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."

(b) Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

(c) Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

(4) Source quality-control test reports.

D. Quality Assurance

(1) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

(2) Comply with NFPA 70.

b. Materials.

1. Products

A. Metal Conduit And Tubing

(1) Rigid Steel Conduit: ANSI C80.1.

(2) EMT: ANSI C80.3.

(3) FMC: Zinc-coated steel.

(4) LFMC: Flexible steel conduit with PVC jacket.

(5) Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

(a) Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.

(b) Fittings for Rigid Steel Conduit: Galvanized steel or malleable iron, threaded type.

(c) Fittings for EMT: Steel~~,~~ set-screw or compression type. Die cast type are not allowed.

(d) Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

(6) Bushings: Impact resistant plastic, 105°C rated. Grounding type shall be insulated steel with proper ground lug.

(7) Joint Compound for Rigid Steel Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

B. Metal Wireways

(1) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

(a) Cooper B-Line, Inc.

(b) Hoffman.

(c) Square D; Schneider Electric.

(2) Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

(3) Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

(4) Wireway Covers: Hinged type.

(5) Finish: Manufacturer's standard enamel finish.

C. Boxes, Enclosures, And Cabinets

(1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

(a) Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.

(b) Eaton Corporation; Cutler Hammer Products.

(c) EGS/Appleton Electric.

(d) Erickson Electrical Equipment Company.

(e) General Electric Co.; Electrical Distribution & Control Division.

(f) Hoffman.

(g) Hubbell Incorporated; Killark Electric Manufacturing Co. Division.

(h) O-Z/Gedney; a unit of General Signal.

(i) RACO; a Hubbell Company.

(j) Robroy Industries, Inc.; Enclosure Division.

(k) Scott Fetzer Co.; Adalet Division.

(l) Siemens Energy & Automation, Inc.

(m) Spring City Electrical Manufacturing Company.

(n) Square D/Group Schneider.

(o) Thomas & Betts Corporation; Steel City.

(p) Walker Systems, Inc.; Wiremold Company (The).

(q) Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

(2) Sheet Metal Outlet and Device Boxes: NEMA OS 1.

(3) Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

(4) Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

(5) Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

(6) Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

(a) Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

(7) Cabinets:

(a) NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Sized as indicated on Drawings.

(b) Hinged door in front cover with flush latch and concealed hinge and screws. Size door to allow access to terminals without removing cover.

(c) Key latch to match panelboards.

(d) Metal barriers to separate wiring of different systems and voltage.

(e) Plywood backboard, 3/4 inch (19 mm) thick, finished with fire retardant sealer.

(f) Terminal Strips

(i) Below 50 volts: Screw terminal type.

(ii) 51 to 250 volts: 250 volt screw terminal type with barrier between each set of terminals and individual terminal points for each conductor.

(iii) 251 to 600 volts: 600 volt terminal strips similar to (ii) above.

(g) Accessory feet where required for freestanding equipment.

(h) Identification

(i) Identify terminal strips with permanent numbers.

(i) Wiring Diagrams

(i) Provide wiring diagram on inside of each cabinet door showing units and conductors connected to cabinet.

D. Wallplates

(1) To match other wiring device wallplates. Refer to Special Provision for Wiring Devices - Section 26 27 26 .

E. Sound Speaker Backboxes And Baffles

c. Construction.

1. Execution

A. Raceway Application

(1) Comply with the following indoor applications, unless otherwise indicated:

(a) Exposed Conduit, Not Subject to Physical Damage: EMT.

(b) Exposed Conduit, Subject to Physical Damage: Rigid steel conduit.

(c) For Supporting Lighting Fixtures: Rigid steel conduit.

(d) Conduit Concealed in Ceilings and Interior Walls and Partitions: EMT.

(e) Connection to Recessed Lighting Fixtures: FMC.

(f) Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC except use FMC in dry locations for 120 volt motors 1/3 HP or less. Provide only sufficient length of flexible conduit necessary to avoid transmission of vibrations.

(g) Conduit, Damp or Wet Locations: Rigid steel conduit.

(h) Boxes and Enclosures, Indoor Dry Locations: NEMA 250, Type 1. Hot dip galvanized construction or cadmium plated, pressed sheet steel, blanked for conduit, attached lugs for mounting, full access screw-on or hinged cover. Provide flush mounted boxes with overlapping cover with flush-head cover retaining screws, prime coated.

(i) Ceiling Outlet Boxes, Flush or Surface Mounted: 4 inch by 2-1/8 inch deep (102 mm x 54 mm deep), octagonal boxes for receiving three or less 1/2 in. (12 mm) conduits.

(ii) Wall Outlet Boxes, Flush Mounted, Gypsum Wallboard

1) 4 inch by 2-1/8 inch deep (102 mm x 54 mm) square boxes with matching square-drawn/tile cover for single or two (2) gang outlets.

2) 4-11/16 inch by 2-1/8 inch deep (119 mm x 54 mm) square boxes with matching square-drawn/tile covers for single or two (2) gang outlets. Use for all 1 inch or 1-1/4 inch conduit entries.

3) 2-1/2 inches deep (64 mm) gangable switch boxes at wall switch locations.

4) 4 inch by 3-1/2 inch deep (102 mm x 89 mm) square boxes with matching square-drawn/tile cover for single or two (2) gang outlets. Use for all communication/data outlets, unless wall thickness dictates shallower box.

(iii) Wall Outlet Boxes, Flush Mounted, Masonry: 3-1/2 inches (89 mm) deep masonry boxes, single or multiple gang, as required or as indicated on the Drawings.

(iv) Wall Outlet Boxes, Surface Mounted: 4 inches by 2-1/8 inches deep (102 mm x 54 mm) square.

(2) Minimum Raceway Size: 3/4-inch (21-mm) trade size.

(3) Raceway Fittings: Compatible with raceways and suitable for use and location.

(a) Rigid Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

B. Installation Of Raceways

(1) Comply with NECA 1 for installation requirements applicable to products specified in **b. Materials** except where requirements on Drawings or in this Article are stricter.

(2) Coordinate installation of raceways in masonry and concrete with construction process.

(3) Route conduit to avoid structural obstructions, minimizing crossovers.

(4) Keep raceways at least 6 inches (150 mm) away from parallel runs of flues, steam or hot-water pipes and other heat sources. Install horizontal raceway runs above water and steam piping.

(5) Install conduit free from dents and bruises. Plug ends to prevent entry of dirt or moisture.

(6) Complete raceway installation and clean out raceway before starting conductor installation.

(7) Support raceways as specified in Special Provision for Hangers and Supports for Electrical Systems - Section 26 05 29. Mount conduits tight to walls. Provide offsets at boxes and equipment.

(8) Arrange stub-ups so curved portions of bends are not visible above the finished slab.

(9) Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

(10) Conceal conduit and EMT within finished walls, ceilings, and floors, excluding overhead in rooms without finished ceilings, mechanical equipment rooms, connections to motors, and connections to surface panelboards, unless otherwise indicated.

(11) Route all exposed conduits and conduits above dropped ceilings parallel, or perpendicular, to building lines. Locate as close to building surfaces, or structure, as possible.

(12) Do NOT install conduit horizontally in slabs except where indicated on drawings.

(13) Install UL approved expansion fittings, complete with grounding jumpers, where metallic conduits cross building expansion joints.

(14) Install bushings on all conduit terminations, except where insulated throat connectors are used. Use insulated steel type bushings where grounding or bonding is required. Use plastic type bushings at other locations.

(15) To avoid conductor derating and mutual heating, do NOT group conduits in earth. Separate conduits immediately after leaving equipment.

(16) Install pull wires in all empty and/or spare raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

(17) Cap all empty and/or spare raceways and install identification tags.

(18) Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

(a) 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).

(b) 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).

(c) Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

(19) Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

(a) Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

(b) Where otherwise required by NFPA 70.

(20) Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

(a) Use LFMC in damp or wet locations subject to severe physical damage.

(b) Use LFMC in damp or wet locations not subject to severe physical damage.

C. Installation Of Boxes And Cabinets

(1) Conceal all pull boxes and junction boxes wherever possible. Locate pull boxes and junction boxes above removable ceilings or in electrical rooms, utility rooms, or storage areas to permit access to interior of the box.

(2) Size pull boxes and junction boxes to provide ample room for conductors, cable bends, and terminations where applicable. Utilize NEC as minimum sizing guide only.

(3) Identify all conductors within pull boxes and junction boxes per Special Provision for Identification for Electrical Systems - Section 26 05 53.

(4) Do NOT install boxes back-to-back in opposite sides of same wall or partition.

(5) Do NOT use through-the-wall type boxes.

(6) Refer to Special Provision for Common Work Results for Electrical - Section 26 05 00 for openings in fire-rated walls, partitions, floors, and ceilings.

(7) Securely anchor all fittings and boxes.

(8) Adjust position of outlets in finished masonry walls to suit masonry course lines.

(9) Coordinate cutting of masonry walls to achieve neat openings for boxes.

(10) Do NOT use sectional or handy boxes unless specifically requested.

(11) Verify that there is insulation behind boxes mounted in exterior walls to prevent condensation in boxes.

(12) Coordinate locations and mounting heights of outlets mounted in video wall with built-in units, walls, equipment, etc., prior to installation. Adjust outlet mounting height to agree with required location for equipment served.

(13) Mount all outlet boxes plumb and parallel with door or window frames, countertops and other building lines.

(14) Terminate conduit in cabinets with lock nut and bushing or lock nut and grounding bushing.

(15) Terminate wiring in cabinets on terminal blocks or strips.

(16) Vacuum clean cabinets on completion of installation.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
CABLE TRAYS FOR ELECTRICAL SYSTEMS – SECTION 26 05 36

a. Description.

A. Summary

(1) This Section includes steel cable trays and accessories.

B. Submittals

(1) Product Data: Include data indicating dimensions and finishes for each type of cable tray indicated.

(2) Shop Drawings: For each type of cable tray.

(a) Show fabrication and installation details of cable tray, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

(3) Field quality-control reports.

(4) Operation and Maintenance Data: For cable trays to include in emergency, operation, and maintenance manuals.

C. Quality Assurance

(1) Source Limitations: Obtain cable tray components through one source from a single manufacturer.

(2) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

(3) Comply with NFPA 70.

D. Delivery, Storage, And Handling

(1) Store indoors in a well-ventilated dry location to prevent water or other foreign materials from staining or adhering to cable tray. Unpack and dry wet materials before storage.

b. Materials.

1. Products

A. Manufacturers

(1) Manufacturers of Ladder Type Tray: Subject to compliance with requirements, provide products by one of the following:

(a) Chalfant Manufacturing Company.

(b) Cooper B-Line, Inc.

(c) Cope, T. J., Inc.; Tyco Electrical & Metal Products.

(d) GS Metals Corp.; GLOBETRAY Products.

(e) MPHusky.

(f) PW Industries.

(g) Square D.

(h) Thomas & Betts.

(i) Wiremold.

B. Materials And Finishes

(1) Cable Trays, Fittings, and Accessories: Steel, complying with NEMA VE 1.

(a) Mill galvanized before fabrication, complying with ASTM A 653/A 653M, G90 (Z275) coating; with hardware cadmium plated according to ASTM B 766.

(2) Sizes and configurations:

(a) Ladder type, side wall depth of 5 inches for loading depth of 4 inches, with 6 inch rung spacing. Provide all horizontal and vertical bends with 12 inches minimum inside radii and of same ladder-type construction. Refer to drawings for loading widths.

(3) Loading Criteria: Design tray for 50 pounds per foot NEMA loading at 12 foot maximum supporting spans. Longer spans will require furnishing suitably higher NEMA class rated cable trays.

C. Cable Tray Accessories

(1) Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.

(2) Gasket Strips: To protect cables from metal edges.

(3) Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

(4) Wall type brackets allowing open access of cable tray on one side. Use steel channel to supplement brackets.

(5) Conduit clamps for securing conduit to trough.

(6) End plates, frame-type dropouts, end-type dropouts, conduit sidetype dropouts, and other incidentals necessary to provide complete and usable tray system.

c. Construction

1. Execution

A. Cable Tray Installation

(1) Comply with recommendations in NEMA VE 2. Install as a complete system, including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees, and crosses.

(2) Coordinate exact tray location with all other trades.

(3) Make field cuts per tray manufacturer’s recommendations.

(4) Remove burrs and sharp edges from cable trays.

(5) Fasten cable tray supports to building structure and install seismic restraints.

(a) Design each fastener and support to carry load indicated by seismic requirements and to comply with seismic-restraint details according to Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

(b) Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

(c) Support bus assembly to prevent twisting from eccentric loading.

(d) Manufacture center-hung support, designed for 60 percent versus 40 percent eccentric loading condition, with a safety factor of 3.

(e) Locate and install supports according to NEMA VE 1 and VE 2, and manufacturer’s recommendations, but in not case may supports be more than 12 feet apart.

(6) Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA VE 1 and VE 2. Space connectors and set gaps according to applicable standard.

(7) Make changes in direction and elevation using standard fittings.

(8) Make cable tray connections using standard fittings.

(9) Workspace: Install cable trays with enough space to permit access for installing cables. Provide complete access to entire length of one side of tray.

(10) After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

B. Connections

(1) Bond cable trays to main building ground and according to manufacturer's written instructions. Grounding of cable trays shall meet the intent of Motorola 1-56 Standard. Provide #2 AWG grounding wire to ground cable tray.

C. Field Quality Control

(1) After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:

(a) Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.

(b) Verify that the number, size, and voltage of cables in cable tray do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.

(c) Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.

(d) Remove deposits of dust, industrial process materials, trash of any description, and any blockage of tray ventilation.

(e) Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.

(f) Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.

(g) Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS – SECTION 26 05 48

a. Description.

1. General

A. Summary

(1) This Special Provision includes the following:

(a) Isolation pads.

(b) Spring isolators.

(c) Restrained spring isolators.

(d) Channel support systems.

(e) Restraint cables.

(f) Hanger rod stiffeners.

(g) Anchorage bushings and washers.

(2) Related Special Provisions include the following:

(a) Hangers and Supports for Electrical Systems - Section 26 05 29 for commonly used electrical supports and installation requirements.

B. Definitions

(1) The IBC: International Building Code.

(2) ICC-ES: ICC-Evaluation Service.

C. Performance Requirements

(1) Seismic-Restraint Loading:

(a) Site Class as Defined in the IBC: D.

(b) Seismic Design Category: C.

(c) Assigned Seismic Use Group or Building Category as Defined in the IBC: III.

(i) Component Importance Factor: 1.5.

(ii) Component Response Modification Factor: 3.0.

(iii) Component Amplification Factor: 3.0.

(d) Design Spectral Response Acceleration at Short Periods (0.2 Second): .133.

(e) Design Spectral Response Acceleration at 1.0-Second Period: .073.

D. Submittals

(1) Product Data: For the following:

(a) Include rated load, rated deflection, and overload capacity for each vibration isolation device.

(2) Welding certificates.

(3) Qualification Data: For professional engineer.

(4) Field quality-control test reports.

E. Quality Assurance

(1) Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

(2) Comply with NFPA 70.

b. Materials.

1. Products

A. Vibration Isolators

(1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:

(a) Ace Mountings Co., Inc.

(b) Amber/Booth Company, Inc.

(c) California Dynamics Corporation.

(d) Isolation Technology, Inc.

(e) Kinetics Noise Control.

(f) Mason Industries.

(g) Vibration Eliminator Co., Inc.

(h) Vibration Isolation.

(i) Vibration Mountings & Controls, Inc.

(2) Pads: Arrange in multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern, and factory cut to sizes that match requirements of supported equipment.

(a) Resilient Material: Oil- and water-resistant 1/4 inch to 5/16 inch thick ribbed or waffle neoprene separated by stainless steel or aluminum plate and permanently adhered together.

(3) Spring Isolators for Emergency Generators: Freestanding, laterally stable, open-spring isolators.

(a) Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

(b) Minimum Additional Travel: 50 percent of the required deflection at rated load.

(c) Lateral Stiffness: More than 80 percent of rated vertical stiffness.

(d) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

(e) Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-(6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).

(f) Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

B. Factory Finishes

(1) Finish: Manufacturer's standard prime-coat finish ready for field painting.

(2) Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

(a) Powder coating on springs and housings.

(b) All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.

(c) Baked enamel or powder coat for metal components on isolators for interior use.

(d) Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

c. Construction.

1. Execution

A. Examination

(1) Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

(2) Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

(3) Proceed with installation only after unsatisfactory conditions have been corrected.

B. Applications

(1) Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

(2) Hanger Rod Stiffeners: Install hanger rod stiffeners where required to prevent buckling of hanger rods due to seismic forces.

(3) Strength of Support and Seismic-Restraint Assemblies: Select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

C. Field Quality Control

(1) Perform tests and inspections.

(2) Tests and Inspections:

(a) Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

(b) Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.

(c) Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

(d) Test at least four of each type and size of installed anchors and fasteners selected by Architect.

(e) Test to 90 percent of rated proof load of device.

(f) Measure isolator restraint clearance.

(g) Measure isolator deflection.

(h) Verify snubber minimum clearances.

(i) If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

(3) Remove and replace malfunctioning units and retest as specified above.

(4) Prepare test and inspection reports.

D. Adjusting

(1) Adjust isolators after isolated equipment is at operating weight.

(2) Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

(3) Adjust active height of spring isolators.

(4) Adjust restraints to permit free movement of equipment within normal mode of operation.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
IDENTIFICATION FOR ELECTRICAL SYSTEMS - SECTION 26 05 53

a. Description. This work consists of the furnishing and installing the labeling and signage of all electrical equipment, panelboards, wiring, devices, etc. for the electrical work installed. The work shall be done to meet the intent of the National Electrical Code's requirements, industry standards, all other applicable codes, and to the manufacturer's requirements.

1. General

A. Summary

(1) This Section includes the following:

(a) Adjust list below to suit Project.

(b) Identification for raceway.

(c) Identification for conductors and communication and control cable.

(d) Instruction signs.

(e) Equipment identification labels.

(f) Panelboard directories.

(g) Identification for wiring devices, control stations, etc.

(h) Miscellaneous identification products.

B. Submittals

(1) Product Data: For each electrical identification product indicated.

(2) Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

(3) Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Quality Assurance

(1) Comply with ANSI A13.1 and ANSI C2.

(2) Comply with NFPA 70.

(3) Comply with OSHA Specifications for accident prevention signs contained in the Code of Federal Regulations as 29 CFR 1910.145.

D. Coordination

(1) Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

(2) Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

(3) Coordinate installation of identifying devices with location of access panels and doors.

(4) Install identifying devices before installing acoustical ceilings and similar concealment.

b. Materials.

1. Products

A. Raceway Identification Materials

(1) Comply with ANSI A13.1 for minimum size of letters for label and for minimum length of color field for each raceway and cable size.

(2) Color for Printed Legend:

(a) Power Circuits: Black letters on an orange field.

(b) Legend: Indicate system or service and voltage, if applicable.

(3) Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

(4) Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

(5) Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

B. Conductor And Communication- And Control-Cable Identification Materials

(1) Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Equipment Identification Labels

(1) Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Permanent adhesive backed, with black letters on a white background. Emergency panels shall have white letters on a red background. Minimum letter height shall be 3/4 inch (10 mm) unless noted otherwise.

(2) Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

D. Miscellaneous Identification Products

(1) Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

(a) Minimum Width: 3/16 inch (5 mm).

(b) Tensile Strength: 50 lb (22.6 kg), minimum.

(c) Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).

(d) Color: Black, except where used for color-coding.

(2) Paint: Paint materials and application requirements are specified in Division 09 painting Sections.

(3) Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

(4) Device Plate Labels: Permanent self-adhesive backed, 3/8 inch (10 mm) wide, clear heavy-duty acrylic tape with machine printed 1/4 inch (6 mm) high black letters. Impression letters on plastic tape are not acceptable.

c. Construction.

1. Execution

A. Application

(1) Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label on both sides of penetrations of walls, floors, etc., and elsewhere at 20-foot (3 -m) maximum intervals.

(2) Empty and/or Spare Raceways: Install identification tag stamped to indicate conduit destination and future use, i.e., sound, telephone, electric, etc.

(3) Power-Circuit Conductor Identification: For secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, use color-coding conductor tape. Identify source, circuit number, and voltage of each set of conductors. For single conductor cables, identify phase in addition to the above.

(4) Control and Branch-Circuit Conductor Identification: At each load or terminal connection, and in control panels, panelboard gutters, outlet boxes, junction boxes and pull boxes, use color-coding conductor tape or aluminum wraparound marker labels.

(a) For branch circuit conductors, identify each ungrounded conductor according to source and circuit number.

(b) For control conductors, include wire number or terminal number from schematic, or interconnection diagrams on installation or shop drawings.

(c) For wires of different systems in common boxes, group each cable with its own system and identify each cable to indicate appropriate system. Handwritten lettering is not acceptable.

(5) Junction and Pull Box Identification: Stencil or neatly identify with permanent marker all junction and pull boxes as follows:

(a) Lighting and Power - 208V, 240V or 480V, circuit numbers enclosed including panelboard names

(b) Telephone - TEL

(c) Data – DAT

(d) Television – TV

(e) Intercom – IC

(f) Emergency - E (white letters on red background)

(g) Emergency - Life Safety Branch - LS (white letters on red background)

(h) Emergency - Critical Branch - CR (white letters on red background)

(i) Emergency - Equipment Branch - EQ (white letters on red background)

(6) Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.

(7) Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

(a) Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

(b) Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

(c) Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

(8) Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

(a) Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

(9) Instruction Signs:

(a) Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

(10) Coordinate paragraph and subparagraphs below with electrical Sections in Divisions 2, 13, and 16. Delete items not in Project.

(11) Equipment Identification Labels: Label all equipment. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Include equipment type, e.g.: PNL, LIGHTING CONTROLS, etc. Verify all equipment names with Owner and Engineer prior to making labels. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

(a) Labeling Instructions:

(i) Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Impression letters on plastic tape will not be allowed. Unless otherwise indicated, provide a single line of text with 3/4-inch (19-mm) high letters on 1-1/2-inch- (38-mm-) high label; where additional lines of text are required. increase label height proportionally.

(ii) Outdoor Equipment: Stenciled legend 4 inches (100 mm) high.

(iii) Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

(b) Equipment to be labeled shall include, but not be limited to, the following:

(i) Identification labeling of some items listed below may be required by individual Sections or by NFPA 70.

(ii) Panelboards, electrical cabinets, and enclosures.

(iii) Access doors and panels for concealed electrical items.

(iv) Electrical switchgear and switchboards.

(v) Emergency system boxes and enclosures.

(vi) Remote-controlled switches, dimmer modules, and control devices.

(vii)Voice and data cable terminal equipment.

(viii) Master clock and program equipment.

(ix) Television/audio components, racks, and controls.

(x) Monitoring and control equipment.

(xi) Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

(c) Identify equipment on inside of cover of flush panels and on outside of cover of surface panels as follows:

(i) Lighting and Power Panels (black letters on white background) - PANEL DESIGNATION (3/4 inch high letters), VOLTAGE (1/4 inch high letters), SOURCE PANEL FEEDING THIS PANEL AND OWNER'S ROOM NUMBER WHERE SOURCE PANEL IS LOCATED (1/4 inch high letters).

(ii) Communications Cabinets - TELEPHONE OR OTHER USAGE (paging, etc.).

(iii) Data Cabinets - DATA.

(iv) Emergency Panels (white letters on red background) - EMERGENCY PANEL DESIGNATION (3/4 inch high letters), VOLTAGE (1/4 inch high letters), SOURCE PANEL FEEDING THIS PANEL AND OWNER'S ROOM NUMBER WHERE SOURCE PANEL IS LOCATED (1/4 inch high letters).

(d) Equip each branch device in all distribution panelboards, switchboards, etc., with laminated label similar to above. Identify load served and location of load. Use identifications compatible with Owner's program. For adjustable-trip circuit breakers, identify trip setting.

(e) Identify all control devices, circuit breakers, disconnect switches, motor starters, contactors, time switches, test switches, etc, including those furnished by other divisions or with pre-purchased equipment, with equipment fed and Owner's room number where equipment is located, source panel or equipment

feeding this device, and Owner's room number where source panel or equipment is located. Height of label may be decreased where mounting space for label is limited.

(12) Device Plate Identification

(a) Engrave device plates of all receptacles on emergency electrical system with word "EMERGENCY". Separate nameplates secured to device plate are not acceptable.

(b) Label device plates of all wall switches, receptacles, control stations, etc., indicating source panel name and circuit.

(c) Label device plates of all wall switches, control stations, volume controls, etc., with permanent adhesive indicating equipment controlled.

B. Installation

(1) Verify identity of each item before installing identification products.

(2) Coordinate first paragraph below with Drawings.

(3) Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

(4) Apply identification devices to surfaces that require finish after completing finish work.

(5) Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

(6) Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

(7) System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

(8) Coordinate Special Provision for Low-Voltage Electrical Power Conductors and Cables - Section 26 05 19 and edit to indicate extent of color-coding required. For existing buildings, clarify if requirements apply to both old and new wiring or to new wiring only.

(9) Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

(a) Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.

(b) Colors for 208/120-V Circuits:

(i) Phase A: Black.

(ii) Phase B: Red.

(iii) Phase C: Blue.

(iv) Neutral: White.

(c) Colors for 480/277-V Circuits:

(i) Phase A: Brown.

(ii) Phase B: Orange.

(iii) Phase C: Yellow.

(iv) Neutral: Gray.

(d) Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

(10) Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

(11) Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
MODULAR DIMMING CONTROLS – SECTION 26 09 36

a. Description.

1. General

A. Summary

(1) This Special Provision includes the following:

(a) Integrated, multipreset modular dimming controls.

B. Definitions

(1) Fade Rate: The time it takes each zone to arrive at the next scene, dependent on the degree of change in lighting level.

(2) Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

(3) Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.

(4) SCR: Silicon-controlled rectifier.

(5) Zone: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a "channel."

C. Submittals

(1) Product Data: For each type of product indicated.

(a) For modular dimming controls; include elevation, dimensions, features, characteristics, ratings, and labels.

(b) Device plates and plate color and material.

(c) Ballasts and lamp combinations compatible with dimmers.

(d) Wiring Diagrams: Power, signal, and control wiring.

(2) Samples for Initial Selection: For master and remote-control stations, and faceplates with factory-applied color finishes and technical features.

(3) Samples for Verification: For master and remote-control stations, and faceplates with factory-applied color finishes and technical features.

D. Quality Assurance

(1) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

(2) Comply with NFPA 70.

E. Coordination

(1) Coordinate features of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions. Include coordination with the following:

(a) Special Provision for Interior Lighting – Section 26 51 00.

(b) Lighting lowering system devices.

F. Warranty

(1) Provide manufacturer's Enhanced 8 Year Limited Warranty:

(a) 2-year Support and Maintenance Plan that covers 100% parts and labor from the date of the system startup completion.

(2) Provide manufacturer's full 4 year warranty covering 100% parts and 100% labor from the date of system startup completion.

(a) Support and Maintenance Plan: includes 100% parts and labor coverage, 24/7 telephone technical support, and can be renewed annually.

(3) For ballasts, refer to Drawings and Special Provision for Interior Lighting – Section 26 51 00.

G. Maintenance

(1) Make ordering of new equipment for expansions, replacements, and spare parts available to end user.

(2) Make new replacement parts available for minimum of ten years from date of manufacture.

(3) Provide factory direct technical support hotline 24 hours per day, 7 days per week.

b. Materials.

1. Products

A. General Dimming Device Requirements

(1) Compatibility: Dimming control components shall be compatible with other elements of lighting fixtures, ballasts, transformers, and lighting controls.

(2) Dimmers and Dimmer Modules: Comply with UL 508.

(a) Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.

(b) Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

B. Manufacturers

(1) Basis of design product: Lutron GRAFIK Eye QS or subject to compliance and prior approval with specified requirements of this section, one of the following:

(a) Lutron GRAFIK Eye QS

(b) Leviton Lighting Controls.

(c) Lightolier.

(2) Substitutions: Under provisions of the contract.

(a) All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders.

(b) Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.

(c) Any substitutions provided by the contractor shall be reviewed at the contractor’s expense by the electrical engineer at a rate of $200.00 per hour.

(d) By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.

(e) Provide complete engineered shop drawings (including power wiring) with deviations for the original design highlighted in an alternate color to the engineer for review and approval prior to rough-in.

C. General

(1) Provide system hardware that is designed, tested, manufactured, and warranted by a single manufacturer.

(2) Architectural Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0° C (32°F) to 40° C (104°F) and 90 percent non-condensing relative humidity.

(3) Designed and tested to withstand electrostatic discharges up to 15,000 V without impairment per IEC 801-2.

D. Dimming Performance Requirements

(1) Electrolytic capacitors to operate at least 20° C below the component manufacturer's maximum temperature rating when device is under fully-loaded conditions in 40° C (104° F) ambient temperature.

(2) Load Handling Thyristors (SCRs and triacs), Field Effect Transistors (FETs), and Isolated Gate Bipolar Transistors (IGBTs): Manufacturer’s maximum current rating minimum two times control’s rated operating current.

(3) Capable of withstanding repetitive inrush current of 50 times operating current without impacting lifetime of dimmer.

(4) Design and test dimmers to withstand line-side surges without impairment to performance.

(a) Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 3,000 amps per ANSI/IEEE C62.41.

(b) Other power handling devices: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 200 amps per ANSI/IEEE C62.41.

(5) Utilize air gap off – activated when user selects “off” at any control to disconnect the load from line supply.

(6) Possess power failure memory such that if power is interrupted and subsequently returned, lights will automatically return to same levels (dimmed setting, full on, or off) prior to power interruption within 3 seconds.

(7) Multiple load type, tested to UL 508 to specifically control incandescent/tungsten, magnetic low voltage, electronic low voltage, neon/cold cathode, digital fluorescent dimming ballasts, fluorescent dimming ballasts, and non-dim loads...

(8) Each dimmer to be assigned a load type that will provide a proper dimming curve for the specific light source.

(9) Possess ability to have load types assigned per circuit, configured in field.

(10) Minimum and maximum light levels user adjustable on circuit-by-circuit basis.

(11) Provide real-time cycle-by-cycle compensation for incoming line voltage variations including changes in RMS voltage (plus or minus 2 percent change in RMS voltage/cycle), frequency shifts (plus or minus 2 Hz change in frequency/second), dynamic harmonics, and line noise. Systems not providing cycle-by-cycle compensation to include external power conditioning equipment to meet these requirements.

(12) Systems not providing cycle-by-cycle compensation to include external power conditioning equipment as part of dimming system.

(13) Each dimmer to incorporate electronic "soft-start" default at initial turn-on that smoothly ramps lights up to the appropriate levels within 0.5 seconds.

(14) Line Voltage Dimmers; Meet following load-specific requirements:

(a) Magnetic Low Voltage (MLV) transformer:

(i) Contain circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472, Section 5.11.

(b) Fluorescent electronic dimming ballast: Refer to Drawings and other Specification Sections for dimming ballast specifications and performance.

(15) Direct low-voltage control of digital ballasts:

(a) Electronically link a digital fluorescent lighting ballast to a zone for both dimming and turn on/off.

(b) Energy usage and light level status visible to operator on an integral display.

(c) Electronically assign occupancy sensors for manual on/auto off and auto on/auto off.

(d) Electronically assign daylight sensors to digital ballasts and line voltage dimmers for proportional daylight harvesting.

(e) Single integral controller with Class 1 or Class 2 isolated digital output signal conforming to IEC 60929; capable of direct (no-interface) control.

E. Power Interfaces

(1) Product: PHPM-PA-DV, PHPM-SW-DV. Provide power interfaced required as defined on project drawings.

(2) Electrical:

(a) Phase independent of control input.

(b) Dimmer to meet limited short circuit test as defined in UL 20.

(3) Diagnostics and Service: Replacing power interface does not require re-programming of system or processor.

F. Wall Stations

(1) Line Voltage Wall Stations:

(a) Preset lighting control with zone override:

(i) Each zone and scene to be field customizable to indicate each zone and scene name.

(ii) Astronomical time clock and programmer interface.

1) Provide access to:

a) Scene selections.

b) Fade zone to a level.

c) Fine-tuning of preset levels with scene raise/lower.

d) Lock out scenes and zones.

e) Fine-tuning of light levels with individual zone raise/lower.

f) Terminal block for wired infrared signal input.

g) Enable/disable wall station.

(iii) Light intensity with real time energy savings by digital display.

(iv) Fade time indicated by digital display for current scene while fading.

(v) Incorporate built-in wide angle infrared receiver.

(vi) For temporary local overrides, individual raise/lower buttons to allow zones to be adjusted without altering scene values stored in memory.

(2) Color:

(a) Match NEMA WD1, Section 2.

(b) Color variation in same product family: Maximum $\Delta E=1$, CIE L*a*b color units.

(c) Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

(3) Provide faceplates with concealed mounting hardware.

(4) Engrave wall stations with appropriate button, zone, and scene engraving descriptions furnished prior to fabrication.

G. Source Quality Control

(1) Perform full-function testing on completed assemblies at end of line. Statistical sampling is not acceptable.

H. Device Short Circuit Rating

(1) Short-Circuit Rating for all Devices: 65 kA for 277 V.

I. Conductors And Cables

(1) Refer to diagram on drawings. Utilize 600 volt wire in conduit.

c. Construction.

1. Execution

A. Wiring Installation

(1) Comply with NECA 1.

(2) Wiring Method: Comply with requirements in Special Provision for Low-Voltage Electrical Power Conductors and Cables – Section 26 05 19. Minimum conduit size shall be 3/4 inch.

(3) Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

B. Identification

(1) Comply with requirements in Special Provision for Identification for Electrical Systems – Section 26 05 53 for identifying components and power and control wiring.

(2) Label each dimmer module with a unique designation.

(3) Label each scene control button with approved scene description. Coordinate with Owner.

C. Field Quality Control

(1) Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, program system data, verify digital control link, assemblies, and equipment installations, including connections. Report results in writing.

(2) Perform tests and inspections and prepare test reports.

(a) Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

(3) Tests and Inspections:

(a) Continuity tests of circuits.

(b) Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.

(i) Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

(4) Remove and replace malfunctioning modular dimming control components and retest as specified above.

(5) Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

(6) Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

D. Demonstration

(1) Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain modular dimming controls.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
WIRING DEVICES – SECTION 26 27 26

a. Description.

1. General

A. Summary

(1) This Special Provision includes the following:

(a) Receptacles, receptacles with integral GFCI, and associated device plates.

(b) Snap switches and wall-box dimmers.

B. Definitions

(1) EMI: Electromagnetic interference.

(2) GFCI: Ground-fault circuit interrupter.

(3) Pigtail: Short lead used to connect a device to a branch-circuit conductor.

C. Submittals

(1) Product Data: For each type of product indicated.

(2) Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

(3) Field quality-control test reports.

(4) Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

(5) Close-out Documents.

D. Quality Assurance

(1) Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available,

obtain all wiring devices and associated wall plates from a single manufacturer and one source.

(2) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

(3) Comply with NFPA 70.

E. Coordination

(1) Receptacles for Owner-Furnished Equipment: Match plug configurations.

(a) Cord and Plug Sets: Match equipment requirements.

b. Materials.

1. Products

A. Manufacturers

(1) Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

(a) Bryant Electric Inc. (Bryant).

(b) Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).

(c) Hubbell Incorporated; Wiring Device-Kellems (Hubbell).

(d) Leviton Mfg. Company Inc. (Leviton).

(e) Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

B. Straight Blade Receptacles

(1) Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498, back and side wired.

(a) Products: Subject to compliance with requirements, provide one of the following:

(i) Bryant; 5361 (single), 5352 (duplex).

(ii) Cooper; 5351 (single), 5352 (duplex).

(iii) Hubbell; HBL 5361 (single), HBL5352 (duplex).

(iv) Leviton; 5361 (single), 5352 (duplex).

(v) Pass & Seymour; 5361 (single), 5352 (duplex).

C. GFCI Receptacles

(1) General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

(a) End of life provision, denying power to receptacle face, when receptacle can no longer provide ground fault protection (as indicated by the inability to pass its internal test function).

(b) Reverse line-load miswire, denying power to receptacle face if device is miswired.

(2) Duplex GFCI Convenience Receptacles, 125 V, 20 A:

(a) Products: Subject to compliance with requirements, provide one of the following:

(i) Bryant; GFR53FT.

(ii) Cooper; XGF20.

(iii) Hubbell; GFR5352A.

(iv) Leviton; 6899-A.

(v) Pass & Seymour; 2094.

D. Twist-Locking Receptacles

(1) Single Convenience Receptacles, 125 V, amperage as indicated: Black face. Provide NEMA receptacle configurations as indicated on plans.

E. Snap Switches

(1) Comply with NEMA WD 1 and UL 20.

(2) Switches, 120/277 V, 20 A: back and side wired.

(a) Products: Subject to compliance with requirements, provide one of the following:

(i) Bryant; 4901 (single pole), 4902 (two pole), 4903 (three way), 4904 (four way).

(ii) Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).

(iii) Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).

(iv) Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).

(v) Pass & Seymour; PS20AC1 (single pole), PS20AC2 (two pole), PS20AC3 (three way), PS20AC4 (four way).

F. Wall Plates

(1) Single and combination types to match corresponding wiring devices. Wall plates of same material shall match same finish and details. Where two gang boxes are required for single gang devices, provide special wall plates with device opening in one gang and second gang blank.

(a) Plate-Securing Screws: Metal with head color to match plate finish.

(b) Material for Finished Spaces and Flush Boxes in Unfinished Spaces: 0.035-inch-(1-mm-) thick, satin-finished stainless steel, beveled type with smooth rolled outer edge.

(c) Material for Surface Boxes in Unfinished Spaces: 0.035 inch- (1 mm-) thick, satin finished stainless steel.

(d) Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

(e) Engraving: Engrave wall plates of all receptacles on emergency electrical system with word “EMERGENCY”. Separate nameplates secured to device plate are not acceptable.

(2) Wet-Location, Weatherproof Cover Plates: Gasketed, NEMA 250, complying with type 3R weather-resistant die-cast aluminum with lockable cover. Provide spring loaded gasketed doors for receptacles.

G. Finishes

(1) Color: Wiring device catalog numbers in special provision text do not designate device color.

(a) Wiring Devices Connected to Emergency Power System: Red.

(b) Cover Plates: Match color of non-metallic coverplates to color of device being provided. Color may vary throughout building.

c. Construction.

1. Execution

A. Installation

(1) Comply with NECA 1, except use the mounting heights shown on Drawings.

(2) Coordination with Other Trades:

(a) Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.

(b) Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

(c) Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

(d) Install wiring devices after all wall preparation, including painting, is complete.

(3) Conductors:

(a) Do not strip insulation from conductors until just before they are spliced or terminated on devices.

(b) Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

(c) The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

(d) Existing Conductors:

(i) Cut back and pigtail, or replace all damaged conductors.

(ii) Straighten conductors that remain and remove corrosion and foreign matter.

(iii) Pigtailing existing conductors is permitted provided the outlet box is large enough.

(4) Device Installation:

(a) Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.

(b) Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

(c) Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

(d) Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

(e) Use a torque screwdriver when a torque is recommended or required by the manufacturer.

(f) When conductors larger than No. 12 AWG are installed on 20-A circuits, splice No. 12 AWG pigtails for device connections.

(g) Tighten unused terminal screws on the device.

(h) When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

(i) Mount switches vertically, plumb with building lines, and approximately 6 inches (151 mm) from door opening.

(j) Mount receptacles vertically, unless otherwise noted on drawings, and at heights shown on drawings.

(k) Secure switches and receptacles firmly to backbox, not to wall and/or coverplate, with device extending through coverplate on all sides.

(l) Coordinate device mounting locations with architectural details and video wall enclosures.

(m) Install switches controlling 277 volt circuits in individual outlet boxes or in gang boxes with approved barriers between switches.

(n) Provide G.F.C.I. outlet at each location shown on drawings. Do not use one G.F.C.I. outlet to protect downstream outlets.

(o) Do not use common neutrals on dimmer circuits.

(p) Install cover plates on all outlet boxes. Match plate configuration to devices within box.

(q) Mount flush plates so all four (4) edges are in continuous contact with finished wall.

(r) Install blank cover plates on all open outlet boxes.

(5) Receptacle Orientation:

(a) Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left (neutral contact at top).

(6) Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

(7) Dimmers:

(a) Install dimmers within terms of their listing.

(b) Follow dimmer manufacturer's directions when ganging dimmers.

(c) Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

(8) Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical. Group adjacent switches under single, multigang wall plates.

B. Identification

(1) Comply with Special Provision for Raceway and Boxes for Electrical Systems - Section 26 05 53.

(a) Receptacles and Switches: Identify each device wall plate with panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black lettering on face of plate, and durable wire markers or tags inside outlet boxes.

(b) Engrave wall plates of all receptacles on emergency electrical system as described in b. Materials.

C. Field Quality Control

(1) Tests for Convenience Receptacles:

(a) Line Voltage: Acceptable range is 105 to 132 V.

(b) Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.

(c) Ground Impedance: Values of up to 2 ohms are acceptable.

(d) GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

(e) Using the test plug, verify that the device and its outlet box are securely mounted.

(f) The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
INTERIOR LIGHTING – SECTION 26 51 00

a. Description.

1. General

A. Summary

(1) This Special Provision includes the following:

(a) Interior lighting fixtures, lamps, and ballasts.

(b) Emergency lighting units.

(c) Lighting fixture supports.

(2) Related Special Provisions include the following:

(a) Modular Dimming Controls - Section 26 09 36 for architectural dimming systems.

(b) Wiring Devices - Section 26 27 26 for manual wall-box dimmers for incandescent lamps.

B. Definitions

(1) BF: Ballast factor.

(2) CRI: Color-rendering index.

(3) CU: Coefficient of utilization.

(4) LER: Luminaire efficacy rating.

(5) Luminaire: Complete lighting fixture, including ballast housing if provided.

(6) RCR: Room cavity ratio.

C. Submittals

(1) Product Data: For each type of lighting fixture, arranged in order of fixture designation. Submit in collated and bound brochures, with fixture type clearly

identified on each cut. Include manufacturer, catalog number, data on features, accessories, finishes, and the following:

(a) Physical description of lighting fixture including dimensions.

(b) Emergency lighting units including battery and charger.

(c) Ballast.

(d) Energy-efficiency data.

(e) Life, output, energy-efficiency data, color temperature, and color rendering index (CRI) for lamps.

(f) Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

(i) Photometric data shall be certified by a qualified independent testing agency.

(2) Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

(a) Wiring Diagrams: Power and control wiring.

(3) Product Certificates: For each type of ballast for dimmer-controlled fixtures, signed by product manufacturer.

(4) Qualification Data: For agencies providing photometric data for lighting fixtures.

(5) Field quality-control test reports.

(6) Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

(7) Close-out Documents.

(8) Warranties: Special warranties specified in this Special Provision.

D. Quality Assurance

(1) Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in the Code of Federal Regulations, Title 29 Labor, 29 CFR 1910.7.

(2) Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

(3) Comply with NFPA 70.

E. Commissioning

(1) Upon completion of the installation, the system shall be completely commissioned by a factory-employed engineer. The commissioning of the lighting controls in the 1st level is to be performed after all ballasts and controls have been installed and all wiring has been connected and checked for proper continuity. The factory-employed engineer shall calibrate and verify proper operation of the system and demonstrate and educate the Owner's representative(s) on the system capabilities and operation.

(2) Lighting controls and ballast manufacturer shall offer an extended warranty based upon successful factory commissioning.

F. Coordination

(1) Confirm compatibility and interface of ceiling system and other materials with luminaire mounting. Report discrepancies to Architect, and defer ordering until clarified.

(2) Supply plaster frames, trim rings and backboxes to other trades.

(3) Coordinate layout and installation of lighting fixtures, suspension system, lighting lowering systems, etc. with other construction that penetrates ceilings or is supported by them, including structure, HVAC equipment and ductwork, fire-suppression system, and partition assemblies.

(4) Coordinate all components of fixtures in control room, ballasts, dimmer systems, fixture lowering systems.

G. Warranty

(1) Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

(a) Warranty Period for Emergency Lighting Unit Batteries: 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

(2) Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.

(a) Warranty Period for Electronic and Dimming Ballasts: Five years from date of Substantial Completion.

(3) Special Warranty for T8 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

(a) Warranty Period: One year from date of Substantial Completion.

H. Extra Materials

(1) Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

(a) Lamps: 48 of each fluorescent type and rating installed.

(b) Plastic Diffusers and Lenses: One of each type.

(c) Ballasts: One of each type.

b. Materials.

1. Products

A. Manufacturers

(1) Lighting Fixture Manufacturers:

(a) Subject to compliance with requirements, provide products by one of the manufacturers specified in the Lighting Fixture Legend on Drawings.

(2) Lamp Manufacturers: Subject to compliance with requirements, provide products by one of the following:

(a) General Electric Lighting.

(b) Philips Lighting.

(c) Osram Sylvania.

(3) Ballast Manufacturers: Subject to compliance with requirements, provide products by one of the following:

(a) Advance Transformer.

(b) Osram Sylvania.

(c) Lutron (only acceptable manufacturer for dimming ballasts)

(4) Emergency Lighting Unit Manufacturers:

(a) Subject to compliance with requirements, provide products by one of the manufacturers specified in the Lighting Fixture Legend on Drawings.

B. Lighting Fixtures And Components, General Requirements

(1) Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

(2) Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

(3) Metal Parts: Free of burrs and sharp corners and edges.

(4) Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

(5) Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

(6) Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

(a) White Surfaces: 85 percent.

(b) Specular Surfaces: 83 percent.

(c) Diffusing Specular Surfaces: 75 percent.

(d) Laminated Silver Metallized Film: 90 percent.

(7) Plastic Diffusers, Covers, and Globes:

(a) Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

(i) Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.

(ii) UV stabilized.

(b) Light transmitting plastic in lighting fixtures and light diffusing systems shall conform to Michigan State Fire Rules and Memorandums.

(8) Fluorescent Fixtures Utilizing Double-Ended Lamps:

(a) Disconnecting means internal to each fixture, to disconnect simultaneously from the source of supply all ballast conductors, including the grounded conductor, if any. Disconnecting means shall be located so as to be accessible before servicing or maintaining the ballast and shall have guarded line side terminals.

(b) The disconnecting means shall not be required for the following:

(i) Fixtures installed in hazardous locations.

(ii) Battery powered emergency lighting.

(iii) Fixtures with an accessible cord-and-plug connection.

(iv) Industrial establishments with restricted public access where only qualified persons service the installation by written procedures.

C. Ballasts for Linear Fluorescent Lamps

(1) Electronic Ballasts: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for voltage and type and quantity of lamps indicated. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

(a) Sound Rating: A.

(b) Total Harmonic Distortion Rating: Less than 10 percent.

(c) Transient Voltage Protection: IEEE C62.41, Category A or better.

(d) Operating Frequency: 20 kHz or higher.

(e) Lamp Current Crest Factor: 1.7 or less.

(f) BF: 0.86 or higher.

(g) Power Factor: 0.95 or higher.

(h) Minimum Starting Temperature: 50 deg. F (10 deg. C) unless noted otherwise.

(i) Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

(2) Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type. Different lamp lengths, wattages, and ballasts for 1, 2, 3, or 4 lamps shall dim evenly when controlled by same dimmer.

(a) Dimming Range: 100 to 1 percent of rated lamp lumens.

(b) Ballast Input Watts: Can be reduced to 20 percent of normal.

(c) Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

(3) Provide Bussman HLR in-line fuse holders and Bussman GLR fuses for each ballast.

D. Ballasts for Compact Fluorescent Lamps

(1) Description: Electronic programmed rapid-start type, complying with ANSI C 82.11, designed for voltage and type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:

(a) Lamp end-of-life detection and shutdown circuit.

(b) Automatic lamp starting after lamp replacement.

(c) Sound Rating: A.

(d) Total Harmonic Distortion Rating: Less than 10 percent.

(e) Transient Voltage Protection: IEEE C62.41, Category A or better.

(f) Operating Frequency: 20 kHz or higher.

(g) Lamp Current Crest Factor: 1.7 or less.

(h) BF: 0.95 or higher, unless otherwise indicated.

(i) Power Factor: 0.95 or higher.

(j) Minimum Starting Temperature: 50 deg. F (10 deg. C) unless noted otherwise.

(k) Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

(l) Ballast Case Temperature: 75 deg C, maximum.

(2) Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type. Different lamp lengths, wattages, and ballasts for 1 or 2 lamps shall dim evenly when controlled by same dimmer.

(a) Dimming Range: 100 to 10 percent of rated lamp lumens.

(b) Ballast Input Watts: Can be reduced to 20 percent of normal.

(c) Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

(3) Ballasts for Low Temperature Environments:

(a) Temperatures 0 deg. F (minus 17 deg. C) and Higher: Electronic type rated for 0 deg. F (minus 17 deg. C) starting and operating temperature with indicated lamp types.

(4) Ballasts with Supply Voltage Greater than 150 Volts: Provide Bussman HLR in-line fuse holders and Bussman GLR fuses for each ballast.

E. Digital Dimming Fluorescent Ballasts (Fixture Type “FA”)

(1) Digital dimming ballast shall have a continuous flicker-free dimming range of 100% down to 10% measured relative light output (RLO) for Biax fluorescent lamps.

(2) Digital dimming ballast shall utilize a combination of 3-wire (line voltage) phase control technology and digital 2-wire input.

(3) Electronic dimming ballast shall maintain constant light output ±2% for a line voltage variation of ±10%.

(4) Digital dimming ballast shall be capable of monitoring lamp and ballast conditions as well as sending information when requested from the parent control system when applicable.

(5) Upon failure by one or multiple ballasts, replacement of digital dimming ballast within the system shall not require reprogramming or re-commissioning. If ballasts are replaced one at a time, information shall be completely restored to replacement ballast automatically. For catastrophic ballast failure, address information must be able to be removed or read from failed ballast(s) and sent to the replacement ballast through use of visible information codes directly on the ballast.

(6) Manufacturer will provide a multi-input digital module that can be used in conjunction with any three-wire phase control dimming ballast or switching ballast. Module shall be capable of switching up to 2A of connected load. Module shall be capable of mounting within a fixture or remote mounting.

(7) Manufacturer shall provide software and a PDA style programming unit to program system functionality, to include assignment of digital ballasts to zone and groups, assign sensors to specific zones and groups, set daylighting parameters, and make system changes at any time. This programming shall be made from the Lutron Grafik Eye Control Units.

(8) Manufacturer shall provide a digital ballast power supply capable of providing power to a 2 wire class 1 or class 2 digital bus interconnecting up to 64 devices. Digital bus wiring shall be polarity-free and topology free when connecting multiple ballasts on a system. Digital bus shall be two #16AWG wires. Digital bus wiring is independent of normal ballast power wiring (hot, neutral, ground). Digital ballast power supply requires 277V AC power.

F. Emergency Lighting Units

(1) General: Designed for voltage available. Provide fully automatic operation upon power failure. Supply rated power for minimum operating time of 1-1/2 hours with all lamps operating.

(2) Description: Self-contained units complying with UL 924.

(a) Battery: Sealed, maintenance-free, nickel cadmium type.

(b) Charger: Fully automatic, solid-state type with sealed transfer relay.

(c) Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

(d) Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

(e) LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

(f) Lamp Types: Unit mounted or remote mounted, as shown in the Lighting Fixture Legend on Drawings.

(g) Mounting brackets and Other Accessories: As required for a complete installation or as indicated on Drawings.

(h) Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

G. Fluorescent Lamps

(1) Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

(2) T8 rapid-start low-mercury lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 2800 initial lumens (minimum), CRI 75 (minimum), color temperature 3500 K, and average rated life 20,000 hours, unless otherwise indicated.

(3) Compact Fluorescent Lamps: 4-Pin, low mercury, CRI 80 (minimum), color temperature 3500 K, average rated life of 10,000 hours at 3 hours operation per start, and suitable for use with dimming ballasts, unless otherwise indicated.

(a) 40 W: T5, triple tube, rated 3150 initial lumens (minimum).

H. Lighting Fixture Support Components

(1) Comply with Special Provision for Hangers and Supports for Electrical Systems - Section 26 05 29 for channel- and angle-iron supports and nonmetallic channel and angle supports.

(2) Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with ceiling canopy. Finish same as fixture. Provide all hardware as required to interface pendant mounted fixtures with lighting lowering devices. Determine and provide stem hanger length such that fixtures coupled to lighting lowering system disconnect unit meets the mounting height at bottom of fixture as indicated on plan drawing.

(3) Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

c. Construction.

1. Execution

A. General

(1) Examine all fixtures delivered to jobsite prior to installation to ensure all specification requirements and shop drawing notes and comments have been incorporated by manufacturer. Installation of fixtures signifies Contractor's acceptance and approval of fixtures from manufacturer.

B. Installation

(1) Lighting Fixtures: Mount all fixtures per manufacturer's recommendations. Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

(2) Support fixtures directly from building structure by rod hangers or metal angle headers supported from framing structure or from appropriately rated ceiling grid system. Do NOT support from metal roof decks.

(3) Securely support fixtures independent of ceiling tile to prevent sagging of ceiling panel.

(4) Provide all rod hangers, metal angle headers, anchors, clamps, etc., to support fixtures.

(5) Provide supplemental support for fixture installations that put excessive stress on ceiling system and for lighting lowering system disconnect unit.

(6) Suspended Lighting Fixture Support:

(a) Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers from lighting lowering system disconnect unit. Route fixture wiring down one stem.

(7) Recessed Lighting Fixtures:

(a) In accessible ceilings, install to permit access to outlet or prewired fixture box from below.

(b) Connect to boxes with flexible conduit and fixture wire, or MC cable.

(8) Align lighting fixtures and clean diffusers prior to final acceptance.

(9) Adjust aimable indirect lighting fixtures as directed by Architect and to provide required light intensities directed at suspended ceiling.

(10) Connect wiring according to Special Provision for Low Voltage Electrical Power Conductors and Cables – Section 26 05 19.

(11) Lamps:

(a) Install lamps in accordance with manufacturer's instructions.

(b) Replace all burned out lamps at time of substantial completion.

(c) Replace all fluorescent and high intensity discharge lamps that fail within three (3) moths of substantial completion.

(12) Ballasts:

(a) Factory mount ballasts unless noted otherwise.

(b) Size wiring between remote ballasts and luminaires to comply with manufacturer's recommendations for distance involved.

(c) Dimming installation shall have IEC rated sockets. Sockets must be installed in accordance with Lutron Application Note #122. Lamp holders and lamp holder installation from fluorescent dimming.

(d) Fixture supplier shall install digital dimming ballast per manufacturer's installation instructions and in accordance with national and local electrical codes. Lamp holders for dimming installations must meet recommendations outlined in ballast manufacturers requirements.

(13) Emergency Lighting Units:

(a) Mount emergency lighting units in secure manner to discourage removal.

(b) Support recessed ceiling mounted units independent of ceiling tile to prevent sagging of ceiling tile.

(c) Provide all rod hangers, metal angle headers, anchors, clamps, etc., to support emergency lighting units.

(d) Connect emergency lighting unit to same branch circuit serving normal lighting in room or area, ahead of any local switches.

C. Field Quality Control

(1) Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

(2) Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

D. Manufacturers" Field Services

(1) Digital dimming ballast manufacturer shall provide toll-free phone technical support assistance 24 hours per day, 365 days per year.

(2) Digital dimming ballast manufacturer shall be capable of providing on-site service support within 24 hours.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
FLAT PANEL DISPLAYS

a. Description. This work shall consist of providing, and installing the flat panel displays and associated wall mounts, included accessories, and mounting hardware.

b. Materials.

1. Flat Panel Displays and included accessories and mounting hardware.

2. Flat panel displays shall be commercial grade device intended for extended use.

3. Acceptable Manufacturers for 42” Flat Panel Display:

   A. HP

   B. NEC

   C. Panasonic

   D. Sharp

   E. Sony

   F. Or equal as approved by the Engineer

4. Acceptable Manufacturers for 32” Flat Panel Display:

   A. HP

   B. NEC

   C. Panasonic

   D. Sharp

   E. Sony

   F. Or equal as approved by the Engineer

5. Flat Panel Displays must meet the following minimum requirements:

   A. Device Type: LCD

B. Native Aspect Ratio: 16:9

C. Analog Video Input: RGB, S-Video, composite video, component video, DVI

D. Video Modes: SD, 480p, 720p, 1080i, 1080p

E. Connectivity: 1 x S-video input - 4 pin mini-DIN, 1 x DVI-D - 24 pin digital DVI, 1 x composite video input - RCA, 1 x audio, line-in - RCA x 2, 1 x audio line-in - mini-phone stereo 3.5 mm, component video (3 RCA with audio), HDMI

F. Remote Control: Wireless

c. Construction. Install flat panel display and mount in location specified on plans using manufacturer's mounting hardware and accessories.

1. As a part of testing equipment, provide PC to test and demonstrate the functionality of each flat panel display as part of the acceptance testing. Final PC for normal operations to be provided by others.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SERVER RACK(S)

XXX:YYY 1 of 1 C&T:APPR:XXX:YYY:00-00-00

a. Description. This work shall consist of providing and installing 19” wide by 72” high by 36” deep standard floor mount 4 post free standing server rack(s).

b. Materials. Will be steel construction. Will be powder coated black in color. Will have RU (rack unit) number designations printed on mounting rails. Will meet or exceed EIA standards. All racks being installed by this contract shall be from one (1) manufacturer. Racks will be capable of supporting a minimum of 300 lbs each. All racks will include all parts and accessories required for a complete installation as a unit.

c. Construction. Install rack(s) in accordance to manufacturer’s instructions, in location designated on the plan sheet(s). Ensure that floor anchors are of appropriate design, type, and capacity, for rack load rating and floor substrate.

1. Permanently fasten rack to floor.

2. Racks shall be grounded and bonded by means of a grounding conductor to an approved grounding electrode in accordance with local and NEC (National Electric Code) standards. Grounding equipment/material shall be attached to an unpainted exposed metallic section of rack. Grounding conductor shall be minimum 16 AWG and bare copper or jacketed with green coloring.

3. Securely support all new or existing cables entering or exiting rack(s) with appropriate cable management equipment to relieve excessive strain and tension on the cables and to dress the cables in a neat, workmanship-like manner in strict accordance to industry-wide standards.

4. Vacuum clean rack(s), and dust all exposed surfaces upon completion of installation.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
VIDEO RECORDER

a. Description. This work shall consist of furnish, install, integration, and warranty of a network based digital video recorder (NVR). The Contractor shall furnish all tools, equipment, materials, supplies, manufactured articles, and perform all operations and equipment integration necessary to provide a complete, fully operational NVR as described herein.

1. General requirements.

A. Furnish, assemble, fabricate or install materials that are new, and in accordance with the details shown on the Plans and in the Special Provision.

B. Use equipment designed to protect personnel from exposure to voltages during equipment operation, adjustments and maintenance.

C. Comply with working clearances and dedicated spaces per NEC Articles 110, 384 and 800-5, as well as all current NEC articles, and Federal, State and Local regulations.

2. Performance Specifications.

A. The NVR shall record a minimum of four (4) simultaneous, real time, network based and analog video streams at 20 frames per second, in 4CIF resolution. The total number of inputs for the NVR shall be four (4) the type of inputs shall be determined by the available outputs of the video system at the time of install.

B. The NVR shall have the capacity to store a minimum of 48 hours of video at a resolution of 4CIF and 20 frames per second. After 48 hours, the video will automatically begin to overwrite stored video and thus operate in a continuous loop.

C. The NVR shall have a built in DVD±RW drive, and USB port for exporting and archiving video.

D. The NVR shall have remote access and viewing of the live and stored video on the NVR from up to a minimum of five (5) Windows based client workstations.

E. The NVR shall allow client workstations to store video clips, and export video from the NVR for the Department’s use.

b. Materials. Furnish a NVR that meets the following minimum requirements.

1. Inputs/Outputs

A. Provide a NVR with a minimum of four (4) recordable analog video inputs, and record four (4) MPEG-4 network based video streams as required to integrate the NVR into the ATMS

B. Analog video input connectors shall be BNC type.

C. Video resolution shall be 704X480

D. Analog video shall use NTSC standard.

E. Minimum of one (1) 10/100 Mbps RJ-45 Ethernet port.

F. Minimum of one (1) USB port.

G. Minimum one RS-232 port.

2. Environmental.

A. Minimum operating temperature range from 32º to 95º F (0º to 32º C).

B. The NVR will operate in up to a maximum of 80% non-condensing relative humidity.

3. Physical.

A. Shall be rack mountable in a 19 inch rack and take up no more than 3 rack units.

4. Electrical and other requirements.

A. Auto ranging input voltage from 100-240 VAC ±50/60 Hz.

B. Video compression of MPEG-4

C. Shall have bandwidth throttle ranging from 128Kbps to 100 Mbps.

D. Support for continuous loop and scheduled recording.

E. Channel resolution, quality, and frame rate settings shall be configurable per individual camera.

F. Shall be capable of Time/Date, bookmark, and pixel search of the recorded video.

G. Provide a minimum of five (5) Windows workstations access to the NVR via software, for video viewing, download, control, and configuration.

c. Construction. Install and integrate NVR in the designated equipment room in rack mount hardware as indicated on the Plans.

1. Integration.

A. The Contractor shall install and integrate the NVR into the Advance Traffic Management System (ATMS) video network such that any four of the cameras in the system can be recorded simultaneously, either through analog or network based recording.

B. The NVR shall be integrated with the existing ATMS network such that the operators are able to select, start, stop, and schedule recording of any of the MPEG-4 streaming videos located on the ATMS network.

C. The NVR shall be integrated on the network as determined by the Department.

D. The NVR shall use password based permissions and such that a workstation may access and configure various levels of features as determined by the Department.

2. Documentation required.

A. Shop drawings that detail the complete NVR and all other components to be supplied and constructed are to be submitted to the Engineer for approval. These drawings detail the exact location and placement of system components and include installation details for the required cables. All cabling is to be installed in accordance with manufacturer recommendations.

B. Provide a training and maintenance manual for the NVR based on the final configured setup, including detailed specifications and information regarding the inventory of installed assemblies by location and corresponding serial number. The manual shall also provide specifications that detail all the features and requirements as specified herein. All material will be provided in both hardcopy and electronic format.

C. Provide documentation detailing the technical and operational aspects of the completed installation, including as built drawings, passwords, field notes, and installed wiring and cabling details.

D. Provide detailed schematic as-built documentation that highlights installed rack position, wired connections, and logical layout of the NVR when installed into the system.

3. Testing.

A. The Contractor shall verify full operation and recording capability of all the cameras in the system on the NVR, via each of the client workstations as designated by the Department.

B. The Contractor shall demonstrate to the Department operational features, and methods necessary for archiving video onto both USB, and DVD media.

4. Provide a three (3) year manufacturer's warranty for parts, labor, and installation defects for the NVR and related appurtenances as accepted; warranty period will begin at the date of final acceptance from the Engineer.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
SOUND MASKING SYSTEM

a. Description. Provide all labor, equipment, materials and all other items specified herein as required to design, deliver, install, program, and warranty a sound masking system (LogiSon Acoustic Network or equal as approved by the Engineer) for the new TMC.

1. General.

A. Provide a complete digital and networked decentralized sound masking system. Allow central control down to individually addressable IP-based speakers. Install sound masking system in the following rooms of the facility (room numbering based upon Barton Malow Plans for the DITC Facility dated 01/12/2009) refer to plans for areas of coverage for the sound masking system:

(1) A135

(2) A136

(3) A137

(4) A138

(5) A144

(6) A145

(7) A146

(8) A147

(9) A148

(10) A225

(11) A227

(12) A228

(13) A229

(14) A230

(15) A231

(16) A232

2. Comply with the latest edition of the following codes or standards:

A. *Underwriters' Laboratories (UL) Standard 6500*.

B. *Underwriters' Laboratories (UL) Standard 2043*.

C. *American Society for Testing and Materials (ASTM) Standard Guide E 1374*.

D. *American Society for Testing and Materials (ASTM) Standard E 1573*.

E. *American Society for Testing and Materials (ASTM) Standard E 1130*.

F. *FCC Federal Communications Commission (FCC) – EN 55103-1&2*.

3. System Requirements.

A. General Requirements.

(1) Centrally controllable from a control panel and/or an attached computer (including over multiple floors).

(2) Network all components to be individually addressable.

B. Sound Masking Requirements.

(1) Use digital signal processing (DSP) technology for masking sound generation and adjustment of masking signals.

(2) Masking sound to be random and provide no noticeable repetitive pattern.

(3) Primary network devices to provide a 1/3 of an octave equalizer for the masking signal, capable of equalizing zones of 1 or more speakers.

(4) Masking volume to be digitally adjustable in 0.5 dBA increments at each primary network device (controlling 1 or more speakers) over a range of 35 dBA to 85 dBA @ 3ft.

(5) Capable of muting the masking volume at each primary network hub device.

(6) After adjustment, complete sound masking system will provide a spatial uniformity of +/-½dBA for the masking volume with furnishings in place.

(7) Capable of system expansion and/or relocation.

C. System Timer Requirements.

(1) Provide a timer function allowing masking volume levels to be automatically adjusted according to a programmed schedule.

(2) Provide a calendar-based programmable timer function. Assign schedules to individual or group of primary network devices.

(3) Provide automatic daylight saving time adjustments.

(4) Provide an acclimatization process that automatically increases the masking volume over a period of time according to a programmed schedule. Allow for independent acclimatization schedules for each timer zone.

(5) Allow for nine or more independent timer zones per control panel/ programmable timer.

(6) Allow independent timer schedules for each day of the week.

(7) Allow variable rates of volume adjustment.

(8) Provide optional exception timer schedules for calendar days requiring a different schedule from the norm.

D. In-Room Occupant Control Requirements.

(1) Provide wall mounted, in-room a minimum of five programmable keypads giving the facility occupants manual control over the masking volume

(2) Capable of adjusting masking volume using keypads.

(3) Capable of using keypads to restrict access to masking volume control.

(4) Capable of using keypads to restrict the allowable range of masking volume adjustment.

(5) Capable of using keypads to mute individual masking output.
(6) Provide an infrared remote control receiver with keypads.

E. Diagnostic Requirements.

(1) Capable of performing system self diagnostics ensuring that the expected number of primary network devices is present and communicating properly with the network control panel.

(2) Capable of identifying the primary network devices that are not communicating properly over the network.

F. Reporting Requirements.

(1) Network control panel to be capable of reading and displaying the current settings for all primary network devices.

(2) Capable of generating detailed reports of all system settings down to the level of individual primary network devices.

G. Security Requirements.

(1) Provide locked metal enclosure to restrict access to network control panel.

(2) Restrict access to control panel functions by password authentication.

(3) No physical controls on system loudspeakers or primary network devices.

(4) Allow for all settings to be backed up on an electronic storage medium.

(5) Capable of monitoring the performance at each network component.

5. Submittals.

A. Include manufacturer's specifications and installation instructions.

B. Include schematics of the network showing quantity and location of network components and related cabling and accessories.

C. Include warranty documents covering the network components.

D. Provide system Acceptance Testing Plan (ATP) for approval by Engineer..

6. Quality Assurance.

A. Minimum of 5 years experience in manufacturing sound masking systems.

B. Network design to be performed by an approved manufacturer representative.

C. Installer approved by manufacturer representative and are trained with the specified products to install all system components. Installer must have a minimum of two years experience with installation of selected manufacturer's system and must have installed five systems for the manufacturer.

D. Approved manufacturer representative or trained contractor to perform network commissioning.

E. A single manufacturer to provide Source Network Control Panels, Network Devices, Loudspeaker Assemblies, Programmable Keypads and Cable Assemblies.

7. Delivery, Storage and Handling

A. Protect from moisture during shipping, storage and handling.

B. Deliver in manufacturer's original unopened and undamaged packages with manufacturer's labels legible and intact.

C. Inspect manufacturer's packages upon receipt.

D. Handle packages carefully.

8. Warranty and Maintenance

A. Provide a written warranty that products installed shall be free from defects in parts or assembly for a 3-year period from date of first use (the date of final acceptance).

B. Warranty to include the maintenance of system and replacement of any defective parts.

C. Perform three site visits for tuning and tailoring of system and operation based upon user feedback, anticipated visits at 2 weeks, 6 weeks, and 12 weeks after staff has begun occupancy of the site.

D. Provide an estimated cost of warranty and system maintenance extension as an option by the Department upon the expiration of the initial 3-year warranty and initial fine tuning of system.

b. Materials.

1. Acceptable Manufacturers:

A. K.R. Moeller Associates Ltd

B. Or approved equal (as approved by the Engineer).

2. Components.

A. Provide distributed primary network device, each with:

(1) A DSP-based masking sound generator.

(2) An individual 1/3 of an octave, minimum 23-band equalizer for masking.

(3) An individual volume control for masking.

(4) Network communication components.
(5) An audio amplifier.

(6) Overall maximum dimensions of:

(a) Diameter ..... 6.0 inches

(b) Height ..... 2.5 inches

B. Provide distributed secondary network device, each with:

(1) A loudspeaker connection.

(2) Signal connections to/from other primary/secondary devices.

(3) Overall maximum dimensions of:

(a) Diameter ..... 6.0 inches

(b) Height ..... 2.5 inches

C. Provide loudspeaker assemblies, each with:

(1) A connection to the network devices.

(2) An acoustically damped enclosure.

(3) Tool-less, on-site adjustment of upward / downward loudspeaker orientation.

(4) Overall maximum dimensions of:

(a) Diameter ..... 8.0 inches

(b) Height ..... 5.0 inches

(5) A loudspeaker driver with the following minimum specification:

(a) Diameter ..... 4.0 inches; 10.0 cm

(b) Power Rating ..... 25 Watts RMS

(c) Sensitivity..... 87 dBA @ 1W / 1m

(d) Frequency Response..... 100 - 10,000 Hz (+/- 6 dB)

(e) Impedance ..... 16 Ohms

(f) Magnet Structure Weight..... 17.6 oz; 500 g

D. Provide one or more network control panels, each with:

(1) Network communication components.
(2) Network control electronics for masking and timer functions.

(3) Connections for audio input modules.

(4) Connections to network devices, additional control panels and a computer.

(5) Ethernet connection and IP addressability.

E. Provide PC network control software with the following functions:

(1) Allow control of all system adjustments from a computer, including:

(a) Network setup.

(b) Sound masking volume and equalization.

(c) Sound masking timer programs.

(d) Programmable keypad setup.

(2) Allow the reporting of all system settings.

(3) Perform network diagnostics.

F. Provide programmable keypads, each with:

(1) Network communication components.

(2) A display indicating function selection and volume adjustments.

(3) A keypad interface for controlling all functions (masking selection, volume increase/decrease, mute).

(4) An infrared remote control receiver.

G. Provide cable assemblies.

(1) Provide power, audio and control signals over a single cable assembly.

H. Provide audio input modules, with.

(1) Audio input for microphone, telephone or auxiliary audio sources.

(2) Level adjustment controls.

I. Provide power supplies.

c. Construction.

1. Network Design.

A. Design network according to manufacturer's specifications. Final design shall be presented to Engineer for review and acceptance. Design shall include parts list and cost quote to furnish, install, and test final system. Purchase no parts and begin no system installation, prior to acceptance of system design.

2. Examination.

A. Ensure that facility build out is at a stage suitable for the system installation.

B. Verify that facility is constructed according to plans including wall locations, ceiling types and plenum barriers.

C. Verify that the plenum height is appropriate as per manufacturer's recommendations and as per plan.

D. Verify power requirements have been provided as per plan.

E. Verify sufficient space for centrally located components is available as per plan and manufacturer's specifications.

F. Verify any third-party components required to be interfaced with the network have been provided.

3. Permits.

A. Obtain necessary permits for installation work.

4. Installation.

A. Comply with all applicable codes.

B. Comply with manufacturer's recommendations regarding installation.

C. Follow the system design for location of loudspeakers and wiring.

D. Record any necessary changes to the system design on the plan.

E. Ensure that supplementary materials used meet applicable safety standards.

5. Field Quality Control.

A. Ensure that plenum heights meet the minimum recommended by the manufacturer for the loudspeakers, revise and resubmit loudspeaker selection, if not compliant.

B. Ensure that distance between the top of the loudspeaker and the deck meets manufacturer's minimum specifications, revise and resubmit loudspeaker selection, if not compliant.

C. Ensure that loudspeakers are suspended in a level manner.

D. Ensure that loudspeakers are not obstructed.

E. Ensure cables are properly supported in the ceiling.

F. Ensure cables are securely terminated.

6. Network Configuration and Adjustment.

A. Follow manufacturer's recommendations for system configuration and settings.

B. Conduct testing according to approved ATP, to be witnessed by Engineer. Any failures in ATP process shall require full ATP to be repeated.

7. Cleaning.

A. Ensure that empty packaging is removed.

B. Ensure that any material waste is removed.

C. Ensure the product is clean and presentable.

D. Protect floor, furniture and surrounding areas from dust during installation.

8. Demonstration and Training.

A. Demonstrate operational system to customer by walking the space.

B. Demonstrate functionality of the system to the customer or customer's representative.

C. Provide two (2) four hour training sessions to train customer employees to maintain system. Provide training curriculum to Engineer 30 days prior to training for Engineer's approval.

9. Testing and Reporting.

A. Test area for consistency of masking volume and quality.

B. Test masking volumes with mechanicals off and with space unoccupied.

C. Provide a printed report detailing system settings.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
METAL FABRICATIONS – SECTION 05 50 00

a. Description.

1. General

A. Summary

(1) This Special Provision includes the following:

(a) Steel framing and supports for countertops.

(b) Steel framing and supports for applications where framing and supports are not specified in other Special Provisions.

(2) Related Special Provisions include the following:

(a) Rough Carpentry - Section 06 10 00 for metal framing anchors.

B. Submittals

(1) Shop Drawings: Show fabrication and installation details for metal fabrications.

(a) Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Project Conditions

(1) Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

(a) Provide allowance for trimming and fitting at site.

D. Coordination

(1) Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

b. Materials.

1. Products

A. Metals, General

(1) Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Ferrous Metals

(1) Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Fasteners

(1) Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

(2) Anchor Bolts: ASTM F 1554, Grade 36.

(a) Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

(3) Eyebolts: ASTM A 489.

(4) Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

(5) Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

(6) Wood Screws: Flat head, ASME B18.6.1.

(7) Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

(8) Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

D. Fabrication, General

(1) Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

(2) Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

(3) Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

(4) Form exposed work true to line and level with accurate angles and surfaces and straight edges.

(5) Weld corners and seams continuously to comply with the following:

(a) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

(b) Obtain fusion without undercut or overlap.

(c) Remove welding flux immediately.

(d) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

(6) Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

(7) Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

(8) Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

(9) Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

(a) Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

E. Miscellaneous Framing And Supports

(1) General: Provide steel framing and supports not specified in other Special Provisions as needed to complete the Work.

(2) Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

(a) Fabricate units from slotted channel framing where indicated.

(b) Furnish inserts if units are installed after concrete is placed.

(3) Galvanize miscellaneous framing and supports where indicated.

c. Construction.

1. Execution

A. Installation, General

(1) Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

(2) Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

(3) Field Welding: Comply with the following requirements:

(a) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

(b) Obtain fusion without undercut or overlap.

(c) Remove welding flux immediately.

(d) At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

(4) Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

B. Installing Miscellaneous Framing And Supports

(1) General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
ROUGH CARPENTRY – SECTION 06 10 00

a. Description.

1. General

A. Summary

(1) This Special Provision includes the following:

(a) Wood blocking and nailers.

(b) Plywood backing panels.

B. Definitions

(1) Exposed Framing: Framing not concealed by other construction.

(2) Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

(3) Timber: Lumber of 5 inches nominal (114 mm actual) or greater in least dimension.

(4) Lumber grading agencies, and the abbreviations used to reference them, include the following:

(a) NeLMA: Northeastern Lumber Manufacturers' Association.

(b) NLGA: National Lumber Grades Authority.

(c) RIS: Redwood Inspection Service.

(d) SPIB: The Southern Pine Inspection Bureau.

(e) WCLIB: West Coast Lumber Inspection Bureau.

(f) WWPA: Western Wood Products Association.

C. Delivery, Storage, And Handling

(1) Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

b. Materials.

1. Products

A. Wood Products, General

(1) Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

(a) Factory mark each piece of lumber with grade stamp of grading agency.

(b) For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.

(c) Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

(d) Provide dressed lumber, S4S, unless otherwise indicated.

B. Miscellaneous Lumber

(1) General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

(a) Blocking.

(b) Nailers.

(2) For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber with 19 percent maximum moisture content of any species.

(a) Hem-fir (north); NLGA.

(b) Mixed southern pine; SPIB.

(c) Spruce-pine-fir; NLGA.

(d) Hem-fir; WCLIB, or WWPA.

(e) Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

(f) Western woods; WCLIB or WWPA.

(g) Northern species; NLGA.

(h) Eastern softwoods; NeLMA.

(3) For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

(4) For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

C. Plywood Backing Panels

(1) Paneling Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness.

D. Fasteners

(1) General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

(2) Nails, Brads, and Staples: ASTM F 1667.

(3) Power-Driven Fasteners: NES NER-272.

(4) Wood Screws: ASME B18.6.1.

(5) Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

(6) Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

(7) Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

(a) Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

c. Construction.

1. Execution

A. Installation, General

(1) Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

(2) Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

(a) Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

(3) Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

(4) Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

(a) NES NER-272 for power-driven fasteners.

(b) Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

(c) Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's Uniform Building Code.

(d) Table 2305.2, "Fastening Schedule," in BOCA's BOCA National Building Code.

(e) Table 2306.1, "Fastening Schedule," in SBCCI's Standard Building Code.

(f) Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

(g) Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's International One- and Two-Family Dwelling Code.

(5) Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

B. Wood Blocking And Nailer Installation

(1) Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

(2) Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

(3) Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

d. Measurement and Payment. The completed work as described will be paid for according to the Special Provision for Measurement and Payment.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
COORDINATION CLAUSE

a. Description. The following points of coordination are critical to the outcome of the project.

1. The construction of the MITS Center Interior Fit-Out and System Integration Project will require coordination with the following to provide for orderly progress of contract work.

A. MDOT Project Engineer located at 18101 West Nine Mile Road, Southfield, MI 48075.

(1) Engineer contact Information:

Michele R. Mueller
Traffic Signals Engineer
Michigan Dept of Transportation
Metro Region Office
248-483-5133 (Office)
248-431-1443 (Cell)
248-569-3103 (Fax)

B. Michigan ITS Center (MITSC) located at 1050 Sixth Street, Detroit, MI 48226 contact MITSC Delivery Engineer, Sandy Montes at 313-256-9800.

(1) MITSC Delivery Engineer contact information

Sandy Montes
MITSC Delivery Engineer
Michigan Dept of Transportation
MITS Center
313-256-9800 (Office)
313-220-0102 (Cell)
313-256-9036 (Fax)

(2) Access will be granted during normal business hours Monday – Friday 7:30am to 4:30pm. Minimum of 24 hours advance notice for access to the site.

(3) After hours access coordinated with the Engineer and MITSC Delivery Engineer.

(4) Coordinate with the Engineer, MITS Center Delivery Engineer, and ITS Maintenance Contractor, Steve Crain, Motor City Electric 248-867-4807 for anticipated periods of system downtime that impacts the daily operation of the TMC's.

(a) ITS Maintenance Contractor contact Information:

Steve Crain
Motor City Electric Technologies, Inc.
9440 Grinnell
Detroit, MI 48213
313.921.5300 office
248.867.4807 cell
scrain@mce-tech.com

(b) Initial notification a minimum of five days in advance of downtime.

(c) Additional notification 24 hours prior to the downtime occurring.

(d) Notify Engineer and MITSC Delivery Engineer when the system has been disabled as well as when operation has been restored.

C. State of Michigan Department of Transportation, Julie Townsend, PE who is managing the construction of the new Detroit Integrated Transportation Center (DITC) for purposes of coordinating access to the site, material storage requests, and other logistics associated with the construction of this project. Additionally, Matt Smith, PE may be contacted for access to the DITC site.

(1) Contact Information:

Julie Townsend, P.E.
Office of Operations Administrative Services
Facilities Administration and Operations
Michigan Department of Transportation
7575 Crowner Drive
Lansing, MI 48909
517.322.1663 office
517.242.4938 cell
517.322.1998 fax

Matt Smith, PE PTOE
Metro Region Traffic and Safety Engineer
Michigan Department of Transportation
18101 W. Nine Mile Road
Southfield, MI 48075
248-483-5120 office
248-361-2470 cell
248-569-3103 (Fax)

D. Once ownership of the DITC facility is transferred to the State of Michigan; coordinate with the Engineer and MITSC Delivery Engineer for access to the DITC site, material storage, prior to commencing work which may impact operations, and prior to conducting work which generates noise in excess of a standard office setting. Minimum of 24 hours advance notice.

(2) Once ownership of the facility is transferred to the State of Michigan access will be granted during normal business hours Monday – Friday 7:30am to 4:30pm. Minimum of 24 hours advance notice for access to the site.

(3) After hours access coordinated with the Engineer and MITSC Delivery Engineer.

E. Coordinate with Verizon for the connection, testing, and verification of equipment and fiber optic cable which is utilized by MDOT as their communications backbone and leased from Verizon.

(1) Contact Information:

David Plentz
OSP Coordinator
21500 Melrose Ave.
Southfield, MI 48075
dplentz@gxtltd.com
(248) 936-3411 – Office
(419) 283-6011 – Cell

Please allow a minimum of one (1) week advance notice for coordination activities.

F. Coordinate with the Engineer for the connection, testing, and verification of equipment which utilizes the new ATMS software currently under procurement by the Department.

G. Coordinate with the Engineer, MITS Center Delivery Engineer, and MITS Center ITS Maintenance Contractor for incorporating or adjusting newly installed by ITS field devices that may be added to the ATMS system through other contracts while this project is being constructed. At a minimum, it is anticipated that the following MDOT projects will be underway during the construction which may impact the number and type of devices that the ATMS systems is comprised of:

(1) ITS Integrator: Upgrade of legacy communication infrastructure to 10 GigE backbone and digital wireless linkages encompassing the MITS Center, Hubs (2, 6, 9 & 10) and Nodes (5 & 7). Including the installation of some new ITS devices and an Interim ATMS software.

(2) I-94 Fiber: Upgrade of legacy devices (CCTV, DMS, MVDS) and communication infrastructure on I-94 between Beech Daly & I-96.

(3) I-96/I-696: Upgrade of legacy devices (CCTV, DMS, MVDS) and communication infrastructure on I-96 from I-696 to Warren Rd.

(4) Gateway: Upgrade of legacy devices (CCTV, DMS, MVDS) and communication infrastructure on I-75 between I-96 & Clark St.

(5) Device Upgrade: Early deployment of Interim ATMS software, establishing Ethernet network using DS-3 to Ethernet convertors over SONET, upgrade remaining DMS & CCTV to NTCIP and legacy detection to MVDS, upgrade remaining DMS communication to be able to support protocol translator boxes.

(6) Troy Backfill: Install/upgrade of legacy devices (CCTV, DMS, MVDS) and communication infrastructure on I-75 between M-59 and I-696.

(7) Statewide ATMS software: Installation of a statewide ATMS software platform in the Metro Region.

(8) Curve/Speed Warning Systems: Warning systems and ITS devices being installed on I-75 between 8 Mile Road and Woodward Heights, I75 NB Connector Ramp to I-75 NB at the I-375 junction, I-375 between Lafayette St and St. Antoine St., I-94 and I-96 interchange (EB & WB) and M-5 between 12 Mile Rd. and 13 Mile Rd.

(9) Road Weather Information System (RWIS): Installation of environmental sensor stations (ESS) at various locations around the Metro Region.

H. Coordinate with the Greyhound Bus Station, Dave Evans prior to the performance of any work at the existing MITS Center which may impact the finished interior of the existing facility as well as generate noises above that generated in a standard office setting which may disturb the operations of Greyhound as well as MITSC. Minimum of 24 hours advance notice required.

(1) Greyhound contact Information:

Dave Evans
Greyhound Supervisor
(313) 961-8009
daevans@greyhound.com
Greyhound Desk (313) 961-8558

I. Coordination with the Michigan Department of Technology, Management and Budget (DTMB), William Pemble will be done by the Contractor contacting the MDOT Project Engineer who will coordinate with DTMB for installation and integration of equipment as specified in the contract documents.

J. Contact Michigan Department of Transportation (MDOT), Keith Belonga for coordination of work to be conducted in Room A225 Emergency Operations Center/2nd Floor Conference Room as specified in the contract documents.

(1) MDOT contact Information:

Keith Belonga
Van Wagoner Building
425 W. Ottawa
P.O. Box 30050
Lansing, MI 48933
Phone: 517 – 243-3908
Email:BelongaK@michigan.gov

2. Table 1 and Table 2 on the following pages provide a high level overview of the Technology Equipment and System Responsibilities that will occur during the construction of the MITS Center Interior Fit-Out and System Integration Project.

Table 1 – Technology Equipment and System Responsibility PART 1

MDOT - Technology Equipment & System Responsibility Matrix TMC Interior Fit-Out and ITS System Integration Project								
Equipment Items			**Installer/Integrator**					
X - Has primary responsibility			DTMB / DTMB Vendor	MDOT / MDOT Vendor	MSP / MSP Vendor	DMB Contractor	**CONTRACTOR - This Contract**
Cabling Infrastructure							
- Raceway						X	
- Copper Twisted Pair (UTP), ITS Systems			X				
- Copper Twisted Pair (UTP), MSP Systems					X		
- Copper Twisted Pair (UTP), Non-ITS/non-MSP Systems			X				
- Coax (CATV)			X				
- Fiber, ITS Systems							X
- Fiber, Non-ITS Systems			X				
Rack Assemblies							
- Racks							X
- Wire Managers							X
- Power Distribution Units						X	
- UPSs						X	
Data/Voice Systems							
- Equipment, ITS Systems							
Crystal Reports Server							X
Network Switches			X				
Wireless Access Points			X				
Servers			X				
PC's, Printers for Consoles.			X				
Telephones				X			
- Equipment, MSP Systems					X		
Video Conferencing							
- Raceway							X
- Cabling				X			
- Projection Screen				X			
- Projector Lift and Mounts				X			
- Projector				X			
- Microphones				X			
- Cameras				X			
- Electronics				X			
- Speakers				X			
- Encoders / Decoders				X			
- Crestron Control System				X			
- Crestron Control System				X			
- Other Equipment (matrix switcher, scalar)				X			

Table 2 – Technology Equipment and System Responsibility PART 2

MDOT - Technology Equipment & System Responsibility Matrix TMC Interior Fit-Out and ITS System Integration Project							
Equipment Items			**Installer/Integrator**				
X - Has primary responsibility			DTMB / DTMB Vendor	MDOT / MDOT Vendor	MSP / MSP Vendor	DMB Contractor	**CONTRACTOR - This Contract**
Flat Panel Display Systems							
- Raceway							X
- Backbox							X
- Data Cabling			X				
- Video Cabling							X
- Mounting Assembly							X
- Displays							X
Sound Masking System							
- Raceway							X
- Cabling							X
- Speakers							X
- Equipment							X
Main Control Room Video Wall							
- Raceway							X
- Cabling							X
- Equipment							X
EOC/Conference Room Video Wall							
- Raceway							X
- Cabling				X			
- Equipment				X			
Video Recorder (DVR)							
- Equipment							X
FCP Base Station							
- Equipment			X				
- Cabling			X				
TMC Operator Workstations							
- Equipment			X				
- Cabling			X				
TMC Control Room Printers							
- Equipment			X				
- Cabling			X				

b. Materials. None.

c. Construction. The Contractor shall coordinate with the Engineer for all submittal reviews, proposed installation variations, equipment installation plans, acceptance testing, and integration activities as requested by MDOT and as noted throughout the Plans and Specifications.

d. Measurement and Payment. None.

MICHIGAN
DEPARTMENT OF TRANSPORTATION

PLANS OF PROPOSED

MICHIGAN PROJECT TMC INTERIOR FIT-OUT AND ITS SYSTEM INTEGRATION

CONTROL SECTION 84917

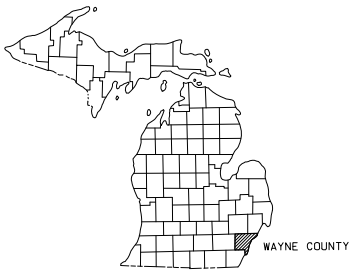
JOB NUMBER 105046A

CITY OF DETROIT

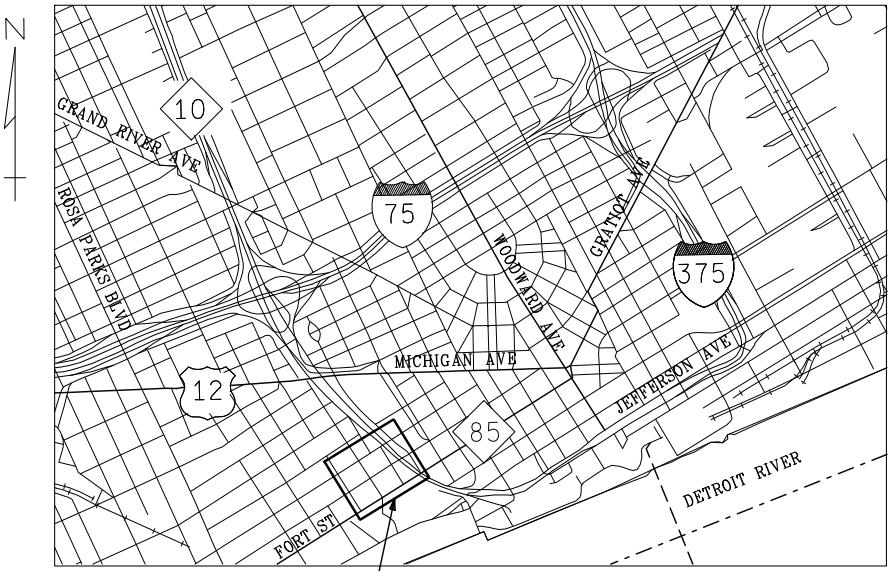
WAYNE COUNTY

THE IMPROVEMENTS COVERED BY THESE PLANS SHALL BE DONE IN ACCORDANCE WITH THE MICHIGAN DEPARTMENT OF TRANSPORTATION 2003 STANDARD SPECIFICATIONS FOR CONSTRUCTION.

PLANS	SHEET NUMBERS



STATE LOCATION MAP



TITLE SHEET LEGEND

PROPOSED PROJECT

EXISTING ROADS
- PAVED
- BITUMINOUS
- GRAVEL
- UNIMPROVED OR CITY STREET

SECTION LINE

TOWNSHIP LINE

COUNTY LINE

CITY OR VILLAGE LIMITS

RAILROADS

CONTRACT FOR: TMC INTERIOR FIT-OUT AND ITS SYSTEM INTEGRATION AT NEW DETROIT INTEGRATED TRANSPORTATION CAMPUS.

THESE PLANS WERE PREPARED FOR THE MICHIGAN DEPARTMENT OF TRANSPORTATION

BY

URS
Surface Transportation
Grand Rapids . Southfield . Traverse City

PB PARSONS BRINCKERHOFF MICHIGAN, INC.

APPROVALS

RECOMMENDED FOR APPROVAL _____ _____
PROJECT MANAGER - MATT SMITH — DATE

RECOMMENDED FOR APPROVAL _____ _____
DELIVERY ENGINEER - MATT SMITH — DATE

MICHIGAN
DEPARTMENT OF TRANSPORTATION
KIRK T. STEUDLE - DIRECTOR

APPROVED BY _____ _____
ENGINEER OF DEVELOPMENT — DATE

MDOT Michigan Department of Transportation

MDOT DESIGN COORDINATOR
MUELLER
DESIGN UNIT

CONTROL SECTION	JOB NUMBER	FEDERAL NUMBERS PROJECT	FEDERAL NUMBERS ITEM	SHEET NO.
84917	105046A			1

CONTROL SECTION — JOB NUMBER: 84917 - 105046A

DATE: $DATE$ CHECKED BY:

DRAWN BY:

FILE NAME: TITLE.DGN

DATE:

ENGINEERING REPORT NO	ENVIRON IMPACT STMT	
METHOD OF SURVEY		YEAR
SURVEY ORDER	SURVEY CHIEF	YEAR
AERIAL SURVEY NO		YEAR
HORIZ DATUM	VERT DATUM	
ROAD DESIGN INITIATED	COMPLETED	
PRELIMINARY PLANS BY	FINAL PLANS BY	
FIELD INSPECTION (GI) BY		DATE
FHWA AREA ENGINEER		

GENERAL PLAN NOTES

UNDERGROUND UTILITIES

FOR PROTECTION OF UNDERGROUND UTILITIES AND IN CONFORMANCE WITH PUBLIC ACT 53, 1974, THE CONTRACTOR SHALL DIAL 1-800-482-7171 A MINIMUM OF THREE FULL WORKING DAYS, EXCLUDING SATURDAYS, SUNDAYS, AND HOLIDAYS PRIOR TO BEGINNING EACH EXCAVATION IN AREAS WHERE PUBLIC UTILITIES HAVE NOT BEEN PREVIOUSLY LOCATED. MEMBERS WILL THUS BE ROUTINELY NOTIFIED. THIS DOES NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY OF NOTIFYING UTILITY OWNERS WHO MAY NOT BE A PART OF "MISS DIG" ALERT SYSTEM.

MDOT'S FREEWAY LIGHTING SYSTEM, MITS/SCANDI SYSTEM, PLD LIGHTING AND TRAFFIC SIGNAL SYSTEM AND OTHER MISCELLANEOUS ELECTRICAL SYSTEMS ARE NOT A PART OF MISS DIG. CONTACT INFORAMTION IS LISTED BELOW FOR EACH, FIFTEEN DAYS ADVANCE NOTICE IS REQUIRED (UNLESS STATED OTHERWISE):

FREEWAY LIGHTING	MDOT REGION OFFICE FREEWAY LIGHTING MAINTENANCE DAVID JOHNS, (248) 483-5125
MITS / SCANDI	MITS CENTER SANDY MONTES (313) 256-9800
LIGHTING AND TRAFFIC SIGNAL CABLE WITHIN CITY OF DETROIT	PUBLIC LIGHTING DEPARTMENT (PLD) CONTROL CENTER (313) 224-0500

IF ANY PART OF MDOT'S FREEWAY LIGHTING SYSTEM, MITS/SCANDI SYSTEM OR OTHER MISCELLANEOUS ELECTRICAL SYSTEMS ARE DAMAGED DURING CONSTRUCTION THE CONTRACTOR SHALL CONTACT THE DESIGNATED MDOT REPRESENTATIVE IMMEDIATELY. IN ADDITION, CALL THE MITS CENTER FREEWAY OPERATIONS AT (313) 965-0777. ANY DAMAGE TO THIS CRITICAL INFRASTRUCTURE SHALL BE REPAIRED IMMEDIATELY BY THE CONTRACTOR CAUSING THE DAMAGE, OR BY ANOTHER CONTRACTOR, AT THE SOLE DISCRETION OF THE MDOT PROJECT MANAGER. ALL COSTS OF THE EMERGENCY REPAIRS SHALL BE PAID BY THE CONTRACTOR RESPONSIBLE FOR THE DAMAGE REGARDLESS OF WHO DOES THE REPAIR.

THE PLANS SHOW THE BEST AVAILABLE UNDERGROUND FACILITIES INFORMATION AS PROVIDED SHALL CHECK THE AREA FOR EVIDENCE OF UNDERGROUND UTILITIES. THE DEPARTMENT WILL NOT BE RESPONSIBLE FOR DAMAGE TO ANY UNDERGROUND FACILITIES CAUSED BY THE CONTRACTOR. THIS WORK WILL NOT BE PAID FOR SEPARATELY. IT SHALL BE CONSIDERED PART OF THE WORK FOR RELATED PAY ITEMS IN THE CONTRACT.

THE TOPOGRAPHY IS DERIVED FROM EXISTING ROADWAY PLANS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONFIRM THE EXISTING CONDITIONS BEFORE SUBMITTING A BID.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR RETURNING ALL AREAS THAT ARE DISTURBED (AS A RESULT OF CONSTRUCTION AND INSTALLATION OF ELEMENTS IN THIS CONTRACT) TO THEIR ORIGINAL STATE WITHIN FIFTEEN DAYS OF COMPLETION OF WORK IN THAT AREA, OR AS DIRECTED BY THE MDOT ENGINEER.

ALL EXISTING SYSTEMS AND INFRASTRUCTURE SHALL ALWAYS BE MAINTAINED IN AN OPERATIONAL CONDITION. ANY PROPOSED DOWNTIME SHALL BE COORDINATED WITH AND APPROVED BY THE MDOT ENGINEER.

SITE PREPARATION IS CONSIDERED INCIDENTAL TO THE PROJECT AND WILL NOT BE PAID FOR SEPARATELY.

THE CONTRACTOR SHALL FIELD VERIFY ALL DEVICE LOCATIONS. THE EXACT LOCATIONS WILL BE CONFIRMED WITH THE MDOT ENGINEER AT THE TIME OF INSTALLATION.

AT ALL LOCATIONS NEW CONDUIT IS NOT SHOWN ON THE PLANS, THE CONTRACTOR SHALL UTILIZE THE EXISTING CONDUIT PATHS.

PULL ROPES SHALL BE INSTALLED IN ALL EMPTY CONDUITS AND CONDUIT DUCTS. PULL ROPES SHALL BE LABELED AT BOTH ENDS.

EQUIPMENT AND MATERIALS SHALL BE SUITABLE FOR THE INTENDED PURPOSE AND SHALL BE FURNISHED WILL ALL NECESSARY HARDWARE AND COMPONENTS.

SPLICES IN CONDUCTORS WILL NOT BE ALLOWED AT ANY LOCATION IN THE POWER SYSTEM, UNLESS OTHERWISE NOTED.

THE REPLACEMENT OF ANY CABLE, CONDUIT, OR BOTH, SHALL INCLUDE REMOVAL OF THE REPLACED CABLE, CONDUIT, OR BOTH AT NO ADDITIONAL COST.

THE CONTRACTOR SHALL PROPERLY GROUND ALL EQUIPMENT AND GROUND RODS PER ALL APPLICABLE STANDARDS, MANUFACTURER SPECIFICATIONS, OR AS DIRECTED BY THE MDOT ENGINEER.

THE CONTRACTOR SHALL DETERMINE THE FINAL LOCATIONS OF CONDUIT RUNS AND HANDHOLE LOCATIONS BASED ON ACTUAL FIELD CONDITIONS AT THE TIME OF INSTALLATION TO ASSURE NO CONFLICTS WITH OTHER SYSTEMS BEING INSTALLED OR EXISTING UTILITIES. THE CONTRACTOR SHALL REVIEW SUGGESTED LOCATION CHANGES WITH THE ENGINEER FRO APPROVAL BEFORE INSTALLATION.

GENERAL PLAN NOTES (CONT)

THE MINIMUM DEPTH FOR COMMUNICATION CABLES SHALL BE 24 INCHES. THE MINIMUM DEPTH FOR POWER CABLES SHALL BE 30 INCHES.

MINIMUM HORIZONTAL AND VERTICAL CLEARANCES MUST BE MAINTAINED TO PROPOSED AND EXISTING UTILITIES/FACILITIES AND FOLLOW LOCAL/NATIONAL CODES AND/OR AS DIRECTED BY THE MDOT ENGINEER.

CONNECTING PROPOSED CONDUITS TO EXISTING CONDUITS WILL BE INCLUDED IN THE PAY ITEMS FOR NEW CONDUIT INSTALLATION AND WILL NOT BE PAID FOR SEPARATELY. NEW CONDUITS BROKEN INTO EXISTING MANHOLES OR HANDHOLES SHALL NOT INTERFERE WITH EXISTING CABLING/SYSTEMS INSIDE.

SPLICING OF NEW CABLES TO EXISITNG CABLES IS TO BE INCLUDED IN THE PAY ITEMS FOR NEW CABLE INSTALLATION. BY THE UTILITY COMPANIES.

CONTRACTOR TO PROVIDE TWO ON-SITE TEMPORARY OFFICE WORKSPACES FOR THE MDOT PROJECT MANAGER TO SIT AT AND WORK BY LAPTOPS. EACH WORKSPACE MUST BE 96" X 96" WITH A WORK SURFACE OF 60"W X 30"D AND OFFICE GRADE SEATING AND LIGHTING. CONTRACTOR TO PROVIDE TWO CELLULAR BASED WIRELESS NETWORK CARDS TO BE USED IN THE MDOT LAPTOPS FOR THE DURATION OF THE PROJECT. CONFIGURATION OF THE NETWORK CARDS AND CONNECTION TO THE MDOT NETWORKS WILL BE COORDINATED WITH MDIT.

CONTRACTOR TO PROVIDE ROOFTOP WIRELESS CONNECTION TO MDOT ITS SYSTEM USING A SP2-5.2 (RADIO WAVES 2FT PARABOLIC DISH) ANTENNA WITH RADOME COVER MOUNTED TO A NON-PENETRATING ROOFTOP MOUNT. ANY ROOFTOP PENETRATIONS ARE TO FOLLOW THE WARRANTY REQUIREMENTS OF THE ROOF FOR THIS FACILITY. CONTRACTOR TO COORDINATE THE FINAL LOCATION OF THE ANTENNA/ROOF MOUNT AND ROOF PENETRATION WITH OWNER. COST AND MISCELLANEOUS ITEMS NEEDED TO COMPLETE THIS WORK SHALL BE INCLUDED IN THE PRICE AND NO ADDITIONAL COMPENSTION WILL BE PROVIDED.

UTILITIES

EXISTING UTILITIES ARE SHOWN ON THE PLANS IN ACCORDANCE WITH THE BEST INFORMATION AVAILABLE. THIS INFORMATION DOES NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY TO BE SATISFIED AS TO ITS ACCURACY AND THE LOCATION OF EXISTING UTLITITES. UTLITIES TO BE CONTAINEDWITH REGARD TO POSSIBLE CONFLICT WITH WORK HEREIN ARE LISTED BELOW:

NAME OF UTILITY/OWNER

AT & T (LNS)
ATTENTION: DALE DEFEVER
1000 TOWN CENTER, SUITE 150
SOUTHFIELD, MI 48075
E-MAIL: DALEDEFEVER@ATT.COM
PHONE: 248-204-0126 FAX: 248-204-0329 CELL: 586-242-2671

AT & T
ATTENTION: NANCY FAVOR
31100 PLYMOUTH ROAD, ROOM 301
LIVONIA, MI 48150
PHONE: 734-523-6884 FAX: 734-523-0802

CITY OF DETROIT
ATTENTION: BHARAT DOSHI
HEAD ENGINEER OF WATER SYSTEMS
DETROIT WATER & SEWERAGE DEPARTMENT
DETROIT DESIGN SECTION
JULIAN MADISON BUILDING, 6TH FLOOR
1420 WASHINGTON BLVD.
DETROIT, MI 48226- 1718
PHONE: 313-967-1541 FAX: 313-964-9810

ATTENTION: RAMESH SHUKLA
GENERAL SUPERINTENDENT
DETROIT WATER & SEWERAGE DEPARTMENT
JULIAN MADISON BUILDING, 5TH FLOOR
1420 WASHINGTON BLVD.
DETROIT, MI 48226- 1718
PHONE: 313-964-9894

CITY OF DETROIT
PUBLIC LIGHTING DEPARTMENT
ATTENTION: DAVID GRAHAM
9449 GRINNELL AVENUE
DETROIT, MI 48213
PHONE: 313-267-5156 FAX: 313-267-8153

COMCAST CABLEVISION OF DETROIT
ATTENTION: BENE CUMMINGS
12775 LYNDON
DETROIT, MI 48227
PHONE: 313-646-4247 FAX: 313-646-4378

DETROIT EDISON CO.
PROJECT MANAGEMENT
ATTENTION: ANJANETTE BORAWSKI
ONE ENERGY PLAZA, ROOM 577 SB
DETROIT, MI 48226-1221
PHONE: 313-235-9284 FAX: 313-235-6569

DTE ENERGY / MICHCON GAS
ENGINEERING & CONSTRUCTION
ATTENTION: DISTRIBUTION DRAFTING CLERK
3200 HOBSON
DETROIT, MI 48201
PHONE: 313-577-7327 FAX: 313-577-7061

ITC HOLDINGS CORP.
ATTENTION: ERIN KEELER
27175 ENERGY WAY
NOVI, MI 48377
PHONE: 248-946-3298 FAX: 248-946-3229

LIGHTCORE, A CENTURYTEL COMPANY
ATTENTION: KIRK THOELKE
MAIL STOP W2M5
1151 CENTURYTEL DRIVE BLDG. A
WENTZVILLE, MO 63385
PHONE: 636-887-4752 FAX: 636-887-4772 CELL: 314-495-6318

MCI WORLDCOM
ATTENTION: DAVE PLENTZ
21500 MELROSE
SOUTHFIELD, MI 48075
E-MAIL: DPLENTZ@GXTLTD.COM
PHONE: 248-936-3411 FAX: 248-936-3488 CELL: 419-283-6011

NAME OF UTILITY/OWNER

MITSC
METRO REGION OFFICE
ATTENTION: MATT SMITH, REGION T & S ENGINEER
18101 W. NINE MILE ROAD
SOUTHFIELD, MI 48075
PHONE: 248-483-5120 FAX: 248-569-3103

DATE:
WORKED ON BY:
DATE:
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FILE NAME: NOTE SHEET.DGN

URS Surface Transportation
Grand Rapids . Southfield . Traverse City

PB 1902 2002 100 YEARS
PARSONS BRINCKERHOFF, INC.
500 GRISWOLD, SUITE 2900
DETROIT, MICHIGAN 48226
313-963-5760

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NOTE SHEET

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WATER & DRAINAGE SYMBOLS

- EXISTING SANITARY CATCH BASIN
- EXISTING SANITARY CATCH BASIN LEFT
- EXISTING STORM CATCH BASIN
- EXISTING STORM CATCH BASIN LEFT
- PROPOSED SANITARY CATCH BASIN
- PROPOSED SANITARY CATCH BASIN LEFT
- PROPOSED STORM CATCH BASIN
- PROPOSED STORM CATCH BASIN LEFT
- SANITARY SEWER MANHOLE
- PROPOSED SANITARY SEWER MANHOLE
- STORM SEWER MANHOLE
- PROPOSED STORM SEWER MANHOLE
- EXISTING MANHOLE - UNIVERSAL
- PROPOSED MANHOLE - UNIVERSAL
- EXISTING CULVERT END SECTION
- PROPOSED CULVERT END SECTION
- EXISTING HEADWALL
- PROPOSED HEADWALL
- WATER SHUT OFF
- WATER GATE VALVE
- WATER GATE WELL
- WATER METER
- WATER MANHOLE
- WATER WELL
- EXISTING FIRE HYDRANT
- PROPOSED FIRE HYDRANT
- RIVER BOTTOM

- ADJ-HYD — ADJUST FIRE HYDRANT
- ADJ — ADJUST DRAINAGE STRUCTURE
- ADJ- — ADJUST DRAINAGE STRUCTURE W/COVER
- ADJ-B/O — ADJUST DRAINAGE STRUCTURE BY OTHERS
- REL-B/O — RELOCATE - BY OTHERS
- SR- — SIDEWALK RAMP TYPE
- CHECK DAM (PROFILES)
- DIKE (PROFILES)
- H.W.T. — WATER TABLE (PROFILES)

REAL ESTATE SYMBOLS

- PROPERTY OWNERSHIP ARROW
- CONTIGUOUS PROPERTY SYMBOL
- 123456 — PARCEL NUMBER BOX
- PARCEL LINES

UTILITIES SYMBOLS

- POWER POLE
- GUY POLE
- LIGHT POLE
- LIGHT STANDARD
- POWER AND LIGHT POLE
- TELEPHONE POLE
- TELEPHONE MANHOLE
- TELEPHONE PEDESTAL
- WALK NO-WALK SIGN
- GAS LINE MARKER
- GAS VALVE
- GAS FILLER PIPE
- GAS WELL
- OIL WELL
- PETROLEUM MARKER
- FIBER OPTIC MARKER
- ELECTRIC MANHOLE
- ELECTRIC HANDHOLE
- PHONE OR CALL BOX
- MAIL BOX
- DEADMAN FOR GUYWIRE
- RAILROAD SWITCH BOX
- R R — FLASHING RAILROAD SIGN
- POWER TOWER

MISCELLANEOUS SYMBOLS

- PINE TREE
- TREE
- RIPRAP
- SIGN
- SIGN2
- STUMP
- SWAMP
- VERTICAL CONTROL POINT
- SECTION CORNER
- 16TH CORNER
- QUARTER CORNER
- HALF QUARTER CORNER
- ROW MARKER
- PROPERTY CORNER
- REFERENCE POINT
- REFERENCE MARKER
- T.H.# — TEST HOLE NO.
- 123 — BEAM G. R. RUN NUMBER (EXISTING)
- BEAM G. R. RUN NUMBER (PROPOSED)

HAZARDOUS OR FLAMMABLE MATERIAL — USED WITH UNDERGROUND GAS & ELECTRICAL LINES

CAUTION - CRITICAL UNDERGROUND UTILITY — USED WITH UNDERGROUND TELEPHONE & FIBER OPTICS LINES

PROPOSED CULVERT/SEWER

EXISTING CULVERT/SEWER

ITS PATTERNS & SYMBOLS

- DEMARCATION ROOM
- 7-0 — FIELD EQUIPMENT CABINET (MDOT/MITS)
- EXISTING HAND HOLE
- EXISTING HAND HOLE
- PROPOSED HAND HOLE
- LOOP DETECTORS
- EXISTING ITS CONDUIT
- NEW ITS CONDUIT

R.O.W. PATTERNS

- EX. LIMITED ACCESS R.O.W.
- EXISTING R.O.W.
- PROP LIMITED ACCESS R.O.W.
- PROP FREE ACCESS R.O.W.
- SECTION LINE

TOPO PATTERNS

- HEDGE LINE
- TREE LINE
- EXISTING GUARD RAIL
- PROPOSED GUARD RAIL
- EXISTING DRAINAGE CRS EDGE OF WATER
- PROPOSED DRAINAGE CRS EDGE OF WATER
- WETLANDS AREA
- CITY LIMITS
- RAILROAD
- SOUND ABATEMENT WALL
- CONCRETE MEDIAN BARRIER
- SLOPE STAKE LINE

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PLAN SHEET DRIVE/APPROACH LEGEND

- CONCRETE
- HMA
- AGGREGATE

PLAN SHEET REMOVAL LEGEND

- REMOVING HMA
- REMOVING SIDEWALK
- REMOVING PAVEMENT
- COLD-MILLING HMA
- HMA BASE CRUSH & SHAPE
- REMOVING CURB, GUTTER AND CURB & GUTTER
- REMOVING ---------- (R)
- ABANDONING ---------- (A)
- SAVE ---------- (S)
- BULKHEAD ---------- (B)
- CLEARING ---------- (C)

TYPICAL CROSS SECTION LEGEND

- REMOVAL OF PAVEMENT, CURB & GUTTER, SIDEWALK AND COLD MILLING
- CRUSH & SHAPE & RUBBLIZE
- HMA TOP COURSE & WEDGING
- HMA LEVELING COURSE
- HMA BASE COURSE
- AGGREGATE, SUBBASE, SIDEWALK, CURB & GUTTER, BARRIER AND VALLEY GUTTER
- CONCRETE PAVEMENT & SHOULDERS

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DATE:

CHECKED BY:

FILE NAME: LEGEND.DGN

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PB — PARSONS BRINCKERHOFF, INC. 500 GRISWOLD, SUITE 2800 DETROIT, MICHIGAN 48226 313-963-5760

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LEGEND SHEET

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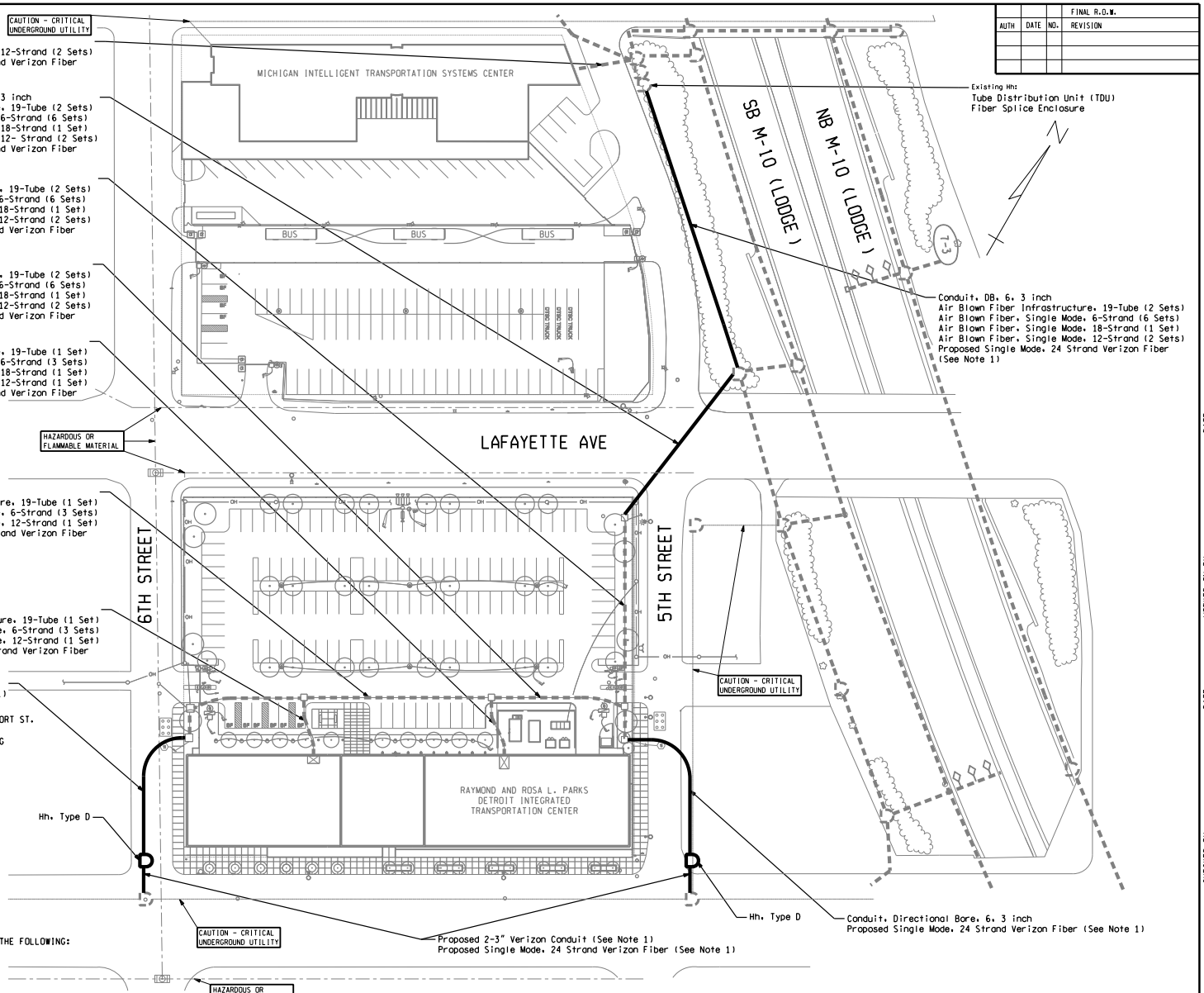

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CONTRACTOR NOTES:

1. VERIZON MUST PERFORM CONNECTION INTO MDOT HANDHOLE(S) FROM VERIZON HANDHOLE(S) ALONG FORT ST. ALL NEW ATMS NETWORK FIBER MUST BE PROVIDED, INSTALLED AND FUSION SPLICED (AS APPLICABLE) BY VERIZON (FORMERLY MCI). THE CONTRACTOR'S BID MUST INCLUDE ALL VERIZON COSTS (INCLUDING BUT NOT LIMITED TO LABOR, MATERIAL AND TESTING).

2. EXISTING CONDUIT, ABF INFRASTRUCTURE AND FIBER CABLE:

SOUTH OF THE MITS CENTER, THE EXISTING NORTHBOUND CONDUIT (2-3") CONTAINS THE FOLLOWING:
- AIR BLOWN FIBER INFRASTRUCTURE (ABF), 7-TUBE
  - TUBE 1 CONTAINS ABF FIBER, SINGLE MODE, 6-STRAND
  - TUBE 2 CONTAINS ABF FIBER, SINGLE MODE, 18-STRAND

SOUTH OF THE MITS CENTER, THE EXISTING SOUTHBOUND CONDUIT (2-3") CONTAINS THE FOLLOWING:
- VERIZON LEASED SINGLE MODE 24 STRAND FIBER
- AIR BLOWN FIBER INFRASTRUCTURE (ABF), 7-TUBE
  - TUBE 1 CONTAINS ABF FIBER, SINGLE MODE, 6-STRAND

NORTH OF THE MITS CENTER, THE EXISTING NORTHBOUND CONDUIT (2-3") CONTAINS THE FOLLOWING:
- AIR BLOWN FIBER INFRASTRUCTURE (ABF), 7-TUBE
  - TUBE 1 CONTAINS ABF FIBER, SINGLE MODE, 6-STRAND

NORTH OF THE MITS CENTER, THE EXISTING SOUTHBOUND CONDUIT (2-3") FROM THE NORTH CONTAINS THE FOLLOWING:
- AIR BLOWN FIBER INFRASTRUCTURE (ABF), 7-TUBE
  - TUBE 1 CONTAINS ABF FIBER, SINGLE MODE, 6-STRAND
  - TUBE 2 CONTAINS ABF FIBER, SINGLE MODE, 6-STRAND

- AIR BLOWN FIBER INFRASTRUCTURE (ABF), 7-TUBE
  - TUBE 1 CONTAINS ABF FIBER, SINGLE MODE, 6-STRAND

3. COUPLE ABF TUBES, AIR TIGHT USING CLEAR TUBING. CAP ENDS OF UNUSED ABF TUBES.

4. CONTRACTOR TO RESTORE SITES TO ORIGINAL CONDITIONS AS APPROVED BY THE MDOT ENGINEER.

PARSONS BRINCKERHOFF, INC.
500 GRISWOLD, SUITE 2900
DETROIT, MICHIGAN 48226
313-963-5760

MDOT Michigan Department of Transportation

TMC CONSTRUCTION

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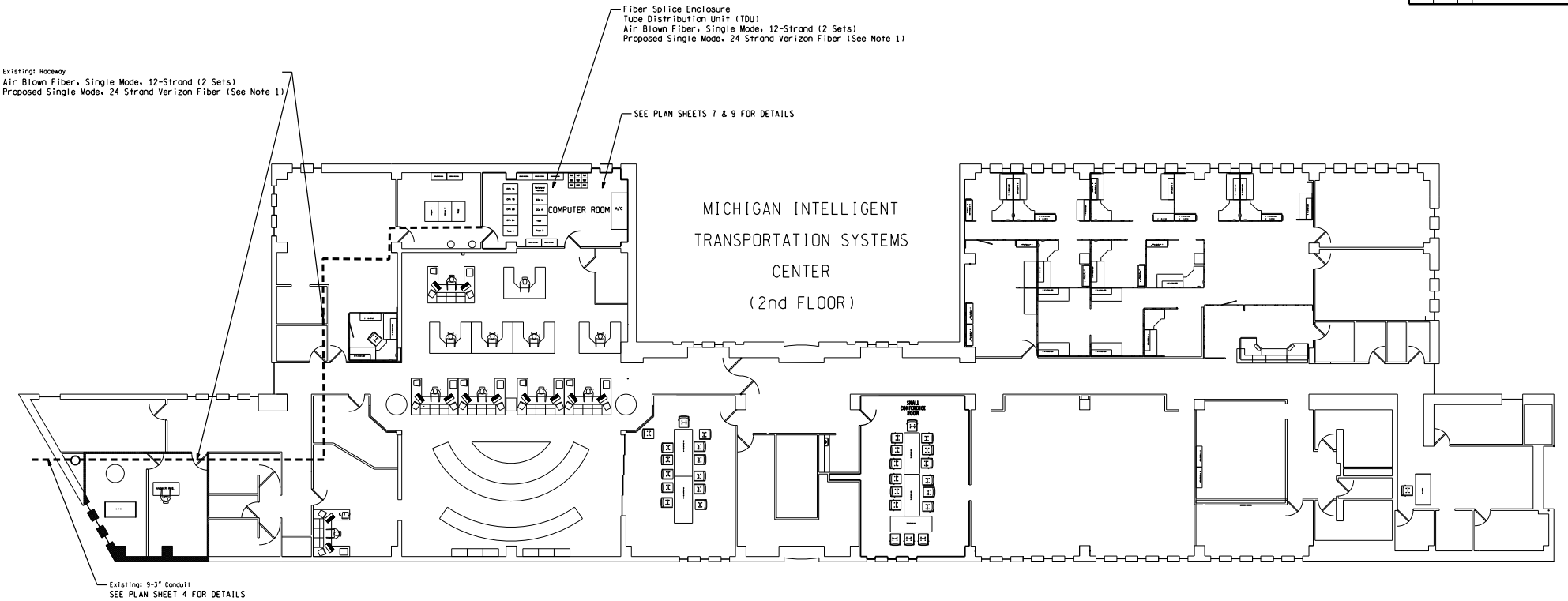

CONTRACTOR NOTES:

1. ALL NEW ATMS NETWORK FIBER MUST BE PROVIDED, INSTALLED AND FUSION SPLICED (AS APPLICABLE) BY VERIZON (FORMERLY MCI). THE CONTRACTOR'S BID MUST INCLUDE ALL VERIZON COSTS (INCLUDING BUT NOT LIMITED TO LABOR, MATERIAL AND TESTING).

2. THE EXISTING CONDUIT (9-3") CONTAINS THE FOLLOWING:
 - AIR BLOWN FIBER INFRASTRUCTURE (ABF), 7-TUBE
 - TUBE 1 CONTAINS ABF FIBER, SINGLE MODE, 6-STRAND
 - TUBE 2 CONTAINS ABF FIBER, SINGLE MODE, 18-STRAND

 - AIR BLOWN FIBER INFRASTRUCTURE (ABF), 7-TUBE
 - TUBE 1 CONTAINS ABF FIBER, SINGLE MODE, 6-STRAND

 - AIR BLOWN FIBER INFRASTRUCTURE (ABF), 7-TUBE
 - TUBE 1 CONTAINS ABF FIBER, SINGLE MODE, 6-STRAND

 - AIR BLOWN FIBER INFRASTRUCTURE (ABF), 7-TUBE
 - TUBE 1 CONTAINS ABF FIBER, SINGLE MODE, 6-STRAND
 - TUBE 2 CONTAINS ABF FIBER, SINGLE MODE, 6-STRAND

 - AIR BLOWN FIBER INFRASTRUCTURE (ABF), 7-TUBE
 - TUBE 1 CONTAINS ABF FIBER, SINGLE MODE, 6-STRAND

3. COUPLE ABF TUBES, AIR TIGHT USING CLEAR TUBING. CAP ENDS OF UNUSED ABF TUBES.

N.T.S.

PARSONS BRINCKERHOFF, INC.
500 GRISWOLD, SUITE 2900
DETROIT, MICHIGAN 48226
313-963-5760

MDOT Michigan Department of Transportation

MITS CENTER (2ND FLOOR)

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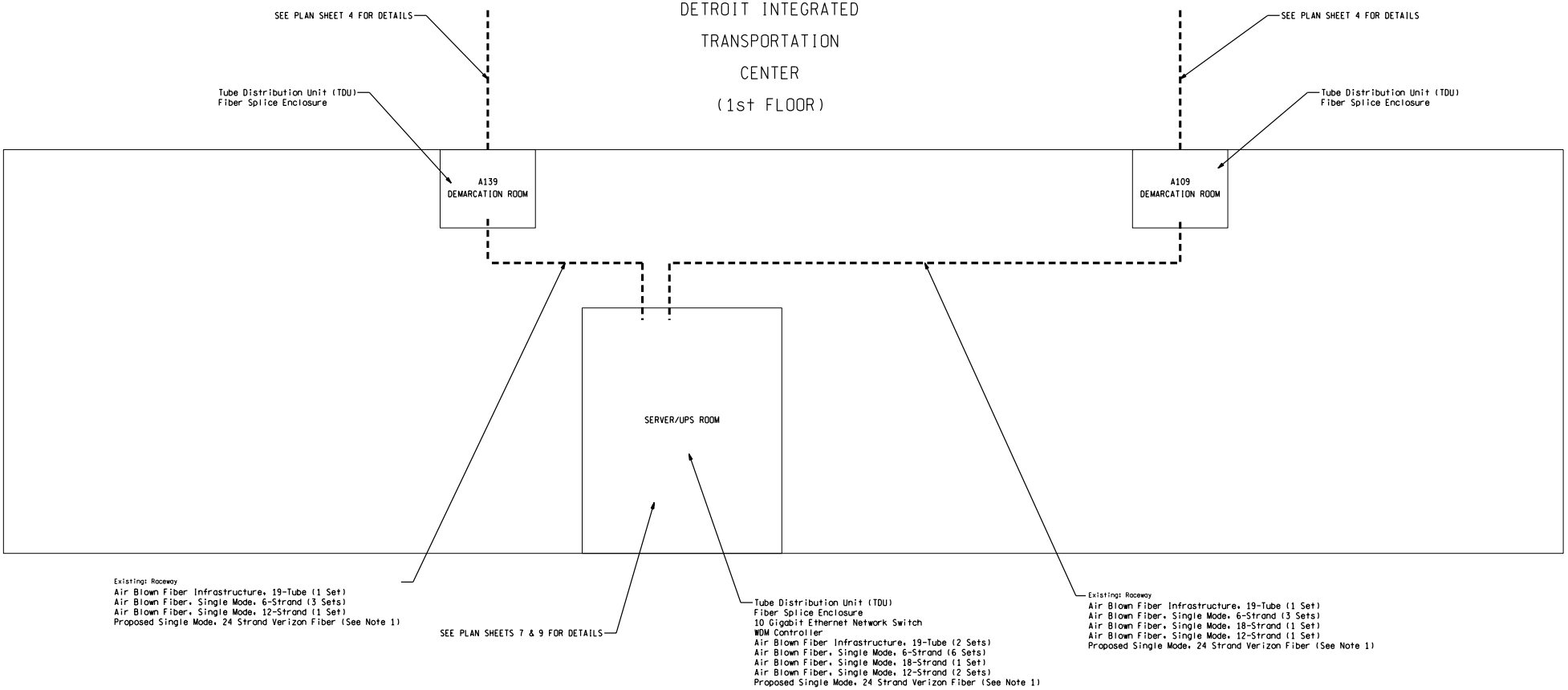
RAYMOND AND ROSA L. PARKS DETROIT INTEGRATED TRANSPORTATION CENTER (1st FLOOR)



CONTRACTOR NOTES:

1. ALL NEW ATMS NETWORK FIBER MUST BE PROVIDED, INSTALLED AND FUSION SPLICED (AS APPLICABLE) BY VERIZON (FORMERLY MCI). THE CONTRACTOR'S BID MUST INCLUDE ALL VERIZON COSTS (INCLUDING BUT NOT LIMITED TO LABOR, MATERIAL AND TESTING).

2. COUPLE ABF TUBES, AIR TIGHT USING CLEAR TUBING. CAP ENDS OF UNUSED ABF TUBES.

N.T.S.

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INTEGRATED TRANSPORTATION CENTER (1ST FLOOR)					
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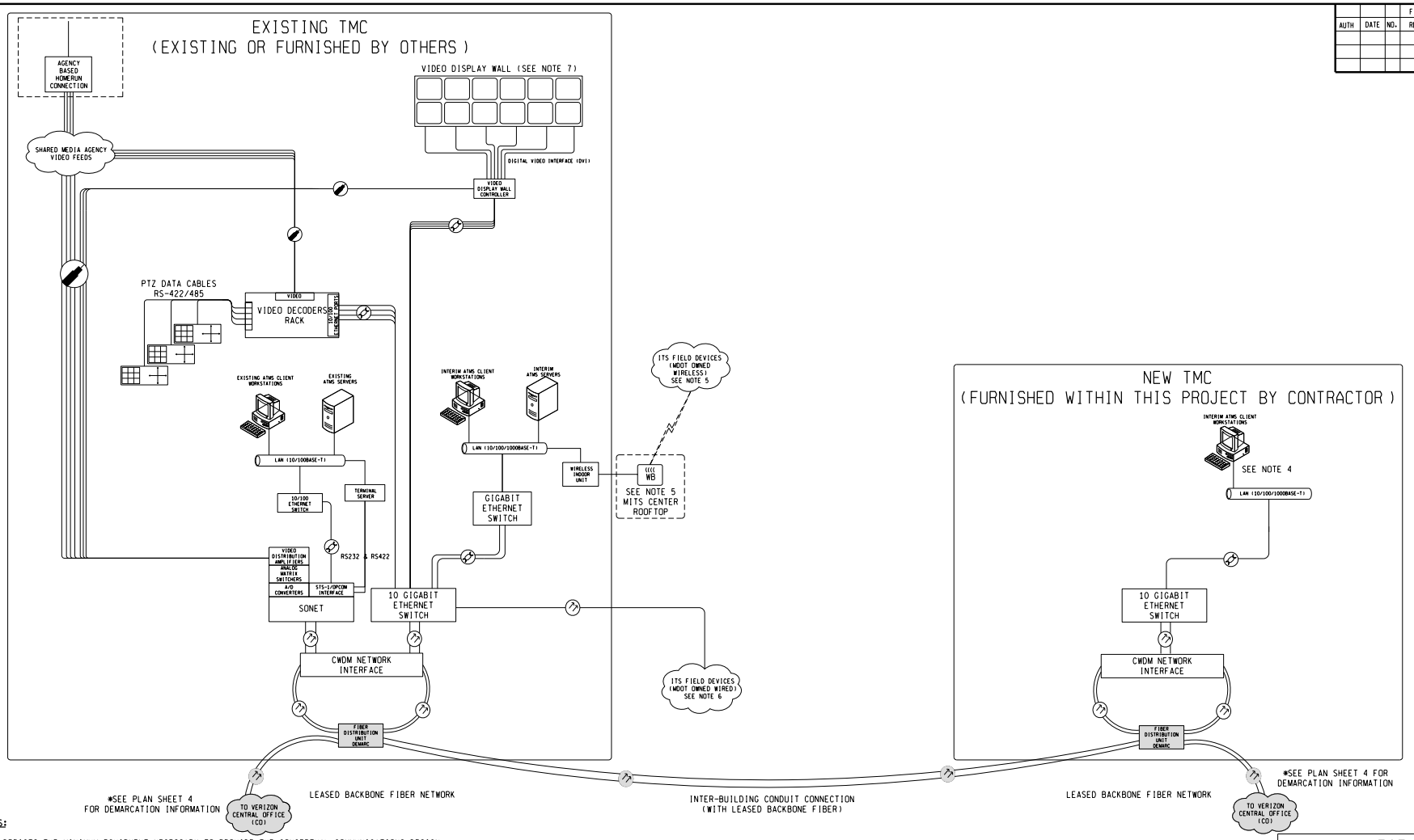

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CONTRACTOR NOTES:

1. THIS DIAGRAM DEPICTS THE MINIMUM EQUIPMENT NECESSARY TO PROVIDE THE CONCEPTUAL COMMUNICATIONS DESIGN. ACTUAL EQUIPMENT AND SITE SPECIFIC DETAILS MAY CHANGE BASED ON THE TYPE OF EQUIPMENT THE CONTRACTOR SUBMITS. THE CONTRACTOR IS REQUIRED TO PROVIDE A CONNECTIVITY DIAGRAM THAT ILLUSTRATES IN DETAIL THE CONTRACTOR'S PROPOSED EQUIPMENT AND CONNECTIONS THAT CORRESPONDS WITH THIS CONCEPTUAL DESIGN.

2. THE COMMUNICATIONS INFRASTRUCTURE WILL HAVE A CONNECTION INTO THE EXISTING, INTERIM AND STATEWIDE MDOT ADVANCED TRAFFIC MANAGEMENT SYSTEM (ATMS), WHICH WILL BE USED TO COMMAND AND CONTROL THE ITS FIELD DEVICES.

3. COORDINATION WITH MDOT PROJECTS WILL BE REQUIRED FOR COMPLETE INTEGRATION AND CONFIGURATION. ANY INTEGRATION WORK MUST BE COORDINATED WITH THE MDOT ENGINEER AND OR THEIR REPRESENTATIVE.

4. AS PART OF SYSTEM ACCEPTANCE TESTING AND PRIOR TO TRANSITIONING INTO PHASE II, THE CONTRACTOR MUST SUCCESSFULLY TEST, DEMONSTRATE AND VALIDATE OPERATIONAL STATUS OF ALL SYSTEMS IN THE EXISTING AND NEW TMCS. TESTING, DEMONSTRATION AND VALIDATION OF OPERATIONAL STATUS FROM THE NEW TMC CAN BE ACHIEVED WITH EXISTING CLIENT WORKSTATIONS.

5. MDOT OWNED WIRELESS COMMUNICATION LINKAGES ARE REQUIRED TO BE RELOCATED TO THE NEW TMC AS SHOWN IN THE PLANS.

6. MDOT OWNED WIRED COMMUNICATION LINKAGES ARE REQUIRED TO BE RELOCATED TO THE NEW TMC AS SHOWN IN THE PLANS.

7. THE EXISTING VIDEO WALL WILL BE RELOCATED TO THE NEW TMC UNDER PHASE II AND AS DESCRIBED IN THE VIDEO WALL RELOCATION AND NEW INSTALLATION SPECIAL PROVISION.

N.T.S.

LEGEND:

- WB — WIRELESS BRIDGE
- 10/100/1000 MBPS TWISTED PAIR LINE TAG (PROVIDED BY OTHERS IN NEW TMC)
- COAXIAL LINE TAG
- SINGLE MODE FIBER OPTIC LINE TAG
- ITEMS PROVIDED BY VERIZON OR EXISTING

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ATMS NETWORK/SYSTEM CONCEPTUAL DIAGRAM (PHASE I)

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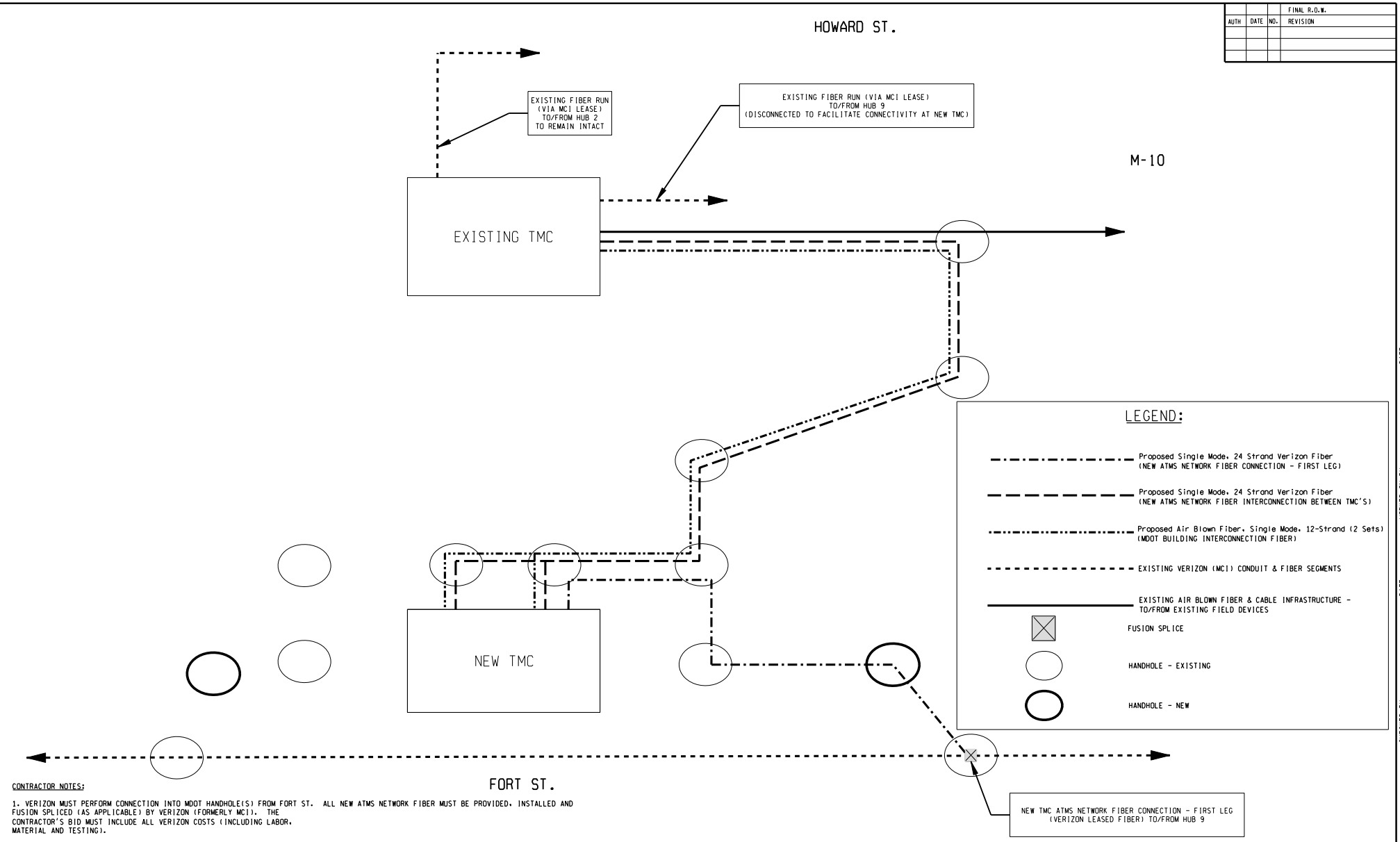

CONTRACTOR NOTES:

1. VERIZON MUST PERFORM CONNECTION INTO MDOT HANDHOLE(S) FROM FORT ST. ALL NEW ATMS NETWORK FIBER MUST BE PROVIDED, INSTALLED AND FUSION SPLICED (AS APPLICABLE) BY VERIZON (FORMERLY MCI). THE CONTRACTOR'S BID MUST INCLUDE ALL VERIZON COSTS (INCLUDING LABOR, MATERIAL AND TESTING).

2. ALL WORK MUST BE COMPLETED WITHOUT ANY DISRUPTION TO EXISTING SYSTEMS OR OPERATIONS.

N.T.S.

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FIBER CONNECTION DETAILS (PHASE I)

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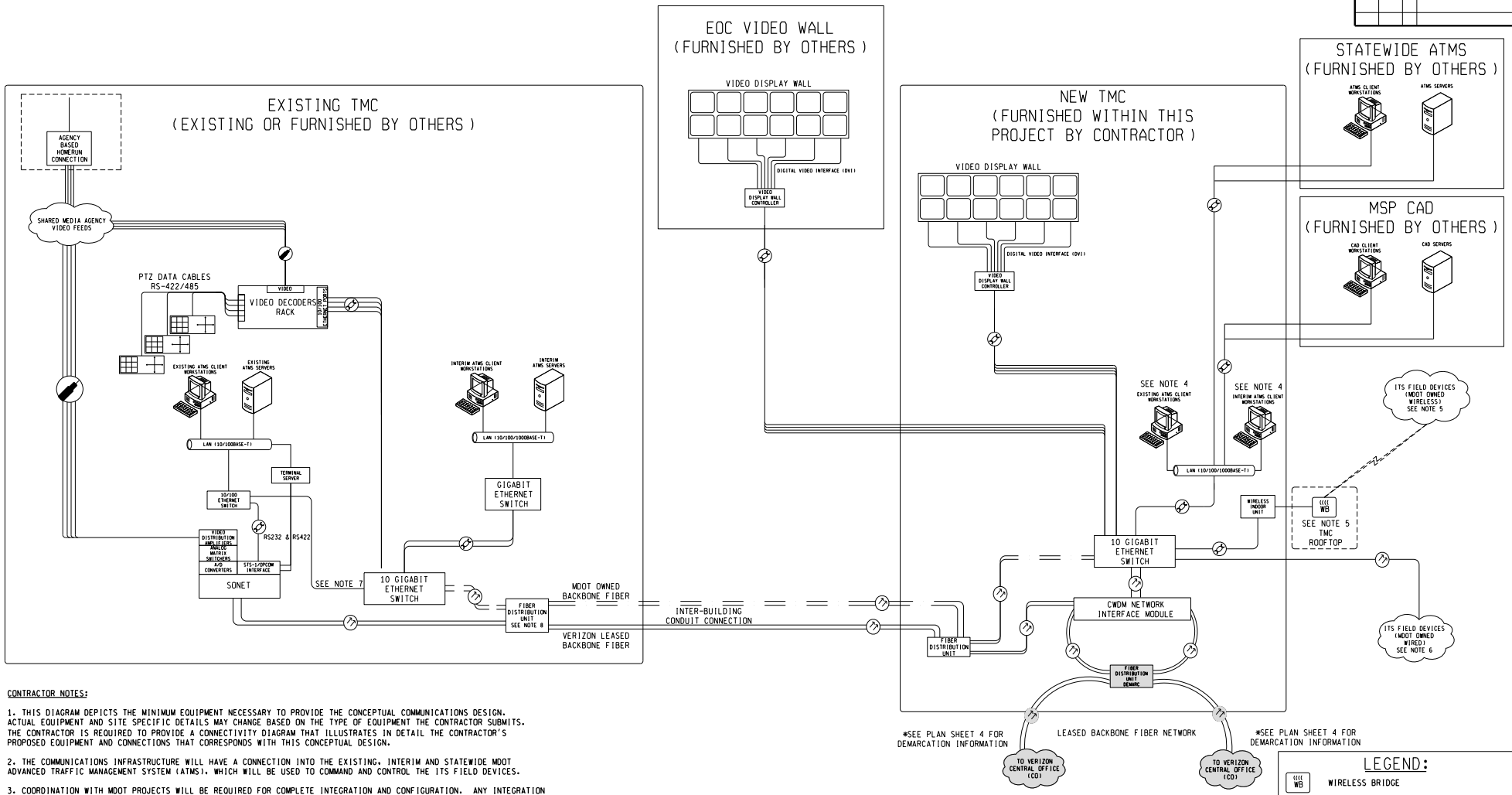
03/26/10	84917	105046A	MUELLER		8

AUTH	DATE	NO.	REVISION
			FINAL R.O.W.



CONTRACTOR NOTES:

1. THIS DIAGRAM DEPICTS THE MINIMUM EQUIPMENT NECESSARY TO PROVIDE THE CONCEPTUAL COMMUNICATIONS DESIGN. ACTUAL EQUIPMENT AND SITE SPECIFIC DETAILS MAY CHANGE BASED ON THE TYPE OF EQUIPMENT THE CONTRACTOR SUBMITS. THE CONTRACTOR IS REQUIRED TO PROVIDE A CONNECTIVITY DIAGRAM THAT ILLUSTRATES IN DETAIL THE CONTRACTOR'S PROPOSED EQUIPMENT AND CONNECTIONS THAT CORRESPONDS WITH THIS CONCEPTUAL DESIGN.

2. THE COMMUNICATIONS INFRASTRUCTURE WILL HAVE A CONNECTION INTO THE EXISTING, INTERIM AND STATEWIDE MDOT ADVANCED TRAFFIC MANAGEMENT SYSTEM (ATMS), WHICH WILL BE USED TO COMMAND AND CONTROL THE ITS FIELD DEVICES.

3. COORDINATION WITH MDOT PROJECTS WILL BE REQUIRED FOR COMPLETE INTEGRATION AND CONFIGURATION. ANY INTEGRATION WORK MUST BE COORDINATED WITH THE MDOT ENGINEER AND OR THEIR REPRESENTATIVE.

4. AS PART OF SYSTEM ACCEPTANCE TESTING AND PRIOR TO TRANSITIONING INTO PHASE II, THE CONTRACTOR MUST SUCCESSFULLY TEST, DEMONSTRATE AND VALIDATE OPERATIONAL STATUS OF ALL SYSTEMS IN THE EXISTING AND NEW TMCS. TESTING, DEMONSTRATION AND VALIDATION OF OPERATIONAL STATUS FROM THE NEW TMC CAN BE ACHIEVED WITH EXISTING CLIENT WORKSTATIONS.

5. MDOT OWNED WIRELESS COMMUNICATION LINKAGES ARE REQUIRED TO BE RELOCATED TO THE NEW TMC AS SHOWN IN THE PLANS.

6. MDOT OWNED WIRED COMMUNICATION LINKAGES ARE REQUIRED TO BE RELOCATED TO THE NEW TMC AS SHOWN IN THE PLANS.

7. CONNECTION BETWEEN EXISTING ATMS LAN AND INTERIM ATMS WAN MUST BE ESTABLISHED TO ENABLE ACCESS TO THE EXISTING ATMS PLATFORM IN THE NEW TMC FOR SYSTEM TESTING, DEMONSTRATION, VALIDATION AND USE.

8. THE TUBE DISTRIBUTION UNIT (TDU) IN THE EXISTING TMC WILL BE PROVIDED WITHIN THIS PROJECT.

N.T.S.

PARSONS BRINCKERHOFF, INC.
500 GRISWOLD, SUITE 2900
DETROIT, MICHIGAN 48226
313-963-5760

MDOT Michigan Department of Transportation

ATMS NETWORK/SYSTEM CONCEPTUAL DIAGRAM (PHASE II)

DATE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO. R.O.W.	SHEET NO. CONST.
03/26/10	84917	105046A	MUELLER		9

DATE:
WORKED ON BY:
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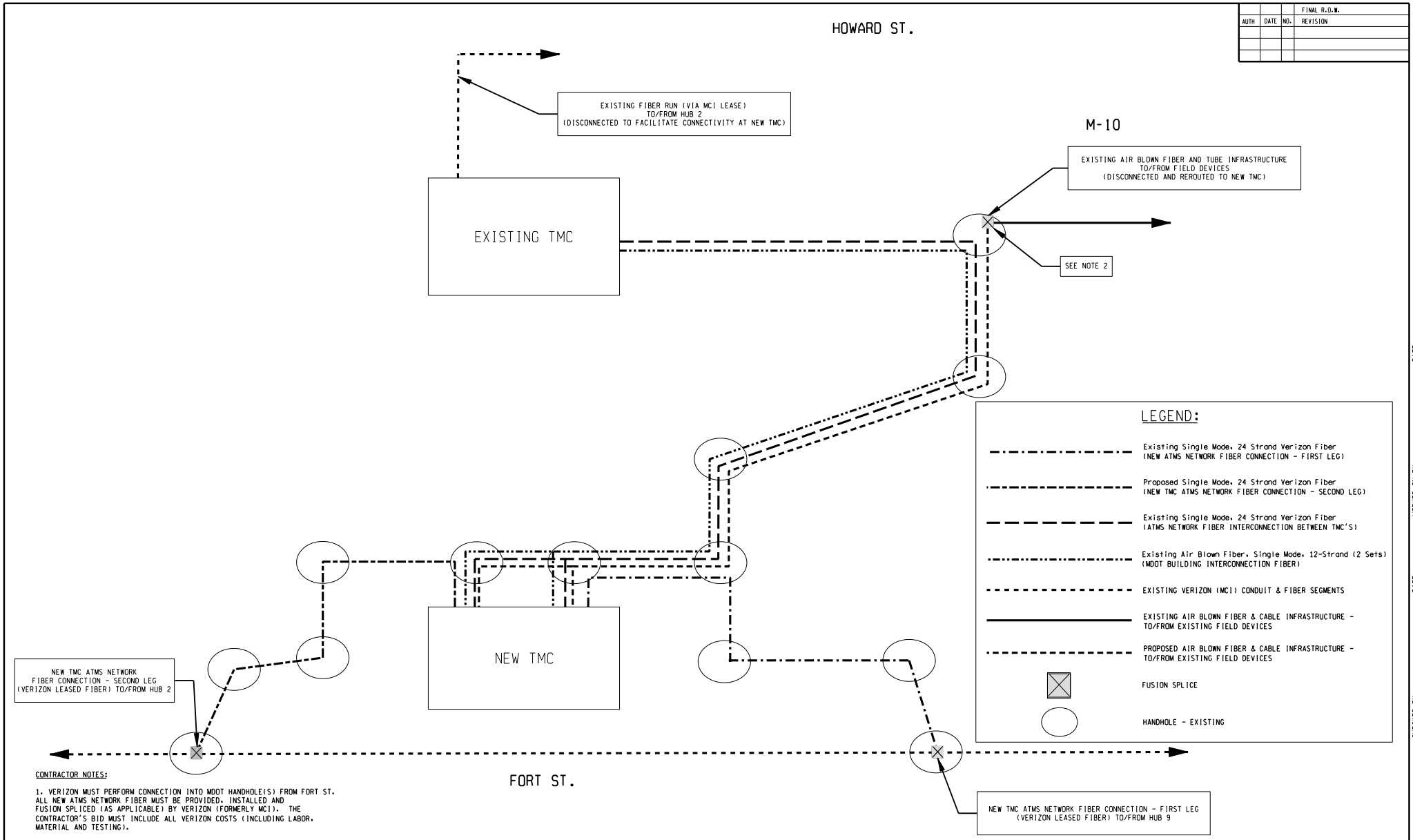
FILE NAME:

AUTH	DATE	NO.	REVISION
			FINAL R.O.W.



CONTRACTOR NOTES:

1. VERIZON MUST PERFORM CONNECTION INTO MDOT HANDHOLE(S) FROM FORT ST. ALL NEW ATMS NETWORK FIBER MUST BE PROVIDED, INSTALLED AND FUSION SPLICED (AS APPLICABLE) BY VERIZON (FORMERLY MCI). THE CONTRACTOR'S BID MUST INCLUDE ALL VERIZON COSTS (INCLUDING LABOR, MATERIAL AND TESTING).

2. EXISTING AIR BLOWN FIBER AND TUBE INFRASTRUCTURE. FUSION SPLICED INSIDE FIBER SPLICE ENCLOSURE WITH NEW FIBER. TUBES COUPLED AIR TIGHT USING CLEAR TUBING INSIDE TUBE DISTRIBUTION UNIT WITH CONNECTION TO NEW TUBE INFRASTRUCTURE. DETAILS AS NOTED ON THE PLANS.

3. ALL WORK MUST BE COMPLETED WITHOUT ANY DISRUPTION TO EXISTING SYSTEMS OR OPERATIONS.

N.T.S.

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500 GRISWOLD, SUITE 2900
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313-963-5760

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FIBER CONNECTION DETAILS (PHASE II)

DATE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO. R.O.W.	SHEET NO. CONST.
03/26/10	84917	105046A	MUELLER		10

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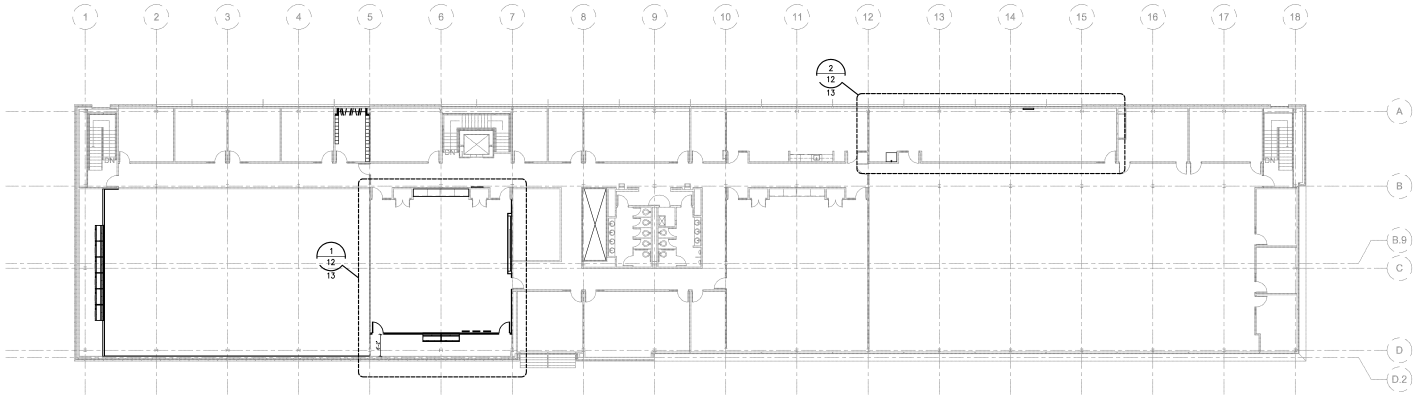
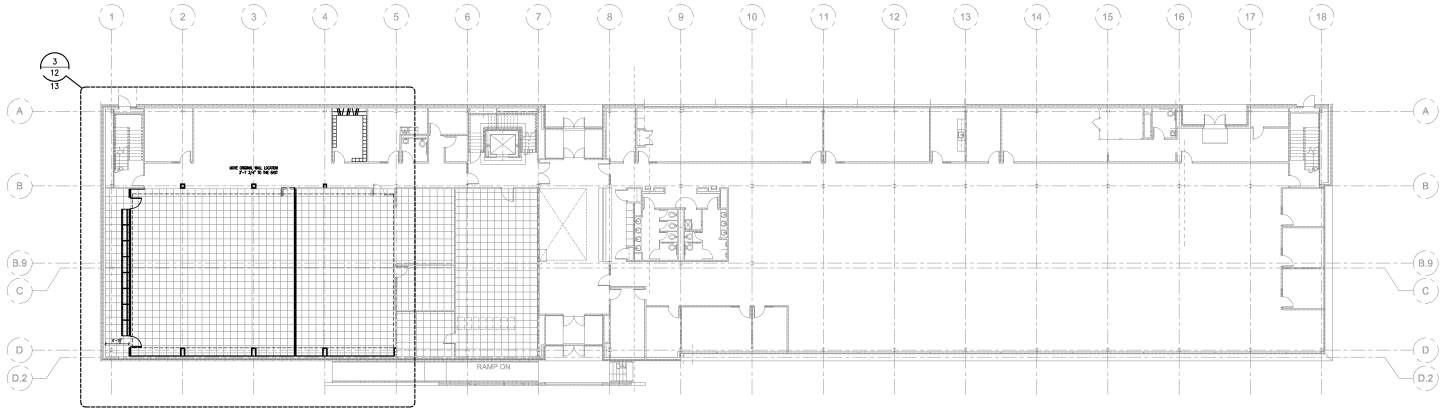


SECOND FLOOR PLAN

SCALE: 1/16" = 1'-0"

0 4' 8' 12' 16'

NORTH



FIRST FLOOR PLAN

SCALE: 1/16" = 1'-0"

0 4' 8' 12' 16'

NORTH

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URS Surface Transportation Grand Rapids . Southfield . Traverse City	MDOT Michigan Department of Transportation	TITLE: OVERALL FLOOR PLANS: FIRST & SECOND FLOOR	
		DATE: 03/26/2010	CONT. SEC.: 84917
		JOB NO.: 105046A	DESIGN UNIT: MUELLER
		SHEET NO. R.O.W.	SHEET NO. CONST. 11

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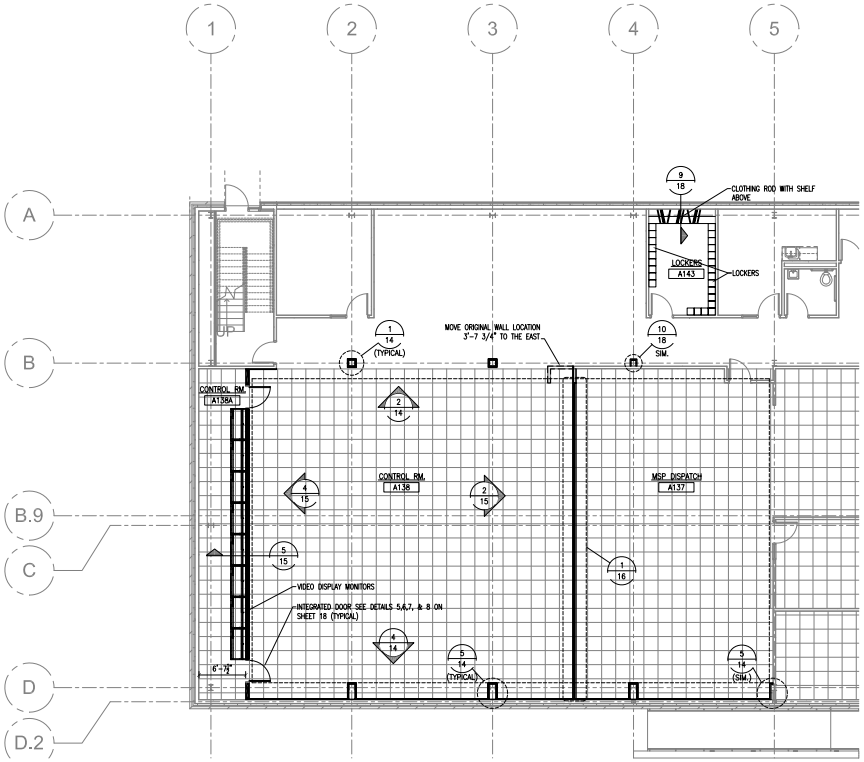
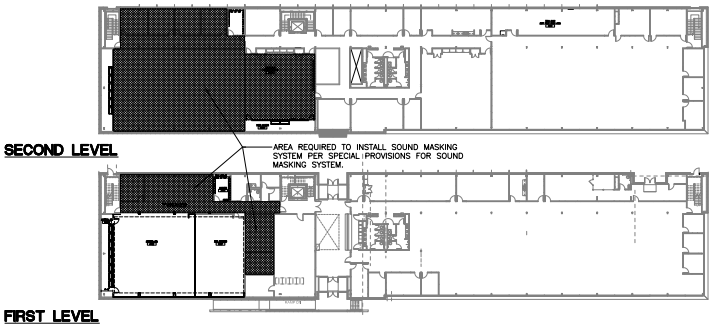
	03/26/10		BIDS & CONSTRUCTION



3/11 **CONTROL ROOM A138**

0 4' 8' 12' 16'

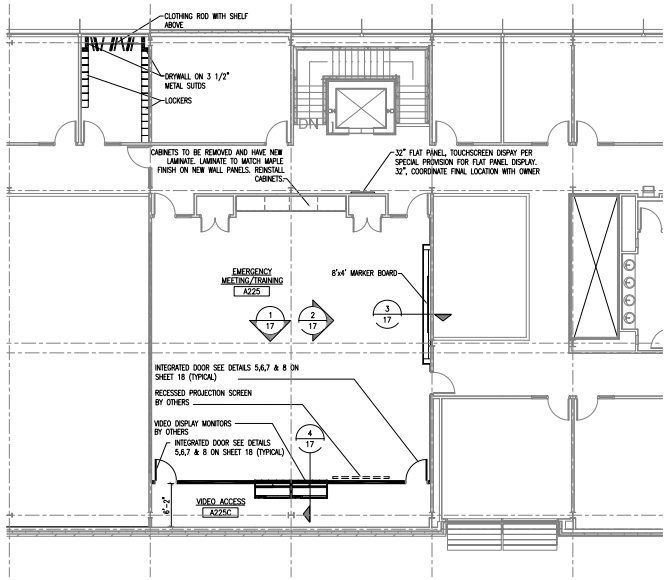
NORTH



SOUND MASKING SYSTEM LOCATION PLAN

0 16' 32' 48' 64'

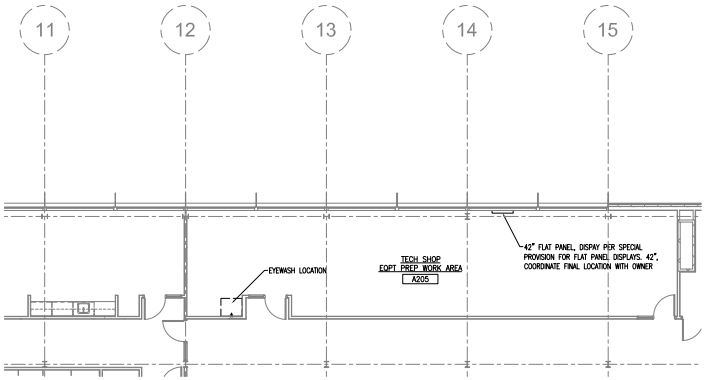
NORTH



1/11 **EMERGENCY TRAINING RM. A225**

0 4' 8' 12' 16'

NORTH



2/11 **TECH SHOP/WORK AREA A205**

0 4' 8' 12' 16'

NORTH

URS Surface Transportation Grand Rapids . Southfield . Traverse City	MDOT Michigan Department of Transportation	TITLE: ENLARGED FLOOR PLANS			
		DATE: 03/26/2010	CONT. SEC.: 84917	JOB NO.: 105046A	DESIGN UNIT: MUELLER
					SHEET NO. R.O.W. / CONST.: 12

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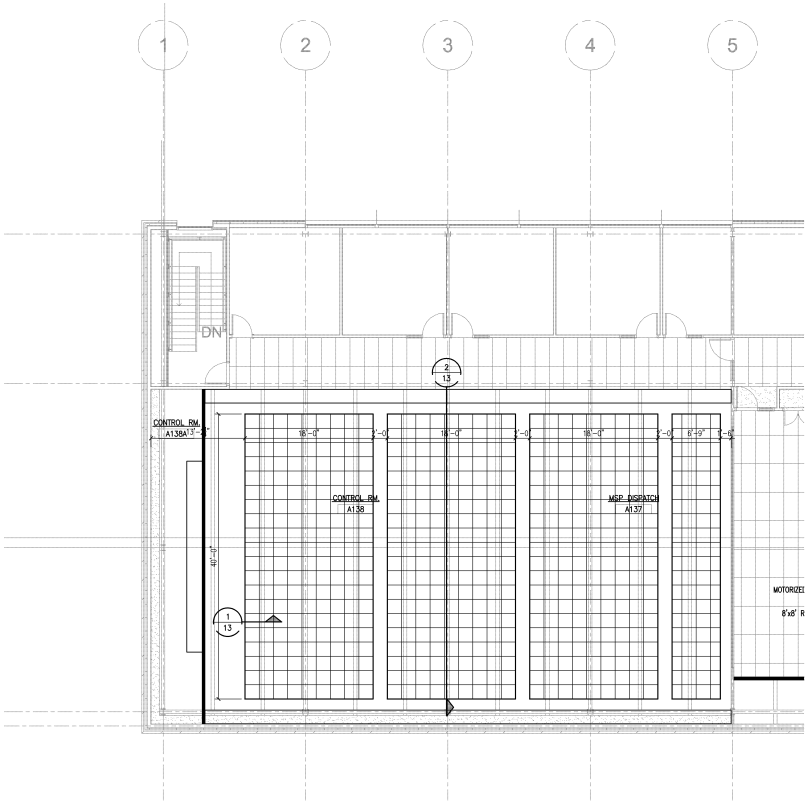
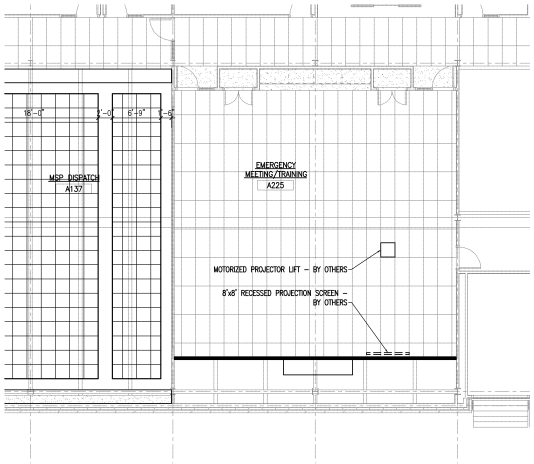


3/11 CONTROL ROOM A138

0 4' 8' 12' 16'

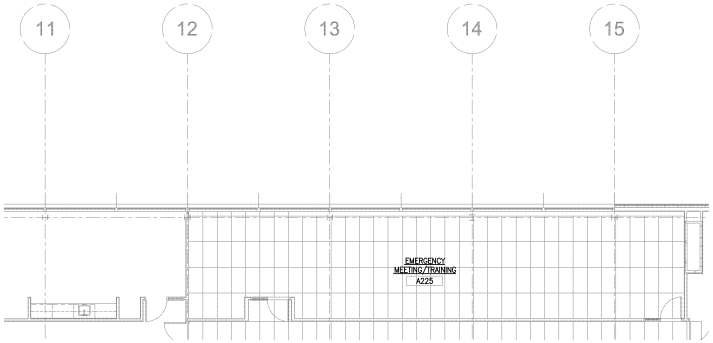
NORTH



1/11 EMERGENCY TRAINING RM. A225

0 4' 8' 12' 16'

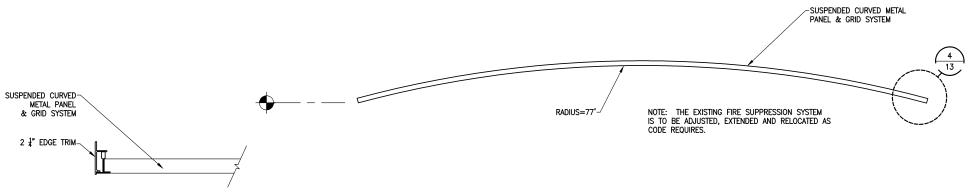
NORTH



2/11 TECH SHOP/WORK AREA A205

0 4' 8' 12' 16'

NORTH



4/13 EDGE TRIM DETAIL

0 2" 4" 6" 8"

5/13

0 4' 8'

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URS Surface Transportation Grand Rapids . Southfield . Traverse City	MDOT Michigan Department of Transportation	TITLE: ENLARGED CEILING PLANS		
		DATE: 03/26/2010	CONT. SEC.: 84917	JOB NO.: 105046A
		DESIGN UNIT: MUELLER	SHEET NO. R.O.W.:	CONST.: 13

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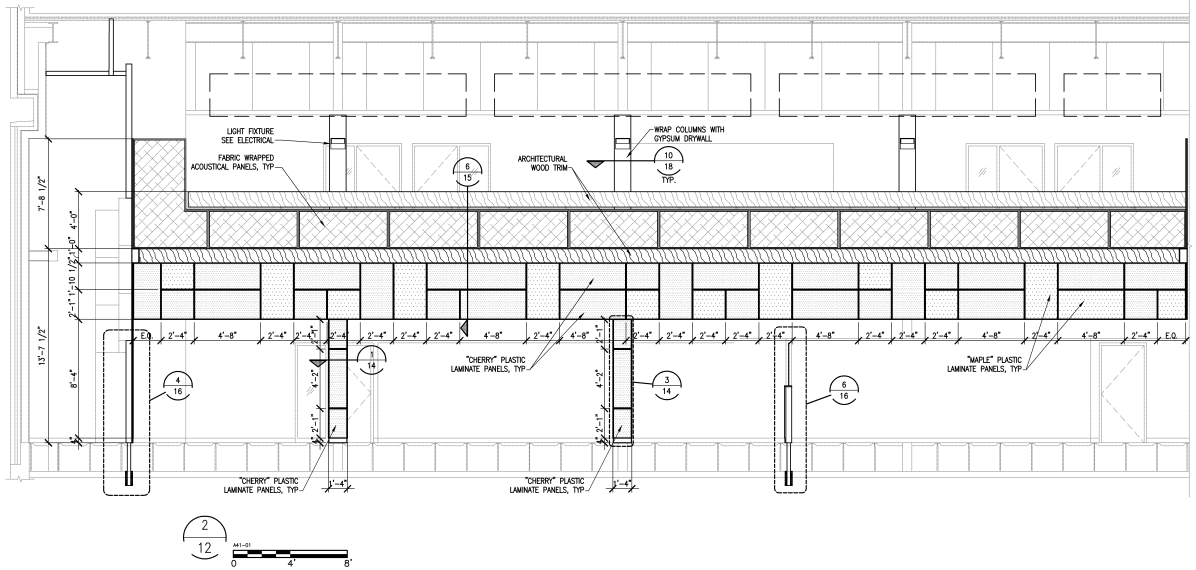
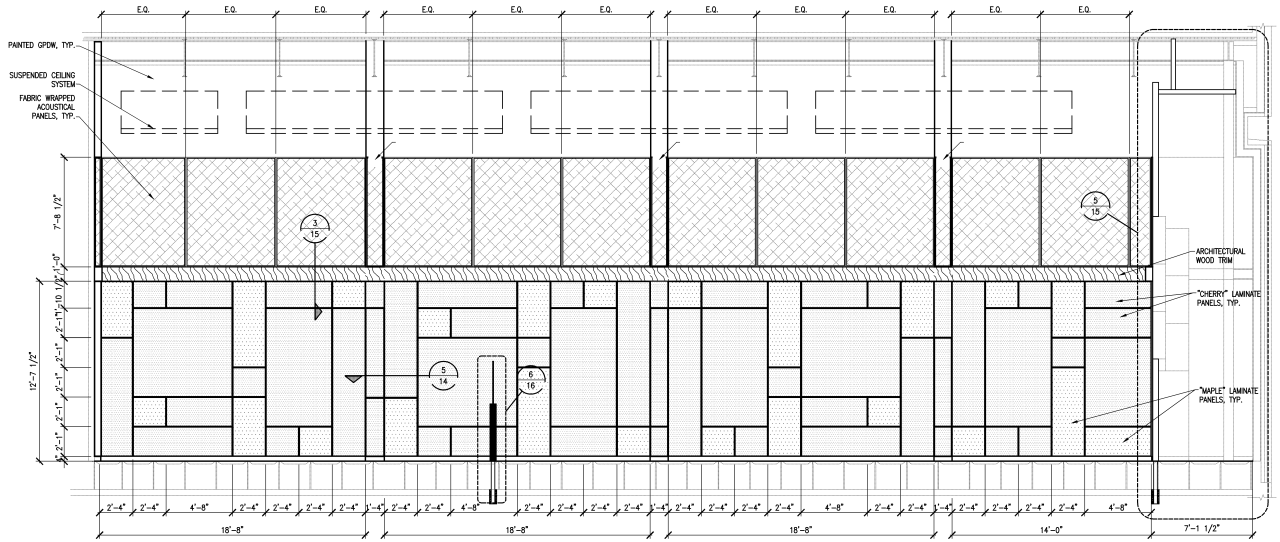
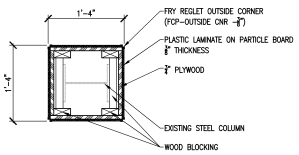


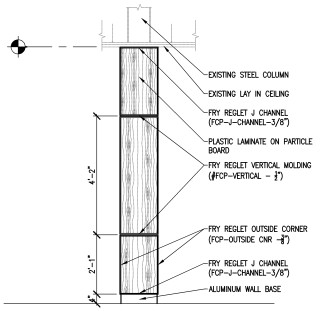
2 / 12 — A41-01 — 0 4' 8'



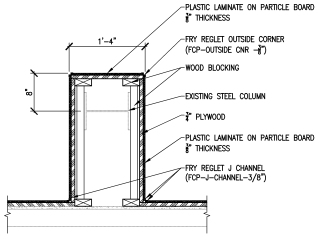
4 / 12 — A4-02 — 0 4' 8'



1 / 14 — A41-07 — 0 6" 1' 2'



3 / 14 — A41-06 — 0 6" 1' 2' 3' 4'



5 / 14 — A41-07 — 0 6" 1' 2'

URS Surface Transportation
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TITLE
INTERIOR ELEVATIONS & DETAILS

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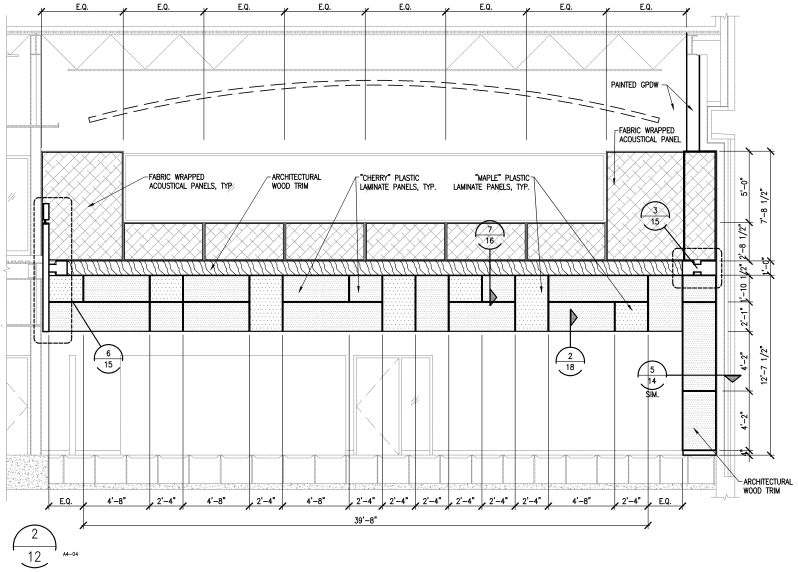

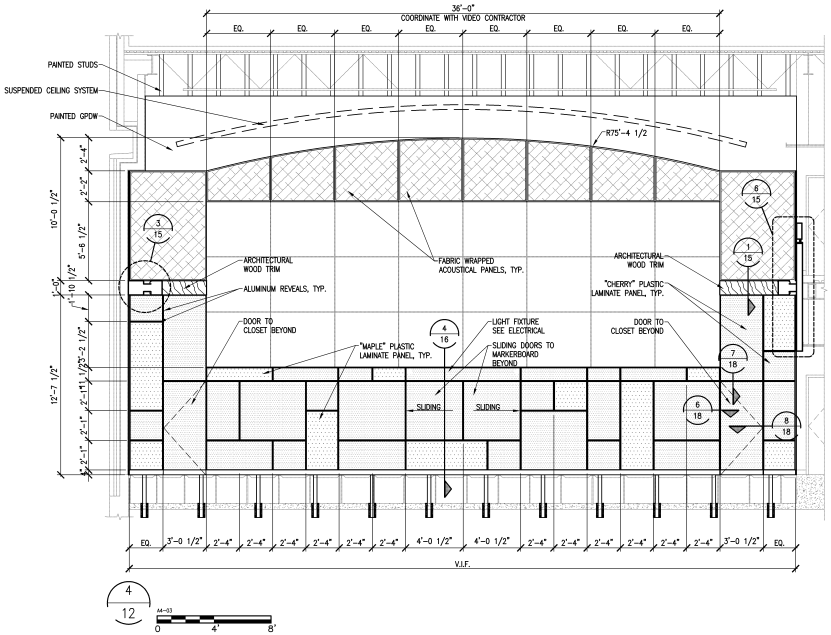

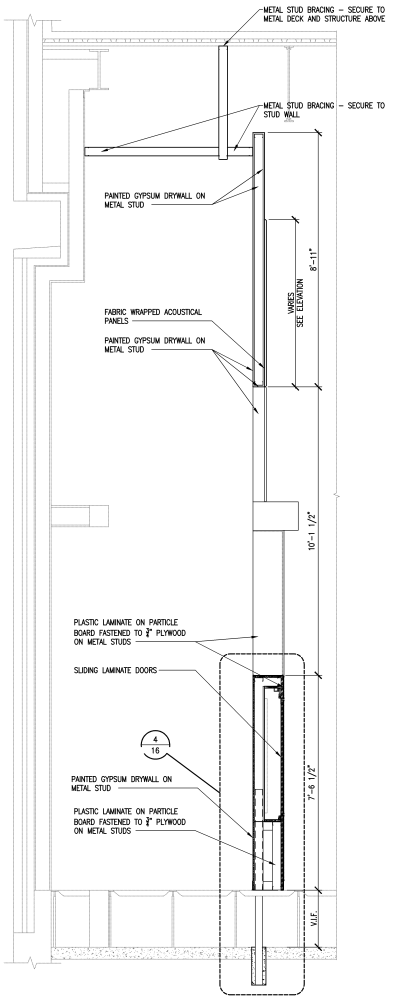

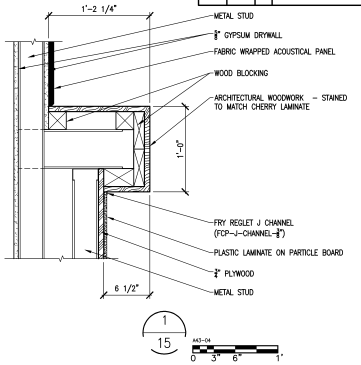

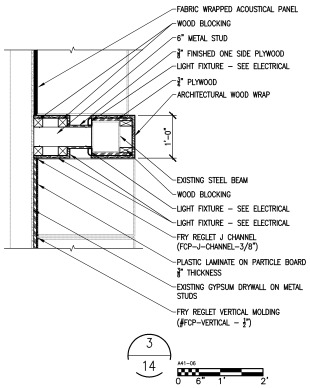

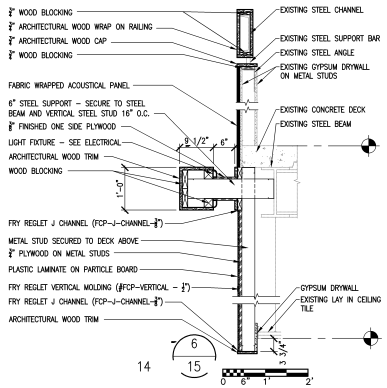

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TITLE
INTERIOR ELEVATIONS & DETAILS

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03/26/2010	84917	105046A	MUELLER		15

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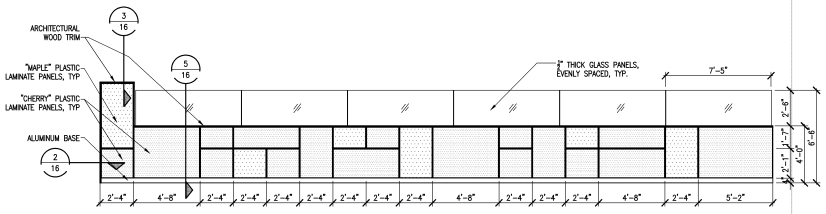

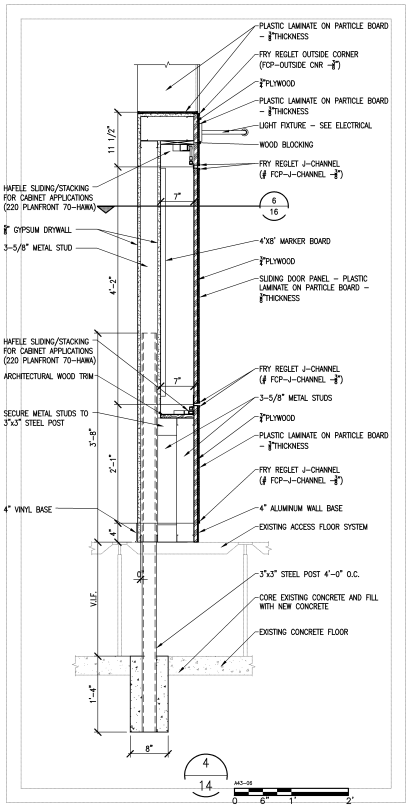

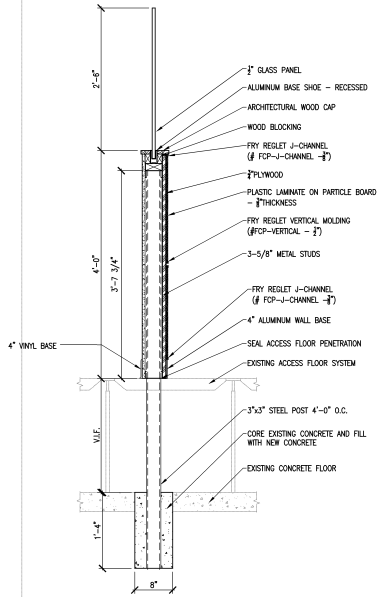

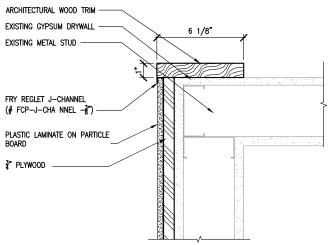

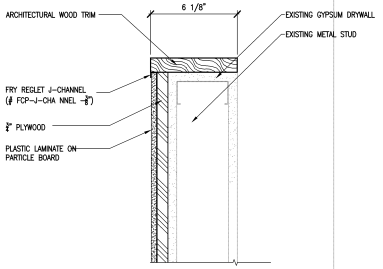

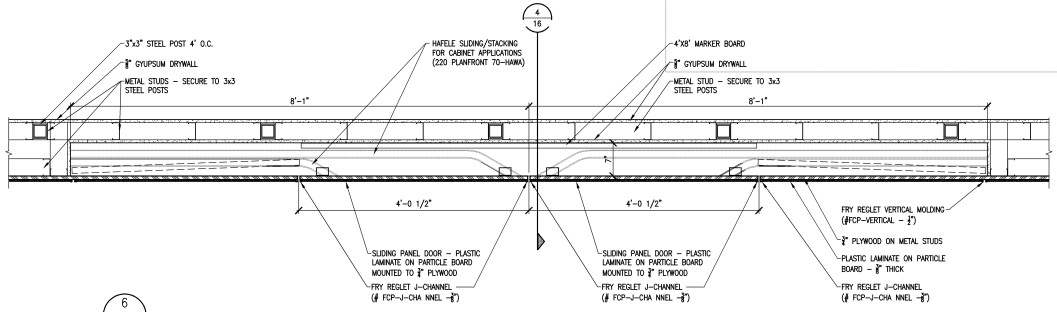

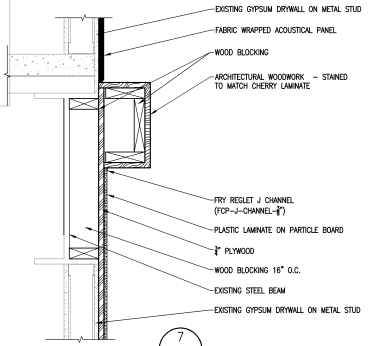

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URS
Surface Transportation
Grand Rapids . Southfield . Traverse City

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Michigan Department of Transportation

TITLE
INTERIOR ELEVATIONS & DETAILS

DATE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO. R.O.W.	SHEET NO. CONST.
03/26/2010	84917	105046A	MUELLER		16

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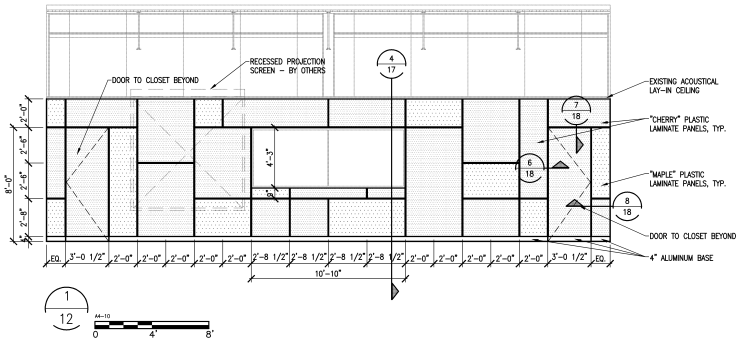

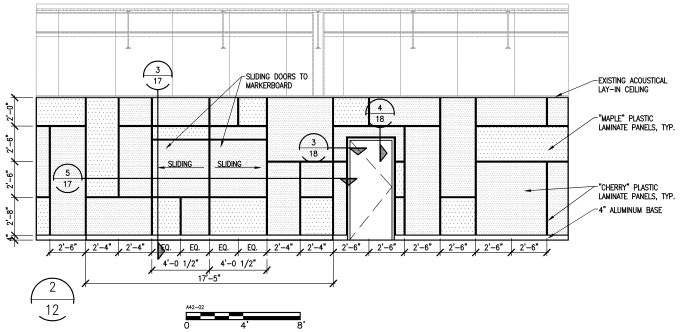

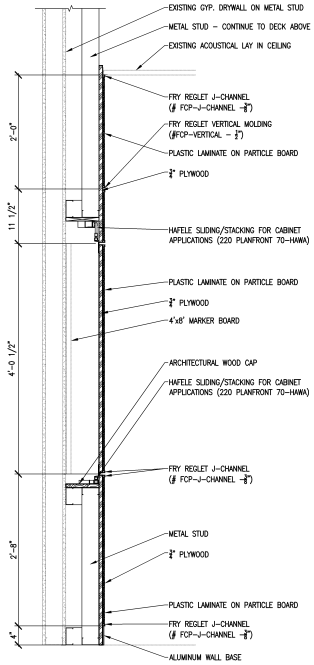

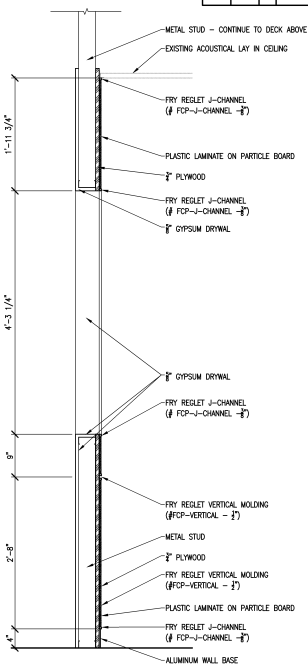

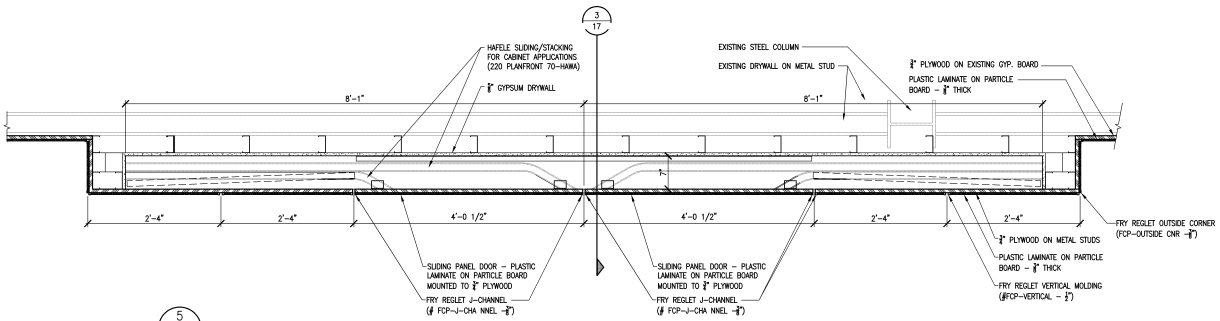

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		03/26/2010	84917	105046A	MUELLER	17

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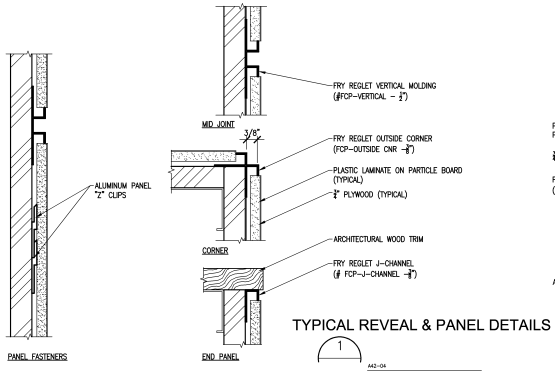

TYPICAL REVEAL & PANEL DETAILS

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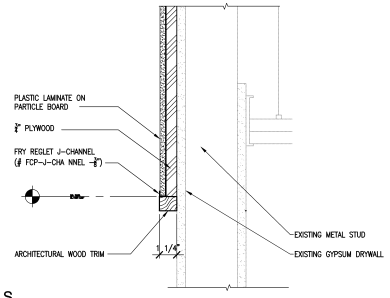
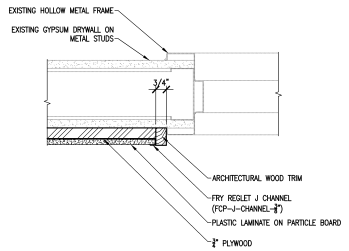
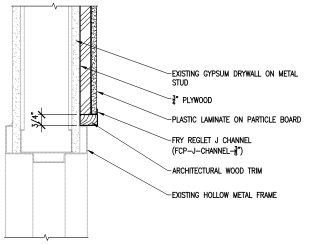


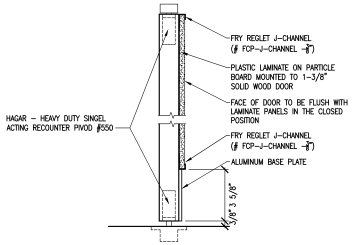
2 / 15 — A43-01 — 0 2" 4" 6" 8"



3 / 17 — A43-08 — 0 2" 4" 6" 8"



4 / 17 — A43-09 — 0 2" 4" 6" 8"



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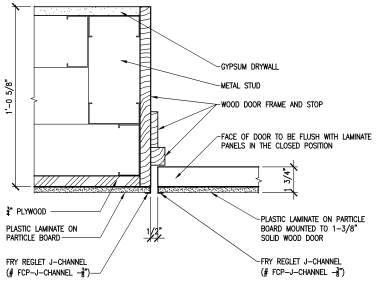
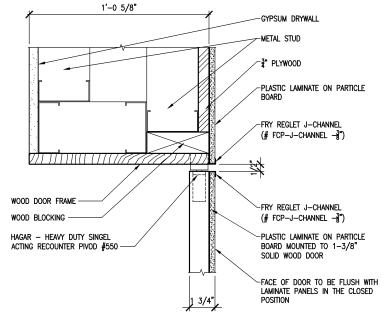
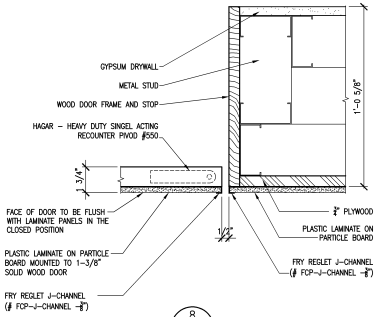


15 / 6 / 17 — Drawing3 — 0 2" 4" 6" 8"



15 / 7 / 17 — A42-08 — 0 2" 4" 6" 8"



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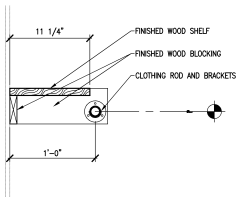
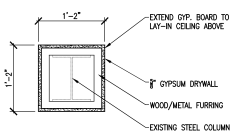
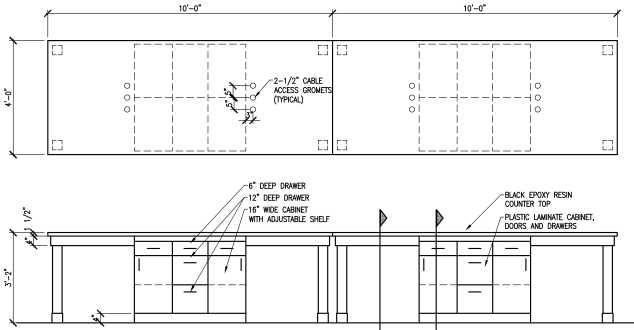


9 / 12 — A43-04 — 0 3" 6" 1'

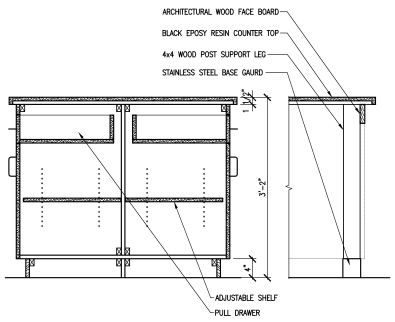


14 / 10 / 12 — A41-07 — 0 6" 1' 2'



11 / 19 — A18-11 — 0 6" 1' 2' 3' 4'

12 / 18 — 12 / 18



11 / 19 — A18-12 — 0 6" 1' 2'

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URS Surface Transportation — Grand Rapids . Southfield . Traverse City

MDOT Michigan Department of Transportation

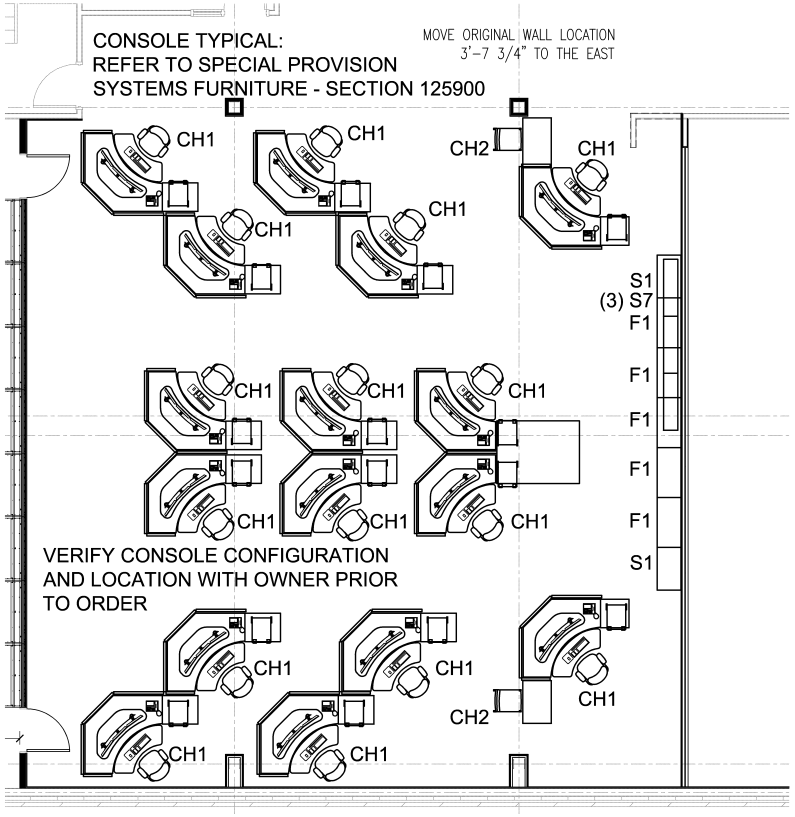
TITLE: **INTERIOR ELEVATIONS & DETAILS**

DATE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO. R.O.W. CONST.
03/26/2010	84917	105046A	MUELLER	18

			FINAL R.O.W.
AUTH	DATE	NO.	REVISION
	03/26/10		BIDS & CONSTRUCTION

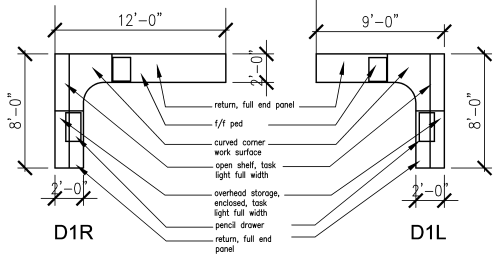
CONSOLE TYPICAL:
REFER TO SPECIAL PROVISION
SYSTEMS FURNITURE - SECTION 125900

MOVE ORIGINAL WALL LOCATION
3'-7 3/4" TO THE EAST



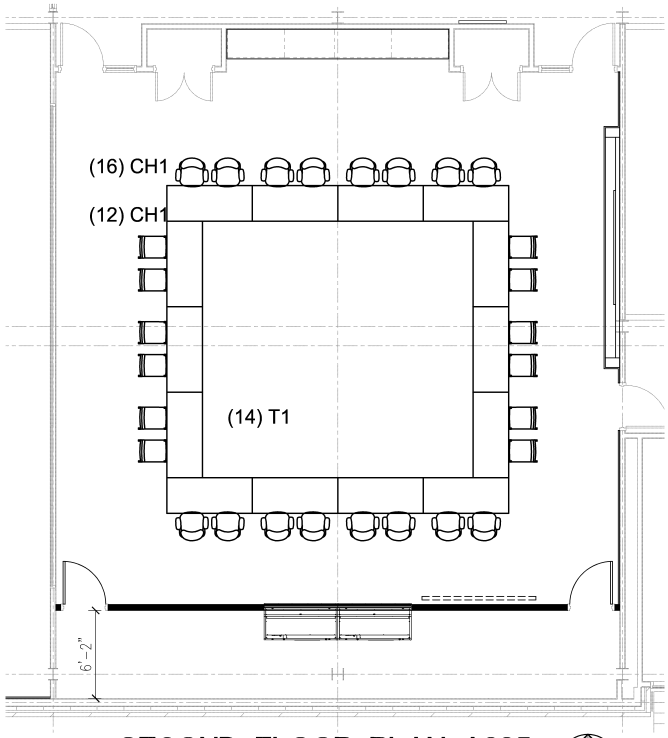
FIRST FLOOR PLAN A138

SCALE: 1/4" = 1'-0"



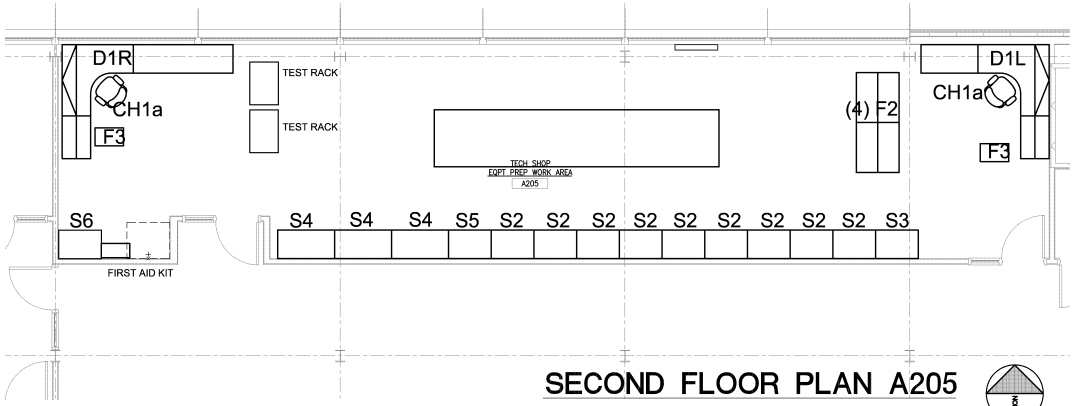
PLAN D1R & D1L

SCALE: 1/4" = 1'-0"



SECOND FLOOR PLAN A225

SCALE: 1/4" = 1'-0"



SECOND FLOOR PLAN A205

SCALE: 1/4" = 1'-0"

URS Surface Transportation
Grand Rapids . Southfield . Traverse City

MDOT Michigan Department of Transportation

TITLE
FURNITURE FLOOR PLANS: FIRST & SECOND FLOOR

DATE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO. R.O.W.	SHEET NO. CONST.
03/26/2010	84917	105046A	MUELLER		19

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			FINAL R.O.W.
AUTH	DATE	NO.	REVISION
	03/26/10		BIDS & CONSTRUCTION

KEYED ELECTRICAL NOTES:

E1 BOTTOM OF FIXTURE SHALL BE 21'-0" ABOVE RAISED FLOOR FOR THIS ROW OF TYPE "FA" FIXTURES. LIGHTING LOWERING SYSTEM CABLES SHALL BE ROUTED THROUGH TRUSS SPACE. COORDINATE EXACT LOCATION OF FIXTURES AND ADJUST ROUTING OF CABLES AS REQUIRED.

E2 BOTTOM OF FIXTURE SHALL BE 23'-0" ABOVE RAISED FLOOR FOR THIS ROW OF TYPE "FA" FIXTURES. LIGHTING LOWERING SYSTEM CABLES SHALL BE ROUTED THROUGH TRUSS SPACE. COORDINATE EXACT LOCATION OF FIXTURES AND ADJUST ROUTING IF REQUIRED.

E3 LIGHTING DIMMING CONTROLS RECESS MOUNTED. LUTRON GRAFIK EYE UNIT.

E4 LUTRON FLUORESCENT DIMMING INTERFACE MODULES MOUNTED IN VIDEO WALL ROOM ON WALL OR IN ON WALL IN ACCESSIBLE CEILING SPACE WHERE APPLICABLE. MOUNT DEVICES WITH COOLING FINS VERTICAL. REFER TO DETAILS AND COORDINATE WITH LUTRON FOR NUMBER OF MODULES REQUIRED.

E5 LIGHTING LOWERING DEVICE BRACKETS, EYE BOLTS, ETC. FOR MOUNTING OF MOVEABLE LOWERING WINCH. TOTAL OF FOUR BRACKETS LOCATED IN EACH OF THREE LOCATIONS, LOCATE GENERALLY IN LINE WITH FIXTURES IN ROW THAT REQUIRE LOWERING. KEEP ALL OBSTRUCTIONS OUT OF LOWERING DEVICE HORIZONTAL AND VERTICAL CABLE RUNS.

E6 DUPLEX RECEPTACLE LOCATION FROM PREVIOUS BID PACKAGE. VERIFY INSTALLATION OF EXISTING RECEPTACLE. EXTEND BRANCH CIRCUIT FROM JUNCTION BOX IN CEILING SPACE ABOVE AS REQUIRED TO LOCATE RECEPTACLE TO NEW LOCATION INDICATED. BLANK OFF OUTLET AND REMOVE UNUSED WIRE FROM CONDUIT OR IF MC CABLE, REMOVE PORTION OF MC CABLE.

E7 PROVIDE QUAD RECEPTACLES AT A LOCATION IN ENCLOSURE CENTRAL TO THREE VIDEO MONITOR VERTICAL LAYOUT (ONE QUAD PER THREE STACKED UNITS) FOR CONTROL WIRING FROM THE VIDEO MONITORS, ROUTE TWO (2) 2" CONDUITS FROM BELOW RAISED FLOOR UP INTO EACH VERTICAL VIDEO MONITOR ENCLOSURE.

E8 DO NOT ROUTE THIS CONDUIT ALONG WEST WALL BETWEEN LIGHTING FIXTURES.

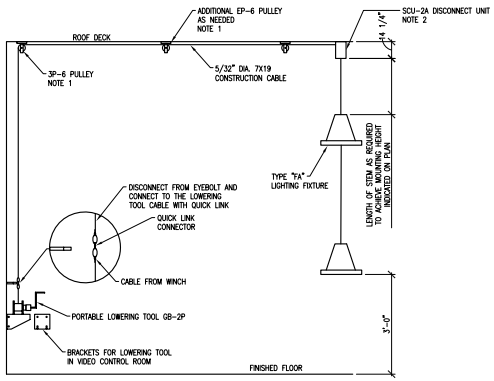
E9 PROVIDE A NEMA L20-21R RECEPTACLE IN EACH OF TWO 19" WIDE VIDEO CONTROL RACKS. PROVIDE DEDICATED BRANCH CIRCUIT 4#12+1#12GND., 3/4"C FOR EACH RECEPTACLE. PROVIDE 20A-3P CIRCUIT BREAKERS WITH AIC RATINGS TO MATCH EXISTING PANELBOARD IN RPUPS8 FOR EACH DEDICATED CIRCUIT, CIRCUITS 24,26,28 AND 30,32,34. REMOVE EXISTING 20A-1P BREAKERS AND RETURN TO OWNER. REFER TO PARTIAL GROUNDING SYSTEM DIAGRAM ON DRAWING EP1.2.

E10 REFER TO WALL ELEVATIONS ON DRAWING E3.1 FOR INFORMATION ON LED COVE LIGHTING LOCATED ON THE NORTH AND SOUTH WALLS OF THE CONTROL ROOM A138 AND DISPATCH A137.

E11 TYPE "FD" FIXTURE MOUNTED ON WALL AT 6'-10" AFF, VERIFY EXACT HEIGHT IN FIELD. FIXTURE SHALL HAVE REMOTE BALLASTS LOCATED IN ON THE WALL IN THE CONTROL ROOM A138A, WITH APPROPRIATE NUMBER OF LUTRON DIMMING MODULES MOUNTED ADJACENT TO BALLASTS. THIS FIXTURE SHALL BE CONTROLLED BY DIMMER j.

KEYED DEMOLITION NOTES:

D1 REMOVE EXISTING LIGHTING FIXTURES IN THIS AREA. EXISTING BRANCH CIRCUIT EPIBB-9 SHALL BE REROUTED TO FEED NEW LIGHTING FIXTURES AS INDICATED.



LIGHTING LOWERING SYSTEM DIAGRAM

NOT TO SCALE

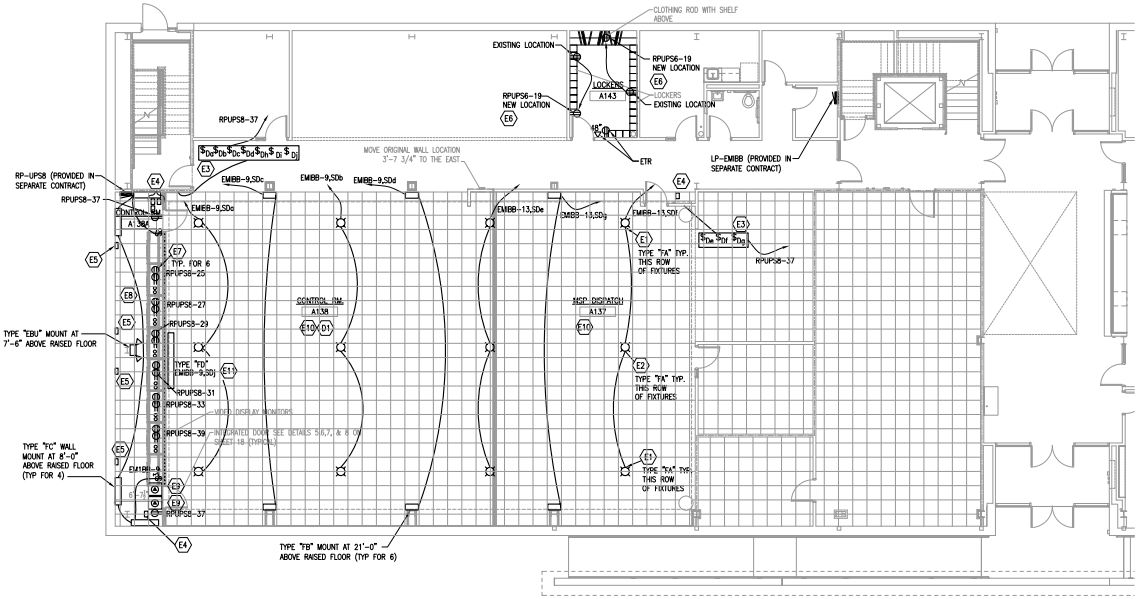
(BASED ON EQUIPMENT BY LIGHTING + LOWERING SYSTEMS, INC.)

NOTES:

1. PROVIDE PULLEYS AT ALL CHANGES IN DIRECTION AND AS REQUIRED BY MANUFACTURER. COORDINATE EXACT HARDWARE REQUIRED WITH MANUFACTURER TO PROPERLY ROUTE THE CABLES FROM THE FIXTURES THROUGH THE TRUS SPACE AND DOWN TO THE LOWERING WINCH LOCATIONS.

2. PROVIDE PROPER NUMBER OF CONTACTS IN DISCONNECT (5, VERIFY EXACT NUMBER WITH LUTRON) TO PROPERLY DIM THE FLUORESCENT FIXTURES WITH DIGITAL BALLASTS.

3. PROVIDE ALL HARDWARE, INSTALLATION, OPERATIONAL TESTING, SYSTEM ADJUSTMENTS, AND TRAINING FOR OWNER'S MAINTENANCE STAFF, ETC. TO PROVIDE A PROPERLY INSTALLED SYSTEM. PROVIDE FACTORY FIELD TECHNICIAN ON SITE DURING INSTALLATION, TESTING, AND TRAINING. PROVIDE MINIMUM 2 YEAR WARRANTY FOR THE ENTIRE SYSTEM.

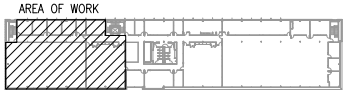


PARTAIL FIRST FLOOR ELECTRICAL PLAN

0 4' 8' 12' 16'

NORTH

AREA OF WORK



KEY PLAN

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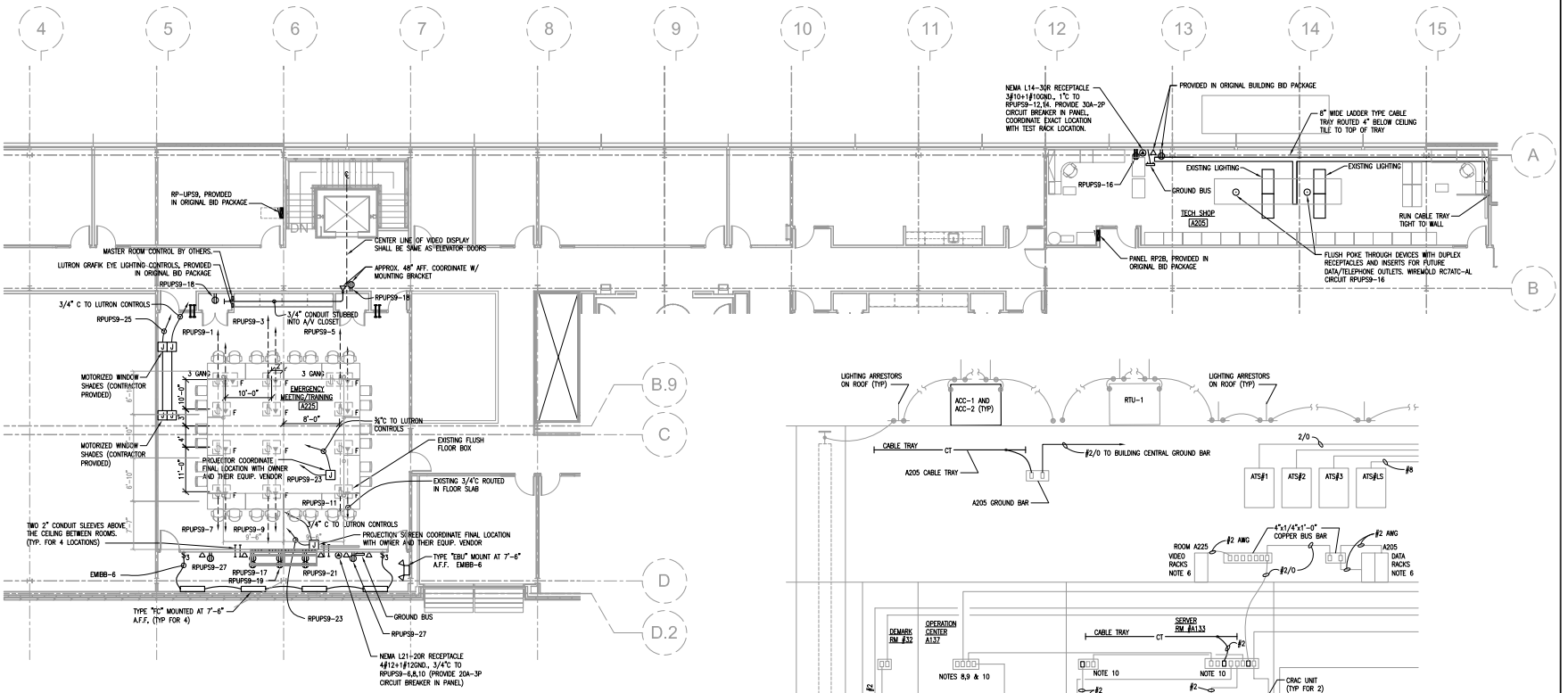
URS Surface Transportation Grand Rapids . Southfield . Traverse City	MDOT Michigan Department of Transportation	TITLE: PARTIAL FIRST FLOOR ELECTRICAL PLAN	
		DATE: 03/26/2010	CONT. SEC.: 84917
		JOB NO.: 105046A	DESIGN UNIT: MUELLER
			SHEET NO. R.O.W./CONST.: 20

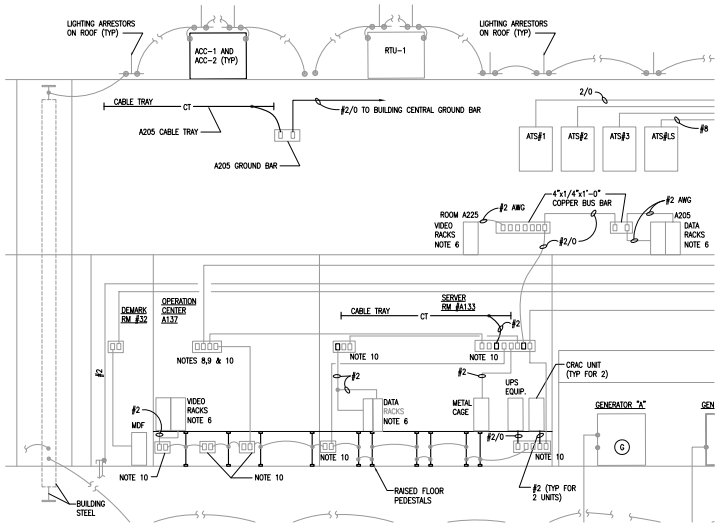
			FINAL R.O.W.
AUTH	DATE	NO.	REVISION
	03/26/10		BIDS & CONSTRUCTION



PARTIAL SECOND FLOOR ELECTRICAL PLAN

0 2' 4' 6' 8'

NORTH



PARTIAL GROUNDING SYSTEM DIAGRAM

NOT TO SCALE

GROUNDING NOTES:

1. NOT USED
2. ALL GROUNDING REQUIREMENTS SHALL MEET MOTOROLA STANDARD R56.
3. ALL GROUND CONNECTIONS SHALL BE WITH 2 HOLE LONG BARREL BOLT TYPE COPPER COMPRESSION LUGS.
4. ALL GROUND WIRING SHALL BE COPPER.
5. ITEMS ON THIS DETAIL INDICATED IN DARK LINE WEIGHT SHALL BE PROVIDED IN THIS SCOPE OF WORK. ITEMS INDICATED AS LIGHTER LINE WEIGHT, REFER TO BARTON MALOW DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL INFORMATION.
6. PROVIDE #2 GROUND WIRE TO EACH VERTICAL RACK UNIT. PROVIDE CONNECTION TO EXTEND AND ROUTE #2 GROUND WIRE TO ALL VERTICAL RACK SECTIONS. TYPICAL FOR ALL RACK LINEUPS.
7. NOT USED
8. REFER TO PLAN DRAWING FOR NUMBER AND LOCATION OF GROUND BUS BARS IN AND BELOR RAISED FLOOR IN OPERATIONS CENTER AND SERVER ROOM.
9. NOT USED
10. GROUND BUS SPECIFIED IN BARTON MALOW DRAWINGS AND SPECIFICATIONS, COORDINATE INTERCONNECTION.
11. ALL GROUND CRIMP CONNECTIONS SHALL BE COATED WITH A CORROSION PREVENTATIVE COMPOUND "GREASE NON-OXIDE".
12. ALL GROUNDING CONDUCTORS SHALL BE RUN CONCEALED IN FINISH AREAS WITH-IN THE BUILDING. CONDUCTORS SHOULD NOT BE RUN IN SLABS. UNLESS OTHERWISE NOTED. USE PVC SLEEVES WHERE GROUND CONDUCTORS PENETRATES WALLS.
13. PACK OPENINGS AROUND GROUND CONDUCTOR PENETRATIONS OF FLOOR SLABS OR WALLS WITH FIRE RETARDANT MATERIAL.
14. ALL GROUND CONDUCTOR CONNECTIONS SHALL BE MADE IN ACCORDANCE WITH THE "NATIONAL ELECTRIC CODE" LATEST EDITION.
15. PROVIDE NYLON TAG AT BOTH ENDS INDICATING WHERE GROUND CONDUCTOR TERMINATION POINTS END ON ALL GROUNDING CONDUCTORS.
16. ALL BENDS ON GROUND CONDUCTORS SHALL HAVE A MINIMUM RADIUS OF 12".
17. INSTALLATION WORK SHALL BE COMPLETED, TESTED AND OPERATIONAL PRIOR TO ENERGIZING ELECTRICAL EQUIPMENT.

AREA OF WORK

KEY PLAN

URS Surface Transportation
Grand Rapids . Southfield . Traverse City

MDOT Michigan Department of Transportation

TITLE
PARTIAL SECOND FLOOR ELECTRICAL PLAN

DATE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO. R.O.W.	SHEET NO. CONST.
03/26/2010	84917	105046A	MUELLER		21

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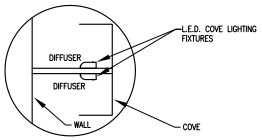
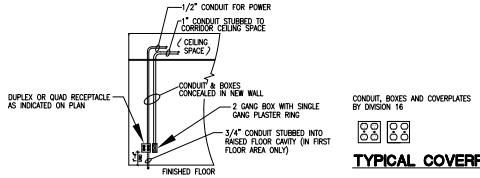
AUTH	DATE	NO.	REVISION
	03/26/10		BIDS & CONSTRUCTION



TYPICAL COVE LIGHTING SECTION

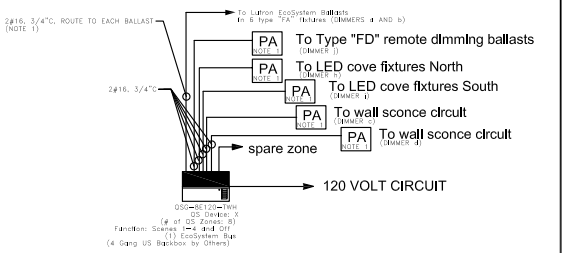
NO SCALE:

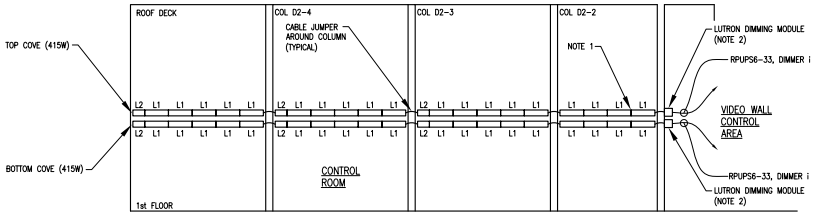


TYPICAL COVERPLATES DETAIL

RECESSED TECHNOLOGY OUTLET DETAIL

NO SCALE



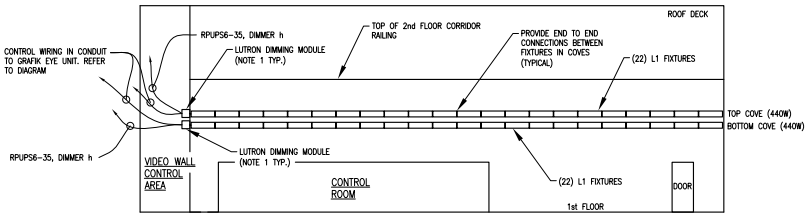


L.E.D. COVE LIGHTING - SOUTH ELEVATION

SCALE: ⅛" = 1'-0"

NOTES:

1. PROVIDE END TO END CONNECTOR BETWEEN FIXTURES IN COVES EXCEPT WHERE JUMPER IS USED AROUND COLUMNS.
2. PROVIDE CONTROL WIRING IN CONDUIT BACK TO WEST LUTRON GRAFIK EYE DIMMING CONTROLS.
3. LIGHTING SYSTEM BASED UPON PHILIPS EW PROFILE POWERCORE LINE OF FIXTURES. (SEE LIGHTNG FIXTURE SCHEDULE ON DRAWING E3.1)



L.E.D. COVE LIGHTING - NORTH ELEVATION

SCALE: ⅛" = 1'-0"

NOTES:

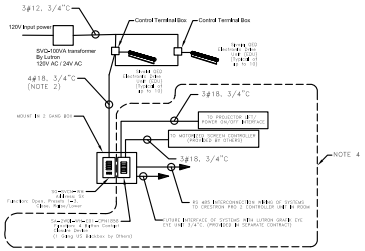
1. PROVIDE CONTROL WIRING ROUTED IN CONDUIT BACK TO WEST LUTRON GRAFIK EYE DIMMING CONTROLS.

CONTROL ROOM WEST LIGHTING CONTROL DIAGRAM

NO SCALE (BASED ON LUTRON GRAFIK EYE DIMMING SYSTEM)

NOTES:

1. PROVIDE LUTRON PHASE ADAPTIVE DIMMING UNIT. UNIT SHALL BE COMPATABLE WITH FIXTURES AND DIMMING BALLASTS THROUGH ENTIRE RANGE OF DIMMING. PROVIDE NUMBER OF DIMMING UNITS AS REQUIRED. PROVIDE ALL HARDWARE, WIRING, PROGRAMMING, ETC. TO PROVIDE A COMPLETE OPERATING SYSTEM.
2. CONTROL CONDUCTORS SHALL BE TAPPED WITHIN THE TYPE "FA" FIXTURE BALLAST CHANNEL TO PROVIDE CONTROL TO EACH OF THE THREE ECO SYSTEM DIGITAL DIMMING BALLASTS, IN EACH FIXTURE.
3. SEQUENCE OF OPERATION FOR DIMMING: LIGHTING CONTROL SYSTEM SHALL PROVIDE PRESET LIGHTING SCENES FOR LIGHTS IN THE CONTROL ROOM, FLUORESCENT TYPE "FA" FIXTURES SHALL BE INDIVIDUALLY CONFIGURABLE SUCH THAT ANY FIXTURE CAN BE CONTROLLED INDEPENDENTLY WITHOUT REWIRING, AND EACH SCONCE AND L.E.D. COVE LIGHTING ZONES AND WHITEBOARD LIGHTING FIXTURE ZONE SHALL BE CONFIGURABLE AND CONTROLLABLE PER ZONE.

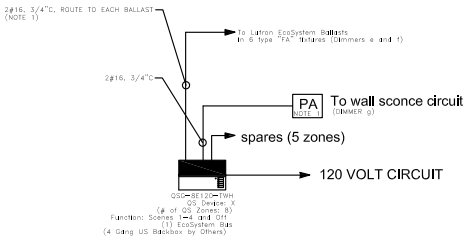


CONFERENCE ROOM A225 CONTROL SYSTEM

NO SCALE (BASED UPON LUTRON CONTROL SYSTEM COMPONENTS)

NOTES:

1. MOTORIZED SHADE SYSTEM IS BASED UPON LUTRON SIVOIA SYSTEM, 24V AC DRIVE UNITS, COORDINATE EXACT WIRING AND HARDWARE REQUIREMENTS WITH SYSTEM PROVIDED TO MATCH OPERATION OF LUTRON SYSTEM.
2. COORDINATE EXACT REQUIREMENTS OF LOW VOLTAGE CABLE WITH LUTRON.
3. THIS DIAGRAM IS BASED UPON LUTRON CONTROL SYSTEM COMPONENTS. EQUALS AS INDICATED IN THE SPECIFICATIONS SHALL BE ACCEPTABLE.
4. HARDWARE, WIRE AND CABLING FOR THIS EQUIPMENT SHALL BE BY OWNER'S VENDOR. CONDUITS AND BOXES FOR SYSTEM SHALL BE BY THIS CONTRACT. COORDINATE EXACT REQUIREMENTS WITH OWNER'S VENDOR.



CONTROL ROOM EAST LIGHTING CONTROL DIAGRAM

NO SCALE (BASED ON LUTRON GRAFIK EYE DIMMING SYSTEM)

NOTES:

1. PROVIDE LUTRON PHASE ADAPTIVE DIMMING UNIT. UNIT SHALL BE COMPATABLE WITH FIXTURES AND DIMMING BALLASTS THROUGH ENTIRE RANGE OF DIMMING. PROVIDE NUMBER OF DIMMING UNITS AS REQUIRED. PROVIDE ALL HARDWARE, WIRING, PROGRAMMING, ETC. TO PROVIDE A COMPLETE OPERATING SYSTEM.
2. CONTROL CONDUCTORS SHALL BE TAPPED WITHIN THE TYPE "FA" FIXTURE BALLAST CHANNEL TO PROVIDE CONTROL TO EACH OF THE THREE ECO SYSTEM DIGITAL DIMMING BALLASTS, IN EACH FIXTURE.
3. SEQUENCE OF OPERATION FOR DIMMING: LIGHTING CONTROL SYSTEM SHALL PROVIDE PRESET LIGHTING SCENES FOR LIGHTS IN THE CONTROL ROOM, FLUORESCENT TYPE "FA" FIXTURES SHALL BE INDIVIDUALLY CONFIGURABLE SUCH THAT ANY FIXTURE CAN BE CONTROLLED INDEPENDENTLY WITHOUT REWIRING, AND EACH SCONCE LIGHTING ZONE SHALL BE CONFIGURABLE AND CONTROLLABLE PER ZONE.

URS Surface Transportation
Grand Rapids . Southfield . Traverse City

MDOT Michigan Department of Transportation

TITLE
LIGHTING DETAILS

DATE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO. R.O.W.	SHEET NO. CONST.
03/26/10	84917	105046A	MUELLER		22

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			FINAL R.O.W.
AUTH	DATE	NO.	REVISION
	03/26/10		BIDS & CONSTRUCTION

LIGHTING FIXTURE LEGEND

TYPE	FIXTURE DESCRIPTION	MOUNTING	LAMPS	VOLTAGE	MANUFACTURE & CATALOG NO.	NOTE	VA
FA	(6) 40 WATT FLUORESCENT BIAX LAMPS IN A SPUN STEEL .35" ROUND WHITE HOUSING THAT IS 3 11/16" THICK, FLAT 12" ARCYLIC DIFFUSER CENTERED AT THE BOTTOM OF FIXTURE. FUSED LUTRON ECO SYSTEM DIGITAL BALLASTS. THREE PER FIXTURE.	PENDANT W/ LOWERING MECHANISM AND DISCONNECT	(6) 40W BIAX FLUORESCENT 3500'	277	LITECONTROL #P-1D-336-BX40-FP-TCWM-F-277-LUTRON (ECO SYSTEM DIGITAL DIMMING BALLASTS) OCL #EV1-P1EE-34-BL-MWP-6BX40-277-(VERIFY STEM LENGTH)- LUTRON (ECO SYSTEM DIGITAL DIMMING BALLAST)	3	207
FB	(2) 40 WATT FLUORESCENT BIAX WALL MOUNTED CEILING UPLIGHTING FIXTURE. MOUNTED TO RECESSED BOX. FUSED DIMMING BALLASTS SEMI GLOSS WHITE ALUMINUM HOUSING, ADJUSTABLE YOKE AND VISOR.	WALL MOUNTED	(2) 40W BIAX FLUORESCENT 3500'	277	ELUPTIPAR #F126-X240-E-02-V-VO-O SPI # EIW2072-FT-2F40DM-277-WHITE-CS-F	-	68
FC	4' WRAPAROUND FLUORESCENT, NARROW BODY STEEL END CAPS	SURFACE OR AS NOTED	(2) SYLVANIA F032/735/XP/ECO	277	COLUMBIA #WC4232-EB8LHR-(*)-GLR DAY-BRITE #OWN232-(*)-1/2-EB10R-GLR1 LIGHTOLIER #JS4A232-(*)HI(RAPID START)-GLR LITHONIA #LB232-(*)-GEB10RS-GLR LSI #F9-2-32-A-SSOL-F-277	-	70
FD	8' OVERALL LENGTH, WALL MOUNTED DISPLAY TYPE FIXTURE, (2) 4' LENGTHS WITH THREE WALL MOUNTING POINTS. REMOTE FUSED DIMMING BALLASTS. 1 T-5 LAMP PER 4' SECTION. ROTATABLE HOUSING WITH WHITE FINISH.	WALL	(1) SYLVANIA FP28/735/ECO PER 4' SECTION	277	BARTCO #BAM290-28-WH-ESS-47 1/2 (PER 4' SECTION)-LNS900-ES5	-	60 TOTAL
L1	LED FIXTURE, 4000K COLOR TEMPERATURE, 39.25"X1.7"X.88" WHITE ALUM HOUSING W/INT. DRIVER, CLEAR POLYCARBONATE LENS. INTEGRAL CONNECTORS, PROVIDE ALL CONNECTORS AND JUMPERS AS REQUIRED FOR CONTINUOUS ROW MOUNTING. 120 VOLT INPUT.	MOUNTED IN COVE	LEDS MOUNTED WITH FIXTURE ON 2" CENTERS	120	PHILIPS (COLOR KINETICS) #523000027-23 W/ END TO END CONNECTORS AND JUMPERS BY PHILIPS AS REQUIRED.	-	20
L2	LED FIXTURE, SAME AS TYPE L1 EXCEPT 19.25"X1.7"X.88" WHITE ALUM HOUSING W/INT.	MOUNTED IN COVE	LEDS MOUNTED WITH FIXTURE ON 2" CENTERS	120	PHILIPS (COLOR KINETICS) #523000027-22 W/ END TO END CONNECTORS AND JUMPERS BY PHILIPS AS REQUIRED.	-	10
EBU	EMERGENCY BATTERY LIGHTING UNIT, WITH TWO LAMPS, 12 VOLT, NICKEL CADIUM BATTERY	SURFACE WALL	25 WATT INCANDESCENT (2) TOTAL	277	LITHONIA #ELT50-N2512-FUSE McPHILBEN #ES12N-50-W-PAWG-F2	-	30

LIGHTING FIXTURE LEGEND NOTES:

GENERAL:

A. FIXTURE CATALOG NUMBERS ARE FOR CONTRACTOR'S CONVENIENCE ONLY. VERIFY TYPE AND VOLTAGE FOR EACH INSTALLATION PRIOR TO PURCHASE.
B. REFER TO SPECIFICATIONS FOR BALLAST REQUIREMENTS AND ADDITIONAL REQUIREMENTS WHICH MAY NOT BE INCLUDED IN MANUFACTURER'S CATALOG NUMBER.
C. ALL FIXTURES OF THE SAME LETTER TYPE, I.E.: A1, A2, ETC. ARE TO BE PRODUCTS OF THE SAME MANUFACTURER.
D. (*) – SEE VOLTAGE COLUMN FOR BALLAST VOLTAGE.
E. CIRCUIT ALL EXIT SIGNS AND EMERGENCY LIGHTING UNITS WITH SELF-CONTAINED BATTERY TO SAME BRANCH CIRCUIT SERVING THE NORMAL LIGHTING IN THE ROOM OR AREA IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. NON-NIGHT LIGHT FLUORESCENT LUMINAIRES THAT ARE PROVIDED WITH EMERGENCY LIGHTING BALLAST ARE TO BE SWITCHED WITH ROOM LIGHTS.

SPECIFIC:

1. FIXTURE LENS TO BE PRISMATIC PATTERN 12, WITH STRAIGHT, FLAT PRISMS, NOMINAL THICKNESS OF .125", AND A MINIMUM WEIGHT OF 8 OZ./SQ. FT.
2. HOUSING AND BALLAST COVER TO BE PAINTED AFTER FABRICATION (PAF).
3. VERIFY AND SPECIAL ORDER EXACT PENDANT LENGTH BASED UPON COORDINATION WITH LOWERING MECHANISM DIMENSIONS AND BOTTOM ELEVATION OF SUSPENDED CEILING.

GENERAL NOTES:

1. REFER TO ARCHETECTURAL DRAWINGS FOR EXACT LOCATIONS AND MOUNTING HEIGHTS OF ALL ELECTRICAL DEVICES.
2. ALL 120 VOLT BRANCH CIRCUIT GREATER THAN 100 FT. IN LENGTH AND 277 VOLT BRANCH CIRCUITS GREATER THAN 250 FT. IN LENGTH SHALL BE #10 AWG.
3. SEE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
4. ALL OUTLETS WITHIN 6'-0" OF SINKS, DRINKING FOUNTAINS, AND OTHER WATER SOURCES SHALL BE GFI TYPE RECEPTACLES.
5. ALL BRANCH CIRCUITS SHALL HAVE A DEDICATED NEUTRAL CONDUCTOR AND GROUND CONDUCTOR.
6. ALL RECEPTACLES CIRCUITED TO PANELS CONNECTED TO THE UPS SYSTEM SHALL BE RED IN COLOR.
7. ALL CONDUIT ON ROOF SHALL BE GALVANIZED RIGID STEEL.
8. ADJACENT AREAS OF THE FACILITY MUST BE FULLY OPERATIONAL DURING CONSTRUCTION. THE CONTRACTOR SHALL COORDINATE HIS WORK SO AS NOT TO CAUSE DISRUPTION IN SERVICES IN AREAS THAT ARE OPERATIONAL. CONTRACTOR SHALL NOTIFY THE OWNER'S PROJECT REPRESENTATIVE A MINIMUM OF FIVE DAYS PRIOR TO ANY NECESSARY SYSTEM SHUTDOWN. AT NO TIME SHALL ELECTRICAL POWER OR SPECIAL SYSTEMS BE INOPERATIVE UNLESS APPROVED BY THE OWNER'S REPRESENTATIVE. PROVIDE TEMPORARY POWER OR CONNECTIONS AS REQUIRES TO MAINTAIN ALL NECESSARY SERVICES FOR THE BUILDING, AT NO ADDITIONAL COST. THE RELOCATION OF EXISTING UTILITIES SHALL BE SCHEDULED AT THE CONVENIENCE OF THE OWNER.
9. IT IS THE CONTRACTORS RESPONSIBILITY TO REPLACE/RESTORE ANY ITEM OR EQUIPMENT DAMAGED DURING DEMOLITION. ANY ITEM OR EQUIPMENT THAT IS REMOVED TO FACILITATE THE DEMOLITION NEEDS TO BE REINSTALLED BACK TO ORIGINAL CONDITION. PATCH ALL OPENINGS IN FLOOR, CEILING AND WALLS MADE IN ADJACENT AREAS THAT ARE NOT BEING DEMOLISHED.

ELECTRICAL SYMBOL LEGEND

SYMBOL	DESCRIPTION	MOUNTING HEIGHT (NOTE 1)	NOTES
S_a	SINGLE POLE WALL SWITCH (LOWER CASE LETTER INDICATES CONTROL)	44"	---
S_D	DIMMER SWITCH DESIGNATION IN DIMMER CONTROL	44"	---
S_3	THREE-WAY WALL SWITCH	44"	---
	DOUBLE DUPLEX RECEPTACLE	16" UNO	---
	DUPLEX RECEPTACLE	16" UNO	---
J	JUNCTION BOX	---	---
	SINGLE PHASE MOTOR	---	---
	THREE PHASE MOTOR	---	---
	SPECIAL OUTLET AS NOTED	---	---
	BRANCH CIRCUIT PANELBOARD	NOTE 15	---
▽	DATA OUTLET	16" UNO	5, 10
▼	COMMUNICATION OUTLET	16" UNO	5, 12
⊗	RECESSED LUMINAIRE	---	---
	SURFACE OR PENDENT LUMINAIRE	---	---
	WALL MOUNTED LUMINAIRE	---	---
	SURFACE OR PENDENT EXIT SIGN	---	---
	WALL MOUNTED EXIT SIGN	---	---
	RECESSED EMERGENCY LUMINAIRE	---	---
	SURFACE EMERGENCY LUMINAIRE	---	---
	PLAN NOTE INDICATION		
NL	NIGHT LIGHT LUMINAIRE	---	---
UNO	UNLESS NOTED OTHERWISE	---	---
WP	WEATHERPROOF	---	---
AFF	ABOVE FINISHED FLOOR	---	---

ELECTRICAL SYMBOL LEGEND NOTES:

1. MOUNTING HEIGHTS ARE FROM FINISHED FLOOR TO BOTTOM OF BOX, UNLESS NOTED OTHERWISE.
2. BUSSMANN TYPE SSY FOR 4" SQUARE BOX. SIZE FUSE AS REQUIRED FOR UNIT PROTECTION.
3. WITH DOUBLE GANG COVERPLATE. INSTALL SWITCH ADJACENT TO DOOR.
4. "c" SUBSCRIPT FOR RECEPTACLES INDICATES DEVIDE MOUNTED ABOVE COUNTERTOP HEIGHT. MOUNT 2" ABOVE COUNTERTOP, BACKSPLASH, OR LAVATORY. COORDINATE LOCATION AND MOUNTING HEIGHT WITH OTHER TRADES.
5. CONCEAL RECEPTACLE BEHIND OR WITHIN WATER COOLER. COORDINATE WITH PLUMBING CONTRACTOR.
6. MULTI-OUTLET PLUGSTRIP ASSEMBLY: WIREMOLD 2000 SERIES WITH 15 AMP OUTLETS AT 1'-0" CENTERS. PROVIDE COUPLINGS, END CAPS, FITTINGS ETC. AS REQUIRED. FEED PLUGSTRIP THROUGH BASE KNOCK-OUT AND FLEXIBLE CONDUIT CONCEALED WITHIN WALL. WIRE PLUGSTRIPS FED BY TWO OR MORE CIRCUITS SUCH THAT OUTLETS ARE EVENLY DISTRIBUTED AMONG ALL CIRCUITS.
7. 4" SQ. BOX, SURFACE MOUNTED: SINGLE GANG FOR SINGLE SERVICES. TWO (2) 2-GANG BOXES FOR COMBINATION ELECTRIC COMMUNICATION AND DATA SERVICES.
8. PROVIDE 3/4" CONDUIT UNO FROM BOX TO ACCESSIBLE CEILING SPACE.
9. SEE PLANS OR DETAILS FOR MOUNTING HEIGHTS.
10. 4" SQ. BOX, 1-GANG RING, WITH 3/4" CONDUIT TO ACCESSIBLE CEILING SPACE. MOUNTING HEIGHT AS SHOWN OR AS NOTED ON THE PLAN.

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TITLE
LIGHTING FIXTURE SCHEDULE, SYMBOL LEGEND

DATE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO. R.O.W.	SHEET NO. CONST.
03/26/2010	84917	105046A	MUELLER		23

	SPECIAL PROVISION NAME	SHEET NUMBER																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	TMC INTERIOR FIT-OUT AND ITS SYSTEM INTEGRATION AND PROJECT OVERVIEW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	MAINTAINING TRAFFIC	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	MEASUREMENT AND PAYMENT				X	X	X	X	X	X	X													
4	ATMS NETWORK OVERVIEW				X	X	X	X	X	X	X													
4.1	BASIC METHODS AND MATERIALS FOR ITS WORK				X	X	X	X	X	X	X													
4.2	PROTECT ITS INFRASTRUCTURE				X	X	X	X	X	X	X													
4.3	ATMS INTEGRATION AND IMPLEMENTATION				X	X	X	X	X	X	X													
4.4	STRUCTURED CABLING				X	X	X	X	X	X	X													
4.5	COMMUNICATIONS GROUNDING AND BONDING				X	X	X	X	X	X	X													
4.6	AIR-BLOWN FIBER-OPTIC (ABF) TUBE & CABLE INFRASTRUCTURE				X	X	X	X	X	X	X													
4.7	10 GIGABIT ETHERNET NETWORK SWITCH				X	X	X	X	X	X	X													
4.8	WDM COMMUNICATIONS CONTROLLER				X	X	X	X	X	X	X													
4.9	CONDUIT, DIRECTIONAL BORE, (NUMBER), _ INCH				X	X	X	X	X	X	X													
4.10	GROUNDING AND BONDING				X	X	X	X	X	X	X													
4.11	ITS CONDUIT CONSTRUCTION				X	X	X	X	X	X	X													
4.12	LIGHTNING PROTECTION				X	X	X	X	X	X	X													
4.13	CONDUIT CLEANING AND TESTING				X	X	X	X	X	X	X													
5	INTERIOR FIT-OUT OVERVIEW											X	X	X	X	X	X	X	X	X	X	X	X	X
5.1	BASIC METHODS AND MATERIALS FOR INTERIOR FIT-OUT											X	X	X	X	X	X	X	X	X	X	X	X	X
5.2	VIDEO WALL RELOCATION AND NEW INSTALLATION											X	X	X	X	X	X	X	X	X	X	X	X	X
5.3	CRYSTAL REPORTS SERVER											X	X	X	X	X	X	X	X	X	X	X	X	X
5.4	FLAT PANEL DISPLAYS											X	X	X	X	X	X	X	X	X	X	X	X	X
5.5	SERVER RACK(S)											X	X	X	X	X	X	X	X	X	X	X	X	X
5.6	VIDEO RECORDER											X	X	X	X	X	X	X	X	X	X	X	X	X
5.7	SOUND MASKING SYSTEM											X	X	X	X	X	X	X	X	X	X	X	X	X
5.8	METAL FABRICATIONS - SECTION 05 50 00											X	X	X	X	X	X	X	X	X	X	X	X	X
5.9	ROUGH CARPENTRY - SECTION 06 10 00											X	X	X	X	X	X	X	X	X	X	X	X	X
5.10	INTERIOR ARCHITECTURAL WOODWORK - SECTION 06 40 23											X	X	X	X	X	X	X	X	X	X	X	X	X
5.11	JOINT SEALANTS - SECTION 07 92 00											X	X	X	X	X	X	X	X	X	X	X	X	X
5.12	PENETRATION FIRESTOPPING - SECTION 07 84 13											X	X	X	X	X	X	X	X	X	X	X	X	X
5.13	FLUSH WOOD DOORS - SECTION 08 14 16											X	X	X	X	X	X	X	X	X	X	X	X	X
5.14	GLAZING - SECTION 08 80 00											X	X	X	X	X	X	X	X	X	X	X	X	X
5.15	NON-STRUCTURAL METAL FRAMING - SECTION 09 22 16											X	X	X	X	X	X	X	X	X	X	X	X	X
5.16	GYPSUM BOARD - SECTION 09 29 00											X	X	X	X	X	X	X	X	X	X	X	X	X
5.17	SPECIAL CEILING SYSTEMS - SECTION 09 54 00											X	X	X	X	X	X	X	X	X	X	X	X	X
5.18	FIXED SOUND-ABSORPTIVE PANELS - SECTION 09 84 13											X	X	X	X	X	X	X	X	X	X	X	X	X
5.19	INTERIOR PAINTING - SECTION 09 91 23											X	X	X	X	X	X	X	X	X	X	X	X	X
5.20	STAINING AND TRANSPARENT FINISHING - SECTION 09 93 00											X	X	X	X	X	X	X	X	X	X	X	X	X
5.21	VISUAL DISPLAY SURFACES - SECTION 10 11 00											X	X	X	X	X	X	X	X	X	X	X	X	X

DATE:

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		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
5.22	METAL LOCKERS - SECTION 10 51 13											X	X	X	X	X	X	X	X	X	X	X	X	X
5.23	BASIC FURNISHINGS REQUIREMENTS - SECTION 12 00 00											X	X	X	X	X	X	X	X	X	X	X	X	X
5.24	SHADES - SECTION 12 20 00											X	X	X	X	X	X	X	X	X	X	X	X	X
5.25	FURNITURE AND ACCESSORIES - SECTION 12 40 00											X	X	X	X	X	X	X	X	X	X	X	X	X
5.26	SYSTEMS FURNITURE - SECTION 12 59 00											X	X	X	X	X	X	X	X	X	X	X	X	X
5.27	COMMON WORK RESULTS FOR ELECTRICAL WORK - SECTION 26 05 00											X	X	X	X	X	X	X	X	X	X	X	X	X
5.28	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES - SECTION 26 05 19											X	X	X	X	X	X	X	X	X	X	X	X	X
5.29	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS - SECTION 26 05 26											X	X	X	X	X	X	X	X	X	X	X	X	X
5.30	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS - SECTION 26 05 29											X	X	X	X	X	X	X	X	X	X	X	X	X
5.31	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS - SECTION 26 05 33											X	X	X	X	X	X	X	X	X	X	X	X	X
5.32	CABLE TRAYS FOR ELECTRICAL SYSTEMS - SECTION 26 05 36											X	X	X	X	X	X	X	X	X	X	X	X	X
5.33	VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS - SECTION 26 05 48											X	X	X	X	X	X	X	X	X	X	X	X	X
5.34	IDENTIFICATION FOR ELECTRICAL SYSTEMS - SECTION 26 05 53											X	X	X	X	X	X	X	X	X	X	X	X	X
5.35	MODULAR DIMMING CONTROLS - SECTION 26 09 36											X	X	X	X	X	X	X	X	X	X	X	X	X
5.36	WIRING DEVICES - SECTION 26 27 26											X	X	X	X	X	X	X	X	X	X	X	X	X
5.37	INTERIOR LIGHTING - SECTION 26 51 00											X	X	X	X	X	X	X	X	X	X	X	X	X
6	COORDINATION CLAUSE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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