

MICHIGAN DEPARTMENT OF TRANSPORTATION
CONSTRUCTION AND TECHNOLOGY DIVISION

WORK ELEMENT PLAN
FOR
ENGINEERING TECHNICIANS

Revised
DECEMBER 2007

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INTRODUCTION

This December 2007 Work Element Plan for Engineering Technicians is an update of the November 1992 plan. This most current plan includes work elements for the Bridge Operations Section.

The November 1992 Work Element Plan for Engineering Technicians was a revision of the original November 1981 Supplemental Personnel Classification Plan for Engineering Technicians. The work elements had been updated and the 1981 plan revised to more accurately reflect current engineering technician duties, and to consider the organizational changes that placed field engineering technicians under the supervisory authority of the District Field Engineering Sections.

BASIC POLICY STATEMENT

The department will develop, adopt, implement, and maintain a personnel training and evaluation system to supplement the engineering technician classifications developed by the State Civil Service Commission. The system will:

- Be fully coordinated with the State Civil Service System.
- Define the specific work that employees must perform to demonstrate their capability.
- Provide work-related criteria for promotion to reduce subjectivity in evaluations.
- Increase employee versatility for more effective utilization of manpower.
- Be based on individual performance with no automatic promotions.
- Have clearly defined career progression paths and requirements.
- Encourage the development of employees to the journey level to enhance employee utilization, improve job interest, and reduce costs.

The department retains responsibilities, authority and relationships for adopting, implementing, and continually improving personnel classification plans, policies, and procedures.

PLAN CHARACTERISTICS

The Construction and Technology (C&T) Work Element Plan for Engineering Technicians provides for advancement based on demonstrated individual capabilities of each employee in the engineering technician (ET) 8 through 11 levels. Advancement is based on demonstrated capabilities to perform designated work elements, as well as the education and experience requirements defined in the Civil Service class specifications. Training and certification in the required work elements may be substituted for the education requirements for entry into the technician series. Employees must meet the minimum Civil Service and department requirements at each level to qualify for advancement. Work elements are not required for the ET 12 (SS) level.

The work elements and minimum requirements have been modified to meet current needs for workload staffing. This plan will be reviewed periodically to ensure that work elements and entrance requirements continue to meet the department's needs.

Work Elements

The qualifications for each classification level include combinations of specific work elements. A work element has three characteristics:

1. It is typical of the work for the level.
2. It is a good indicator of the employee's ability to perform or learn other work elements at the same skill level.
3. There is a sufficient volume of work to allow the employees an opportunity to learn and maintain their skills through satisfactory performance.

OPERATING POLICY

This policy statement covers the operation of the plan to the engineering technician personnel classification plan.

Evaluations

Evaluations of all employees will be conducted at least once each year. These evaluations will normally be undertaken after the construction season closes and completed before April 1 of the following year.

Unit supervisors, or their representatives, will annually review and update the work element chart for each employee.

Employees will be evaluated in open meetings of supervisory personnel, where necessary, and if needed an employee improvement program will be developed for the coming year. Minimum elements of the improvement program will include:

1. Identification of additional training and experience needs of each technician.
2. A training plan and general work assignment scheme to assist the employees in gaining the needed experience.
3. An evaluation of individual strengths and weaknesses, and a general program to reinforce strengths and to correct weakness.
4. An evaluation of personnel problems and guidelines to assist supervisors in solving problems.

Continuing Evaluations

An effective personnel program requires the continuing evaluation of personnel. Take personnel actions when needed rather than waiting for the annual evaluation period.

The unit supervisor will make continuing evaluations and request appropriate personnel action.

Employees are expected to effectively perform any work elements for which they are given credit. Where an employee has not been assigned a work element to perform for two or more years, a reasonable time period for becoming effective will be allowed.

Work Element Substitution

Higher level work elements may be substituted for lower level work elements; however, the number of work elements required at each level must be met before advancement to the next level. A work element cannot be counted for more than one level. Technical work elements from other divisions may be substituted at each level, as described in the minimum entrance requirements. Double credit

for similar work elements from other divisions cannot be used for advancement. Working on higher level elements will not constitute working out-of-class. Work elements need not all be earned in one unit or specialty in order to advance.

Authority

Unit supervisors have the authority to recommend promotions for persons from an ET 8 to the 9 level, and from the ET 9 to the E10 level. Actions taken by the section supervisors will be in accordance with personnel classification plans, policies, and procedures. These actions are subject to review and approval by the Office of Human Resources, Civil Service, and the C&T Division.

Nothing in this plan is to conflict with provisions of the collective bargaining agreement for Civil Service rules, procedures and guidelines.

Satisfactory Job Performance Evaluations of Engineering Technician Employees

When an employee is promoted, reassigned, or transferred to a different organizational unit having new and different work elements, he or she must demonstrate an ability to effectively perform the required work elements for the new position after a reasonable period of training. This will be a basis of evaluation when job performance service ratings are conducted.

OPERATING PROCEDURES

The following are operating procedures adopted by the C&T Division in accordance with MDOT's governing policies, procedures, and regulations.

- I.** The C&T Division's administrative section head, or named representative, shall coordinate the operating procedures for the C&T Division's Work Element Plan for Engineering Technicians. This includes maintaining work element certification records on computer file for both Lansing and region C&T engineering technicians.

- II.** The procedure for defining the minimum requirements to demonstrate effective performance of each work element is:
 - A.** When an employee is first assigned duties in an organizational unit work area, their immediate supervisor shall inform them which of their duties constitute the work elements necessary to be promoted to the next ET level (8, 9, E10 or 11).

 - B.** During the work element training period, the employee will be informed of the level of competence they need to demonstrate an effective level of work performance to be certified for each work element, along with the criteria used to evaluate this performance.

 - C.** The evaluation criteria for each activity of a particular work element will include minimum levels of quantity or accuracy, and working time experience. It will also include completing all required documentation neatly and accurately.

- III.** The procedure for evaluating an employee's capabilities to meet minimum requirement for work element certification is:
 - A.** When the supervisor observes that an employee has sufficient training and experience in performing the tasks of a work element and a capability of meeting the minimum evaluation requirement, the supervisor will recommend work element certification for the employee. The recommendation is submitted to the unit supervisor for approval using the appropriate form.

 - B.** An employee may request an evaluation for work element certification at reasonable intervals if they believe they can demonstrate an effective performance to meet the minimum evaluation criteria.

 - C.** The unit supervisor reviews the recommendations of the first line supervisor for work element certification. If approved, the supervisor will forward copies to the employee and the C&T Division Work Element Coordinator (office manager). If the first line supervisor does not recommend approval of a certification request, the employee may request a review of the evaluation with the unit supervisor to clarify the minimum requirements and interpretations. The employee may appeal if not satisfied with the results of this review.

D. If an employee is not assigned the duties of a work element required for advancement within the unit, he or she shall be given the opportunity to perform those tasks that would demonstrate effective performance for work element certification approval. The employee may appeal if not provided a reasonable opportunity to demonstrate work element proficiency.

IV. Procedure for processing appeals. The basis of an appeal should be on inconsistencies in establishing and evaluating minimum requirements for quantity, quality, and reliability levels where it can be alleged they are above the normal C&T work standard prevalent in other C&T organizational units. Following is the appeals process:

A. An employee may appeal a denial of a work element certification or lack of opportunity to demonstrate work element proficiency in writing to the unit supervisor.

B. The Engineer of Construction and Technology will appoint an ad hoc work element panel consisting of three unit supervisors, outside of the appealing employee's chain of command, to consider the appeal.

C. The appealing employee's unit supervisor shall present the unit's position to the panel. The employee may enlist the aid of the local union steward, if desired.

D. The appeal panel, after hearing the contesting positions, will designate a panel member to write a majority decision and the reasons for that decision. The decision will be sent to the appropriate section and division heads for review and concurrence before being issued.

V. Documenting approved work element certification.

A. The C&T Division's office manager shall maintain electronic records of work element certification for each engineering technician in C&T Division and regions.

GUIDELINES FOR ASSIGNING TECHNICIANS FOR TRAINING

The intent of these guidelines is to provide guidance for supervisors to promote uniformity and fairness in administering the necessary training for technicians to attain certification of work elements to meet the division needs. These guidelines were developed with the recognition that sufficient work elements are assigned to each organizational unit for a technician to reach the ET 11 level.

The guidelines for assigning technicians for training purposes are defined below:

- Assignments to gain expertise in work elements in other organizational units will be made when additional personnel in that area are needed or anticipated.
- Improved technician versatility is necessary for effective use of manpower and can be attained through cross-training. However, work loads and priorities must be considered in making these assignments.
- The first line supervisor will grant certification for each work element as individuals demonstrate their ability to effectively perform the work elements.

MINIMUM ENTRANCE QUALIFICATION REQUIREMENTS

ENGINEERING TECHNICIAN 8

Employees assigned to this class and level must possess an associate's degree in civil technology or a college credit equivalent recognized by the Department of Civil Service, or four years of experience equivalent to an engineering technician or construction technician.

ENGINEERING TECHNICIAN 9

Employees assigned to this class and level must have one year of experience as an ET 8, and have demonstrated the ability to perform effectively:

- Six 200 level elements **AND** Three 300 level elements

ENGINEERING TECHNICIAN E10

Employees assigned to this class and level must have two years of experience equivalent to an ET, including one year equivalent to an Engineering Technician 9, and have demonstrated the ability to perform effectively:

- Six 200 level elements **AND** Three 300 level elements (the 9 level requirements)
- **PLUS** three 400 (or higher) level elements.

ENGINEERING TECHNICIAN 11

Persons will be appointed to positions in this class and level only when vacant positions are requested by the division to be filled.

Employees assigned to this class and level must have three years of experience equivalent to an ET, including one year equivalent to an Engineering Technician E10, and have demonstrated the ability to perform effectively:

- Six 200 level elements **AND** Three 300 level elements (the 9 level requirements)
- **PLUS** three 400 (or higher) level elements (the E10 level requirements)
- **PLUS** three additional 400 (or higher) level elements.

WORK ELEMENT CHART

DISTRICT SUPPORT SECTON

TECHNICIAN LEVEL	DENSITY TECHNOLOGY	DISTRICT MATERIALS		ROADWAY MANAGEMENT SYSTEM DEVELOPMENT	
8	201	201	210	216	
	204	202	216	220	
	205	203	220	223	
	206	205	227	225	
	220	206	237	226	
			208	238	227
			209		
9	301	301	318	332	
	302	303	322	342	
	315	304	330	343	
	332	306	332	344	
	339	308	336	347	
			312	352	
			315	356	
			317	363	
E10	401	401	449	401	
	421	402	450	434	
	423	405	454	449	
	449	412	476	456	
	450	421	479	457	
	451	423	480	459	
			426	482	
			427	483	
			429	484	
			430		
11	511	504	526		
	522	506	529		
	529	523	530		
		524	531		
		525	535		
			536		

WORK ELEMENT CHART

TESTING LABORATORY SECTION

STRUCTURAL SERVICES UNIT

TECHNICIAN LEVEL	AGGREGATE & METAL PRODUCTS TESTING	CONCRETE TESTING	FABRICATION INSPECTION	CORING	SCALE CHECKS
8	201	202	201	201	201
	208	211	216	214	206
	210	216	219	216	216
	216	220	220	230	232
	220	221	228	231	233
			229		234
9	308	304	301	301	301
	319	320	308	303	354
	326	330	325	352	355
	331	332	331	353	356
	332	334	332		
		335	349		
			350		
			351		
E10	401	401	401	401	401
	416	413	420	402	468
	438	415	426	465	469
	439	426	427	466	470
	440	441	439	467	471
	449	449	449		
			462		
			463		
			464		
11	511	507	515	513	538
	523	509	523	540	539
		510	527		
		511	528		

WORK ELEMENT CHART

TESTING LABORATORY SECTION (Continued)

BITUMINOUS TECHNICAL SERVICES UNIT

TECHNICIAN
LEVEL

8	201	213
	206	216
	207	220
	208	222
9	308	313
	310	332
	311	333
	312	334
E10	401	433
	402	436
	407	444
	408	447
	409	448
	411	449
	427	476
11	431	
	501	522
	502	523
	503	529
	505	533
	511	536

WORK ELEMENT CHART

TECHNICIAN LEVEL	<u>RESEARCH SECTION</u>					
	STRUCTURES RESEARCH	PAVEMENT TECHNOLOGY		CHEMICAL TECHNOLOGY		INSTRUMENTATION AND DATA SYSTEMS
8	204	202	220	201	215	204
	206	204	223	204	216	206
	214	205	224	205	217	216
	215	206	225	206	220	220
	216	208	226			227
	220	214	235			
			215	236		
		216				
9	323	303	334	301	332	305
	325	304	343	305	336	329
	326	305	345	324	337	332
	322	306	346	327	338	
	332	312	358	328	348	
		314	359			
		315	360			
		320	361			
		332	362			
E10	419	401	449	414	447	401
	421	415	455	424	448	422
	431	417	458	425	460	428
	432	418	459	428	461	449
	472	426	473	442	474	474
		431	474	445	475	
		432	477	446		
		433	478			
		435	481			
11	503	503	517	503		503
	514	504	520	518		511
	515	505	521	533		519
	516	506	531			534
		509	533			
		512	537			
		513	541			

WORK ELEMENT CHART

TECHNICIAN LEVEL	<u>GEOTECHNICAL UNIT</u>	
	SOILS TESTING	GEOTECHNICAL INVESTIGATIONS
8	201	201
	204	202
	205	203
	209	204
	220	214
	237	237
9	309	301
	314	303
	315	330
	316	340
	332	341
E10	401	401
	403	412
	410	421
	412	453
	449	454
	452	
11	503	506
	504	513
	506	525
	508	535
	513	
	517	
	525	

WORK ELEMENT CHART

GEOENVIRONMENTAL SERVICES UNIT

TECHNICIAN
LEVEL

8	203	220
	204	237
	206	239
	216	240
9	301	367
	332	368
	364	369
	365	370
	366	
10	401	454
	421	483
	448	484
	449	485
11	503	
	542	
	543	
	544	

WORK ELEMENT CHART

BRIDGE OPERATIONS UNIT

TECHNICIAN
LEVEL

8	241	245
	242	246
	243	247
	244	
9	371	374
	372	375
	373	
10	486	491
	487	492
	488	493
	489	494
	490	495
11	545	
	546	
	547	
	548	

WORK ELEMENT DESCRIPTIONS

LEVEL 8 ELEMENTS

- 201 **BASIC SAMPLING:** Collect representative aggregate samples from stockpiles, belts, conveyors, trucks or the grade following the procedures detailed in the aggregate procedures manual. Complete sample identification form or as an alternate be proficient in sampling specialty items such as soil, pavements, reflective sheeting, etc.
- 202 **CORING HELPER:** Assist core drill operator in obtaining core samples from pavements and/or structures. May include location of reinforcement steel and dowel bars with pachometer.
- 203 **BORING CREW HELPER:** Assist on boring rig in sampling soils, rock, and swamps, drilling wells and investigating other subsurface conditions.
- 204 **ELEMENTARY FIELD MEASUREMENTS HELPER:** Assist in taking field measurements using such equipment in resistivity and seismic instruments, slope indicators, extensometer, piezometers, settlement plates, pachometers, Benkelman beams, frost gages, calipers, fault gages, level rod, range finders, counters and photometers.
- 205 **MECHANICAL ANALYSIS OF GRANULAR MATERIALS:** Perform gradation test, compute results, and prepare reports in accordance with AASHTO-88.
- 206 **RECONDITION AND REPAIR EQUIPMENT HELPER:** Assist with inspection, reconditioning, repairing and calibrating test equipment.
- 207 **ASPHALT PENETRATION TESTING:** Perform asphalt penetration tests, compute results, and prepare reports in accordance with ASTM D 5.
- 208 **MECHANICAL ANALYSIS OF DENSE GRADED AGGREGATE:** Perform gradation tests of dense graded aggregate, compute results, and prepare reports in accordance with ASTM C 136. Test for dense graded aggregate also include crushed particle content, loss by washing (ASTM C 117) and when performed in the central laboratory may include a Los Angeles abrasion test (ASTM C 131).
- 209 **VOLUMETRIC ANALYSIS OF CLAY SOILS IN THE UNDISTURBED STATE:** Perform natural moisture content and density test, compute results, and prepare reports in accordance with MTM 406.
- 210 **STEEL POSTS:** Perform physical measurements, weight per lineal foot, tensile strength if required, and weight of zinc coating tests, compute results, and prepare reports in accordance with ASTM A 499 and ASTM A 123.
- 211 **FILTER WRAP – ROUTINE ACCEPTANCE:** Perform test to determine weight per unit area, compute results and prepare reports. Test also includes visual inspection to determine extent of possible damage to fabric.
- 213 **GRADATION AND BITUMINOUS CONTENT:** Perform gradation and bituminous content tests on asphalt pavement samples, compute results, and prepare reports in accordance with AASHTO T 30 and ASTM D 2172.
- 214 **BRIDGE DECK SURVEY HELPER:** Assist in obtaining cores or other samples and data, such as pachometer surveys, from bridge decks to determine condition.
- 215 **ELEMENTARY LABORATORY MEASUREMENTS:** Measure cross sectional dimensions of physical test specimens using micrometers and calipers and determine metallic crack lengths using calibrated microscope.
- 216 **ELEMENTARY DATA ANALYSIS:** Tabulate data; compute sums, differences, products, quotients, averages.

- 217 **PREPARATION OF SAMPLES:** Apply reflective materials to substrate, condition in environmental chamber, set-up reflective materials, luminaries, and signals in photometric range.
- 219 **PROCEDURE WELD – SHOP, TRAINEE:** Under supervision, inspect the preparation and welding of procedure specimen. Submit sample to laboratory testing.
- 220 **BASIC COMPUTER TERMINAL OPERATION:** Under close supervision, use computer terminal to enter data into existing programs.
- 221 **BRICK AND BLOCK:** Perform physical measurements, compressive strength and absorption on concrete brick and block and clay brick. Compute and record results in accordance with ASTM C 55, C 139, C 62 and C 56.
- 222 **MATERIAL HANDLING AND PROPORTIONING:** Assist the bituminous mix design unit by receiving submitted aggregate materials, and doing necessary preparation and proportioning prior to the bituminous mix design operations.
- 223 **BEGINNING LOCATION REFERENCE SYSTEM USAGE:** Learn the current highway location reference system and how to use that system and the PMS data base to locate PMS survey, or roughness survey locations.
- 224 **RAPID TRAVEL PROFILOMETER (RTP) DRIVER:** Drive RTP vehicle in a smooth, safe manner, following instructions of the operator.
- 225 **ELEMENTARY PAVEMENT DISTRESS IDENTIFICATION:** Learn to identify basic pavement types and basic distress characteristics for each type.
- 226 **ELEMENTARY PAVEMENT SURVEY PROCEDURES:** Learn both Analytical and Condition pavement survey procedures.
- 227 **DISTANCE PROCESSOR USAGE:** Learn the functions of the Mobile Distance Processor, and be able to operate it.
- 228 **SHOP FABRICATION INSPECTION – HELPER:** Under direct supervision, assist in inspection at metal, sign, or prestress/precast fabrication shops. Performs basic testing and inspection work functions and calculations.
- 229 **REVIEW OF SPECIFICATIONS FOR STRUCTURAL FABRICATION AND ERECTION:** As directed, review and become familiar with Department specifications, Project specifications, National Association’s standards and manuals, and Industrial handbooks and bulletins for field fabrication and erection of structural components. Observe how standards and specifications are applied during construction.
- 230 **PAVEMENT CORING OPERATION HELPER:** Under direct supervision, assist in and learn the concrete pavement acceptance coring operation.
- 231 **SPECIAL CORING OF STRUCTURES HELPER:** Under direct supervision assist in and learn how cores in concrete structures are obtained and become aware of the procedures and safety hazards associated with such specialized operations.
- 232 **CONCRETE PLANT CHECK HELPER:** Under direct supervision, assist in concrete batch plant inspections.
- 233 **INSPECTION OF BEAM AND ANALOG SCALE – HELPER:** Under direct supervision assists in the preliminary system review of beam and analog scale systems.
- 234 **SCALE TESTING – HELPER:** Under direct supervision, assist in testing of proportioning platform and belt conveyor scales.
- 235 **FRICTION TEST VEHICLE DRIVER:** Drive pavement friction test vehicle in a smooth, safe manner, following instructions of the operator.

- 236 **FALLING WEIGHT DEFLECTOMETER DRIVER:** Drive falling weight deflectometer in a smooth, safe manner, following instructions of the operator.
- 237 **PHYSICAL MEASUREMENTS:** Measure the physical dimensions of a material or product by the use of tapes, rules and micrometers and the weight by use of scales or balances. Prepare reports to transmit measurement data to the proper location.
- 238 **WIRE:** Perform physical measurements, weight per lineal foot, tensile strength, and weight of zinc coating tests; compute results and prepare reports in accordance with ASTM A 499 and ASTM A 123.
- 239 **ENVIRONMENTAL DECONTAMINATION:** Know and perform latest decontamination techniques on equipment that is used in environmental testing.
- 240 **ENVIRONMENTAL FIELD SCREENING:** Know and perform proper techniques for field screening on environmental field samples using a Photo Ionization Detector (PID).
- 241 **BRIDGE PLAN READING:** Learn to read and interpret bridge design plans and quantities.
- 242 **BASIC COMPUTER AND SOFTWARE OPERATION:** Under close supervision, use computer terminal, while being trained in the use of various software applications used to enter, update and edit data into existing programs.
- 243 **STRCUTURE NUMBERING SYSTEM:** Learn the current “Control Section” numbering system as it is tied to the “Structure” numbering system.
- 244 **MDOT BRIDGE FILING SYSTEM:** Learn, know and maintain an essential bridge filing system in the Bridge Management Unit.
- 245 **LOCAL AGENCY BRIDGE FILING SYSTEM:** Learn, know and maintain structure inventory inspection files for Local Agencies, Statewide.
- 246 **CULVERT MAINTENANCE REPORTS:** Learn, know and maintain Culvert Maintenance report files, Statewide, MDOT and Local structures.
- 247 **STRUCTURE INVENTORY AND ANALYSIS MANUAL:** Read, study, and understand use of the SI&A manual (Michigan Structure Inventory and Appraisal Coding Guide).

WORK ELEMENT DESCRIPTIONS

LEVEL 9 ELEMENTS

- 301 **MATERIALS SAMPLING:** Collect representative materials samples, prepare sample identification forms and submit samples for testing. Procedures for sampling are listed in the Materials Procedure Manual or Soils Manual. Materials to be sampled include soil, rock, paints and materials.
- 302 **DENSITY TESTING:** Under close supervision, perform density and moisture tests as described in the Density Control Handbook, on soils, bituminous mixtures, stabilized materials, aggregates, and pulverized bituminous mixtures. Compute tests results, and properly prepare reports on the appropriate forms.
- 303 **CONCRETE SAMPLING FOR CHLORIDE:** Obtain sample cores from concrete pavements or structures for chloride content determination, as directed by supervisor.
- 304 **CONCRETE CORES (DIMENSION AND STRENGTH):** Measure cores for diameter, length, and depth of steel; prepare and test cores for compressive strength; compute results and prepare reports in accordance with AASHTO T 148, AASTM C 39 and C 49, and MTM 201.
- 305 **INDEX AND STORE C&T RECORDS:** Collate C&T data, enter data in computer, select documents for microfilming, proof microfilms and store, and locate documents and information on demand.
- 306 **PAVEMENT CONDITION SURVEY HELPER:** Recognize and plot various types of pavement deterioration of concrete and bituminous roadways.
- 308 **MECHANICAL ANALYSIS OF COARSE AGGREGATE:** Perform gradation tests of coarse aggregate, compute results, and prepare reports in accordance with ASTM C-136. Test also includes crushed particle content, loss by washing (ASTM C117), a deleterious particle pick, and when performed by the central laboratory, a Los Angeles abrasion (ASTM C 131).
- 309 **GRADATION ANALYSIS OF FINE GRAINED SOILS:** Perform hydrometer test, compute results, and prepare reports in accordance with AASHTO T 88.
- 310 **ASPHALT CEMENT OR CUTBACK:** Under general supervision, perform all MDOT specification testes, compute results, and prepare reports in accordance with appropriate ASTM Standards for testing.
- 311 **PAVEMENT JOINT FILLER:** Under general supervision, perform tests on bituminous fiber joint or rubberized asphalt pavement joint sealers, compute results and prepare reports in accordance with ASTM D 1190, D 1850 and D 1751 test procedures or modified MDOT test procedures.
- 312 **MARSHALL STABILITY:** Perform Marshall Stability tests on mix design samples, compute results and prepare reports in accordance with ASTM 1559 Mod.
- 313 **ASPHALT EXTRACTION:** Perform independently asphalt extraction and gradation tests on bituminous mixture samples, compute results and prepare reports in accordance with ASTM T 30 and D 2172 test procedures. In addition, perform MDOT Modified Abson Recovery test, ASTM D 1856.
- 314 **SPECIFIC GRAVITY OF SOILS:** Perform test to determine the specific gravity of soils with particle size of 4.75 mm (No. 4 sieve) or smaller, computer results, and prepare reports in accordance with AASHTO T 100.

- 315 **SOIL MOISTURE DENSITY RELATIONSHIPS:** Under close supervision, perform tests to determine the moisture density relationship of soils, compute results, and prepare reports in accordance with AASHTO T 99, Michigan Cone plus ASTM D 2049, using the nuclear density gauge or the Rainhart test method.
- 316 **UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOILS:** Perform test to determine the ultimate unconfined compressive strength and the ultimate shearing resistance of clay soils, compute results, and prepare reports in accordance with MTM 405 (Mod AASHTO T 208).
- 317 **CORRUGATED MEDAL PIPE FIELD INSPECTION:** Inspect pipe for proper fabrication. Checks include proper size, rivet or bolt spacing, sheet overlap and spelter thickness. Prepare inspection report.
- 318 **SOIL SURVEYS AND SWAMP SOUNDINGS HELPER:** Assist in the conducting of soils surveys and swamp soundings. Assist in the classification of soils, soil textures, soil consistency, top soil depths and location of water table.
- 319 **STEEL BAR OR FABRIC:** Perform tensile strength and/or bend tests, compute results, and prepare reports in accordance with ASTM A 615, A 616, A 617, A 309, A 36, and A 185.
- 320 **ABSORPTION AND SPECIFIC GRAVITY OF AGGREGATES AND CEMENTS, POZZOLANIC ADMIXTURES (FLY ASH):** Perform absorption and specific gravity of fine aggregates, coarse aggregates, and specific gravity of cements and fly ash; compute results, and prepare reports in accordance with ASTM C 128, C 127, C 188, and C 618.
- 322 **STRUCTURAL STRESS AND VIBRATION ANALYSIS:** Aid in stress or vibration studies by setting up and operating seismometers, recording equipment and reading traces.
- 323 **STATIC MATERIAL PROPERTIES EVALUATION AND CHARPY IMPACT TESTING:** Perform static materials tests on universal testing machine and conduct Charpy impact tests in accordance with procedures provided. Determine yield strength, ultimate strength and/or impact resistance of specimens and prepare test reports.
- 324 **PHOTOMETRIC FIELD MEASUREMENTS:** Perform photometric measurements of traffic control devices in the field in accordance with procedures provided. Operate the photometric research van.
- 325 **BASIC NON-DESTRUCTIVE EVALUATIONS:** Perform magnetic particle and/or die penetrant evaluations in accordance with procedures provided.
- 326 **BASIC METALLAOGRAPHIC PROCEDURES:** Cut, mount, polish, etch specimens, and run macro hardness test in accordance with procedures provided.
- 327 **ROUTINE PHOTOMETRIC MEASUREMENTS:** Perform photometric measurements of reflective materials in photometric range in accordance with procedures provided.
- 328 **COATING TESTS HELPER:** Assist in preparation of standard test panels for ultra-violet or salt spray or other tests by sandblast and spray or brush coating with test paint.
- 329 **SOUND MEASUREMENTS:** Under general supervision conduct noise measurements using sound meters, and sound analyzers for environmental impact studies and citizen noise complaints in accordance with procedures prescribed for a particular site.
- 330 **OPERATION OF BORING AND CORING EQUIPMENT:** Ability to operate 03 and 04 vehicles and associated equipment such as pumps, drills, roto hammer and delamination detector.
- 331 **PROCEDURE WELD-SHOP:** Inspect the preparation and welding of procedure specimen. Identify and record material information. Determine that proper preparation and welding techniques are observed. Perform

measurements, such as fillet radii. Make final determination as to the suitability of the specimen for further laboratory testing. Use AWS D1.1, D1.2 and D1.5 and Departmental specifications as guidelines.

- 332 **COMPUTER TERMINAL OPERATIONS:** Input data and run computer programs usually used by the division.
- 333 **ASPHALT EMULSION TESTING:** Under general supervision, perform asphalt emulsion tests such as penetration of residue, distillation and Saboldt Viscosity, compute results and prepare reports in accordance with ASTM D 244.
- 334 **ANALYSIS OF FREEZE THAW DATA:** Analyze data obtained during freeze thaw testing of concrete specimens. May involve both hand calculations and computer assisted calculations.
- 335 **CEMENT & POZZOLANIC ADMIXTURE (FLY ASH) – PHYSICAL TESTING HELPER:** Assist in performing tests to determine physical properties of cement and fly ash. These include normal consistency, time of set, autoclave soundness, air content, compressive strength, pozzolanic activity index with Portland cement and air entraining admixture requirements. Compute results and prepare reports in accordance with ASTM D 150 and C 618.
- 336 **GLASS BEADS:** Perform the physical evaluation of glass beads for gradation properties, alkalinity, and color.
- 337 **CANVAS BAGS:** Perform the physical evaluation of canvas bags, determining the weight, size and mesh count.
- 338 **SPECIFIC GRAVITY MEASUREMENT:** Determine the specific gravity of liquids such as calcium chloride solution, water, admixture, etc.
- 339 **DENSITY TESTING – CONSTRUCTION WORK ELEMENT NUMBERS 18:** Select test sites. Know testing methods. Use Speedy moisture meter or determine moisture content by stove drying. Perform Michigan Concrete Test. Perform one-point Proctor Tests. Determine in place density with a volumeter. Prepare reports. Inform contractor of failing tests.
- 340 **PLUGGING OF FOUNDATION TEST BORINGS:** Working knowledge of methods used and demonstrated ability to plug foundation test borings in accordance with the provisions of the Mineral Well Act and General Rules (Act 315).
- 341 **PENETRATION TESTING:** Perform the standard penetration tests in accordance with ASTM D 1586 to determine density of sands or other non-cohesive soils or as a relative measure of shear strength for cohesive soil.
- 342 **ELEMENTARY SURVEY DATA CHECKING:** Under direct supervision check incoming analytical pavement survey data for correct location reference and data completeness.
- 343 **SURVEY HELPER:** Assist in conducting analytical and condition pavement surveys.
- 344 **BEGINNING PAVEMENT SURVEY DATA ANALYSIS:** Under direct supervision analyze survey data, for rating or cause of distress in pavement.
- 345 **RAPID TRAVEL PROFILOMETER MAINTENANCE:** Maintain RTP vehicle and the vehicle logs.
- 346 **RAPID TRAVEL PROFILOMETER HELPER:** Drive RTP and using mobile distance processor determine control section mileage as directed by the operator.
- 347 **PAVEMENT MANAGEMENT SYSTEM DATA UPDATE:** Under direct supervision, use other information sources such as T&R records, Sufficiency Book, Control Section Log Record, to obtain data for inclusion in or revision of PMS data bases.
- 348 **AIR QUALITY MONITOR SET UP:** Assist with set up of air quality monitoring units.

- 349 **ASSIST IN FABRICATION INSPECTION – SHOP:** Under direct supervision, assist in assembling data, preparation of reports, and maintaining records. Assist in testing and inspection of all phases of fabrication operation. Works independently as directed.
- 350 **PREPARATION OF TEST SPECIMENS:** Make, identify, cure, and test in compression concrete specimens used to determine transfer of prestress strength and 28 day strength; or inspect preparation and welding of procedure and welder qualification test plates. Submit plates to laboratory for testing. Maintain current welding records for each assigned fabrication shop and its personnel.
- 351 **ASSIST IN PROJECT SITE FIELD REVIEW:** Under direct supervision, assist in resolving job site problems related to fabricated members. Observe construction practices and procedures for erecting structural components. Document field findings and prepare synoptic report.
- 352 **PAVEMENT CORING ASSISTANT:** Assists in all phases of the pavement coring operation as directed including driving the truck, operating the equipment, and layout.
- 353 **SPECIAL CORING OR STRUCTURES ASSISTANT:** Assists in all phases of special coring of structures as directed including obtaining of cores, erecting special work platforms, and determining where cores are to be taken.
- 354 **CONCRETE PLANT INSPECTION – TESTING ASSISTANT:** Assists in the inspection of concrete plant lay-out, equipment and facilities, materials handling, and operations; assists in testing procedures to establish that proportioning and mixing specification requirements are met.
- 355 **ASSIST IN INSPECTION OF BEAM AND ANALOG SCALES:** Assists in the preliminary inspection and aids in noting modifications and free functioning of elements. Becomes familiar with Handbook 44.
- 356 **SCALE TESTING ASSISTANT:** Assist in the testing of proportioning, platform and belt conveyor scales including tests for accuracy and repeatability.
- 357 **MISCELLANEOUS CONCRETE ITEMS FABRICATION INSPECTION:** Inspect the fabrication of concrete pipe or concrete reinforced earth panels or concrete sound barriers and related items to assure compliance with plans and specifications. Complete reports.
- 358 **FRICTION TEST VEHICLE MAINTENANCE:** Maintain the pavement friction test vehicle and prepare vehicle logs.
- 359 **FALLING WEIGHT DEFLECTOMETER MAINTENANCE:** Maintain falling weight deflectometer test system and prepare vehicle logs.
- 360 **FRICTION TEST VEHICLE HELPER:** Drive pavement friction test vehicle and using mobile distance processor determine location within control section as directed by the operator.
- 361 **FALLING WEIGHT DEFLECTOMETER HELPER:** Drive assist traffic vehicle and perform traffic control operations as directed by the operator.
- 362 **AGGREGATE WEAR INDEX (WEAR TRACK PHYSICAL TESTING HELPER):** Assist in preparation of Wear Track test slabs including placement of test aggregate in molds, mix and place concrete, position slabs in wear track, adjust safety stops and assist in conducting static skid testing.
- 363 **LOAD TRANSFER ASSEMBLY INSPECTION HELPER:** Under direct supervision, assist in the inspection of load transfer assemblies.
- 364 **ENVIRONMENTAL WATER TESTING:** Perform field evaluation of Ph, Conductivity, etc., as needed in the collection of water samples.

- 365 **ENVIRONMENTAL GROUNDWATER SAMPLING:** Obtain groundwater samples for chemical testing, using bailers, submersible pumps, etc.
- 366 **ENVIRONMENTAL MONITOR WELL CONSTRUCTION AND INSTALLATION:** Under the direction of Unit Professionals, construct and install monitor wells as environmental sites in accordance with the latest standard procedures for the industry.
- 367 **ENVIRONMENTAL FIELD TESTING:** Assist Unit Professionals in performing specialized environmental field tests, such as soil gas surveys, pump/slug tests, etc.
- 368 **ENVIRONMENTAL FIELD EQUIPMENT USE:** Know the use, maintenance, field repair, and calibration of environmental equipment such as gas meters, photo ionization detectors (PID's), water level meters, submersible pumps, etc.
- 369 **ENVIRONMENTAL CHEMICAL ANALYSIS SELECTION:** Independently determine appropriate laboratory analytical methods to be utilized in the chemical analysis of soil and groundwater for typical sites of environmental interest.
- 370 **ENVIRONMENTAL SOIL SAMPLING:** Collection, storage and transportation, including chain custody, of environmental soil samples for chemical analysis in accordance with the standard procedures for the industry.
- 371 **BRIDGE UNDERCLEARANCE DATA:** Measure bridge underclearances using laser mounted equipment on truck Statewide.
- 372 **LASER MOUNTED TRUCK MAINTENANCE:** Responsible for scheduled truck maintenance and upkeep.
- 373 **USE OF LAPTOP COMPUTER:** Ability to use computer and software that has been setup for measuring bridge underclearances.
- 374 **SELECT DATA ENTRY:** Traffic count data, and bridge underclearance data entry into the Transportation Management System (TMS).
- 375 **BRIDGE INSPECTION:** Assist Bridge Inspectors from the Bridge Operations Section, during field inspection of structures.

WORK ELEMENT DESCRIPTIONS

LEVEL E10 ELEMENTS

- 401 **TECHNICAL OFFICE FUNCTION:** Review plans and specifications. Review, tabulate, evaluate and update technical records, test reports, and test procedures. Write letter reports.
- 402 **DETERMINATION CORING OF PAVEMENTS:** Responsible for obtaining preliminary design core samples from pavements and structures, or form new pavements as required by specifications and MTM 201 for final acceptance testing. Responsible for operation and routine maintenance of coring equipment.
- 403 **INSTRUMENTATION – SOILS:** Assist in field instrumentation projects. Ability to establish ground control, read plans, reduce data, prepare sketches, monitor instruments such as slope indicators, extensometer, piezometer, resistivity and seismic instructions, and assist installation of instrumentation.
- 405 **DENSITY QUALITY CONTROL:** Monitor density quality control performed by construction personnel on soils, aggregates, bituminous courses, stabilization and concrete recycling for state and local government agencies and consultants. Perform density I.A.T.S.
- 407 **ASPHALT CEMENT OR CUTBACK TESTING:** Independently perform all MDOT specification tests on asphalt samples of cement or cutback, compute results and prepare reports in accordance with ASTM D 244.
- 408 **ASPHALT EMULSION:** Under general supervision perform asphalt emulsion tests, such as a penetration of residue, distillation, and saboldt viscosity; compute results and prepare reports in accordance with ASTM D 244.
- 409 **ASPHALT VISCOSITY:** Perform asphalt viscosity tests using the saboldt, cone plate, and kinematic methods; compute results and prepare reports in accordance with ASTM D 2170, D 2171, and D 88.
- 410 **TRANSVERSE SHEARING RESISTANCE OF COHESIVE CLAY SOIL:** Perform test to determine the shearing resistance of clay soils by measuring the force required to cause failure in double shear of a soil cylinder, compute results, and prepare reports in accordance with MTM 401.
- 411 **ASPHALT EXTRACTION AND RECOVERY:** Independently perform asphalt extractions and recovery tests on bituminous test samples and the modified Abson recovery test. Compute results and prepare report in accordance with ASTM T 30, D 2172 and Modified ASTM D 1856 test procedures.
- 412 **GROUND WATER AND SURFACE WATER INVESTIGATIONS:** Assist in ground and surface water investigations. Ability to establish ground control, read plans, reduce data, prepare sketches, collect samples and water level information. Demonstrated ability to determine the appropriate method based on soil conditions. Assist in field testing and assist in installing monitor wells.
- 413 **PLASTIC UNDERDRAIN PIPE:** Perform tests to determine dimensions, pipe stiffness, elongation, etc.; compute results and prepare reports in accordance with ASTM F 405, D 2412, and AASHTO M 294 and M 252.
- 414 **PAINT AND VARNISH-PHYSICAL ANALYSIS:** Perform tests to determine volatiles, pigment content, consistency, weight per gallon, drying time, fineness of grind, color, etc.; compute results and prepare report in accordance with procedures provided. Ability to calibrate with standards various instruments required for testing.
- 415 **FREEZE-THAW DURABILITY HELPER:** Grade samples, weigh out fine and coarse aggregate, cement and water, perform air and slump tests, mix concrete, make concrete cylinders, freeze-thaw beams, aid in dilation measurements and tabulate data in accordance with procedures provided.

- 416 **PROCEDURE WELD – LAB:** Inspect weld sample for possible visual rejection due to undercutting, improper size and generally poor weld characteristics. Perform rough cut of sample prior to machine shop preparation. Perform tensile, bend, and Charpy V-notch tests in accordance with AWS Structural Welding Code. Compute results and prepare reports.
- 417 **EPOXY TESTING:** Perform tests to determine viscosity, specific gravity, gel time, tensile strength, elongation, shear bond strength and absorption of water; compute results and prepare test reports in accordance with procedures provided.
- 418 **ELASTOMERIC MATERIAL TESTING:** Perform tests to determine dimensions, tensile strength, elongation, hardness, property changes after oven aging, oil immersion and ozone exposure, and recovery from compression at different temperatures; compute results and prepare test reports in accordance with procedures provided.
- 419 **METALLURGICAL EVALUATION:** Assist in metallurgical evaluations by preparing specimens, determining grain size and micro hardness, and performing metallurgical inspections; take microphotographs; compute test results and prepare test report where applicable in accordance with procedures provided.
- 420 **WELD TESTING – NON-DESTRUCTIVE - RADIOGRAPHIC:** Determine that radiographs have been provided for specified welded joints. Interpret radiographs for quality of welds. Approve welds or require necessary repairs.
- 421 **SURVEYING:** Using level and transit establish ground control for investigations. Determine location, elevation, and layout.
- 422 **SOUND EQUIPMENT OPERATION:** Operate sound measurement equipment including sound meters and sound analyzers. Acquire knowledge of sound measurement test procedures and fundamentals of human response to noise.
- 423 **REPAIR AND RECONDITION EQUIPMENT:** Annual checking, repairing, and calibrating soils, concrete, and inventory of field construction testing kits, for density, concrete, bituminous, etc.
- 424 **REFLECTIVE MATERIALS TESTING:** Photometrically and physically test reflective sign material, delineators, and markers; compute results and prepare test report in accordance with procedures provided.
- 425 **ARTIFICIAL WEATHERING OF REFLECTIVE MATERIALS:** Operate and maintain artificial weatherometer and perform analysis of weathered materials in accordance with procedures provided.
- 426 **CONCRETE TESTING – FIELD:** Conduct field tests (air, slump, yield) on fresh concrete; compute results and prepare test report in accordance with procedures provided.
- 427 **QUALITY ASSURANCE-AGGREGATE:** Monitor aggregate quality by reviewing aggregate reports, aggregate inspection procedures, methods of production, stockpiling and handling of aggregates.
- 428 **CALIBRATION AND RECONDITIONING SOUND LEVEL METERS:** Periodic checking, reconditioning and calibration of sound level meters for numerous local law enforcement agencies in conjunction the vehicle noise enforcement program.
- 429 **INVESTIGATION FOR FOUNDATION; SLOPES, AND SUBGRADES:** Assist in investigating soil and drainage conditions for foundations, slopes and subgrades to determine need for corrective action. Make recommendations for corrective action and keep up to date project records of actions taken.
- 430 **SOIL SURVEY:** Assist in mapping soil profile and classify soils according to the pedological classification system. Assist in the sounding and boring of swamps and unstable soil areas. Help prepare records and reports.
- 431 **PHYSICAL MATERIALS EVALUATIONS:** Perform physical experiments on materials including such tests as ultimate and yield strength determination, ductility, hardness, shear strength and anchorage strength, make

comparisons, record data, analyze and prepare brief technical letter reports in accordance with established procedures.

- 432 **INSTALLATION OF REFERENCE AND DATA GATHERING FOR FIELD RESEARCH INVESTIGATIONS:** Field measurements for research investigations: Install reference points for rotational or displacement measurements in experimental pavements or bridge projects. Make measurements including deflections, translations, rotations, and elevations, using equipment such as deflectometers, transit, benkelman beam, and fault gages, record, assemble and evaluate data.
- 433 **NON STANDARDIZED SOILS AND BITUMINOUS TESTING:** Under close supervision, perform soils and bituminous tests which have been modified or are experimental such as triaxial repetitive load testing, field permeability testing and frost susceptibility testing.
- 434 **PMS ANALYTICAL SURVEYS:** Independently perform Pavement Management Systems (PMS) analytical distress surveys.
- 435 **PAVEMENT FRICTION TESTING:** Assist in obtaining pavement friction measurements, routine equipment repair and calibrating equipment, and preparing data for reporting.
- 436 **PAVEMENT JOINT FILLER:** Perform independently tests on bituminous fiber joint material or rubberized asphalt pavement joint sealers, compute results and prepare reports in accordance with ASTM D 1190, D 1850 and/or ASTM D 1751 or MDOT modified test procedure.
- 437 **COLOR ANALYSIS:** Perform color measurements, plot data, and maintain and calibrate color standards in accordance with procedures provided.
- 438 **STEEL BOLTS AND NUTS:** Perform physical measurements, yield and tensile strengths, elongation, and turn-of-nut tests, compute results, and prepare reports in accordance with ASTM A 153, A 325, and A 563. Train field personnel including project engineers, inspectors, etc. on turn-of-nut technique on the job.
- 439 **STEEL COATINGS EVALUATION:** Perform tests to determine spelter, aluminum, epoxy, and polyethylene coatings condition and thicknesses over various steel products, compute results and prepare reports in accordance with ASTM Specifications (A 90, A 428, D 3963 and E 376) and Department specifications.
- 440 **FRACTURE CRITICAL STEEL EVALUATION:** Assist in evaluating fracture critical steel components according to the Drop Weight Tear Test (ASTM E 436), Charpy V-notch requirements of the Department Specifications, Brinell and Rockwell Hardness tests. The appropriate ASTM Specs (A 36, A 572, A 588, A 500, etc.) and proposals Special Provisions also apply.
- 441 **CONCRETE PROPORTIONING CHARTS:** Assist supervisor in preparing concrete proportioning charts. Obtain values needed from current files of specific gravities, absorptions, unit weights, etc. Enter data into computer to obtain weights of materials required per cubic yard of concrete.
- 442 **WATER FOR PORTLAND CEMENT CONCRETE:** Determine the total solids, organic solid and PH of water used in making concrete.
- 443 **AGGREGATE:** Determine the percent insoluble in aggregate used in concrete and other highway projects.
- 444 **CALIBRATE WITH STANDARDS VARIOUS INSTRUMENTS REQUIRED FOR TESTING:** Calibrate instruments used in analysis of paints and related materials, such as photometer, viscosimeter, etc.
- 445 **CONCRETE CURING COMPOUND:** Perform the analysis of concrete curing compounds for non-volatile, pigment, reflectance, etc.
- 446 **CALCIUM CHLORIDE:** Determines the percent calcium chloride in flakes and the percent gradation.

- 447 **BITUMINIZED FABRIC:** Perform total analysis of bituminized fabric; size, bituminous content, and mesh count.
- 448 **WASTES:** Properly dispose of chemicals and hazardous wastes according to provided procedures.
- 449 **INTERMEDIATE COMPUTER TERMINAL OPERATION:** Independently use terminal to enter data into new or existing programs. Generate reports, charts, graphs, and related data.
- 450 **ADVANCED DENSITY TESTING:** Independently perform density and moisture tests as described in the Density Control Handbook, on soils, bituminous mixtures, stabilized materials, aggregates, and pulverized bituminous mixtures. Compute test results, and properly prepare reports on the appropriate forms.
- 451 **ADVANCED DENSITY TESTING – CONSTRUCTION WORK ELEMENT NUMBER 18:** Two (2) construction seasons experience performing work element.
- 452 **ATTERBERG LIMITS TESTS:** Perform test to determine liquid, plastic, and shrinkage limits to establish consistency of fine-grained soils, compute results and prepare reports in accordance with procedures.
- 453 **UNDISTURBED SAMPLING:** Working knowledge of equipment and procedures and demonstrated ability to obtain, process, and transport undisturbed samples of cohesive or semi-cohesive soils or suitable quality suitable for laboratory testing.
- 454 **FIELD CLASSIFICATION OF SOILS AND TEST HOLE LOGGING:** Demonstrated ability to accurately characterize and record the soil profile to include soil classification, consistency, density, grain size, layer thickness, moisture condition, static water level, and other properties which could effect soil behavior.
- 455 **RAPID TRAVEL PROFILOMETER EQUIPMENT OPERATIONS:** Develop a general knowledge of the electronic and computer functions of the RTP and recognize when malfunctions of the equipment occur.
- 456 **PAVEMENT SURVEY DATA CHECKING:** Check incoming survey data for accuracy and logical errors.
- 457 **PAVEMENT CONDITION SURVEY MONITORING:** Assist in monitoring the districts field survey data using video tapes or on site inspections.
- 458 **RAPID TRAVEL PROFILOMETER DRIVING OPERATIONS:** Independently perform the driver's duties in the RTP including all operations of the mobile distance processor.
- 459 **PROCEDURES DEVELOPMENT PROCEDURES:** Assist in developing new data bases and/or new analytical survey procedures.
- 460 **STANDARD CHEMICAL PROCEDURES:** Perform standardized chemical procedures, including preparation of solutions.
- 461 **HI VOL SAMPLING:** Set up, operate and repair Hi Vol Samplers; prepare new filters and process used filters.
- 462 **FABRICATION INSPECTION – SHOP:** Working under general supervision, responsible for all phases of fabrication acceptance of materials and final product. Examples may include inspection of precast concrete elements such as reinforced earth panels, long span arch systems, and precast culvert sections, or inspection of bridge bearings, pins and link plates, and other bridge components, or inspection of signs, cantilever and overhead sign structures, and bridge mount structures.
- 463 **COATING INSPECTION:** Conduct field or shop inspection of painting, chrome plating or galvanizing of structural steel. Check surface preparation, temperature/humidity conditions, coating thickness, continuity, etc. Prepare project inspection report.

- 464 **PROJECT SITE FABRICATION AND ERECTION REVIEW:** Resolve construction problems related to field fabrication and erection as directed. Review construction practices and procedures with field personnel.
- 465 **SPECIAL CORING OF STRUCTURES:** Determine where cores are to be taken. Obtain cores using portable core drill and generator and report findings. Responsible for erection of working platforms at heights, in tunnels and over water, and insure all safety precautions are taken.
- 466 **CLASSIFICATION OF CORES:** Responsible for classifying cores into core types and determining the number and locations of additional cores required in pavement penalty situations.
- 467 **PROJECT CORING LAY-OUT:** Review road plans, project records, and project proposals to determine road stationing limits for coring units on a project. Prepare reports for project engineers.
- 468 **INSPECTION OF BEAM AND ANALOG SCALES:** Conduct preliminary systems review in accordance with Handbook 44 to note modifications and free functioning of elements of beam and analog scales. Review scale components for user requirements.
- 469 **SCALE TESTING:** Conduct testing procedures on basic scale types to determine scale accuracy by increasing load test, repeatability, and sensitivity tests. Approves scales for use. Submits reports.
- 470 **CONCRETE PLANT INSPECTION – TESTING NON-AUTOMATIC/AUTOMATIC BEAM SCALES:** Conducts inspection of non-automatic plants. Conducts inspection and testing of automated plants equipped with beam scale proportioning systems and sets proportioning tolerances. Inspects truck mixers. Submits reports describing plant facilities, equipment, and operations. Approves plants for use that meet specification requirements.
- 471 **COMPUTERIZED SCALES SYSTEMS:** Become familiar with the operation of computerized scale systems including calibration of load cells, programming of scale functions, and determining linearity of the computer. Makes adjustments as directed.
- 472 **DYNAMIC MATERIALS PROPERTIES AND FRACTURE TOUGHNESS EVALUATIONS:** Conduct fatigue or fracture toughness experiments, using the programmable loading systems in the laboratory and in accordance with practices provided.
- 473 **PAVEMENT CONDITION SURVEY:** Responsible for planning, scheduling, conducting or supervising, and analyzing pavement condition surveys; and preparing required survey reports.
- 474 **PROCESS FIELD DATA:** Summarize, evaluate, interpret and organize field data.
- 475 **PHOTOMETRIC CHEMICAL ANALYSIS:** Prepare standards and calibration curves, and perform standardized analysis based on photometric measurement of colored solutions.
- 476 **INDEPENDENT ASSURANCE TEST:** Conduct independent assurance test on employees and equipment used in performing quality assurance testing on state and federally funded local government projects.
- 477 **FALLING WEIGHT DEFLECTOMETER TESTING:** Assist in performing falling weight deflectometer tests, routine equipment repair, calibration of equipment, and preparing data for reporting.
- 478 **FALLING WEIGHT DEFLECTOMETER HELPER:** Independently organize and perform traffic control operations necessary for operation of the falling weight deflectometer.
- 479 **AGGREGATE WEAR INDEX (WEAR TRACK):** Prepare test slabs, set up and operate wear track including required maintenance, conduct static skid testing, and record and analyze data as required by MTM 111.
- 480 **FINAL MATERIALS REVIEW HELPER:** Assist in the construction project reviews to ensure that materials sampling and inspection requirements have been met on projects programmed through MDOT.

- 481 **TIMBER AND LUMBER INSPECTIONS:** Inspection of timber products for quality, size and straightness. Sampling to determine penetration and quality of preservative retained.
- 482 **LOAD TRANSFER ASSEMBLY INSPECTION:** Independently inspect load transfer assemblies for specified sizing, spacing, alignment, and other fabrication requirements. Prepare inspection report.
- 483 **ENVIRONMENTAL PROJECT OVERSIGHT:** Oversee contractors work on less complex environmental projects such as underground storage tank removals, site investigations, remediations, etc. Have a comprehensive understanding of the requirements of environmental project proposal, relevant environmental regulations, and MDOT environmental standard operating procedures to assure contractor compliance. Resolution of non-compliance issues shall be at the direction of the Unit Professional.
- 484 **SPECIALIZED ENVIRONMENTAL GROUNDWATER SAMPLING:** Assist Unit Professionals in the determination of the approximate groundwater contaminant distribution using methods such as drill and drive, screened augers, and direct push samplers. Includes understanding of the standard methods, equipment, and techniques of the industry which are typically used for this purpose as well as proper operation of equipment and collection of representative groundwater samples.
- 485 **ENVIRONMENTAL SOIL GAS SURVEY:** Independently perform a soil gas survey to approximate contaminant distribution at sites of environmental contamination.
- 486 **BRIDGE MANAGEMENT SYSTEM (BMS):** Maintaining and updating records on the BMS.
- 487 **EDITING BMS:** Review existing data for incorrect or incomplete technical engineering data to insure its integrity.
- 488 **FREEDOM OF INFORMATION ACT (FOI):** Respond in a timely manner to FOI requests. Requires searching for existing structural plans and design information. Running copies of such material when located.
- 489 **AUTOMATED DRAFTING:** Be available as an automated drafting resource person for the entire Support Area.
- 490 **STRUCTURAL STEEL SHOP REPORTS:** Assist Structural Fabrication Engineers with review and distribution of structural steel shop reports.
- 491 **OVERLOAD TRUCK PERMITS:** Assist Unit engineers with Overload Truck Permits.
- 492 **STRUCTURE INVENTORY:** Interpret, extrapolate and compute technical data from engineering drawings supplied to the Unit.
- 493 **PERMANENT IDENTIFICATION NUMBERS:** Update county maps and assign permanent identification numbers to designate all bridges and culverts for the inventory.
- 494 **HISTORY DATA BASE:** Maintain and update a separate data base that has records of bridge repair and replacement contracts. Maintain "As Constructed" data field.
- 495 **LOAD RATINGS:** Assist in scheduling structures to be analyzed by BMU engineers for load ratings.

WORK ELEMENT DESCRIPTIONS

LEVEL 11 ELEMENTS

- 501 **BITUMINOUS MIX DESIGN:** Assist in design of bituminous mixture for pavements using specific sources of materials to meet design criteria. Prepare samples, run gradation and crush count on aggregates, proportion aggregates using computer program, make mixture and prepare Marshall specimens, test specimens, analyze test data and adjust mix as required, and report results in accordance with procedures provided.
- 502 **BITUMINOUS PLANT AND PLACEMENT INSPECTION:** Conduct District wide inspection of bituminous plants. Inspection includes calibration, screening, aggregate feeds, temperature control, and asphalt content. Inspection of the project site for proper placement is also required.
- 503 **COMPUTER REDUCTION AND ANALYSIS OF DATA:** Develop and document computer programs to reduce, evaluate, and summarize test data. Must be able to run unit developed programs without supervision.
- 504 **PERMEABILITY COEFFICIENT OF GRANULAR MATERIALS:** Perform tests to determine the permeability coefficient of granular soils, compute results, and prepare reports.
- 505 **INSTRUMENTATION OF FIELD AND LABORATORY EXPERIMENTS:** Select, assemble, and monitor instrumentation equipment used in laboratory and laboratory studies. This includes instrumentation of pavements and laboratory samples for the measurement of stress, strain, moisture tension, water content, freatic surface, deflection, frost depth, temperature, etc.
- 506 **GROUND WATER AND SURFACE WATER INVESTIGATIONS:** As lead worker, field test samples, supervise installation or install monitor wells, contact property owners as required, obtain existing data from DNR publications, water well logs, etc.
- 507 **CEMENT-PHYSICAL TEST:** Perform tests to determine physical properties of cement. These include normal consistency, time of setting, autoclave soundness, air content, fineness of grind, compressive strength and false set. Compute results and prepare reports in accordance with ASTM C 150.
- 508 **INSTRUMENTATION – SOILS:** As lead worker, supervise installation or install instrumentation. Must have in-depth knowledge of specific pieces of equipment to evaluate reasonableness of collected data, make minor repairs, and calibrate as necessary.
- 509 **FREEZE-THAW DURABILITY:** As lead worker, schedule dates for making concrete beams and cylinders. Direct work of support personnel. Determine amounts of fine and coarse aggregate, water, cement and admixture for concrete. Calculate and check test results and generally perform tasks in all phases of freeze-thaw testing in accordance with procedures provided.
- 510 **CONCRETE PROPORTIONING CHARTS:** Receive requests for concrete proportions as required by project. Often advises requestor what he needs for project. Obtain values needed from current files of specific gravities, absorptions, unit weights, etc. Enter data to computer to obtain weights of materials required per cubic yard of concrete. Prepare report.
- 511 **WRITING AND UPDATING MANUALS, ETC.:** Prepare and update operational and procedural manuals, test procedures, inventories, and other references.
- 512 **PREFORMED NEOPRENE BRIDGE EXPANSION DAMS:** Plan and direct the testing of complete expansion dam systems for use under specific allowable movement ranges and skew angles. This includes design,

review of new dam sections and details of installation. This also entails planning and implementing field inspections of various dam systems and organizing results in report format to assess long term performance.

- 513 BRIDGE DECK SURVEY:** Conduct detailed surveys of bridge decks to assess and document various types of concrete deterioration such as cracking, delamination, spalling, corrosion (copper-copper sulphate half cell) and sampling of chloride.
- 514 EARTH VIBRATION INVESTIGATION:** As lead worker, for field investigations of earth vibration problems locate equipment, set-up, calibrate, record data, and prepare report.
- 515 RADIOGRAPHIC AND/OR ULTRASONIC EVALUATIONS:** Conduct research type evaluations of structural members, using radiographic or ultrasonic non-destructive evaluation techniques. Special search techniques may be required. Record data and prepare report.
- 516 STRESS AND VIBRATION MEASUREMENTS:** As lead worker, set-up and run experiments on stress measurements in the laboratory or in the field. Determine amplitudes, frequencies, and report findings.
- 517 EVALUATE FIELD DATA:** Summarize, evaluate, and interpret field data on the more repetitive and less complex field data collection projects such as pachometer surveys and slope indicator projects.
- 518 PHOTOMETRIC AND ELECTRICAL TESTING OF TRAFFIC CONTROL DEVICES:** Perform photometric electrical analysis of roadway luminaries, signals, and other traffic control devices in accordance with procedures provided.
- 519 SOUND MEASUREMENTS:** As lead worker, establish field testing procedure for sound measurement investigations for environmental impact studies and citizen noise complaints, including determination of sampling time and duration of test and sound impact locations. Conduct and supervise resulting field tests. Must have in depth knowledge of specific pieces of equipment to evaluate reasonableness of collected data including calibration and minor adjustments.
- 520 PAVEMENT FRICTION TESTING:** Responsible for equipment calibration and modification, planning, scheduling and conducting tests; analyzing data; preparing letter reports and annual summary, and maintaining historical pavement friction trunkline history.
- 521 PAVEMENT RIDEABILITY:** Responsible for scheduling and conducting pavement riding quality program; calibration and maintenance of equipment; and preparation of annual report and required interim reports.
- 522 CONDUCT TRAINING:** Conduct formal classroom training in materials quality control and related technical areas, such as density control, bituminous plant and street inspection and aggregate inspection for MDOT personnel, contractors, local government personnel, consultants, suppliers and other private and public agencies.
- 523 PROJECT PROPOSAL REVIEW:** Review proposals for specific items of work or materials having effect on testing of materials or design of mixes peculiar to the individual project (special provision or supplemental specification required).
- 524 SOILS SURVEY AND SWAMP SOUNDING:** Map and classify soils according to the pedological classification system. Sound swamps. Classify organic and unstable soils. Prepare soils survey and swamp sounding reports.
- 525 SUBSURFACE INVESTIGATION:** Conduct soil and/or rock borings and corings to define foundation conditions. Work may include culvert and sewer borings, correlation borings for resistivity surveys borings for borrow pits and mitigation ponds, shoulder borings, borings for weigh stations and rest area buildings, and other miscellaneous structures. Demonstrated ability to size and match equipment to the specific site conditions. Must be able to determine type, depth, and quantity of information needed based on subsurface conditions encountered.

- 526 **SUBGRADE AND SLOPE INSPECTION:** Inspect the subgrade soils to 5'± below plan grade to determine the presence of water, silts, unstable soils, and the uniformity of soils. Inspect slopes for the presence of water and unstable conditions. Make written recommendations to the project engineer to correct undesirable conditions found in the subgrade and slopes.
- 527 **METAL FABRICATION-SHOP:** Inspect fabrication of metal structures and components to assure compliance with plans and specifications.
- 528 **CONCRETE PLANT INSPECTION-TROUBLESHOOTING:** Inspect and troubleshoot concrete plant equipment to ensure conformance with specification requirements.
- 529 **DENSITY QUALITY CONTROL – TROUBLESHOOTING:** Investigate and advise on unusual density problems.
- 530 **FINAL MATERIALS REVIEW:** Conduct construction project reviews to ensure that materials sampling and inspection requirements have been met on projects programmed through MDOT.
- 531 **PAVEMENT CONDITION SURVEY:** Responsible for planning, scheduling, conducting or supervising, and analyzing pavement condition surveys; and preparing required PMS survey reports.
- 532 **DYNAMIC MATERIALS PROPERTIES AND FRACTURE TOUGHNESS EVALUATIONS:** Conduct fatigue or fracture toughness experiments, using the programmable loading systems in the laboratory and in accordance with practices provided. **Work Element 532 is now credited as 472.**
- 533 **MODIFICATION AND DEVELOPMENT OF TEST PROCEDURES OR DEVICES:** As a lead worker, under general supervision, to participate in the modification and development of test procedures, experimental methods, or laboratory and field apparatus required for the conduct of assigned research investigations and projects. Examples include adaption of triaxial soil testing to determine stiffness modulus, hydrodynamic material properties, and plastic deformation under repeated load, development of devices for the determination of permeability and diffusivity and capillary potential, and development of apparatus and test procedures involving photometers and photo-optical devices.
- 534 **NOISE ANALYSIS:** Analyze field noise measurements to determine noise level distribution. This involves knowledge of traffic volumes, elevations, distances from source to effected location and sound intensity variation. Compare with applicable noise standards, make recommendations and prepare letter reports in accordance with established procedures.
- 535 **SWAMP INSPECTION AND INVESTIGATION:** Provide technical expertise to the resident/project engineer during the excavation and backfilling of swamp and unstable soil areas. Evaluate the degree of success of swamp excavation and backfilling operations by inspection and the taking of borings in a timely manner so corrective actions can be made in the operations. Take or supervise the taking of borings in excavated swamps to determine if the swamps have been satisfactorily excavated. Take or supervise the taking of quantity borings in excavated swamps and unstable soil areas. Prepare boring logs.
- 536 **INDEPENDENT ASSURANCE TESTS:** Responsible for the programming of the taking of independent assurance tests on all federally funded state and local government projects in the district. Includes the keeping of accurate, up-to-date records of independent assurance tests conducted in the district.
- 537 **FALLING WEIGHT DEFLECTOMETER:** Responsible for planning, scheduling, conducting, analyzing, and reporting results for the statewide falling weight deflectometer program.
- 538 **QUALITY ASSURANCE TESTS, SCALE SYSTEMS:** Responsible for the scheduling and conducting quality assurance tests of scale systems and independent scale inspection agencies used on federally funded state and local government projects on a statewide basis. Keep accurate, up-to-date records and history of quality assurance tests.

- 539 **SCALE SYSTEMS TROUBLE-SHOOTING:** Inspect and troubleshoot non-automated and computerized scale systems. Includes adjustments as necessary and calibration of load cells, programming of scale functions, and determining linearity of the computer.
- 540 **PROJECT PROPOSAL REVIEW, PAVEMENT CORING:** Review project proposals for specific items of work related to concrete pavement coring. This includes documentation of quantities and specifications peculiar to individual projects and filing of project records.
- 541 **NEW MATERIALS EVALUATIONS:** Conduct investigations into background and potential uses and benefits of new materials submitted for use in the transportation system. Conduct laboratory and/or field evaluations using new or existing techniques. Maintain and analyze data, make written recommendations and assist in making required changes in areas such as specifications and qualified products lists.
- 542 **ENVIRONMENTAL AQUIFER TESTING:** Independently perform aquifer tests including pumping tests and slug tests, to determine hydraulic properties of environmentally impacted aquifer systems.
- 543 **ENVIRONMENTAL REMEDIATION INSPECTION:** Inspect and direct the construction of complex environmental projects involving remediation of contaminated soil and groundwater. A comprehensive understanding of the requirements of the environmental project proposal, appropriate environmental regulations, and MDOT environmental standard operating procedures as required to assure contractor compliance. Inspection shall include directing the work, resolving infield conflicts, tracking of project quantities and budget, completion of inspector's daily reports (IDR's).
- 544 **ENVIRONMENTAL FORMATION PROFILING:** Independently perform formation profiling to determine approximate groundwater flow direction and contaminant distribution. Formation profiling shall be performed using drill and drive, screened auger, and direct put sampler methods. A comprehensive understanding of the standard methods, equipment, and techniques of the industry which are typically used for this purpose is required. Includes collection of all field data necessary to meet the above listed objectives, interpretation of data, development of preliminary groundwater contour maps and iso-concentration maps using appropriate software, and generation of site summary reports detailing site conditions and investigation results.
- 545 **TRAIN AND OVERSEE:** Train and oversee the work of the seasonal and less experienced employees in the Unit. They are used for gathering of underclearance data, and many other technical support assignments within the Bridge Operations Section.
- 546 **BRIDGE MANAGEMENT SYSTEM:** Compile and analyze engineering data, and using that information to develop spreadsheets that consist of technical calculations and statistical information to monitor unit costs of bridge construction, which is required by federal regulations.
- 547 **HAZARDOUS WASTE SITE IDENTIFICATION:** Formally request EPA numbers for hazardous waste bridge sites and forward them to the Department of Environmental Quality (DEQ) for further processing and approval.
- 548 **TECHNICAL LIAISON:** To Design, Local Services, and Maintenance Support Areas.