Chapter

8

Cost Estimating

The Estimating Process (revised 6-24-2019)

Importance of getting a good estimate and what happens when the estimate is bad

The Estimating Process, during the Scoping Phase, includes determining the costs associated with all phases of a candidate project. The development of a complete and accurate estimate is critical to a successful project scoping package. The estimate developed, as part of the project scoping process, is used to program the funding of the design, Right of Way (ROW) and construction for the project. When the scoping estimate is not accurate, a lack of funding may result. Consequences resulting from lack of funding may include project delay, the need to request funds from other sources, modifications to the project scope, a reduction in the project limits or potential conflicts with the Region or Statewide Strategies and Goals.

Who to communicate with when estimating, and why

It is important when estimating, and designing, the project to continually communicate with other staff (not only in the same office but at the region and statewide) to obtain/maintain information on the latest design practices. In addition, it is important to include construction staff in the discussions and incorporate the information provided for the scope. This assists in the understanding of what may be included and how the project will be constructed (the construction method may affect the pay items used in the estimate). For a better understanding of what the standard pay items are and how they are used, refer to MDOT's Standard Specifications for Construction.

Pay items are found in MDOT's Standard Specifications for Construction

What an estimate includes and a method of developing one

An estimate shall include all major aspects of the proposed project, either as individual pay items or as a lump sum category (i.e. soil erosion items). One way to develop an estimate is to look at what will be removed as part of the project and what is necessary to rebuild the roadway or bridge. To achieve a complete estimate, it is important to include the removal of existing items and the replacement or new items.

Different methods to approach estimate calculation

There are different ways to approach calculating an estimate. One way is to compute the quantities for all the removal type items first and then compute the quantities for the proposed items. Another method would be to compute the quantities by categories (i.e. pavement, drainage, traffic, etc.). The important thing is to account for all the items of work and provide as complete and comprehensive an estimate as reasonably practical for the scoping package.

Scoping Report and Details Worksheet

The information gathered on the "Scoping Report & Details Worksheet" is extremely valuable when developing the estimate. The worksheet is designed to guide a person through the scoping process and develop an estimate that includes all of the items which should be considered and included in the scope and estimate.

Here are some basic steps that will help develop a good project estimate:

- **Documentation**

  Providing documentation is important and verifies an estimate. Document all assumptions, decisions on what to include or not to include in the estimate, and all notes that will assist those that review and use the estimate and

scoping documents should be recorded. Make sure the documents are well organized.

- **Always Start Fresh**

Why to avoid using old estimates, spreadsheets, or computations

When beginning an estimate always start fresh. The use of old estimates, spreadsheets or computations can result in errors, duplications or omissions. Unit prices often change, quantities are unique to a project and the pay items to include in a project may be unique to that project. Also spreadsheets and worksheets may be revised over time.

- **List Your Assumptions**

Where to put assumptions for easy viewing

QA/QC reviewers and designers cannot account for or follow assumptions that were made and not documented. List the general assumptions at the beginning of the calculation sheets. If other assumptions come up as the estimate progresses, state them in words and make them stand out on the calculations sheet, so they are easily seen. If using Excel for calculations, type the assumptions into the file so they will be displayed and/or print whenever the file is viewed.

- **Be Clear**

Avoiding the most common problem with estimates

Tips for clarifying calculations

Don't assume the QA/QC reviewer or the designer will know the thought process behind the estimate. This is probably one of the biggest problems with estimates. Estimates should be prepared in such a way that someone unfamiliar with the project can clearly understand the estimate. An easy way to do this is to write a small sentence or statement before a set of calculations stating what is going to be calculated and why. When formulas are used, be sure the input into the formula is clear for everyone to follow. Formulas used in Excel spreadsheets must be clearly defined, as well.

- **Be Neat**

If the first run through of an estimate is sloppy and unclear then re-write it on another sheet of paper. This will allow reorganization of items into a logical manner that flows.

How to organize calculations and categories of pay items

Keep all calculations for the same pay item in the same location. It may be difficult to track a quantity that is listed in several different areas. If it makes more sense to break out the estimate into segments, use a totals sheet with columns for the different segments should be used. When the calculations are done in an Excel spreadsheet the worksheets may be tabbed for the different categories of pay items (i.e. Removals, Pavement, Drainage, Guardrail, Traffic Control and etc).

Tips on rounding and estimating HMA

Converting from cubic yards (CYD) to tons

- **Quantities & Rounding**
  - Round quantities for all items to the nearest ten after computing the total
  - Add an additional 5 percent to quantities of (Hot Mix Asphalt (HMA) for estimating purposes. Include a note that this was done.
  - Weights for conversion from CYD (cubic yards) to Tons:
    - Aggregate = 4000 lbs/cyd or 110 lbs/syd*in
    - Shoulder Class II = 4000 lbs/cyd or 110 lbs/ syd*in
    - Coldmilling = 4000 lbs/cyd or 110 lbs/ syd*in

    Note: Weights for Aggregate and Shoulder Class II are for compacted in place (CIP)

Scoping Report and Details Worksheet

- **Sketches and Typical Sections**

  The Scoping Report and Details Worksheet provide space for existing and proposed typical sections to be drawn or inserted. If additional sheets or drawings are needed to show the existing features or proposed work, include them in the scoping documents. These drawings will be helpful in estimating the project, by showing the items to be included for removal and construction. Include a sketch of what is being proposed for construction, and show dimensions, materials and etc. In addition, include old plans in the file to show the existing road conditions.

Tips for including drawings

Tips for documenting project identification

- **Project Identification**

  Always identify the project at the top of the calculation sheet or in the header of the Excel spreadsheet, and note if there are different versions or different scopes. Often the system manager may ask for two different scopes to compare costs. Identify these as different work types and different versions. The information should include the job information (job number, route, control section, limits and etc), name of the estimator, date the estimate was done, name of the reviewer and the date the calculations were reviewed.

- **QC/QA Review of Estimate**

  The calculations, assumptions and documentation for the estimate should all be reviewed at the TSC prior to submittal to the Region. Although the region will review the estimate, it is not the intent that the Region be the sole reviewer. The Region review should be a quick review of the estimate, not a thorough review that examines all calculations. The reviewers should mark their comments in a color pen that distinguishes the review comments from other marks on the calculations. The reviewer should sign (or initial) and date the estimate when the review is complete. If the signature of the reviewer is difficult to identify, the reviewer should also print their name. Make sure the names of the QC and QA reviewers are included on both the Statewide Scoping Package Master Checklist and the Road Scoping Report and Details Worksheet.

Tips for reviewers

Time spent making sure the calculations/estimate are clear and accurate will save time later on the phone. If you are not available to clarify the intent, clarity will prevent the estimate from being changed to something unintended simply because the reviewer could not understand what the original intent was.

- **Project Concept Statement**

JobNet Chapter 10

JobNet sums the categories from the estimate spreadsheet and places them into the categories that are most typically used by the region. This information will be helpful when initiating a concept in JobNet, see Chapter 10 of this manual. Due to rounding differences and the different category breakouts, always make sure that the total on the concept statement is the same as the total on the estimate spreadsheet. The two numbers are compared on the bottom of the JobNet Concept sheet to ensure nothing is missed.

Specific Situations in the Estimating Process

Determining how long a guardrail needs to be

Guardrail - If guardrail is to be removed, replaced and/or installed, the length of the existing guardrail to be removed can be determined from field measurement, old plans or existing inventory. Current guidelines may require longer guardrails. So the guardrail length could be estimated as the existing guardrail length plus about 10 percent. The estimate should include guardrail terminal treatments, should be included in the estimate as well as reflectors and 8 foot posts if needed.

Other ROW cost considerations besides fence removal and replacement

ROW Fence - A proposed freeway project may require the existing ROW fence to be removed and replaced. In addition to providing for the cost to remove and replace the fence, it would be advisable to include a quantity of Clearing for Fence, if the project location has areas of woods or overgrowth.

What to consider if the roadway has a nonstandard cross slope or a parabolic cross section

Crown and Superelevation Modification - If an existing HMA roadway has a cross slope less than the current standard (2 percent) or has a parabolic cross section, the project may include upgrading the roadway to the current standard. This may be accomplished by profile cold-milling or the addition of a HMA wedging course. The additional HMA quantity for the wedging course must be included in the estimate, as this can have a large impact on the funding. Modification of superelevation rates must also be addressed in the estimate, if included in the project work.

The importance of identifying roads with parabolic crowns

Although existing parabolic crowns are less frequent than in previous years, an effort to modify these cross slopes has been on going, however, roads with parabolic crowns still exist in Michigan. It is important to properly identify roads with parabolic crowns to correctly estimate the HMA needed to resurface the roadway to modify the cross slopes to the standard 2 percent "A crown" cross sections.

How to get a good estimate for embankment and excavation work

Earthwork, Subbase and Aggregate – Earthwork, both embankment and earth excavation, may be difficult to estimate at the Scoping phase. Old plans, and cross sections if available, may be used to determine the existing sections at various locations and conditions (cut or fill) along the length of the project. Approximate cross sections should be developed for use in estimating the earthwork. Cut and fill sections, within the project limits, should be examined separately. Computed earthwork quantities should be increased by 15 percent and rounded up to the nearest 100 cubic yards (cyds) for inclusion in the scoping estimate.

Determining a treatment when sub-grade undercutting is needed

Soils Engineer

If a project requires sub-grade undercutting, request old plans, field investigation information and recommendations from the Soils Engineer. During the scoping process, also request soil borings, which will assist in the analysis, determination of method and recommended quantities. The Soils Engineer needs to understand the proposed scope and strategy for this project, for the appropriate recommendations for treatment. Depending on the strategy for the roadway, the fix may range from removal to managing treatments of the section.

Estimating subbase

If a project requires proposed subbase, this too should be estimated by drawing approximate existing and proposed cross sections and determining the area of the subbase for the one cross section, then multiplying by the length of the project. The estimated subbase quantity should be increased by 10 percent and rounded up to the nearest 100 cyds for inclusion in the scoping estimate.

Estimating aggregate

If aggregate is required, use a similar method as described above, with the appropriate depth. The estimated aggregate quantity should be increased by 10 percent and rounded up to the nearest 100 cyds for inclusion in the scoping estimate.

Tips for good shoulder work estimations

Shoulders – When estimating the cost for shoulder work, it is important to include both the left and right shoulders or for divided roadways, two median shoulders and two outside shoulders. Remember shoulder thickness is often less than the HMA thickness of the mainline. The TSC Manager and/or the System Manager should be consulted with respect to cold milling and/or paving shoulders. Often the shoulders are fair or good condition and are excluded from the proposed work. This best practice encourages the focus of work on the mainline of the MDOT Trunkline system. In addition, class II gravel should be considered for the 2 foot gravel ribbon.

Accounting for deterioration

Joint Repairs – For projects that are scoped to include joint and/or pavement repairs, a factor for continued deterioration should be included in the quantities of work. This deterioration factor should be approximately 10 percent, after discussion with the Region System Manager or Region Pavement Engineer.

An estimating shortcut it's OK to take

Grouping of Specific Pay Items - For the estimate at the scoping stage it is not always necessary to compute individual pay items and quantities for every item. Some items may be grouped together and estimated as a lump sum amount or as a percentage of the project. For example, a cost for soil erosion and sedimentation control items should be included in the estimate for all projects; however it is not necessary to break out each type of soil erosion control item. A single line item in the estimate for soil erosion and sedimentation and control items will indicate this work has been accounted for in the estimate.

Estimating slope restoration

Another item, where this approach is acceptable, is for slope restoration. An overall slope restoration quantity should be computed with less concern over which type (type A, B, C or D). The estimate for slope restoration on a project should be increased by approximately 5 percent, as this is often an item that is difficult to accurately estimate at the time of scoping.

Identifying which items are based on a percentage of the project costs

Lump Sum Pay Items – Some of the pay items that MDOT uses have a Lump Sum pay unit and are based on a percentage of the project costs. Although not all projects require all of these items, many of the projects do require the inclusion of these items. It is important to determine at the scoping phase which pay items should be included and which are not necessary.

Lights during night work

If night work is anticipated for the project, due to circumstances related to the maintaining traffic, a pay item to compensate the contractor for providing the necessary lights to the project site is included in the project estimate.

Pavement cleaning

Road Design Manual

Pavement Cleaning may be required on cold-milling and HMA resurfacing projects, see the Road Design Manual 6.03.04 section B 2 for more detail.

Project Cleanup and what it includes

"Project Cleanup" is cleaning up the project area, including roadsides, prior to final acceptance. Project Cleanup includes removing all debris (such as old fences, fallen timber, logs and rubbish), within the ROW, up to 50 feet beyond the grading limits. This work also includes cleaning out all culverts, sewers and drainage structures that contain sediments from the contractors operations. Project Cleanup should be included as a pay item on most projects.

Contractor staking

Discuss with TSC Delivery staff

Contractor Staking on a construction project is the surveying and staking work to lay out the alignment and other control points for the contractor. The inclusion of Contractor Staking should be discussed with the TSC Delivery staff. Not all projects require inclusion of Contractor Staking, since MDOT forces may be available to perform these duties. During the design phase of a project, contractor staking is broken down into four separate pay items. For the scoping estimate, the cost of Contractor Staking is included in one lump sum pay item and is estimated at the rate listed in the table below.

Storm Water Management BMP

The post construction storm water management portion of the Storm water Management Plan requires that all MDOT projects be reviewed for storm water impacts and Post Construction Best Management Practices (PC-BMPs). These PC-BMPs maybe structural or vegetated and range in cost. For the scoping estimate, the cost for these PC-BMPs is included in lump sum pay item and is estimated at the rate listed in the table below.

Floodplain, Stream, and/or Wetland Mitigation

The anticipated cost of floodplain, stream and/or wetland mitigation permit requirements should be accounted for in the scoping estimate. Percentages for including this lump sum item in the scoping estimate are shown in Table 8-1 below.

Mobilization and what it includes

Mobilization is to reimburse the contractor for initial costs incurred prior to starting work on the project. This all costs involved with moving personnel, equipment, supplies and incidentals to the project site, as well as the cost of establishing the contractor's offices, buildings and other facilities necessary to undertake the work. It also includes other work and operations needed, or for expenses incurred, prior to work on the project site. This item applies to all projects.

Landscaping site preparation

Dealing with watering and cultivating

For projects with landscaping and planting material, pay items for Site Preparation are included. If MDOT is requiring the contractor to maintain by water and cultivating the planting for two years period the two pay items for Watering and Cultivating, 1st and 2nd Season are included in the project. Often a waiver is obtained to exclude the water and cultivating from the project and then these two items are not in the estimate.

The following table (8-1) provides guidance for the percentage to use for these lump sum pay items:

Lump sum percentages

Table 8-1: Lump Sum Items

Pay Item	Percent of Cost
Lighting for Night Work and Paving	0.50% of Interim Const Total
Pavement Cleaning	0.25% of Interim Const Total
Contractor Staking (*includes* staking items)	2.50% of Interim Const Total
Storm Water PC-BMPs - Roadway widening for Capacity Improvement (<$1,000,000)	3.00% of Interim Const Total
Storm Water PC-BMPs - Roadway widening for Capacity Improvement (>$1,000,000)	$100,000
Storm Water PC-BMPs - New Drainage Outlet	$50,000
Storm Water PC-BMPs - Recon/Rehab/Creation of enclosed drainage system	$50,000 or 1.00% of Interim Const Total, whichever is greater
Floodplain, Stream, Wetland Mitigation Permit (<$1,000,000)	3.00% of Interim Const Total
Floodplain, Stream, Wetland Mitigation Permit (>$1,000,000)	$100,000
Mobilization	10% of Interim Const Total
Site Preparation	35% of Plant Material Cost
Water and Cultivating, 1st Season	17% of Plant Material Cost
Water and Cultivating, 2nd Season	21% of Plant Material Cost

Note: The interim cost is the total cost of a project before these lump sum items are included in the estimate.

Soils/Pavement Engineer

Concrete Pavement versus HMA Pavement or Concrete versus Steel Bridge Beams – During the scoping phase it may not be known whether a pavement section, for a reconstruction project, will be concrete or HMA. This is often determined during the design phase with a Life Cycle Cost Analysis. For the purpose of estimating the project completely, it is prudent to prepare an estimate for both an HMA pavement section and a concrete pavement section. Obtain the depth of the HMA or concrete and the underlying material from the Region Soils/Pavement Engineer.

Likewise, for bridge replacement projects, develop an estimate for both concrete bridge beams and steel bridge beams. The determination of beam type will be done during the design phase, but it is beneficial to know both costs for estimating purposes. The estimate should contain the higher cost, and all of the other aspects will be evaluated in the next phase, for the final decision and inclusion in the bridge study.

Alternate Pavement Design – This is a method of design for a project, MDOT bids a project as either Concrete or HMA pavement. The selection of the successful bidder is based on upon the life cycle cost of the proposed pavement section. If the candidate project is proposed to be an alternate bid projects, it is imperative that the scoped project estimate must take these details in to account. The comparison is not limited to just the direct pavement cost differences. There may be other factors, such as maintaining traffic, drainage (ditching, culverts, outlets due to thicker/thinner pavement section and etc) and underclearance corrections that will need to be accounted for.

Bridge Approach Pavement and Maintenance of Traffic on Bridge Projects – The cost for the approach pavement (on bridge projects), other roadway related items and the maintenance of traffic items will be estimated according to methods described later in this chapter. Specific pay items and quantities will be used in the estimate, instead of estimating these items on a percentage basis, as previously computed on the Bridge Repair Cost Estimate spreadsheet.

Estimating Structures/Bridges (revised 6-24-2019)

Best Practices/Tips for Successful Completion

Scoping Engineer
Region Bridge Engineer

Structures or bridges requiring work are typically estimated by the Region Bridge Engineer or by a consultant hired to perform the bridge scoping duties. If a road and a bridge job are being packaged together, the Scoping Engineer will need to discuss the project with the Region Bridge Engineer to plan, coordinate and/or combine the two projects. The Maintenance of Traffic (MOT) may dictate how the structure work is performed or may need to be revised to reflect how the structure work is being planned.

Estimating alternate fixes for bridges

As part of the Call For Projects, as many as three alternative fixes may be analyzed and estimated for each bridge. The Region Bridge Engineer will utilize the Project Quantity Spreadsheet (PQS) and AASHTOWare Project (AP) Preconstruction to provide a variety of proposed fixes for the structure. This spreadsheet is updated annually; therefore an updated spreadsheet must be obtained for each year's Call For Projects. Refer to the following links for PQS and access to AP Preconstruction.

Project Quantity Spreadsheet (PQS) Guidance Document

AP Preconstruction Users Guide

CFP Bridge Repair Cost Estimate spreadsheet and key

Also use PQS and AP Preconstruction for estimating Capital Scheduled Maintenance (CSM) for bridge work. A sample of this spreadsheet can be found in Appendix E-3. Refer to the following link to access PQS and AP Preconstruction

Project Quantity Spreadsheet (PQS) Guidance Document

AP Preconstruction Users Guide

CFP Bridge Repair Cost Estimate spreadsheet and key

Bridge Deck Preservation Matrix

The proposed fix options are based on the findings of the detailed bridge inspections, performed as part of the scoping process. For deck repair options, use the current Bridge Deck Preservation Matrixes. These documents can be found in Appendix A-6. The condition of the deck is usually the driving force, or the key indicator, leading to a structure being considered for rehabilitation or replacement. However, there are times when other issues affecting the bridge may elicit the need for a rehabilitation project and these matrixes do not address those situations. Some of these situations are superstructure deterioration, substructure deterioration, scour criticality and functional issues such as under-clearance and/or bridge width. Sometimes it is desirable for an entire corridor to be brought up to a specific condition level as part of an overall strategy. Therefore, be careful regarding the interpretation of the information from the matrixes. Evaluate each specific case and use engineering judgment applied.

Don't rely on the Matrix alone

Region Bridge Engineer
Bridge Scoping Engineer at C&T

For assistance in completing the Scoping Estimate, or any other items related to scoping of a bridge project, contact the Region Bridge Engineer or the Bridge Scoping Engineer located at Construction & Technology (C&T).

The estimate for the proposed bridge option shall be placed into AP Preconstruction as described later in this chapter. This enables all project costs to be captured in one location.

When existing structure foundations are to be replaced, widened or subjected to increased load, use old plans and existing geotechnical data to conduct a structure foundation review to analyze the increased load. Include recommendations from the review in the ProjectWise documents and incorporated them into the project scope. The Region Bridge Engineer shall coordinate this review with the Bridge Operations Unit at C&T.

If plans of the existing structure are not available, rehabilitation alternatives will be severely limited according to the Bridge Design Manual, Chapter 12. A useful tool to determine the adequacy of the superstructure is to contact the Bridge Management Unit in C&T. Furthermore, additional Preliminary Engineering (PE) funds will be required to account for a structure survey.

Bridge Scoping Report & Details Worksheet

Bridge Rehabilitation Scoping Checklist

During the detailed inspection and field review, fill out the Bridge Scoping Report & Details Worksheet with all required information and necessary repairs. Also use the Bridge Rehabilitation Scoping Checklist if there is additional information needed. Choose the repair strategy based on these findings, corridor plan, MOT options and the completed estimate. For comparison purposes, estimate additional repair strategies. For example, if a deck replacement is the chosen strategy, and steel beam end repairs and full painting of the steel beams are included, also complete an estimate for a superstructure replacement. The cost of new beams could be comparable in cost and provide a longer service life.

During scoping process, analyze the Life Cycle of the structure. Investigate all previous rehabilitation and repairs previously done, to determine where

the structure is in its Life Cycle. The Bridge Preservation Timelines (see below) represent strategies for maintenance and rehabilitation work, in order to get the maximum life from a bridge.

Table 8-2: Bridge Preservation Timelines

The following fix alternatives include general assumptions regarding the expected service life of the rehabilitation option shown:

Rehabilitation Option	Expected Service Life
• Structure Replacement	40 yrs
• Superstructure Replacement	40 yrs
• Deck Replacement	40 yrs
• Deep Overlay	25-30 yrs
• Shallow Overlay	10-15 yrs
• HMA Overlay (with membrane)	5-10 yrs
• Joint replacement and Deck Patch	10-12 yrs

It is important to recognize that situations where design exceptions will not be acceptable may exist. In those cases, enough funds to cover the cost of the approach work should be included in the estimate. Some factors that will affect the approach work on bridge jobs include:

- The length of work required for any crown correction wash out
- The length of work required to correct any geometric insufficiencies (i.e. horizontal and vertical alignments, superelevations and transitions)
- The length of approach work required to correct any underclearance deficiencies.

Bridge Repair Items to Estimate and Analyze

If a bridge is Scour Critical, investigate mitigation measures or the replacement of the structure (Bridge Engineer and Geotechnical Unit. Mitigation measures could range from installing a designed riprap section to adding micro-piles to the structure foundation and may require a hydraulic analysis for design. If mitigation measures are not feasible then the region will either have to continue to manage the structure for scour per the Plan of Action, over the long term or replace the structure. Discuss with the Hydraulics Unit the feasibility of mitigation measures. If scour countermeasures are not feasible or cost effective, the bridge should be scheduled for replacement.

If estimating a replacement structure over a river, changes to the bridge span and/or rise may be necessary. Changes to bridge span, rise, length, or grade raise may need a hydraulic survey. In addition, construction methods such as haul roads or causeways may need a hydraulic survey. It should be noted that scopes and designs of new bridges over rivers should be estimated with deep foundations so the bridges are not scour vulnerable (discussion with the Hydraulics Unit may be of assistance).

If a structure is over a waterway, it is important to include additional funding for a Hydraulic survey, contact the Region Survey Unit for assistance.

If a bridge is over a railroad, a railroad flagman will be required during construction over and/or near the railroad. The Railroad Coordination Unit within the Design Division in Lansing should be consulted for an estimate for any railroad coordination and flagging cost to be included in the scoping estimate.

Calculation for aesthetic treatments

Aesthetic treatments (concrete form liners) and concrete surface coating may be desirable in some locations. If needed, estimate the treatments as 2 percent of construction cost.

Maintaining traffic concepts and the volume of traffic on the road may influence the repair strategy. For example, in locations where traffic control costs are very high, it may not be cost effective to do deck patching and crack sealing. Or maintaining a certain number of lanes may cause the bridges to be temporarily widened or constructed under part width and the need for temporary sheet piling for the substructure.

Bridge Design Manual Chapter 12

In Chapter 12 of the Bridge Design Manual, additional information on repair strategies and how to estimate quantities are presented.

For deck repairs, the existing crown of the bridge deck may have an impact to the proposed work and may need to be analyzed. For replacements and overlays other than epoxy overlays, the crown will need to be brought to current standards which may require a grade raise (note that correcting the crown with an overlay can result in the bridge having deficient load capacity). The estimated grade raise will affect the length of approach work necessary to match the existing roadway.

Bridge Design Manual Chapter 12

Depending on the type of railing, it may be necessary to replace or retrofit the railing (see BDM chapter 12).

For deck patching, calculate the area of delamination on the deck and then multiply by 2, for the quantity that will be included in the estimate. Use this factor to account for continued deterioration.

For expansion joint repairs, determine if spalling on the fascia and barrier would need to be included in the quantities of concrete patching.

For superstructure repairs, consider the type of temporary supports needed, if new bearings are warranted and if protection of utilities (under the bridge) is required.

For substructure repairs, consider the amount of spalling and delamination on substructure elements (i.e. piers, pier caps or abutments). If there is 30 percent or greater delamination identified, consider replacing the element.

Estimate and plan for Temporary Supports for spalling areas located under beams or when replacement of a substructure element is being proposed. The placement of temporary supports could affect and/or require slope paving removal, excavation, storm sewers and guardrail. The proposed location may also require temporary concrete barrier for maintaining traffic and protection of the temporary support.

Take the following steps for a detailed inspection:

- Gather the old plans to take in the field
- Make copies and enlarge them for the substructure details
- Mark out where the delamination occurs and the appropriate quantity to be considered
- Make copies of the general plan of structure and mark out the delamination on the deck, with quantities
- When doing a detailed beam inspection, the beam detail sheets shall be utilized (this assists in documenting the locations of the required repairs and that the beams will be laid out correctly, in terms of orientation)
- Take standard set of photos of structure and photos showing areas in need of repair (see the Bridge Scoping Report & Details Worksheet for a list of suggested photos)

Inspection manuals and forms

For additional information, manuals and forms see the website:

http://www.michigan.gov/mdot/0,4616,7-151-9625_24768_24773---,00.html

Resources for Estimating Specific or Specialty Items

Various resources are available within the Department (TSC, Region, Lansing and C&T) with expertise in specific areas that may be utilized when developing an estimate at the scoping level.

Tips for successful collaboration with others

When requesting information from others, be specific in your request. Provide them all the information you have which may be beneficial to them in estimating the portion you have requested assistance on. Give a deadline for when you need the information, keeping in mind the time it will take for the specialist to perform their work and the time you will need after you have the information to incorporate it into your final estimate. Tell the specialist what the information is for (i.e. scoping estimate) and what is expected to be included in the estimate. Provide them with the opportunity to ask questions both at the time the initial request is made and during the time the specialist is developing the estimate.

Geometrics

Geometric Design Guides

Projects often propose added features such as lane drops, lane shifts, tapers, re-alignments and etc. It is important to have an estimate that includes the proper impacts, lengths and widths for these items. Prior to estimating, you should: use the Geometric Deign Guides, consider the existing conditions (for side impacts), ensure the proposed feature can be added to the roadway segment and consult with Lansing Traffic & Safety with questions or assistance on applying these guidelines. Be sure to fully consider the improvements to the roadway geometry and its impacts to the bridges and vice a versa.

Right of Way (revised 6-24-2019)

Region Real Estate staff

If a project requires any proposed permanent or temporary land or land access, contact the Region Real Estate staff to aid in the development of the ROW estimate. The cost of land differs greatly across the State and will vary within Region and TSC boundaries. Region Real Estate Staff will need project maps (often ROW map sheets found on the MDOT website can be an appropriate map) for the purpose of estimating ROW costs. During the scope development, identify on the map areas where proposed fee ROW, air rights, grading permits, drive permits, relocations, permit to close drives, sidewalk permits and drainage easements are anticipated. Also on the map the type of anticipated ROW needs and the estimated size or area of taking should be shown on the map. These maps can then be presented to the Region Real Estate staff with an explanation of the proposed project and a request to provide a ROW estimate for inclusion in the project scoping estimate. Electronic ROW maps are available on the MDOT website and in ProjectWise by County at:

Creating maps for the Real Estate staff to use

ProjectWise

pwname://MDOTProjectWise/Documents/Reference Documents/ROW Maps
or
http://mdotcf.state.mi.us/public/ROWFiles/index.cfm

Other ROW considerations

Keep in mind that sometimes grading permits are needed for temporary widening to maintain traffic. Include these ROW needs in the estimate.

What to do if Real Estate staff is not available

If the Region Real Estate staff is not available to provide an estimate in the timeframe needed, use recent projects in the area to help develop an estimate for the ROW cost. The project should be in a similar area (city, suburban or rural), with parcels or ROW activities of similar size and features.

Completing the estimate

AP Preconstruction

Round up the total estimated cost for ROW on a project, including all permits and easements, to the nearest $1000, before placing it into AP Preconstruction.

Permanent and Temporary Maintenance of Traffic Items

TSC Traffic & Safety Engineer
Region Traffic & Safety Engineer

Make the estimate, developed during the scoping phase, of the project as complete as possible. Include it in computing quantities for various permanent traffic items, such as signing, pavement marking and traffic signals. Also estimate quantities for the proposed method of maintaining traffic during the construction of the project. To obtain estimates for permanent pavement markings, signing, signals, MOT or other safety items the estimator will need to discuss the project with the TSC or Region Traffic & Safety Engineer. Include the Traffic Management Plan (TMP) that is developed in the documentation for the candidate project. Also include any traffic restrictions and the associated costs and schedule. It is also important to note that all maintaining traffic improvements require environmental review for potential environmental impacts. MOT improvements can range from temporary crossovers to temporary widening and/or detour route improvements.

Deciding whether old signs should be replaced and where new signs should go

Include permanent signing in the following instances,: where the proposed construction limits will impact existing signs, where new features requiring new signs (turn lanes, passing flares and etc) are designed into the project, on reconstruction projects (4R), and where signs are mounted to bridges that may require modification. Capital Preventive Maintenance (CPM), cold-mill/resurface projects and other work types that do not impact the existing signs do not require permanent signing work or quantities.

TSC Traffic & Safety Engineer
Region Traffic & Safety Engineer

Also consider the age and reflectivity of the existing signs, to determine if new signs are required or if the existing signs may be salvaged and then re-erected on new posts. It is important to find out if a corridor signing project is planned, and where the new signs would be included in the signing project, thereby decreasing the work and money needed for permanent signing in the project being scoped. The Region or TSC Traffic & Safety Engineer can provide information regarding the need for permanent signing on a project. Include sign and post quantities in the scoping estimate, as well as all cantilever, trusses and bridge-mounted signs.

Calculation for pavement markings

Many projects require permanent pavement markings, including CPM sealing projects, such as thin overlay or mill and one course overlay. To estimate the cost of CPM sealing projects, the Traffic & Safety Division suggests using a figure of 20 percent of the project's pavement marking cost. Projects that may not require permanent pavement markings include some CPM projects, except for thin overlay or mill/one course overlay projects. For CPM sealing projects, it has been established (with the Traffic & Safety Division) that 20% of the pavement marking quantities will be calculated as a miscellaneous quantity. If the schedule for the region wide pavement marking contract does not coordinate, then the quantities required will be included in the project. The pavement markings for the sealing projects will be included in the yearly pavement marking contract and should be coordinated with the TSC Traffic & Safety Engineer.

For projects that require shoulder and/or centerline corrugations, include the corrugation quantities and cost in the scoping estimate. Refer to

Chapter 6 of the Road Design Manual for guidelines regarding when shoulder and/or centerline corrugations are required.

Traffic Signals Unit
Traffic & Safety in Lansing

Obtain estimates for work on the traffic signals and the related components should be obtained from the Traffic Signals Unit of Traffic & Safety in Lansing. This staff will need to know the limits and type of work for the proposed project. Additionally, they will need to know the anticipated method for maintaining traffic, as this may require the installation of new temporary signals or the relocation of existing signal heads. Estimates for impacts to traffic loop detectors will be provided if necessary, in addition to the estimates for the traffic signals themselves.

Traffic & Safety Engineer

The estimator should discuss, with the Traffic & Safety Engineer, the scope of work and the compatibility of different phasing or MOT alternatives to give the Traffic & Safety Engineer a thorough understanding of the scope of work and potentially viable MOT alternatives. This will allow the Traffic & Safety Engineer to analyze the best or most efficient method of maintaining traffic during the construction of the project, in accordance with MDOT's Work Zone Safety and Mobility Policy. Be aware of all the items that may be necessary to include in the estimate. Items to maintain traffic may go beyond plastic drums, temporary signs and temporary pavement markings. Depending on the proposed method of MOT, temporary widening may be needed. Include in the estimate the cost of this HMA and the cost to remove it. Also, if rumble strips need to be filled in to maintain traffic flow during construction, include the cost to fill and remove this HMA.

Items needed beyond drums, signs, and pavement markings

TSC Manager and Delivery staff
Local agency involved with detour

If a detour route is proposed, include in the estimate any improvements to the detour route, either before or after use by MDOT. It is very important to discuss the proposed detours with the TSC Manager and the Delivery staff. Not all detours require upgrades or modifications. The appropriate staff may have prior knowledge of the condition or agreements for a particular detour plan. It may be beneficial to have prior discussion with the local agency that will be involved with the detour. Some projects require modifications to existing traffic signals or installations of temporary traffic signals in order to maintain traffic. The cost of this signal work must be included in the estimate. The cost for Minor Traffic Devices, which is used on all projects, is 0.5 percent of the interim construction cost. To compute the cost for Flag Control, if applicable to the project, 0.5 percent of the interim construction cost should be used.

Rules for estimating costs of minor traffic devices and flag control

Utilities (revised 6-24-2019)

Avoiding conflicts with utility poles, street lights etc.

At the scoping stage, review old plans to investigate the presence of utilities on the project. Additionally, a field review of the site may identify the existence of utilities within the project limits. The presence of large utilities, transmissions lines or vaults can seriously impact project cost and schedule. Utilizing Preliminary Planning/Scoping Letter (Form#2483) the scoping may be used to acquire existing utility information from the utility companies. Using all three methods of obtaining existing utility information will aid in identifying potential conflicts and a more informed cost estimate for utility relocation. Private Utility companies will be

contacted during the design phase, to request additional utility location maps and information.

MDOT policy on utility reimbursement

MDOT will relocate municipal utilities (including sanitary sewers, storm sewers, power lines, power poles, street lights, communications lines and etc at project costs) not including betterments, only when they are in direct conflict with the proposed construction. Betterments are the responsibility of the municipality having jurisdiction over the utility.

Watermain may be a potential threat for the roadway. The current policy requires an evaluation of Evaluate the existing water main's watermain's condition (per the current policy), break/fix history and age, to estimate its potential effects on the life cycle of the proposed pavement and.

Splitting water main costs

Municipality officials Governmental Coordination Engineer

Guidance Document 10087

If it is determined that the watermain relocation will be included with the project, the municipality shall be required to participate in 50 percent of the non-federal costs of the installed price of the main and appurtenances. Initiate an agreement with the municipality, through the Governmental Coordination Engineer. Watermain betterments shall be in accordance with the Guidance Document 10087. If it is determined that watermain relocation will not be included with the project, but watermain relocations which are required due to direct construction conflicts, these costs shall be included in the project cost estimate.

TSC Utility Coordinator Municipality Utility Unit, Design Division in Lansing

For assistance in estimating municipal utility relocation work, specifically water mains, contact the TSC Utility Coordinator and/or the Municipal Utility Unit in the Design Division in Lansing.

Round up the total estimated cost, for utility relocation work, on a project to the nearest $1000, before placing it into AP Preconstruction.

Soils & Pavement Design

Region Soils Engineer

Consult the Region Soils Engineer for pavement design options to be estimated. The Region Soils Engineer may provide the proposed pay items which will make up the proposed pavement structure along with the estimated thicknesses of each layer. This estimated pavement structure is based on the proposed fix type, existing pavement information obtained from old plans, pavement cores, Average Daily Traffic (ADT) and pavement design guidelines published by MDOT. The Region Soils Engineer should also be aware of any potential peat excavation or contaminated soil within the project limits and may provide an estimate for the work necessary to deal with these situations.

In addition to providing the soil borings and/or pavement cores information, the Region Soils Engineer may provide quantities for specific soil needs (i.e. undercutting and etc). Consult the Region Soils Engineer for confirmation of the estimation for soil erosion and sedimentation control items.

Hydraulics

Dealing with drainage items such as culverts and storm sewers

The scope of hydraulic work on a proposed project can be widespread. The work can vary from extending culverts and placing new end sections to replacing culverts or placing new ones culverts or box culverts. Similarly, the scope for storm sewers can range from extending existing sewer systems to replacing existing sewers or even the adding new sewer systems. Once the magnitude of the drainage work is identified, appropriate pay items can be quantified and an estimate developed.

Thought should be given to the method of construction. For example, will the placement or replacement of a culvert be done as an open cut or will the culvert be bored and jacked under the pavement. The method of construction will impact the pay items proposed in the scoping estimate. Methods of diverting the flow of water may be required during construction. These costs should be accounted for in the estimate developed during the scoping process.

Hydraulics Section in the Design Division in Lansing

The Hydraulics Unit in the Design Division in Lansing may be consulted for input into the design and estimate for the hydraulic portion of the scoping package. However, the Hydraulics Unit must be consulted on any project that has a stream crossing with a drainage area greater than 2 square miles, if the culvert or crossing has proposed work being considered.

Hydraulics and bridges

Hydraulics and Region Surveys unit

A Hydraulic and Scour Analysis may be requested and conducted for bridges and culverts crossing regulated watercourses, during the design phase it should be requested. Additionally, an analysis may be required for bridge work over waterways, widening in a floodplain, a raise in road grade over four inches (MDOT Drainage Manual section 2.9.11.1 General Exemptions), lowering underclearance (resulting in a reduction of the hydraulic opening), culvert extensions and culvert end grates. Include this information in a hydraulic report, identifying recommended structure sizes and scour countermeasure designs, may be included in the scoping estimate. If this is not available at this time, it will be part of the design phase. Prior to any hydraulic analysis, coordinate a hydraulic survey with the Hydraulics and Region Surveys units, to determine the cost and the time needed to complete this work.

Items to Consider while Estimating and Analyzing Drainage Items

- If the stream velocity increases dramatically through the culvert or the stream width is substantially wider than the culvert it may be a sign of an undersized culvert. Complete hydraulic evaluation of the culvert during the design phase to determine if it has sufficient capacity.

- Identify the Ordinary High Water Mark (OHWM). The OHWM is generally located where staining is evident or where the bank vegetation growth starts. A design that allows for open capacity in the culvert will help debris to pass through and not block the culvert.

- If soil backfill has been washed away from downspouts it may be an indication that the downspout is undersized or is placed on too steep of a grade. Options that may be used for failed downspouts are to install drop structures (consisting of a deep manhole inlet with storm sewer outlet), install riprap on a geotextile fabric or to engineer a stable slope.

- If the downstream culverts are smaller, they may obstruct water flow. If the upstream or downstream culvert sizes are larger than the MDOT's culvert, this may indicate that MDOT's structure is undersized. Analyze issues during the design phase and make sure there is discussion of the next steps needed.

- Inspect Roadway
  a. Have pavement cracks formed parallel to the culvert?
     Cracking across roadway, almost as if outlining the culvert, may indicate culvert movement, roadway approach movement or an undermining of the culvert is present. Investigate the cause. Causes may include piping, soil entering the culvert at joints or corrosion points, roadway settlement and/or culvert settlement. Culvert replacement may be necessary if this is the case.

  b. Are there any road drainage issues?
     If storm sewers are not functioning properly, the storm sewer system may need to be evaluated as part of a separate process. If storm water is eroding the embankment, drop structures or embankment stabilization may be required.

  c. Are there sinkholes (or patched sinkholes) in the roadway, shoulder or side slope?
     This could result in displaced soil seeping into the pipe and creating a void which may lead to other structural problems including culvert and roadway settlement or the wash out during a large storm event. Culvert repair or replacement is recommended to prevent further structural damage.

Instances in which a wider road requires a larger culvert

  d. Will the road be widened?
     A widened road may require a longer culvert. A longer culvert has more friction losses, possibly causing a higher 100 year event elevation. This could be a violation of state law in watersheds greater than 2 square miles. A larger culvert may have to be considered. Therefore, further discussion and next steps will need to take place during the design phase.

Drainage Manual

e. Will the profile of the roadway be increased by more than four inches?

A road grade raise will act like a barrier for water during a flood event. Reference the Drainage Manual for the requirements and analysis required in this case.

f. Is there an adequate outlet or any history of flooding in the area?

For flooding issues, investigate the site and surrounding area to find the source of the problem. Refer to section 8.1.1 in the Drainage Manual for discussions on acceptable outlets.

g. Have best management practices (BMP's) been considered on the project?

Verify if any existing BMP's along the project length (detention basins, vegetated swales/ditches, etc.) will need to be resized due to the addition of impervious area. If none exist, verify the feasibility of placing new BMP's. See Drainage Manual section 9.4.1 for guidance on selecting BMP's.

h. Projects with capacity improvements should maintain the existing flowrates. The estimate should include additional storage cost and possible ROW.

Retaining Walls (revised 6-24-2019)

Holding back earth during construction

Occasionally a retaining wall is required on a project to hold back earth when a roadway is widened or other situations. For information and assistance with the cost estimate for retaining walls see the Region Bridge Engineer and/or a Lansing Bridge Unit. To complete the estimate for the retaining wall(s) they will need to know the location, limits and type of work of the project; the anticipated location of the wall(s) and the reason for the wall(s); the soil conditions where the wall is required; and the location of existing utilities which may impact the depth and location of the retaining wall. Another issue which should be discussed is the need for any specific or special aesthetic treatment of the retaining wall for the area.

Region Bridge Engineer
Lansing Bridge Unit

Completing the cost estimate

AP Preconstruction

Round up the total estimated cost, for retaining wall work, on a project to the nearest $1000, before placing it into AP Preconstruction.

Wetland Mitigation (revised 6-24-2019)

Projects that involve unavoidable impacts to wetland resources may require wetland mitigation. Projects impacting less than 1/3 acre of wetland or less than 2 acres, for a project total (as long as impacts to individual wetlands complexes are less than 1/3 acre each) may be mitigated at a Moment of Opportunity (MOO) site or wetland bank site anywhere in the state. Projects impacting over 1/3 acre, of an individual wetland complex, must be mitigated in the same watershed or eco-region as the impacted wetland. This often requires the creation of new wetlands within the project limits or at an offsite location. Occasionally, a wetland bank site has already been

Region Resource Specialist

created as a separate project in the same watershed as the impacted wetland that may have "credits" available for mitigation requirements. All efforts should be made to design the project and avoid or minimize the impacts to existing wetlands before mitigation is considered. Wetland impacts and mitigations requirements should be discussed with the Region Resource Specialist, in consultation with the Environmental Section's Wetland Mitigation Specialist. To accurately analyze the impacts, the Region Resource Specialist needs a description of the project, limits for the project, location of the existing wetlands that will be impacted, extent of wetland impact expressed in acres and the reason for the impacts. The Region Resource Specialist can provide an estimate for the proposed mitigation activities. This estimate should include the cost of earthwork, plant materials, and other necessary items to create a new wetland, if required. The proposed purchase of property to create the new wetland must also be included in the estimate.

Completing the estimate

AP Preconstruction

Round up the total estimated cost, for wetland mitigation work (including the potential ROW cost if mitigation is needed off-site or beyond the existing ROW), on a project to the nearest $1000, before placing it into AP Preconstruction.

Pump Stations (revised 6-24-2019)

Maintenance Division Region System Manager

The Maintenance Division has the primary responsibility to determine which pump stations will be selected for rehabilitation. This decision is based typically on two factors: known poor condition and age of the pump station, beyond normal service life. The corridor approach should be used when selecting the pump stations to be rehabilitated to take advantage of lower mobilization costs and economies of scale. Alert the Region System Manager and Maintenance personnel to the proposed candidates, so they may provide input or suggestions if alternate pump stations should be included in the Call For Projects.

Capacity improvements to a pump station may necessitate redesign and/or reconstruction of the downstream conveyance system. This anticipated work should be included in the estimate for the project.

What to do if a pump station fails within the project limits

Contact the Maintenance Division when an existing pump station falls within the project limits. The Maintenance Division will determine if any upgrades are needed to the pump station and provide an estimate for the proposed work.

Completing the estimate

AP Preconstruction

Round up the total estimated cost, for pump station work, on a project to the nearest $1000, before placing it into AP Preconstruction.

Noise/Sound Walls (revised 6-24-2019)

Noise/sound walls help abate traffic noise for those residences that were in place at the time a freeway was constructed and prior to 1976.

Noise Abatement Specialist at Construction & Technology

To estimate the cost for a noise/sound wall (location previously studied and verified for need), provide a description of the proposed project, anticipated location of the noise/sound wall and the data which supports the need for a noise/sound wall to the Noise Abatement specialist at C&T. Another issue to discuss is the need for any specific or special aesthetic treatment of the noise/sound wall for the area. Once the Noise Abatement Specialist has confirmed that the proposed location meets the requirements for a noise/sound wall, the specialist will then analyze the height and length needed for the wall and also the depth of the supports. The specialist will provide the cost of the noise/sound wall.

Completing the estimate

AP Preconstruction

Round up the total estimated cost, for noise/sound wall, on a project to the nearest $1000, before placing it into AP Preconstruction.

At-Grade Railroad Crossings (revised 6-24-2019)

When an at-grade railroad crossing crosses a roadway, for a proposed project, examine the crossing for potential work. There are two aspects of railroad work to be considered. The first involves the physical items. The crossing may need improvements. Examine the crossing itself and also see whether the warning signs or gates require upgrading or replacement. An entirely new installation may even be needed.

The other aspect of railroad work to include in a project (whether or not actual work on the crossing is included in the project) is the cost to maintain train traffic on the tracks during construction. The contractor must provide flaggers for the train traffic during project construction. Apply the cost to maintain the train movements any time the railroad crossing is within the construction influence area. This would include a project where the railroad runs parallel to the roadway, but traffic on the cross street crosses the tracks and is impacted by the construction. Include this project cost in the estimate.

Governmental and Railroad Section of the Local Agency Unit in Lansing

Contact the Governmental and Railroad Section of the Local Agency Unit, in Lansing for assistance with the coordination and estimate.

Completing the estimate

AP Preconstruction

Round up the total estimated cost, for railroad crossing work, on a project to the nearest $1000, before placing it into AP Preconstruction.

Rest Areas (revised 6-24-2019)

Roadside Development Unit in Lansing

For project limits that include a rest area, contact the Roadside Development Unit in Lansing to determine if any work to the rest area should be included in the project. If work in the existing rest area is to be included in the project, the Roadside Development Unit will provide a cost estimate and possible funding for the proposed rest area work. If no work is anticipated for the rest area facilities, evaluate the condition of the ramps and parking areas. If the condition warrants work to be done, estimate the surfacing, sealing or pavement patches needed and include this in the scope costs.

Completing the estimate

AP Preconstruction

Round up the total estimated cost, for rest area work, on a project to the nearest $1000, before placing it into AP Preconstruction.

Carpool Lots

Region System Manager

When an existing carpool lot falls within the project limits of a road project, determine if the carpool lot requires any work, such as preventive maintenance, improvements or upgrades. Check with the Region System Manager to assist in making this determination.

Region Real Estate Staff

If an existing carpool lot requires work as part of a road project or as a stand alone project, estimate the cost for this work. The work on the existing carpool lot will depend on the existing surface (HMA or gravel) and the proposed surface. If paved, the existing carpool lot may require cold milling prior to resurfacing. The existing pavement surface should be inspected to make this determination. If it is necessary to enlarge an existing carpool lot, consider additional pay items, including earthwork and possible ROW needs. Discuss any ROW needs with the Region Real Estate staff, as mentioned earlier in this chapter.

When a new carpool lot is considered, whether as a stand alone project or to be combined with a road project, estimate and program the work to construct the carpool lot.

Carpool Lot map

Before estimating the cost to construct the new carpool lot, determine the need, location and size of the lot. Contact the Region System Manager to discuss the options for a carpool lot in a given area. Verify the location with the statewide Carpool Lot map. Also consider other factors when analyzing the location of a proposed carpool lot such as the proximity to local transit systems, availability of property in the area and any local ordinances which may play a role in the decision to build a carpool lot.

Carpool Lot Coordinator Statewide Planning Division

MDOT Road Design Manual Section 12.13

Once a location has been determined, property is known to be available and local ordinances will not prevent the project from being constructed; determine the size, shape and pavement structure for the lot. Base the size of the carpool lot on the anticipated use and consult with the Carpool Lot Coordinator in Statewide Planning Division. The shape of the lot will be based on the property available, the terrain, size of vehicles that will likely use the carpool lot and the overall size of the carpool lot. Also consider traffic flow patterns when considering the shape and size of a carpool lot.

Region Soils Engineer

Section 12.13 of the MDOT Road Design Manual discusses various aspects of carpool lot design, including number and size of parking spaces, width for aisles and other geometric issues. Contact the Region Soils Engineer to determine the most suitable pavement structure for the proposed carpool lot. See detailed information early in the chapter on Soils & Pavement Design.

When estimating an upgrade to an existing carpool lot or the construction of a new carpool lot, include similar items as a non-freeway roadway. Also include drainage items, permanent pavement markings, signing, underdrains and any improvements to the approach work on the cross road. Maintaining traffic is typically not an issue for a carpool lot, as the lot is generally closed during the construction phase of the project. Carpool lots should be evaluated to see if they are candidates for the addition of bicycle racks it enhance their usability by other modes.

Intelligent Transportation Systems

Region Intelligent Transportation Systems (ITS) Coordinator

For freeway projects, contact the Region Intelligent Transportation Systems (ITS) Coordinator to determine if any ITS work is needed within the limits of the proposed project. The work may include upgrades to the existing system, complete installation of a new system or preliminary work done in preparation for a future ITS project.

The Region ITS Coordinator will need to know the limits and type of work included in the proposed project before a determination can be made as to what type, if any; ITS work may be packaged with a road or bridge project. When a decision is made to include ITS work with a road or bridge project, the Region ITS Coordinator will provide a complete estimate of the proposed ITS costs and will provide funding from the ITS funding sources, if available. This estimate will not include cost to maintain traffic, as that will be included in the road or bridge maintaining traffic costs.

Region System Manager

The Region ITS Coordinator will plan, estimate and coordinate all stand alone ITS projects. The stand alone ITS project estimates must include all costs to construct the project, including maintaining traffic, permits, survey, PE (Preliminary Engineering), CE (Construction Engineering) and etc. These projects will then be coordinated with the Region System Manager.

Freeway Lighting

Electrical Unit of the Utility, Drainage and Roadside Section Design Division in Lansing

Freeway projects in urban settings may include freeway lighting work, whether it will be for new lighting, repair or upgrade to the existing lighting system. If the proposed project work impacts the existing freeway lighting, contact the Electrical Unit of the Utility, Drainage and Roadside Section of the Design Division in Lansing to coordinate the impacts to the existing freeway lighting system. The staff in the Electrical Unit in Lansing will need to know the limits and type of proposed work to be included in the road or bridge project, with a description of the impacts to the freeway lighting. The staff of the Electrical Unit will examine the proposed road or bridge work and develop a detailed estimate for the removal and replacement of the existing freeway lighting system. This estimate will not include cost to

maintain traffic, as that will be included in the road or bridge maintaining traffic cost.

For a project that will include new freeway lighting, coordinate the type and limits of the lighting with the staff in the Electrical Unit in Lansing. Consideration of the power source for the lights and any existing or proposed utilities (underground or overhead) in the project area which may impact or be impacted by the proposed freeway lighting will be evaluated. The staff of the Electrical Unit will provide a detailed estimate for all new freeway lighting.

For a stand alone Freeway Lighting project, the staff of Electrical Unit will plan, estimate and design the project. The stand alone Freeway Lighting project estimate must include all costs to construct the project, including maintaining traffic, permits, survey, PE (Preliminary Engineering), CE (Construction Engineering) and etc.

Commercial Vehicle Enforcement (revised 6-24-2019)

Michigan State Police Traffic Safety Division

Region/TSC Traffic & Safety Engineer

Region Delivery Section

Region Development Section

The estimated cost for commercial vehicle enforcement repair or improvements depends on the type of enforcement tools (see Chapter 2) that are proposed for the site. Coordination with the Michigan State Police Traffic Safety Division, the Region/TSC Traffic & Safety Engineer, Region Delivery Section and the Region Development Section is necessary. During the Call For Project's process, on a yearly basis, the Commercial Vehicle Enforcement Committee will provide guidelines that will assist in the planning and estimating of a project.

Completing the Estimate

AP Preconstruction

Round up the total estimated cost for commercial vehicle enforcement work on a project to the nearest $1000 before entering it into AP Preconstruction.

Non-Motorized Paths

Road Design Manual Chapter 12

AASHTO Guide for Development of New Bicycle Facilities

TSC Development Engineer

Region System Manager

Items for non-motorized paths are similar to those for a roadway. The cross sectional elements (i.e. width of the path, maximum horizontal curvature and maximum vertical grades) will differ from roads. Check the elements against the information in Chapter 12 of the RDM and the AASHTO Guide for Development of New Bicycle Facilities. Conveyance of drainage must be maintained. If assistance is needed during the development of a non-motorized path estimate contact the TSC Development Engineer, Region System Manager, Department's Bicycle and Pedestrian Coordinator or the Bicycle Safety Engineer.

Survey (revised 6-24-2019)

Region Surveyor

Survey needs for a project will be determined by the Region Surveyor based on the type of work for the project. The survey needs for a mill and resurface project may be very different than those for a complete reconstruction project. It is important that the survey fit the scope of proposed work. If inadequate survey information is obtained, the project may be delayed while the required information is collected. If too much survey data is collected for a project it is a waste of funds and time that

could have been utilized elsewhere. Similarly the survey needs for a bridge deck repair project are different than the survey needs for a superstructure replacement project. The Region Surveyor will need to know the type of work included in the project; limits of the project; the type of ROW (fee or permits) if anticipated; and potential maintaining traffic scheme for construction, particularly if temporary widening may be required and the projected timeframe for the project. Convey the type and extent of drainage or hydraulic work to the Region Surveyor so that the extent of hydraulic surveys can be determined.

The Region Surveyor will determine whether MDOT forces will perform the survey, how the survey may be done and basic costs for the maintaining traffic. The Region Surveyor can assist in providing an estimated cost for the project survey work. In the estimate provided by the surveyor, additional funds may be added because the work will be performed by a consultant. If extra costs are added, document this in the scope.

Stream or water crossings with drainage areas greater than 2 square miles will have the hydraulic survey scope completed by the Lansing Hydraulics Unit, if the proposed work identified affected these features. The Hydraulics Unit may be consulted for crossings less than 2 square miles for advice on developing a hydraulic survey scope. The Region Surveyor can assist in providing an estimated cost for the project survey work.

Completing the Estimate

AP Preconstruction

Round up the total estimated cost for the survey on a project to the nearest $1000, before entering it into AP Preconstruction.

Project Support Cost

Contingency (revised 6-24-2019)

Providing for the Unexpected

Use the following tables when preparing preliminary estimates for projects, during the scoping phase of the project. In general, all project estimates should include some amount of contingency to account for the unknowns that may arise during the detailed design of the project. Contingency values account for change in conditions, standards, specifications and policy implementations that occur between the time the project is scoped and time of construction, as well as other minor work items not easily estimated at the time of scoping.

AP Preconstruction

The following Table (8-3) provides recommended contingency percentages based on the size and complexity of projects. Apply the contingency percentages entered into the scoping estimate in AP Preconstruction after a project construction subtotal has been calculated.

The following definitions apply to the tables below:

- **High Complexity** projects are generally characterized as major reconstruction, major rehabilitation, major widening, realignment and/or new construction type projects. Such

projects may have variable and complex cross-sections and/or site conditions, and may have an increased potential impact on environmental and/or right-of-way factors.

- **Medium Complexity** projects are characterized as minor rehabilitation, resurfacing and minor widening type projects. Such projects may have consistent cross-sections and/or site conditions, and typically have minimal impacts on environmental and/or right-of-way factors.

- **Low Complexity** projects are usually characterized as preventive maintenance and/or minor repair type projects with little or no widening. Such projects have consistent cross-sections and/or site conditions, and have little to no impacts on environmental and/or right-of-way factors.

Table 8-3: Suggested Contingency Factors for Projects

Suggested Contingency Factors for Projects			
Approximate Project Construction Cost *	Project Complexity		
	High	Medium	Low
≤$5 Million	10%	5%	5%
$5 Million to $10 Million	7%	5%	5%
≥ $10 Million	5%	3%	3%

* Note: Contingency percentages are applied to the construction subtotal. The construction subtotal is the sum of construction items prior to the PE (Preliminary Engineering), CE (Construction Engineering), Inflation and Incentive costs. These costs are added to the total project cost.

Preliminary Engineering (PE)

Preliminary Engineering includes all design activities (i.e. surveys, soil investigations, identifying ROW needs, drainage, hydraulic analysis and etc.) and plan preparation performed for the development of the construction plans and specifications for a transportation project.

Include the cost for survey items in the PE or EPE (Early Preliminary Engineering) phase (blank phase). The EPE phase makes it possible to obligate the funding for the survey work without obligating the entire PE phase. For additional information on estimating survey work, see the Survey section earlier in this chapter.

The following Table (8-4) contains factors that may impact the PE cost:

- Consultant or MDOT design
- Urban or rural area
- Number of sheets in plan set
- Surveys complexity (see the Survey section in this Chapter)
- Detours/MOT Issues
- Drainage/hydraulic analysis

- Soil investigation

The following guidance is provided for estimating PE (Preliminary Engineering):

Table 8-4: Other Factors That May Impact PE Cost

Type of Work	Estimated Cost *	% of Total Cost
Rehabilitation & Reconstruction/Replacement CMAQ/Safety (T&S)	$0 to $500,000	15
Rehabilitation & Reconstruction/Replacement	$500,000 to $3 Million	12
Rehabilitation & Reconstruction/Replacement	$3 Million to $6 Million	8
Rehabilitation & Reconstruction/Replacement	$6 Million and above	5
CPM (Road)	All	3
CPM (Road)	All (Justified)	5
CPM (Bridge)	All	10

- Note: PE percentages are applied to the construction subtotal

ProjectWise

Also include this information in the project's ProjectWise file.

Construction Engineering (CE)

Construction Engineering is the management of a project during the construction phase. This includes, but is not limited to, specification and plan interpretation, cost control, contract payment, project documentation, material testing and quality assurance.

The following Table (8-5) contains factors that may impact CE cost:

- Consultant or MDOT oversight (a slightly higher percentage should be considered if consultant oversight is planned)
- Distance between the office and project (added time and expense)
- Project schedules may be expedited, constrained or overall duration of the work may increase or decrease CE cost
- Materials and testing is part of the project's CE or an independent "As Needed" contract

Construction Engineer

The following guidance is provided for estimating the Road and Bridge project CE (Construction Engineering) and should be discussed with the Construction Engineer:

Table 8-5: Other Factors That May Impact CE Cost

Type of Work	Estimated Cost *	% of Total Cost
Rehabilitation & Reconstruction/Replacement	$0 to $2 Million	12
Rehabilitation & Reconstruction/Replacement	$2 Million to $10 Million	10
Rehabilitation & Reconstruction/Replacement	$10 Million and above	7

* Note: CE percentages are applied to the construction subtotal.

Indirect Cost Allocation Plan

In an effort to utilize all of the FHWA Federal Aid money that is available to Michigan, MDOT implemented an Indirect Cost Allocation Plan (ICAP) in October 2010. Using an indirect cost rate will allow MDOT to be reimbursed with federal aid for some of its administrative/overhead costs.

The ICAP, which was approved by FHWA, allows MDOT to develop a rate which will be applied to all MDOT direct labor costs on federally funded trunkline capital outlay projects. This rate is not applied to federal/local, State Planning and Research (SPR) funded, American Recovery and Reinvestment Act (ARRA) funded or 100 percent state funded projects. The indirect cost rate to be used for FY 2013 forward is 70.00 percent.

The indirect cost rate is to be applied to the PE and CE budgets based on the percentage of work to be completed by MDOT staff. This rate will increase the PE and CE budgets.

Inflation

How inflation rates are calculated

Every year in the annual Integrated Call for Project Instructions, all Regions are given direction for inflation. The inflation calculations may change from year to year based on the economy, material availability etc. Statewide Planning attempts to provide the Regions with a value that will be appropriate for the Five Year Transportation Plan. By using a consistent inflation standard statewide, it provides the ability to compare project costs consistently.

Where to see estimates with inflated dollars

MAP Database

Inflation is a constant and must be considered when all projects are programmed. All project estimates on the Michigan Architecture Project (MAP) Database should reflect future year dollars. This is the assumption for other systems using the MAP Database and when future year programs are reported.

Region System Manager

The Region System Manager should be consulted on all issues related to inflation.

PQS and AP Preconstruction (revised 6-24-2019)

AP Preconstruction

The first step for estimating projects include preliminary quantities being placed in the PQS spreadsheet. This spreadsheet is updated yearly and provided by the C&T Bridge Section.

Project Quantity Spreadsheet (PQS)

Project Quantity Spreadsheet (PQS) Guidance Document

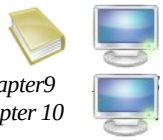
Project Quantity Sheet

AP Preconstruction

There are two reports that need to be developed as a result of AP Preconstruction scope estimating. They are "The Itemized Estimate Report" and "The Project Concept Estimate Report". These two documents shall be included in the scoping package and will be included in the project folder, as well as in ProjectWise.

AP Preconstruction Users Guide

AASHTOWare Project



Step 8, Chapter9
Chapter 10
Project Wise

ProjectWise

Add the web reports in the Adobe PDF format into ProjectWise. If the job number does not yet exist in ProjectWise, contact your TSC/Region ProjectWise administrator and request the creation of the job number folder. Once created, add the Adobe PDF Web report and other related documents into the appropriate "0-Early Preliminary Engineering (EPE)/Project Scoping Document Package/....." folder, located under the proposed job number. See chapter 10 of this manual for ProjectWise instructions and details.