Key Message (do this only if this is a standalone module)
Welcome participants to AASHTO Estimating Course.
Confirm they are in the right location.

Background (do this only if this is a standalone module)
Introduce yourself and share information regarding your experiences with estimating and with teaching this class. Recognize the sponsorship of AASHTO and NCHRP in developing the course materials.

Interactivity (do this only if this is a standalone module)
Before the class begins, greet each student individually and find out something about them, like their location, their job function, and estimating experience. If an executive is attending the overview in the first part of the course, ask them to help you introduce the course by providing their perspective on the importance of estimating and on its job relevance for attendees.

Notes (do this only if this is a standalone module)
This is also a good time to cover logistics and administration. The participants will need to know about breaks, lunch, location of bathrooms, telephones, smoking areas, start and stop times, forms to be completed.
Learning Objectives

- Select appropriate estimating approach and prepare base cost estimate.
- Determine cost estimate components and quantify them.

Key Message
There are four learning objectives for this module.

Background Information
With completion of this module the participant should be able to:

Select appropriate estimating approach and prepare cost base estimate.
Determine cost estimate components and quantify them.

Interactivity
Are there any other objectives that are of interest to the group?

Notes
None
Key Message
There are four learning objectives for this module.

Background Information
With completion of this module the participant should be able to:

Develop estimate data based on historical cost database.
Apply conceptual estimating techniques

Interactivity
Are there any other objectives that are of interest to the group?

Notes
None
Key Message
Conceptual estimating is used early in project development to determine total project cost.

Background Information
The use of conceptual estimating primarily supports the preparation of planning and early scoping estimates when very little project definition is available and project characteristics are not well known. Conceptual estimating techniques can be used to estimate total project cost by major components:

• Right of way (ROW).
• Construction.
• Engineering/Design (often termed preliminary engineering [PE]).
• Construction engineering (CE).

Interactivity
None

Notes
None
Key Message
Conceptual estimating is based on relationships.

Background Information
A number of estimating techniques are conceptual by classification. These techniques are most often based either on statistical relationships or ratios between project definition information/data and historic costs. For a particular facility type, the development of an estimate of a project using statistically derived relationships between key dimensional information and historical costs is often referred to as parametric conceptual estimating. One approach is to use the relationship between facility type and dimensions and costs as reflected in statistically derived equations from historical data. The other common approach is to use ratios between historical data and key project parameters to calculate the cost of work elements.

Interactivity
Are there other approaches to conceptual estimating other than the two identified in this slide?

Notes
None
Key Message
Major project features (i.e., key cost driving parameters) is basis for conceptual estimating.

Background Information
Because conceptual estimates are prepared early in project development when specific work items are not defined or not quantifiable at the time, it becomes very difficult to estimate costs in detail. Therefore, both approaches use major project features that reflect a specific type of facility (e.g., centerline miles for pavements and square feet of deck area for bridges) to develop the cost relationships. Further, estimators use historical percentages to estimate construction elements that are difficult to quantify early in a project. Historical percentages are also used for total project cost components such as engineering/design, construction engineering, and right of way.

Interactivity
None

Notes
None
Key Message
Conceptual estimating is an early type of estimating.

Background Information
Conceptual cost estimation is a methodology used to attain total project cost when a project is in its earliest stages of development. The techniques described here are straightforward, but an STA should have its own historical cost database to support development of these estimates based on minimal definition of project parameters or facility components. STAs consider these techniques sophisticated if statistical relationships are used, but when using ratios or percentages, the techniques are relatively simple.

Interactivity
What is your definition of conceptual estimating? Does your agency have another terms for this type of estimating?

Notes
None
Key Message
Conceptual estimating is an early type of estimating.

Background Information
Early in project development, a project’s definition is usually very ambiguous. However, newly developed projects are often similar to previous projects that are under design, under construction, or recently completed by the agency. Historical cost data from these past projects can serve as a basis for developing a uniform, repeatable, conceptual estimating approach. Conceptual estimating approaches provide reasonably accurate estimates in a timely manner. Statistical relationships and/or non-statistical ratios between historical data and other parameters form the basis for conceptual estimating.

Interactivity
None

Notes
When using past projects they should be similar in scope to the project being estimated.
**Why to Use Conceptual Estimating?**

Develop early projections of project cost when limited information is available to:

- develop long-range plans
- assess benefit-to-cost ratios
- compare the cost of different project alternatives

**Key Message**
Need cost projections to support early project work.

**Background Information**
The purpose of conceptual estimating is to develop early projections of project cost when limited information reflects only approximate dimensions of key facility features. The time and effort required to prepare a conceptual estimate should be minimal. The techniques provide simplified, reliable, early estimates based on historical data and adjusted to current costs. Because of these attributes, decision-makers use conceptual estimates to develop long-range plans, assess benefit-to-cost ratios for prioritizing projects, and compare the cost of different project alternatives.

**Interactivity**
None

**Notes**
The project activities shown on this slide occur most often in planning and early project scoping (see next slide).
Determine Estimate Basis

The basis of the estimate comes from:
- project definition
- project characteristics

Challenge:
Ensure the estimate covers all categories of each major project component.

Key Message
Developing the scope for a conceptual estimate is a challenge.

Background Information
Conceptual estimating requires that estimators determine the basis from which the estimate will be prepared. The basis of the estimate mainly comes from the project definition and project characteristics as determined by planners and designers. The estimator should visit the project site to confirm the completeness of project definition requirements and assess potential constructability (e.g., material storage locations, haul routes, and construction staging issues). Further, a site visit can help detect potential environmental mitigation, utility relocation, and right-of-way issues that might influence cost.

The challenge when preparing a conceptual estimate is to ensure that the estimate covers all categories of each major project component, that is, construction, right-of-way, preliminary engineering, and construction engineering. At this level of estimating, defining the construction effort is often very difficult due to lack of specific project information.

Interactivity
None

Notes
None
Key Message
Project definition description should identify project type and major components.

Background Information
The exactitude and work description detail during early project definition can vary greatly. Project definition includes the general cost components of a facility, such as construction, engineering/design, construction engineering, and right-of-way. Descriptive information usually included whether the project type is a preservation (e.g., overlay), rehabilitation (remove and replace), reconstruction (add capacity) project, or new construction (new roadway/bridge). Specific project details available at this stage in project development are project boundaries such as between milepost A and milepost B. Estimators then uses general descriptions of the provided project elements such as pavement width or lane widths, bridge deck dimensions, and possible drainage requirements. In addition, there are some assumptions made regarding the pavement or bridge type. Also, a determination of whether or not ROW is required is made.

Interactivity
None

Notes
None
**Key Message**
Conceptual estimating requires sketches or early schematic drawings.

**Background Information**
At the conceptual phase, planners or designers develop early project definition data using sketches or schematic drawings with approximate dimensional information. In addition, there should be some idea of whether or not right-of-way is required, as well as a statement about potential environmental impacts. However, in most instances, there is a lack of specificity around details. In general, the level of project definition varies depending on when in the project development process the conceptual estimate is being prepared, that is, early in the planning phase or early in the scoping phase or at some point between. Project complexity also affects the level of project definition. To prepare a credible conceptual estimate for more complex projects, there needs to be an increased level of definition details.

**Interactivity**
None

**Notes**
None
**Project Characteristics**

Focus is on the **larger picture** characteristics:

- project location
- potential environmental issues and utility impacts
- the extent of right-of-way required

---

**Key Message**
Project characteristics must be understood as they impact project definition costs.

**Background Information**
Since project definition is incomplete, planners, designers, and estimators most likely cannot define all specific work characteristics. Thus, the estimate focus must be on the “larger picture” characteristics such as project location, potential environmental issues and utility impacts, and the extent of right-of-way required. Depending on project complexity, consideration should be given to traffic management and major drainage issues. Thus, the project’s level of complexity would be the principle driver that defines specific project characteristics.

**Interactivity**
What other project characteristics do you consider when preparing a conceptual estimate during the planning/scoping phase?

**Notes**
None
Key Message
Estimators must understand site characteristics as they relate to the project’s definition.

Background Information
It is highly recommended that the estimator visit the project site to comprehend the project’s definition in relation to existing site characteristics and in consideration of major constructability issues that might be relevant to the project (e.g., significant potential material logistic and traffic management issues). If a physical visit is not possible, utilizing technology such as Google street view or Google Earth in many cases aids the estimator in gaining an understanding of site conditions.

Interactivity
Do you visit project site when preparing conceptual estimates? Why or why not?

Notes
None
Key Message
Conceptual Estimating Key Inputs

Background Information
There are a number of techniques that can be used to perform conceptual cost estimating. The most common techniques are shown on this slide. Lane mile, bridge cost factors, and historical percentages are used to estimate construction costs. Non-construction costs such as right-of-way, utility relocation, and engineering/design are often estimated using historical percentages when preparing a conceptual estimate for total project cost.

Interactivity
None

Notes
The next slides cover these conceptual estimating techniques.
Key Message
Construction cost factors can be developed based on bid history.

Background Information
STAs define basic cost elements with the activities associated with traditional project development processes. Cost data for the construction component starts with the lowest level of cost details and pay items from contractor bids. These construction costs reflect the anticipated contract award amount represented by a responsive low-bid construction contractor. Actual construction bids for a project are aggregated to reflect a fundamental parameter associated with the project type (i.e., $/mile or $/square foot) in combination with other factors for cost elements, such as but not limited to roadway approaches for bridge projects or utilities, large culverts, and/or bridges within a roadway project. The sum of these construction cost elements becomes the fundamental basis for estimating the remaining project components (i.e., ROW, PE, and CE).

Interactivity
None

Notes
None
Key Message
Construction cost factors may not cover all requirements for the project.

Background Information
Current conceptual cost factors developed from historical data might not include newly enacted project requirements. For example, conceptual cost factors will likely not capture any new costs imposed by a recently legislated environmental regulation. Therefore, an appropriate contingency will need to account for these new project requirements until estimators receive and analyze data associated with the actual cost of this work and then can assign it a cost element, or assume these costs are captured by the conceptual cost factor.

Interactivity
How does your agency deal with these issues when preparing conceptual estimates?

Notes
None
check grammar - this doesn't make sense
Tribellhorn, Lesly, 3/29/2015
Lane Mile Cost Factors

- Lane-mile cost factors can be based on:
  - typical sections representing common types of facilities
  - historical cost data.
- Use data from relevant bid items.

Key Message
Lane Mile Cost Factors

Background Information
An STA develops lane-mile cost factors based on the concept of using typical sections representing common types of facilities and historical cost data to derive key cost factors. For example, estimators can use typical lane configurations and pavement type sections as the basis for estimating pavement construction cost for a given length of roadway, pavement thickness, and typical shoulder width. Often, cost estimators develop costs per lane mile using specific pay items from historical bid data and typical sections. Historical data may reflect weighted costs for a given time period and are not necessarily specific to any one area or district within a state. However, it is beneficial to use data from a specific district to provide a location-specific cost factor.

Interactivity
None

Notes
None
Key Message
Lane mile cost factor development example using typical section.

Background Information
This slide represents an example of Florida DOT typical section which has been utilized to develop a lane-mile cost factor based on weighted average unit prices per pay item.

Interactivity
None

Notes
The development of lane-mile cost for the above section is shown in the next slide.
### Key Message
Detailed cost data from bid history is used to develop lane mile cost.

### Background Information
Based on the typical section as depicted in the previous slide, this The table in this slide shows an example of developing a lane-mile cost factor using weighted average unit prices per pay item. The lane-mile cost for this section is $4,700,000 as shown on the top of the table.

### Interactivity
Does your agency have a database of lane mile cost factors?

### Notes
None

---

**Development of Lane-Mile Cost Factor**

<table>
<thead>
<tr>
<th>Pay Item</th>
<th>Description</th>
<th>Total Quantity</th>
<th>Unit</th>
<th>Weighted Avg. Unit Price</th>
<th>Total Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>0020 1</td>
<td>MOBILIZATION</td>
<td>10.00</td>
<td>EA</td>
<td>$419.501.06</td>
<td></td>
</tr>
<tr>
<td>0024 4</td>
<td>MAINTENANCE OF TRAFFIC</td>
<td>7.00</td>
<td>EA</td>
<td>$274,475.04</td>
<td></td>
</tr>
<tr>
<td>0024 15</td>
<td>SEDIMENT BARRIER</td>
<td>10,500.00</td>
<td>LF</td>
<td>$844.80</td>
<td>$9,074,480</td>
</tr>
<tr>
<td>0024 16</td>
<td>FLOATING TURBIDITY BARRIER</td>
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<td>LF</td>
<td>$7.76</td>
<td>$1,940.00</td>
</tr>
<tr>
<td>0024 12</td>
<td>STAKED TURBIDITY BARRIER - NYLON REINFORCED PVC</td>
<td>250.00</td>
<td>LF</td>
<td>$3.75</td>
<td>$937.50</td>
</tr>
<tr>
<td>0024 17</td>
<td>SOIL TRACKING PREVENTION DEVICE</td>
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<td>EA</td>
<td>$2,154.40</td>
<td>$2,154.40</td>
</tr>
<tr>
<td>0024 18</td>
<td>INLET PROTECTION SYSTEM</td>
<td>1.00</td>
<td>EA</td>
<td>$581.55</td>
<td>$581.55</td>
</tr>
<tr>
<td>0027 1</td>
<td>LITTER REMOVAL</td>
<td>1.00</td>
<td>AC</td>
<td>$49.09</td>
<td>$49.09</td>
</tr>
<tr>
<td>0027 2</td>
<td>MOWING</td>
<td>1.00</td>
<td>AC</td>
<td>$29.11</td>
<td>$29.11</td>
</tr>
<tr>
<td>0100 1</td>
<td>CLEARING &amp; GRADING</td>
<td>20.18</td>
<td>AC</td>
<td>$4,852.83</td>
<td>$97,522.47</td>
</tr>
<tr>
<td>0120 1</td>
<td>REGULAR EXCAVATION</td>
<td>19,500.00</td>
<td>CY</td>
<td>$3.54</td>
<td>$68,555.40</td>
</tr>
<tr>
<td>0120 6</td>
<td>EMBANKMENT</td>
<td>103,315.75</td>
<td>CY</td>
<td>$4.96</td>
<td>$513,104.58</td>
</tr>
<tr>
<td>0400 4</td>
<td>TYPE B STABILIZATION</td>
<td>4,292.55</td>
<td>SY</td>
<td>$2.55</td>
<td>$10,803.25</td>
</tr>
<tr>
<td>0263700</td>
<td>OPTIONAL BASE, BASE GROUP 09</td>
<td>39,803.35</td>
<td>SY</td>
<td>$10.66</td>
<td>$425,262.00</td>
</tr>
<tr>
<td>0334 1 24</td>
<td>SUPER-PAVING ASPH CONC, TRAF D - PC74-22</td>
<td>6,582.40</td>
<td>TN</td>
<td>$86.37</td>
<td>$568,521.89</td>
</tr>
<tr>
<td>0337 7 20</td>
<td>ASPH CONC FBC COURSE, DSC RB, PC-25, PC-PC76-22</td>
<td>3,191.47</td>
<td>TN</td>
<td>$140.75</td>
<td>$449,109.40</td>
</tr>
<tr>
<td>0400 2 2</td>
<td>CONCRETE CLASS II ENSWALLS</td>
<td>36.00</td>
<td>CY</td>
<td>$795.54</td>
<td>$28,339.44</td>
</tr>
<tr>
<td>0425 151</td>
<td>INLETS, CURB, TYPE I, &lt;10&quot;</td>
<td>36.00</td>
<td>EA</td>
<td>$3,091.55</td>
<td>$110,531.80</td>
</tr>
<tr>
<td>0425 152</td>
<td>INLETS, CURB, TYPE I, &lt;10&quot;</td>
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<td>EA</td>
<td>$4,602.64</td>
<td>$46,026.40</td>
</tr>
<tr>
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<td>EA</td>
<td>$1,899.03</td>
<td>$9,495.15</td>
</tr>
<tr>
<td>0425 154</td>
<td>INLETS, DT, TYPE D, &lt;15&quot;</td>
<td>1.00</td>
<td>EA</td>
<td>$2,404.23</td>
<td>$2,404.23</td>
</tr>
<tr>
<td>0425 2 41</td>
<td>MANHOLES, P-7, 10&quot;</td>
<td>5.00</td>
<td>EA</td>
<td>$2,589.06</td>
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</tr>
<tr>
<td>0425 2 71</td>
<td>MANHOLES, P-7, 10&quot;</td>
<td>1.00</td>
<td>EA</td>
<td>$4,477.67</td>
<td>$4,477.67</td>
</tr>
<tr>
<td>045071103</td>
<td>PIPE CULVERT OPTIONAL MATERIAL, ROUND, SHAPE, 37-48&quot; STORM SEWER</td>
<td>5,056.00</td>
<td>LF</td>
<td>$137.23</td>
<td>$693,834.88</td>
</tr>
<tr>
<td>045071104</td>
<td>PIPE CULVERT OPTIONAL MATERIAL, ROUND, SHAPE, 49-60&quot; STORM SEWER</td>
<td>200.00</td>
<td>LF</td>
<td>$195.73</td>
<td>$39,146.00</td>
</tr>
<tr>
<td>046075112</td>
<td>PIPE CULVERT OPTIONAL MATERIAL, ROUND, 2&quot;SCD</td>
<td>2,128.00</td>
<td>LF</td>
<td>$43.82</td>
<td>$94,062.08</td>
</tr>
<tr>
<td>0530179139</td>
<td>PIPE CULVERT, OPT MATERIAL, ROUND, 39&quot;PCD</td>
<td>200.00</td>
<td>LF</td>
<td>$68.39</td>
<td>$13,679.12</td>
</tr>
<tr>
<td>0520 1 10</td>
<td>CONCRETE COMB &amp; GUTTER, TYPE F</td>
<td>10,960.00</td>
<td>LF</td>
<td>$12.68</td>
<td>$138,060.80</td>
</tr>
<tr>
<td>0522 1</td>
<td>SIDEWALK CONCRETE, 4&quot; TCH</td>
<td>5,800.67</td>
<td>SY</td>
<td>$26.49</td>
<td>$153,404.06</td>
</tr>
</tbody>
</table>
**Key Message**
Developing lane mile cost factors using past similar projects.

**Background Information**
An alternative approach is to develop lane-mile cost factors based on the concept of using the actual cost of completed or ongoing projects. The data should represent typical STA projects. These completed or ongoing projects have known costs and definitions. The completed project cost becomes dollars per centerline mile by dividing the cost of the completed project by the total centerline miles for the project. The cost per centerline miles reflects a specific location and time period. The compiler of these gross cost numbers should note the location and time information. This cost per centerline mile factor allows estimators to estimate a similar project that has the same types of construction categories.

**Interactivity**
None

**Notes**
None
Bridge Cost Factors

Bridge costs per deck area ($/SF) is similar to the lane-mile approach for roadways.

Key Message
Developing bridge cost factors based on deck area is a common approach.

Background Information
STAs derive bridge costs per deck area (usually in $/SF) in a manner similar to the lane-mile approach for roadways. They build this cost factor using bid data for typical bridge types and span lengths together with location characteristics (over land or water). Since cost per square foot of deck area varies, it is important to provide a range for the deck cost factor. Again, one must specify the time period and project location to create the cost factors. It is also important to state the dimensional data (width and length) used to calculate the deck area.

Interactivity
None

Notes
None
### Key Message
Dollar/SF of bridge deck-statewide average historical ranges in 2011 dollars by bridge type.

### Background Information
This slide provides an example table of bridge cost factors including a reference to deck area calculations and other qualifications regarding the cost data.

### Interactivity
None

### Notes
Always reference the time period of the normalized cost data reflected in the table.

### Table: $/SF of Bridge Deck - Statewide Average Historical Ranges in 2011 Dollars

<table>
<thead>
<tr>
<th>Type of Bridge</th>
<th>Measure (SF Bridge Decks)</th>
<th>Low ($/unit)</th>
<th>Average ($/unit)</th>
<th>High ($/unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prestressed Concrete Girders—Span 50-175 ft</td>
<td>SF</td>
<td>150</td>
<td>175</td>
<td>200</td>
</tr>
<tr>
<td>Water Crossing w/ Piling</td>
<td>SF</td>
<td>140</td>
<td>165</td>
<td>190</td>
</tr>
<tr>
<td>Dry Crossing w/ Spread Footings</td>
<td>SF</td>
<td>120</td>
<td>155</td>
<td>180</td>
</tr>
<tr>
<td>Dry Crossing w/ Spread Footings</td>
<td>SF</td>
<td>110</td>
<td>145</td>
<td>160</td>
</tr>
<tr>
<td>Reinforced Concrete and Post-Tensioned Concrete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Box Girder—Span 50-200 ft</td>
<td>SF</td>
<td>200</td>
<td>250</td>
<td>300</td>
</tr>
<tr>
<td>Water Crossing w/ Piling</td>
<td>SF</td>
<td>175</td>
<td>225</td>
<td>275</td>
</tr>
<tr>
<td>Dry Crossing w/ Piling</td>
<td>SF</td>
<td>160</td>
<td>200</td>
<td>250</td>
</tr>
<tr>
<td>Dry Crossing w/ Spread Footings</td>
<td>SF</td>
<td>150</td>
<td>190</td>
<td>230</td>
</tr>
<tr>
<td>Concrete Bridge Removal</td>
<td></td>
<td>20</td>
<td>35</td>
<td>50</td>
</tr>
<tr>
<td>Widening Existing Concrete Bridges (including Removal)</td>
<td>SF</td>
<td>175</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>SE Wall Precast Concrete Panels</td>
<td>SF</td>
<td>30</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>SE Wall Welded Wire</td>
<td>SF</td>
<td>20</td>
<td>30</td>
<td>40</td>
</tr>
</tbody>
</table>

**NOTES:**
- Bridge areas are computed as follows:
  - Typical Bridges: Width x Length
  - Length:
    - Distance between back of pavement seats, or for a bridge having wingwalls, 3'-9" behind the top of the embankment slope; typically end of wingwall to end of wingwall.
  - Special Cases:

Source: Design Manual 2011
Key Message
Dollar/SF of bridge deck-statewide average historical ranges in 2011 dollars by bridge type.

Background Information
This slides illustrates incorporating an increased level of detail into a database of bridge cost factors. Comparative bridge costs provide guidance on where in the cost factor range the estimator may want to select from based on general bridge dimensional information and typical location characteristics. An approach defined by the Federal Highway Administration (FHWA) helps in calculating these cost factors.

Interactivity
Does your agency have a cost factor database for bridges? How is it structured?

Notes
None
Key Message
Historical percentage cost factors are used frequently when preparing conceptual estimates.

Background Information
Historical percentages are often used to estimate costs for construction elements that are not typically defined at the planning phase and are not covered in historical data sources (e.g., lane-mile cost factors). A percent is developed based on historical cost information from past projects to cover very specific construction elements such as drainage and environmental mitigation. This percentage is based on a relationship between the selected construction elements and the total construction cost category.

Interactivity
None

Notes
None
Historical Percentage Cost Factors (cont’d)

- Projects should be similar in definition and complexity.

- Several projects should be used
  - so that a range of percentages can be reviewed.

**Key Message**
Development of historical percentage cost factors.

**Background Information**
The projects from which historical percentages are developed should be very similar in definition and complexity to the project being estimated. The elements that are represented by the percentage should be based on a similar set of standard pay item numbers. Several projects should be used to develop the percentages so that a range of percentages can be reviewed prior to selecting the specific percentage that is applied by the estimator. As the dollar size of the project increases, historical percentages for elements normally decrease.

**Interactivity**
None

**Notes**
None
Computer-Generated Cost Factors

Computer software is used to store and sort historical cost data.

- AASHTO Trns•port BAMS/DSS®
- AASHTOWare Project Estimation

**Key Message**
Computer software can aid in generating cost factors.

**Background Information**
Computer software is often used to aid in storing and sorting historical cost data and other pertinent project details. In its most elementary form, one can use a spreadsheet to store historical lane-mile information based on different types of projects. Alternatively, computer software, such as the AASHTO Trns•port Bid Analysis Management System/Decision Support System® (BAMS/DSS), allows users to store bid data. The Trns•port BAMS/DDS® system provides a structured classification of bid items used by an STA, and the system allows for classification of contracts based on work type. The Trns•port BAMS/DSS® data used with other programs helps to develop lane-mile costs. To refresh the lane-mile cost, estimating personnel update the calculations based on current bid data. Finally, historic cost data can be stored within an estimating program along with other project type elements and dimensional information. An example of such a program is the AASHTO TRAnsportation Cost EstimatoR® (Trns•port TRACER). Trns•port Cost Estimating System® (CES) also helps to develop conceptual estimates. Rather than developing templates for typical sections in order to establish cost factors for lane miles, using these same templates helps with developing cost groups in CES® to represent elements of work. These cost groups could then be included within the estimate when one needs the work elements. The resulting estimate would more closely resemble that of a detailed estimate, but it would include higher contingencies due to the greater uncertainties in the earlier stages of the project.

**Interactivity**
None
Notes
None
Prepare Base Estimate

Key Steps

1. Select appropriate estimating approach.
2. Determine estimate components and quantify.
3. Develop estimate data.
4. Calculate cost estimate.
5. Document estimate assumptions and other estimate information.
6. Prepare estimate package.

Key Message
Preparation of the base estimate requires performing six steps.

Background Information
After establishing the estimate basis, the estimator can prepare the base estimate. The base estimate covers what is known about the project. Project unknowns are covered under contingency based on some sort of risk analysis. There are six general steps for preparing a base estimate:

- Select appropriate estimating approach.
- Determine estimate components and quantify.
- Develop estimate data.
- Calculate cost estimate.
- Document estimate assumptions and other estimate information.
- Prepare estimate package.

Interactivity
None

Notes
Each step will be discussed individually in the context of conceptual estimating in the slides that follow.
2. Determine Estimate Components and Quantify (cont’d)

**Example:**
- project requires both structures and pavement construction.
- Estimators derives quantities for the major parameters such as:
  - lane miles
  - square foot of bridge deck area/retaining wall area

**Key Message**
Calculate quantities for given components at appropriate unit.

**Background Information**
If the project requires both structures and pavement construction, estimators will then derive quantities for the major parameters such as lane miles and square foot of bridge deck area or retaining wall area. The estimator must define the lane mile as centerline or project lanes for estimating purposes only. If using centerline, then estimators should identify mileposts at the project boundaries. The difference between the mileposts represents the centerline distance. If project lane miles are used, the estimator needs to know how many lanes are involved in construction. This may include existing lanes plus new lanes added if the project is a capacity expansion. Next, the estimator should calculate the total project lane miles. If the project involves bridges or other major structures, then the basic dimensions of the replacement or new bridges must be determined (e.g., deck width, length, height above water or land).

**Interactivity**
None

**Notes**
None
3. Develop Estimate Data

The estimator:

1. matches the types of quantities with the construction cost data.
2. applies proper adjustments based on:
   - Project type
   - Project definition
   - Site characteristics
3. decides on the percentages of ROW, PE, and CE costs.

**Key Message**
Developing estimate data requires finding the correct data and adjusting that data.

**Background Information**
In this step, the estimator has to match the types of quantities developed in the previous step with the construction cost data available in the STAs historic cost database. Then, the estimator has to ensure proper adjustments of historic data to fit the current estimate. Adjusting historic data depends upon the type of project, its definition, and specific site characteristics, as these attributes relate to the current estimate. In addition, the estimator must decide on the percentage to use in calculating ROW, PE, and CE costs, again from the data in the STA’s historic cost database.

**Interactivity**
None

**Notes**
Various adjustments will be discussed in the following slides.
Key Message
Develop Estimate Data

Background Information
It might be necessary to develop the appropriate cost data if the STA database does not cover the needed items to complete the conceptual estimate for a project. There are items that should be considered when adjusting historic data.

Interactivity
None

Notes
The information on this slide will be discussed in the following slides.
Key Message
Selecting appropriate historical cost data issues.

Background Information
Selecting the appropriate historic data for estimating a project is vital. The estimator must ensure that the data selected represents the type of project for which an estimate is being prepared. As an example, if the project relates to pavement work only, then a lane-mile approach is appropriate. In this case, the estimator can select the appropriate project type and the corresponding cost factor (i.e., dollar per lane mile). Bridge estimating takes a similar approach. The bridge type selected from STA charts must be similar to the current bridge estimate. The estimator then selects the corresponding cost factor. If the project has both pavement and bridge categories, the estimator may select cost factors developed from similar past projects.

In selecting the cost factor, the estimator should be clear about the project definition or scope covered by the cost factor (e.g., does the factor include substantial environmental mitigation costs or costs for relocating utilities?). This is critical information to know when adjusting historic cost factors to fit the project for which an estimate is being prepared. Other adjustments will also likely be necessary.

Interactivity
None

Notes
None
Adjusting Historic Data
Location

- Cost factors are often developed based on statewide averages.
- Cost differentials may impact:
  - labor wage
  - materials cost
  - construction equipment cost

**Key Message**
Location adjustments may be required depending on the state.

**Background Information**
Cost factors are often developed based on statewide averages. In some states, construction costs are different by district or region depending on location. Cost differentials may be due to labor wage changes. Typically, an urban area has higher wage rates than a rural area. Other differentials in costs resulting from location could affect both materials and construction equipment (typical haul distances). In all cases, the estimator has to evaluate cost differentials between statewide averages and costs for the actual project location. Thus, estimators must make appropriate increase or decrease adjustments as necessary.

**Interactivity**
Is this location issue of concern in your state? If so, how do you account for the differences in costs around your state?
Is location an issue in the interchange project?

**Notes**
States with many urban areas may have higher costs in those areas relative to rural locations. This issue may necessitate cost adjustments.
Key Message
Specific cost adjustments may be required based on site characteristics.

Background Information
Estimators should take into consideration the location of the project in relation to such issues as terrain, batch plants, and haul distances. Flat terrain normally improves contractor productivity, so costs should be lower compared to terrain characterized by hills or mountains. If distance influences the transportation of materials, then costs are likely higher than the average. The estimator must use judgment to adjust cost factors so they reflect these types of location characteristics. The estimator may need input from construction engineers in developing adjustments for such factors.

Interactivity
How does your agency adjust for unique location characteristics?
What might be unique about the interchange project?

Notes
Some states have factors used to adjust for different haul distances.
Adjusting Historic Data
Scope

- The estimator develops percentages to cover work elements not covered by the basic cost factor.

- The cost factors database should identify what is included in the standard cost factor,
  - so estimators can make any appropriate adjustments.

Key Message
Scope Adjustment

Background Information
The estimator has to develop percentages to cover work elements not covered by the basic cost factor. For example, if the cost factor for a bridge (e.g., dollars per bridge deck area) does not cover the approach slabs, then the estimator has to add this cost. Developing percentages should help estimate these types of additional costs. The database of cost factors should clearly identify what is included in the standard cost factor so estimators can make any appropriate adjustments when applying the cost factor on a current project estimate.

Interactivity
Does your agency maintain a database of these types of cost factors or percentages?
How do you confirm that all project scope items are covered such as in the interchange project estimate?

Notes
Use of contingency or historic percentages (will be discussed shortly)
Key Message
Cost adjustments are often necessary for unique scope items such as wetlands.

Background Information
In some instances, a project has unique project scoping issues. For instance, if a project adds lanes using an existing grass center median, the amount of drainage required will increase substantially in terms of catch basins, pipe, and retention ponds. If the pavement cost factor assumes a grass center median, but with the new lanes located on the outside of the existing pavement structure, then the estimator has to make an adjustment for the cost of additional drainage work. The estimator could develop a percentage of other construction costs to apply to the lane-mile factor to capture added drainage requirements. Alternatively, the estimator could make some assumptions about the likely scope of the drainage and ponds and then calculate costs by developing quantities and using bid prices. Cost adjustments are sometimes required for wetlands and other environmental impacts not clearly identified in cost factors.

Interactivity
How does your agency handle these types of issues?
Is this a concern in the interchange estimate?

Notes
None
Key Message
Summary of cost adjustments for conceptual estimates.

Background Information
There is an argument for covering various adjustments to cost factors under the contingency category, especially cost factors related to location characteristics, project definition, and project complexity. This approach is certainly acceptable as long as the contingency estimate can clearly identify costs related to these types of adjustments. The cost-estimate documentation should describe all adjustments and how one calculated the costs for any adjustments. If data reflect historic cost factors as a range, the estimator may use a cost factor on the higher end of the range to incorporate the impact of the adjustments discussed.

Interactivity
None

Notes
None
**Key Message**
Cost factors for non-construction components often based on percentages.

**Background Information**
When focusing on total project cost, a common conceptual estimating technique is to estimate non-construction cost components as percentages of the calculated construction cost. Estimators typically relate these percentages to construction costs where the percentage comes from historical expenditures using activity codes for right-of-way, preliminary engineering, and construction engineering.

**Interactivity**
None

**Notes**
Each of the three non-construction components will be discussed separately in the following slides.
Construction Engineering

Cost of activities associated with administering a project such as:

- payroll and expenses for inspection forces
- material testing and evaluation
- central office administrative efforts
- field reviews

Key Message
The scope of construction engineering.

Background Information
Construction engineering covers the cost of all activities associated with administering a project from the date of award until final acceptance or the time the construction engineering expenditure account is closed. This cost includes but may not be limited to payroll and expenses accrued by STA and/or consultant inspection forces, material testing and evaluation by the STA and/or consultant forces, central office administrative and business-related efforts, and field reviews by the STA and/or design staff.

Interactivity
None

Notes
None
Key Message
How Construction Engineering is calculated?

Background Information
In the case of conceptual estimates, the estimator should calculate CE costs as a percentage of total construction costs. The percentage will vary with type and complexity of project and the dollar size of the project. According to the Washington State Department of Transportation (WSDOT), the percent could be as low as 8 percent for large ($10,000,000 or greater) roadway or structure preservation projects and as high as 20 percent for small ($250,000 or less) preservation projects (“Contract Estimate”, 2011). Alternatively, for small highway improvement projects in an urban environment, CE could be as high as 26 percent and as low as 10 percent for large improvement projects. The WSDOT average for CE across all improvement and preservation program projects is 15 percent.

Interactivity
Does your agency have typical percentages for CE? How are they stored and what format is used?

Notes
None
Determine Risk and Set Contingency

- Estimators should develop a contingency amount for the project based on the risk analysis process.

- Larger percent contingencies should be considered for conceptual estimates.

**Key Message**
Contingency should be set best on risks and other project uncertainties.

**Background Information**
Estimators need to develop separately a contingency amount for the project based on the risk analysis process. They should expect to have larger percent contingencies for conceptual estimates based on both the lack of detailed project definition and the types of conceptual estimating techniques used to prepare conceptual estimates. Also, conceptual estimates are often prepared quickly, so the estimator may not have time to carefully analyze and make all the necessary adjustments to the base estimate; therefore, a larger percent contingency becomes appropriate.

**Interactivity**
Why should contingency reflect project uncertainties and possible variation in conceptual estimates?

What are the uncertainties associated with the interchange conceptual cost estimate, either scope or cost data used?

**Notes**
Module 6 contains a more extensive treatment of risk and contingency.
Contingency

Conceptual cost estimates require considerable estimator experience and judgment to estimate contingency due to:

- lack of detailed project definition
- types of conceptual estimating techniques

Key Message
Contingency should reflect variability in the estimate.

Background Information
Conceptual cost estimates have substantial uncertainty associated with the completeness of the project’s definition as well as the techniques used to prepare these estimates. They require considerable estimator experience to ensure all project definition elements are covered and the most appropriate historic cost data was used for preparing the estimate. A risk analysis, covers estimate variability associated with the level of definition and cost factors used in preparing the conceptual estimate.

The estimator is probably in the best position to assess the uncertainty associated with cost factors, while planners/designers can assess completeness of project definition.

Interactivity
None

Notes
Contingency should also capture risk related events that might occur. Contingency estimating is covered in Module 6, Risk-based Estimating.
Key Message
Check conceptual estimates against other recently completed projects or ones that are under construction.

Background Information
Conceptual estimates typically have little detail to check. One review approach for these types of estimates is to compare estimated costs with other similar projects. Estimators compare conceptual cost estimates for current projects to projects currently under construction, recently bid, or in the letting phase. For proper comparison purposes, estimators will need to convert these past projects to the appropriate cost factor. To illustrate, estimators should divide the construction cost by the appropriate quantity such as the centerline miles. Next, they must compare the resultant dollar per centerline mile of the similar project to the same number for the current conceptual estimate. If there are substantial differences between the two cost factors, the estimator has to explain the differences. Then, the estimator makes a decision as to whether or not to change the current estimate based on this check.

Interactivity
How does your agency check a conceptual estimate? What do you typically look for when doing this check?

Notes
None
Summary

- To create a conceptual cost,
  - The estimator should prepare a total-project cost estimate based on major project parameters.

- The estimator must ensure that cost factors reflect the scope of the current project estimate.

Key Message
Conceptual estimates summary

Background Information
The goal of estimating is to determine a reasonable cost to deliver a project. Highway estimators develop conceptual estimated costs based on historical cost factors. They adjust the historical data, based on key parameters, for geographical location, project definition differences, and major site conditions and/or constraints that possibly influence costs.

To create a conceptual base estimate plus a reasonable contingency, it is necessary to prepare a comprehensive total-project cost estimate based on major project parameters. When using historical cost factors, the estimator must ensure that these cost factors reflect the scope of the current project being estimated as best determined by planners and designers.

Interactivity
None

Notes
We want to ensure that all the project’s scope is covered somewhere in the conceptual estimate.
Resources


Image References

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