S&B LEADERSHIP MEETING
PRE-SCOPING FOR 603 PROJECTS WITH BRIDGES

Todd Springer, PE, Program Manager
Bridge Maintenance & Management Program Area
Structure and Bridge Division

October 29, 2019
PARADIGM SHIFT – PROJECT SELECTION

Before: SELECT PROGRAM → $ → PLAN → SCOPE

Now: PLAN → SCOPE → SELECT PROGRAM → $ → FIXED BUDGET & SCOPE
RECENT DEVELOPMENTS
PROJECT ESTIMATING TASK GROUP [May 2019]

COMMONWEALTH of VIRGINIA
DEPARTMENT OF TRANSPORTATION

MEMORANDUM

To: Susan Keen, L&D Engineer
Kerry Watts, Sr. Construction Engineer
Shellene Pantel, Alternative Project Delivery Division Administrator
Kim Peay, Infrastructure Investment Division Administrator
Angel Deen, Environmental Division Administrator
Kendall Wake, Value Structure and Bridge Engineer
Lori Siler, Right of Way Division Administrator
John Land, Chair, District Administrators Council

From: Garrett Moore, Chief Engineer

Re: Project Estimating Task Group

May 10, 2019

You are assigned as members of the newly formed project estimating task group. The lead for the Task Group is the State L&D Engineer, Susan Keen. The members are those directly addressed by this memo.

The purpose of the task group is to review VDOT estimating procedures and develop, by May 1, 2019, an estimating process tailored to your group program, SMART SCALE, State of Good Repair and other streams of funding to projects. Additionally, the working group is to provide interim steps that can be executed to improve estimating from setting budgets through final estimate and award.

The end product is to include an estimating manual, a template to guide cost estimating, a guidance document for all involved in estimating, training, and a review and feedback loop for lessons learned.

We are engaging several national experts in project estimating that will be available to work with you that should provide:

- up front advice, review of the system and sub-processes as they are developed;
- assistance with peer exchanges;
- help with reviewing tasks from project teams that give report cards or estimates and help with best practices.

Please explore and plan to include in your task success:

- Use of Quality Control Measures of cost estimates from at least 3 independent sources (calculations) to determine worst case and most likely case.
- A revised cost escalation process and periodic adjustment for actual cost changes as the project develops.
- An Economic and Market forecasting sub-process.
- A component to correct for RLS.
- A component to limit and quantify ADO or elements,
  - included in project requirements that are higher than standard or base VDOT requirements,
  - PSL requirements,
  - mitigation for community, educational facilities, military bases, historic or other stakeholders to obtain the go-ahead,
  - Citizen voice and cost drivers.
- A robust component for scope and cost control including a cost control metric.

A robust Risk Management Component including a continually developing risk register:

- Include guidance to develop the risk help and for each unknown possibility develop the solution and estimated cost as the evaluation for inclusion.
- Consider a separate office or functional group for risk management procedures and review for higher risk and correlate projects.

- Establish thresholds for higher level of risk analysis.

Use the gated process at key milestones to determine Go/No-Go for further expenditures and development of the project.

- Use of cost estimates by project and competitive bid.
- Use of options to reduce project alternatives.
- Use of options to determine if lowest items are affordable in context.
- Identify the resources needed to support the success of the estimating system.

Cc: Stephen C. Birch, P.E.
Robert W. Canary, P.E., L.S.
Richard L. Waller, Jr.
MohamadMirsedah, P.E.
District Engineers
IIM-SGR-2: State of Good Repair Program Overview and Details

• “If a budget increase is identified during project development of an SGR bridge project, Project Managers must demonstrate that the project scope has been reviewed for opportunities to modify or reduce scope to bring the cost back in line with the original budget while maintaining similar project benefits.”

• “If the project scope cannot be reduced while providing similar benefits, the project contingency budget will be used to address budget increases prior to seeking additional funding.”

• “Budget increases may be considered to address unanticipated conditions revealed during the project development process and/or higher than anticipated bids according to the thresholds set forth in IIM-IID-2.5.”
**Table 1: Threshold Requirements for Transfer of Funds**

<table>
<thead>
<tr>
<th>Total Cost Estimate of Recipient Project</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; $5 million</td>
<td>up to a 20% increase in total allocations</td>
</tr>
<tr>
<td>$5 million to $10 million</td>
<td>up to a $1 million increase in total allocations</td>
</tr>
<tr>
<td>&gt; $10 million</td>
<td>up to a 10% increase in total allocations up to a maximum of $5 million increase in total allocations</td>
</tr>
</tbody>
</table>

IIM-IID-2.5: Six-Year Improvement Program Amendments & Fund Transfers

District CTB member concurrence and full Board approval is required for all fund transfers of Highway Construction District Grant Program (DGP), High Priority Projects Program (HPP), State of Good Repair Program (SGR), CTB Formula, discretionary (federal or state) and special program funds per the following guidelines:

• The District CTB member must be informed of all transfers with few exceptions.
• The IID Director is authorized to approve transfers of funds that are less than the thresholds shown in Table 1. The District CTB member should be made aware of those transfers that do not exceed the established thresholds prior to the next scheduled CTB meeting they will be presented. District CTB member concurrence is not required.
• If the transfer of funds exceeds the required thresholds shown on Table 1, on the following page, the District CTB member must concur with the transfer request prior to submitting to IID for processing. The request will be placed on the CTB’s agenda to be approved by the full CTB at the next scheduled monthly meeting.
• Certain special fund types identified in the CTB transfer concurrence list may also require concurrence from Special Program Managers. Concurrence from the special program manager should be obtained prior to coordinating with the District CTB member and submission of the transfer request to IID. Refer to the Infrastructure Investment Procedures and Guidelines located on IID’s website.
PRE-SCOPING REQUIREMENTS
CONSTRUCTION COST ESTIMATE ACCURACY RANGES
(AACE Classification System)

- VDOT UPC Initiation
  - Before
    - fixed budget
  - Now
    - Fixed scope

- Pre-Scoping
- Funding
- Staffing
- Resources
- Guidance
- Document

Accuracy Range

Project Definition 3%-5%
Schematic Design 15%-20%
Design Development 35%-45%
Construction Documents 90%-100%

Class 5 0%-2%
Class 4 1%-15%

AACE 18-R-87 Cost Estimate Classification System

VDOT
Virginia Department of Transportation
PRE-SCOPING FOR 603 PROJECTS WITH BRIDGES

- Narrative Summary
- Smart Flags – Support Documentation
- Project Cost Estimate Summary (PCES backup)
- Site Plan – Existing and Proposed Features (conceptual)
- Cross Sections
  - Existing Approach Roadway
  - Existing Bridge Deck
  - Proposed Bridge Deck (conceptual)
PRE-SCOPING – NARRATIVE SUMMARY

• Project description
• Scope Justification
• Scope Elements (significant)
• Risk Assessment
• Project Cost Estimate
  • Considerations
  • Contingency / Risk
  • Inflation
PRE-SCOPING: PROJECT COST ESTIMATE SUMMARY

- PCES Estimate (or equivalent)
- All phases (PE, RW, CN)
  - VDOT Oversight Costs (LAP Manual)
  - Inflation
  - Contingency
- Required Estimates
  - Proposed SGR Repair Scope
  - Proposed SGR Bridge Replacement
- Usage
  - Establish SGR Project Allocations (Budget)
  - SGR Priority Scope
PRE-SCOPING: CONCEPTUAL SITE PLAN

- GIS & Aerial Background
  - Contours
  - Right-of-Way & Utilities
- Concept Details
  - Bridge Limits
  - Limits of Approach Work
  - ROW Impacts (Fill)
  - Utility Impacts
- MOT
  - More Impacts with Offset Alignment
PRE-SCOPING: CONCEPTUAL SITE PLAN
PRE-SCOPING: GIS FOR CONCEPTUAL SITE PLAN

A Conceptual plan view of the project must be provided on an 11 x 17 size map. The plan shall be developed using GIS data and include available information that will help develop an accurate cost estimate including the proposed bridge footprint, project limits (touchdown points), existing right of way, existing utilities and contours.

**Suggested Method for Creating the GIS Basemap from VITA:**
(Note: Some Cities/Counties have their own GIS Mapping)

**Download Imagery**
1. Go to VITA Virginia Base Map Program Site:
   https://vgin.maps.arcgis.com/apps/Viewer/index.html?appid=cbe6a0c1b2c440168e228ae33b89cb38
2. Zoom to the project location, right click on the image file name, and download the MrSID zip file.

**Download GIS Data**
3. Download supporting GIS/shape files for project location (roadway edges, sidewalks, building, parcels, utilities, railroads, contours, etc.) from county GIS website (shapefiles or dwg).
4. Example: https://www.albemarle.org/department.asp?department=gds&relpage=3914#Planimetrics

**Create Basemap File and Setup the Environment**
5. Create new 2D dgn file (US Survey feet) using VDOT seed file (USFootSeed.dgn).
6. Save as Basemap.dgn
7. Select the “Workspace” menu/Preferences/ Raster Manager
   - Select the Georeference tab
   - Change the Default Unit Settings to US Survey Feet.
8. Select the “Tools” menu
   open the Geographic toolbox
   Click the Geographic Coordinate System and search Virginia.

   ![Geographic Coordinate System](image)
   - Current Geographic Coordinate System
     - Name: VA83-NF
     - Description: NAD83 Virginia State Plane, North Zone.
     - Source: Calculated from VAS5N by Memo Software

9. Select the appropriate coordinate system name for your project location (VA83-NF or VA83-SF).

**Build Basemap**
10. Select the “Raster Manager” menu and attach the downloaded imagery (*.sid) file from steps 1 and 2.
11. Select the “Tools” menu and reference in the downloaded planimetric files (*.shp or *.dwg) from step 3. (Note: when attaching these files, set the “Attachment Method” to Geographic – Reprojected.

   ![Raster Manager](image)
   - Note: If elevation information is needed, lidar data can be download and converted to an existing surface TIN file (*.tin). Virginia LiDAR:
     https://vgin.maps.arcgis.com/home/item.html?id=1e964be36b454a12a68a3ad0bc1473ce
PRE-SCOPING: EXISTING APPROACH ROADWAY SECTION

- Used to Assess Proposed Bridge Deck Section
PRE-SCOPING: EXISTING BRIDGE SECTION

Used to Assess Proposed Bridge Deck Section

Source: Examples
Existing Bridge Plans
(or Safety Inspection Report)
PRE-SCOPING: PROPOSED BRIDGE DECK SECTION

- More interested in Section Geometry
- Less Interested in Superstructure
PRE-SCOPING CHALLENGES
PRE-SCOPING: REVIEW ITEMS

- General Project Scope Description
- Risk Assessment
- Project Cost Estimate
  - Inflation, Contingency/Risk
- SGR (IIM-S&B-95) & Non-SGR Scope
- Design Waivers & Common Sense Engineering
- Structure Alternatives Evaluation
- Conceptual Type, Size and Location
- Features Carried
- Features Intersected
  - Waterway (H&HA, Scour, Waterway Adequacy)
  - Roadway
  - Railroad/Transit
- Community and Stakeholder Involvement
- Bicycle & Pedestrian Accommodations
- Traffic & Safety Issues
- Drainage
- Materials / Geotechnical
- Utilities (in-plan / out-of-plan)
- Environmental / Permits / Navigation / Coast Guard / USACE
- MOT
- Constructability & Construction Requirements
- Right-of-Way
- Other Significant Items

Most scope and estimate issues on projects with bridges are not the direct bridge items.
Lessons Learned – Examples of Specific Issues

• **Maintenance of Traffic**
  • Closed Road with Detour becomes Part-Width Construction
    • Additional Costs: MOT bid items add cost, access, double mobilization
  • Part-Width Construction becomes an Offset Alignment
    • Additional ROW and Utility Impacts

• **Utilities (often underestimated)**

• **Right-of-Way**
  • Partial ROW takes become full takes
  • ROW Inflation Costs

• **Schedule**
  • Delays cost additional Inflation Costs
Lessons Learned - Project Needing Early Review

- **SGR Projects with Non-SGR Scope Elements**
  - SMART SCALE Funding/Scope
  - Other Funding Sources With Specific Scope Requirements *
    * Where other funding source has specific scope requirements
      Examples: HSIP, Container Funds, etc.
  - Other Funds Covering Non-SGR Scope **
    ** Where other funding does not have specific scope requirements
      Examples: DBF, CTB, M&O, Locality, etc.

Early review helps to
1) Have all scope items are funded by the correct fund source
2) Reduce chance on rejection of WNF for SGR
3) Reduce chance of rejection of application for other fund source
Lessons Learned - Project Needing Early Review

- Exceeding SGR Limits (Ex. Touchdown) in IIM-S&B-95
  - Items requiring approval from District Structure & Bridge Engineer
  - Items requiring approval from Assistant State Structure & Bridge Engineer
- Bicycle/Pedestrian/Shared-Use-Path Elements
- Railroad or Transit Elements
  - Immediately start Coordination
- Navigational Waterways (clearances/permits)
  - Immediately start Coordination
- Uncommon / Complex Environmental Permits
- Accommodating Future Expansion
- Other High Risk or Unusual Situations
QUESTIONS?
Construction (603) Bridge Project Pre-Scoping Summary Form

Item No. 8: Feature(s) Carried: Roadway (including approach roadway, profile, alignment, safety)

1. Determine design criteria to set geometrics, typically SGR projects are considered small bridge improvement projects and the guidelines provided in IM-UD-227 / IM-58B-70 shall apply. (Reference 1,6,8)
2. Consider cross slope effects when determining low chord for hydraulic opening or vertical clearance.
3. Determine if a curved alignment or complex geometry will be required.
4. Evaluate the risk that an offset alignment may be required.
5. Determine if an alignment shift will be required due to phased construction or the final bridge configuration/location.
6. Consider approximate length and termination requirements of proposed guardrail based on site conditions, existing entrances, and existing guardrail when setting project limits. 6,8
7. If the existing roadway profile is raised, consider existing topography based on a site visit and GIS mapping when estimating the limits of proposed fill.
8. Consider the effect on the project limits / bridge touchdown points if a temporary bridge or on-site detour is anticipated. (Reference 6)
9. Determine the transition length required to tie into the proposed bridge section. 6,8
10. Determine minimum sight distance requirements and how this may affect the limits of construction. 6,8
11. Evaluate the limits of construction to determine survey limits.
12. Estimate the land disturbance area to determine permitting requirements.
13. Develop a conceptual profile and alignment based on existing survey or GIS mapping data.
14. Describe any roadway related items not included in this checklist that could be considered high risk and impact the schedule or budget of this project.

Item No. 9: Feature Intersected by Bridge

Roadways

1. Determine the vertical and horizontal clearances required for the ultimate condition. 1
2. Determine the vertical and horizontal clearances required during construction, and evaluate whether they may affect contractor's means and methods or MOT. 1
3. Determine the required geometrics for the roadway below the bridge. 1
4. Determine whether the constrained long-range plan includes provisions to widen the roadway below the bridge. If so, additional bridge length to accommodate widening is eligible for SGR funding. Otherwise, additional bridge length is not eligible for SGR funds. (see IM-58B-95). 6
5. Evaluate whether pier protection systems will be required to protect substructures. 3
6. Consider pedestrian / bike / trail connectivity below the bridge and applicability of SGR funding. 6

Waterways, H&HA, Scour, Waterway Adequacy

1. Consider whether a replacement structure can be sized based on hydraulic equivalency, or whether a full hydrologic and hydraulic analysis is required. Consider the potential cost effects on the roadway profile, project footprint and preliminary engineering efforts.
2. Consider the condition of the existing stream bank when setting bridge length. Example: stream banks may have eroded around the existing abutments causing the existing abutments to be inside ordinary high water. The proposed bridge will have to be longer than the existing bridge to account for this.
<table>
<thead>
<tr>
<th>Score</th>
<th>1-Project Schedule</th>
<th>Score</th>
<th>2-Feature Carried</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>High (e.g. Aggressive Compression)</td>
<td>4</td>
<td>High (e.g. Interstate)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Medium (e.g. Some Compression)</td>
<td>2</td>
<td>Medium (e.g. Primary or Urban)</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Low (e.g. Normal Schedule)</td>
<td>0</td>
<td>Low (e.g. Secondary)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>High (e.g. Complex Large Fixed Span)</td>
<td>10</td>
<td>High (e.g. Railroad, Transit Facility)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>High (e.g. Movable Bridge)</td>
<td>8</td>
<td>High (e.g. Large Navigable Waterway)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Medium (e.g. Curved steel girder with straddle bents)</td>
<td>3</td>
<td>Medium (e.g. Interstate, Primary or Urban Road)</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Low (e.g. Routine bridge)</td>
<td>1</td>
<td>Low (e.g. Minor Waterway)</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>0</td>
<td>Low (e.g. Secondary Road)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>High (e.g. Contentious)</td>
<td>4</td>
<td>Medium (e.g. Present)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Medium (e.g. Some Issues)</td>
<td>0</td>
<td>Low (e.g. Not Present)</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Low (e.g. Not Contentious)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>High (e.g. Significant Safety Issues)</td>
<td>3</td>
<td>Significant</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Medium (e.g. Moderate Safety Issues)</td>
<td>1</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Low (e.g. Minimal or no issues)</td>
<td>0</td>
<td>Minor or None</td>
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</tr>
<tr>
<td>4</td>
<td>High (e.g. Organics, Karst, Significant Settlement Expected)</td>
<td>4</td>
<td>High (e.g. Protected Species, Contaminated Soils, Hazardous Materials)</td>
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</tr>
<tr>
<td>2</td>
<td>Medium (e.g. Limited borings or subsurface information)</td>
<td>2</td>
<td>Medium (e.g. Wetlands or Historical Impacts)</td>
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</tr>
<tr>
<td>0</td>
<td>Low (e.g. Routine Foundation Types)</td>
<td>0</td>
<td>Low (e.g. Little or No Impacts)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>High (e.g. Offset Alignment)</td>
<td>7</td>
<td>High (e.g. Substantial Impacts/Relocations or Unknown Utility in Urbanized Area)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Medium (e.g. Part-Width / Staged Construction)</td>
<td>3</td>
<td>Medium (e.g. Significant Impacts/Relocations on well-defined Utilities)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Low (e.g. Detour / Bridge Closed)</td>
<td>0</td>
<td>Low (e.g. No Impacts)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>High (e.g. High ROW impacts)</td>
<td>4</td>
<td>Significant temporary works (Ex: temporary shoring, temporary structures, cofferdams, causeways, temporary shoring, etc.)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Medium (e.g. Some ROW impacts)</td>
<td>4</td>
<td>Non-standard techniques are needed (Ex. underwater construction, monopile, concrete, etc.)</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Low (e.g. No Impacts)</td>
<td>4</td>
<td>Issues with access, staging areas, lay down areas, crane placement, materials areas, and delivery of materials.</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Constructability (add scores that apply)</td>
<td>3</td>
<td>Project requires aggressive construction schedules, night work, work during winter months</td>
<td></td>
</tr>
<tr>
<td>Completed Not Completed High Risk</td>
<td>Action</td>
<td>Ref. Docs.</td>
<td>Notes</td>
<td></td>
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<tr>
<td><strong>General</strong></td>
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<tr>
<td>Drop-down Menu Determine if any design exceptions or waivers will be required.</td>
<td>8</td>
<td></td>
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<tr>
<td>Drop-down Menu Determine if bridge aesthetics will influence the project and include costs for items such as architectural treatment if necessary.</td>
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<tr>
<td>Drop-down Menu Consider cross slope effects when determining low chord for hydraulic opening or vertical clearance.</td>
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<tr>
<td>Drop-down Menu Determine if a curved alignment or complex geometry will be required.</td>
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<tr>
<td>Drop-down Menu Consider Select Backfill (Abutment zone) requirements when estimating costs for excavation and backfill for abutments including effects of foundation type.</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drop-down Menu Evaluate the existing bridge details to determine whether phased construction is feasible. Phased construction may not be suitable for bridges that are fracture critical, have two column piers or spill-thru abutments, etc.</td>
<td></td>
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<tr>
<td>Drop-down Menu Consider whether temporary shoring is required and include in the estimate if phased construction is anticipated.</td>
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<tr>
<td>Drop-down Menu Evaluate the risk that an offset alignment may be required.</td>
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<tr>
<td>Drop-down Menu Describe any structure and bridge items not included in this checklist that could be considered high risk and impact the schedule or budget of this project.</td>
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<tr>
<td><strong>Bridges over Waterways</strong></td>
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<tr>
<td>Drop-down Menu Consider whether a replacement structure can be sized based on hydraulic equivalency, or whether a full hydraulic and hydraulic analysis is required. Consider the potential cost effects on the roadway profile, project footprint and preliminary engineering efforts.</td>
<td></td>
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<tr>
<td>Drop-down Menu Consider the condition of the existing stream bank when setting bridge length. Example: stream banks may have eroded around the existing abutments causing the existing abutments to be outside ordinary high water. The proposed bridge will have to be longer than the existing bridge to account for this.</td>
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<tr>
<td>Drop-down Menu Consider the direction of flood-stage water flow and skew when setting bridge length, locating substructures, and determining the substructure type.</td>
<td>4</td>
<td></td>
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<tr>
<td>Drop-down Menu Consider the risk of scour as it pertains to the bridge foundation type assumed (shallow foundations / piles / drilled shafts), required scour protection, suitability of retaining wall structures, etc.</td>
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<tr>
<td>Drop-down Menu Investigate the need for cofferdams.</td>
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<tr>
<td>Drop-down Menu Investigate the need for a causeway or work bridge.</td>
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<tr>
<td>Drop-down Menu Determine if the bridge is over a navigable waterway and if Coast Guard coordination is required. Complete initial contacts with Coast Guard to obtain preliminary information on navigation clearances if necessary.</td>
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<tr>
<td>Drop-down Menu Determine if a temporary stream diversion will be required and coordinate with Hydraulic and Environmental Sections.</td>
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</tbody>
</table>
PRE-SCOPING FOR 603 PROJECTS WITH BRIDGES

✓ • Pre-Scope ALL “ Likely to be Selected SGR Projects”
✓ • Pre-Scoping Funding
✓ • Requirements Pre-Scoping
≈ • Guidance Pre-Scoping
? • Staffing Resources
Future • Tools
SGR Projects - Likely to be Selected

- **Eligible Projects**
- **Identify Projects to be Funded by SGR Program**
  - Review Projects & Scopes
  - Review Delivery Methods
  - Review Scores
- **Pre-Scope Likely to be Selected**
- **Application Scoring**

FIXED BUDGET & SCOPE

Six-Year Improvement Program

- Process that:
  - Develops manageable list of viable, ready projects
  - Well defined conceptual level Project scopes and cost estimates (budgets)
  - Optimal use of financial and staff resources