

SCOPE OF WORK

The Colorado Department of Transportation (CDOT) seeks proposals from qualified engineering services firms interested in assisting (REGION 3 and 5) with program delivery. Although the final award will be to a single firm, CDOT will accept proposals presented by a collaboration of firms. In such cases, the submitted proposal must specify which firm is lead and will act as the contractor and which firms are the subcontractors for whose performance the contractor will take responsibility. Therefore for the remainder of this document this potential grouping is collectively referenced as Consultant. The selected Consultant will assist the REGION 3 and 5 in their efforts to deliver high quality construction projects by participating in the development and/or review PS&E packages to ensure that engineering, design, plans and quantities are supported by sound engineering judgment, comply with established policies, guidelines and standards, and contain appropriate design flexibility and cost saving measures in a cost-effective and efficient manner.

For plan review services, the scope of the services required for any individual project will be determined based on an assessment of project risk by the CDOT Project Manager. CDOT has identified five basic levels of plan review services to be performed by the Consultant under this Scope of Work:

1. **Biddability Reviews** - Biddability reviews include a review of the contract documents to identify errors, omissions and conflicts in the plans, specifications and bid item schedule. Biddability reviews identify uncertainty and minimize unquantified risks to the bidder. These reviews will usually be conducted during or after the FOR stage of the CDOT project development.
2. **Constructability Reviews** - A constructability review is a systematic process to ensure that project plans delineate clear and feasible construction techniques. Depending on the level of risk identified, a Constructability Review Process may start at the inception of the project and continue throughout project development. The CDOT project Manager will coordinate with the Consultant to identify those elements of the Project which may require a Constructability Review and the appropriate level of experience the reviewers must have. The task may include assistance with planning of construction phasing and construction schedules while in the design phase.
3. **Independent Construction Cost Estimates** – An independent construction cost estimate may be required to be completed in order to reflect different construction methods or phasing which may be identified in the Constructability Review.
4. **Technical Reviews** - Technical reviews may be required when the CDOT project manager identifies an issue that requires specialized expertise.
5. **Policy Reviews** - Policy reviews are meant to ensure relevant CDOT policies are being followed during the design process. Examples of this include but are not limited to CDOT policy regarding ADA issues, bicycle and pedestrian policy, and CDOT policy regarding culvert materials.

The work shall include:

1) Project Risk Identification and Project Specific Review Plan

The level of effort that will be required for design reviews of a project will be determined by CDOT based on an assessment of projects risks. For lower risk projects, the CDOT Project Manager may require the Consultant to perform only a biddability review of the contract documents. For higher risk projects, the Consultant may be required to perform Constructability reviews at various stages of the project and a biddability review on the Final PS&E package. To better define the level of review required, the Consultant may be tasked with assisting the CDOT project manager in the identification of project risks.

For more complex projects, the Consultant may be tasked with developing and submitting a Project Specific Review Plan for the CDOT Project Manager's approval to define the level of review effort needed, critical project elements to be reviewed by the Consultant, acceptable levels of experience the reviewers must have for any given element of the design, time required to do an effective review, and other requirements to ensure the best set of plans for construction.

2) Provide Plan Checking Services for CDOT projects.

- a. Biddability Reviews -Biddability reviews by the Consultant is intended to supplement the quality control efforts of CDOT personnel. A list of Biddability Review Considerations is included in Appendix A to aid the reviewer in identifying problems commonly found in the contract documents. The Biddability Considerations are not to be used as a checklist or turned in with the PS&E package. The intent of the Considerations is to focus on the issues that are often overlooked and cause confusion in advertising and bidding. The focus of this review is on quantities /estimate, suggested plan changes, specifications and special provisions.
- b. Constructability Reviews -The level of constructability review required for a project as directed by the CDOT Project Manager based on the level and nature of project risk identified by CDOT or during the preparation of the Project Specific Review Plan. The level of review will depend on the stage of project development, i.e. scoping, FIR, DOR or FOR. Depending on risk identification, the Constructability review may include all elements of the project, or only those elements determined to represent the greatest risk to the successful completion of the project.

In reviewing the Preliminary Plans for constructability, geometric features, such as line and grade, and traffic control should be considered. A list of Constructability Considerations for Preliminary Design Review is provided in Appendix B to assist in the constructability review process. The Constructability Considerations are not to be used as a checklist or turned in as review comments. The intent of the Considerations is to focus on the issues that should be considered and discussed at the Preliminary Design Review stage.

In reviewing the Intermediate Plans for constructability the specific details of the design should be considered. A list of Constructability Considerations for Intermediate and Final Design Review is provided in Appendix C to assist in the constructability review process. The Constructability Considerations are not to be used as a checklist or turned in as review comments. The intent of the Considerations is to focus on the

issues that should be considered and discussed at the Intermediate Design Review stage.

In reviewing the Final Design documents for constructability, the plans, special provisions, estimate, permits, schedule and all other aspects of the project shall be reviewed in detail.

- c. **Technical Reviews** -The CDOT project manager may assign the Consultant to review project elements that are unique or technically complex. This may especially include geotechnical, Tolling/ITS, or structural elements. Technical Reviews may also include a review of the plan set of FHWA's 13 controlling criteria which have been identified by FHWA as having substantial importance to the operational and safety performance of any highway (Appendix D).
- d. **Policy Reviews** - The CDOT project manager may direct the Consultant to conduct a general review of the project to ensure CDOT procedural directives have been followed. Verify compliance with Design Exception and Variance Procedures.

3) Recommend internal CDOT Region 3 and 5 QC procedures and methods

The Consultant shall recommend specific procedures and methods by which CDOT Region 3 and 5 may improve its internal quality control during the design phase of project development. As part of this effort, the Consultant shall communicate with appropriate CDOT personnel, including the Region Program Engineers and appropriate Region 3 and 5 Resident Engineers and designers.

The Consultant shall submit a report to CDOT Region 3 and 5 management including specific and implementable recommendations by which CDOT Region 3 and 5 may improve quality control for internally developed design projects.

APPENDIX A

BIDDABILITY REVIEW CONSIDERATIONS

- Verify that plan notes do not conflict with specifications and special provisions. Ideally plan notes should not repeat what is already covered in the specifications and special provisions.
- Verify that quantities are correctly carried forward from plan sheets, through individual tabulations to the Summary of Approximate Quantities.
- Verify that all bid items shown on the plans and special provisions are included in the bid schedule.
- Check the standard specification sections pay items against the bid schedule to ensure that all needed items are included in the bid schedule, or if not that these items are either 1) included in the bid item description or 2) called out as incidental to an included item. For example, items are often missed in Sections 212 and 405. An item for Braces is often missed in Section 610.
- Verify that specified sizes of pipes and structures match bid item descriptions.
- Verify that the most current revisions of CDOT's Standard Special Provisions are included.
- Verify that all special provisions have the necessary measurement and payment clauses.
- Verify that all required permits are included (e.g., SWPP, 404, NPDES).
- Verify that a list of all utility owners and contact numbers is included for the utilities shown on the plan sheets.
- Verify that the limits of construction are shown and that abandoned alignments are noted and dashed on the plan sheets.
- Verify that required drainage structures are numbered in the plan and profile sheets.
- Verify that the Index of Sheets on the Title Sheet is complete and accurate.
- Verify that the log of test borings is included, if applicable.

APPENDIX B
CONSTRUCTABILITY
CONSIDERATIONS PRELIMINARY
DESIGN REVIEW

Access, Traffic Maintenance, Utilities and General Constructability Issues

- Is the sequence of construction compatible with the maintenance of traffic phasing and/or utility relocation phasing?
- Is there sufficient clearance within the work zone for construction operations (such as crane swing room)?
- Is there adequate access to the construction?
- Will construction be impacted by existing horizontal and vertical clearances?
- Is access to businesses and residences provided?
- Have pedestrian and bicycle accommodations been addressed?
- Can residents and customers safely use approaches? Are approach tie-ins reasonable? Are they too steep?
- Will school buses, mail carriers, fire trucks, emergency vehicles or other local traffic require special maintenance of traffic provisions?
- Will sound wall be required?
- Do the project specifications comply with Region Lane Closure policy or approved variances?
- Are there utilities that will be impacted which have not been identified or considered in the design?
- Are there railroad and/or highway crossing within 25 feet of construction?
- Will a railroad agreement be required?
- Is there any maintenance problems or procedures anticipated as a result of the proposed construction? If yes, has special attention been directed to each situation?
- Have conditions that changed since project was first initiated been properly addressed?

Removal/Demolition

- Do removal items require an asbestos survey?
- Are there clear limits of removal vertically and horizontally?
- Have hazardous materials been identified?
- Is there adequate construction access for demolition?

New Structures and Structure Rehabilitation

- Have borings been taken in locations where the information is necessary? Are there enough borings?

- Are the depths sufficient? How do the locations of borings compare to actual locations of the foundations?
- If a stream is in the project limits, is stream navigable either by law or local usage? And does this affect the design?

Roadway Plans

- Are sufficient typical sections provided to cover the proposed construction, including transitions, detour roads and turnouts?
- Is the alignment and grade beyond the beginning and end of the project shown properly shown?
- Are cross sections developed as required?
- Are benchmark data, needed elevations and curve data in the plans?
- Can any improvements be made to the alignment?
- Do the designed sections match the existing conditions?
- Do the typical cross sections include existing conditions?
- Are the actual site conditions represented in the plans?
- Will designed sections fit into the right of way or will right of way need to be acquired?
- Will any right of entry agreements or construction easements be required?
- Are approach types, widths, profile and stations shown?
- Have plan/profile sheets been provided for turnouts where necessary?
- When doing a resurfacing project, has traffic barrier resetting or height adjustment been considered?
- Has guardrail post placement and installation over drainage structures, retaining structures or other features been considered?
- Are there any drainage issues that have not been addressed?

APPENDIX C

CONSTRUCTABILITY CONSIDERATIONS INTERMEDIATE AND FINAL DESIGN REVIEWS

Staging and Phased Construction

- Is staged construction adequately shown on the plans?
- Is construction staging addressed in the traffic control plans?
- Is transition from one phase into the next phase adequately addressed (horizontally and vertically)?
- Are there any safety issues between phasing and are they adequately addressed?
- Has construction site drainage been adequately addressed?
- Are there any drainage problems between phases?
- Can water get to inlets or drainage structures during phase transitions and during each phase of construction?
- Does the sequence of construction match the proposed layout?
- Do the staging plans show how traffic is being handled for each stage?
- Is there a striping plan for each maintenance of traffic phase?
- Is the construction phasing compatible with the maintenance of traffic phasing and/or utility relocation phasing?

Schedule

- Do work hour restrictions allow time to perform work?
- Has the construction schedule been reviewed for feasibility?
- Is the number of working days appropriate for proposed work?
- Are the hours and locations of lane closures specified?
- Will night construction be required?
- Will the project go through winter? Will construction continue in winter?
- Are there any conflicts with on-going or anticipated contracts or projects?

Constructability

- Are the plans stakeable from a construction survey point of view?
- Is there sufficient clearance within the work zone for construction operations (such as crane swing room)?
- Is there adequate access to the construction?
- Will construction be impacted by existing horizontal and vertical clearances?

Maintenance of Traffic

- How will traffic be maintained?
- Are specifications for traffic handling and lane closures included and adequate? Do they conform to Region Lane Closure Policy and approved variance?
- Are the traffic control plans clear and complete?
- Are the necessary restrictions (lane closure restrictions, hours of operation restrictions, holiday, weekend and special event restrictions, etc.) indicated in the plans?
- Is clearance sufficient under bridges to allow maintenance of traffic?
- Are lanes on which traffic is to be maintained compatible with local conditions? Are they intended to be paved?
- Will any temporary shoring be required to maintain traffic? If so, has a method of payment been established?
- Is traffic addressed on side streets?
- Will temporary maintenance aggregate be required and is it addressed in the plans?
- Have the minimum number of lanes and minimum lane widths been shown consistently on the traffic control plans, cross sections and typical sections?
- Are drop-offs adequately addressed and protected?
- Have temporary widenings been included in excavation and material quantities?
- Will borrow be required and cause a waste of material at end of job?
- Have excess material and waste sites been addressed?
- Are items and quantities for temporary lighting included if necessary?

Access

- Is access to businesses and residences provided in the design?
- Have pedestrian and bicycle accommodations been addressed?
- Can residents and customers use approaches safely? Are approach tie-ins reasonable? Are they too steep?
- Will school buses, mail carriers, fire trucks, emergency vehicles or other local traffic require special maintenance of traffic provisions?
- Can work be safely accessed, especially median work?
- During construction, is adequate access for residents and businesses in the area provided?
- Has consideration been given to shopping centers, churches, schools, military installations, seasonal traffic constraints, sports arenas, special local events, etc.?
- Has access for maintenance personnel (trash, landscape, electrical, structures, snow plow turnarounds, etc.) been adequately addressed in the design and during construction?

Detours

- Have detour routes been approved by the appropriate jurisdiction on?
- Has duration of detours been identified?
- Will detours run through the winter? If so, has plowing of snow or maintenance of detour been considered?

- Does temporary barrier need to be backed up to provide stability during winter slowdown?

Traffic Control Devices Signs

- Does the contract provide for the relocation of existing signs if necessary?
- Do sign footings conflict with underground structures and/or obstructions such as utilities, retaining walls/MSE slopes, storm drains, under drains, outlets, concrete traffic barriers, other footings, etc.?

Signals/Electrical

- When staking out control cabinets for traffic and lighting devices, can signals and lights be seen from the controllers when technician is working on devices?
- Do the location of signal heads, poles, loops, power supply, etc. match project phasing and/or maintenance of traffic?
- Is the power supply to the traffic and lighting devices going to change as a result of moving the utility lines during construction of the project?
- Have the appropriate junction boxes been specified?
- Are the signal pole locations/signal controller location in conflict with utilities and drainage structures or sight distance?
- Can signal poles/signal controllers be moved to a more appropriate location vis-a-vis traffic and pedestrian safety concerns?

Temporary Traffic Control Devices

- Have construction openings in barriers been provided and protected?
- Will temporary signals be required?
- What effect will traffic barriers and other devices have on sight distance, driveways, intersections and turning radius?
- Are temporary safety devices required and are there adequate provisions in the contract (i.e. guard rail, attenuators, barrier mill, etc.)?
- Are traffic operation requirements properly addressed (i.e. signing, pavement markings, signal, etc.)?
- Are flashing arrow boards and variable message signs at appropriate locations?
- Are there sufficient items and quantities for all necessary traffic control items such as lane markings, tape and paint, flagging hours, drums, tubular markers, concrete barriers, signs, variable message signs and arrow panels, traffic control maintenance, etc.?

Sound Walls

- Have provisions for drainage been made on the property owner's side of wall?
- Are the location of access doors and hydrants in agreement?
- Is adequate clearing and access allowed to construct walls?

Utilities

- Are all utilities and required relocations indicated in plans?
- Are the right of way or easements adequate to allow construction of drainage structures?
- Are there any conflicts between drainage and utility work?
- If utility relocation is required, is the work to be done before construction or during construction, and by whom?
- Is required utility work consistent with project phasing?
- If utilities are to be relocated before construction is the utility schedule reasonable?
- Are existing utilities and facilities accurately shown on the plans?
- Are proposed utility relocations clear of proposed traffic control devices?
- Are underground obstructions clearly marked?
- If work is to be done by the utility companies: 1) how does it fit into the duration of the project? 2) Who is responsible for maintenance of traffic? 3) Who is responsible for access to the utilities? 4) Is a schedule for relocation of utilities provided? 5) Is time for clearing and grading being allowed in the schedule? 6) What impact will occur if reallocation does not happen as scheduled?

Removal/Demolition

- Are there clear limits of removal, both horizontally and vertically?
- Have hazardous materials been identified?

New Structures

- Have utilities and conduits through bridges been incorporated into bridge plans if necessary?
- Do the following items fit into the sequence of construction: wick drain locations, fill placement and settlement monitoring, retaining walls in multiple phases, stream diversions, sheeting for multiple phase construction?
- Have paint systems been verified, are they the correct type and do they match existing surroundings?
- Could alternate paint systems or methods be used to expedite painting?
- Have borings been taken in the appropriate locations and are they sufficient in number and depth?
- How do the boring locations compare to the actual foundation locations?
- Is the structure compatible with the retaining wall/MSE system?
- Are straps or other devices on retaining walls in the way of excavation and/or the foundation?
- If wetlands/waterways are involved, are closure periods shown?
- Are the stream diversions shown, if necessary, and are they practical and/or buildable in conjunction with other work scheduled for area involved?
- Do permits require work not shown on plans?

- Are traffic control plans for the bridge coordinated with roadwork phasing?
- If battered piles are used will leads be over moving traffic?
- Is the high water elevation shown?
- Will riprap/armoring be required and have the type, location and other details been included?
- Are pile design loads and type shown?

Structure Rehabilitation

- Have all areas of repair been identified clearly on plans?
- Are the quantities for repairs sufficient?
- Are suggested or allowed removal requirements included?

Roadway Plans

- Are sufficient typical sections provided to cover the proposed construction?
- Are typical sections provided for transitions, detour roads and turnouts?
- Is the alignment and grade beyond the beginning and end of the project shown?
- Is the detour alignment shown, if required?
- Are cross-sections developed as required?
- Have cross-sections for grade changes at phase tie ins been checked?
- Do site conditions represented in plans conform to actual project site conditions?
- Will designed sections fit into the right of way or has right of way acquisition been planned/completed?
- Are the limits of grubbing, clearing and landscaping clear?
- Have existing trees that are required to remain in place been identified?
- Have manholes, inlets, valve boxes, etc, requiring adjustment been noted?
- Are approach types, widths, profiles and stations shown?
- Are abandoned alignments noted and dashed?
- Have areas where abandoned roadways are to be obliterated been shown on the plans?
- Are locations, sizes and descriptions of drainage structures to be removed shown?
- Are all existing drainage structures addressed?
- Have plan/profile sheets been provided for turnouts where necessary?
- Are special conditions adequately described in Special Provisions?
- How are tie-ins to be made and are they appropriate for existing conditions and phases?
- Will sawed joints be required for pavement removals and has a method of payment been included?

Guardrail

- Do cross sections reflect the embankment widening required for guardrail?
- Have adequate design and pay items been provided for grading needed for end treatments?
- When doing a resurfacing project, have traffic barrier resetting or height adjustment been

addressed in the plans?

- Have guardrail post placement and installation over drainage structures, retaining structures or other features been adequately addressed?

Right of Way

- Has all necessary Right-of-way been identified and acquired?
- Are all necessary construction easements identified?
- Are right of entry agreements required and who will obtain them?

Erosion Control/Seeding/Landscaping

- Will plants fit into specified areas, such as behind sidewalks and between curbs and sidewalks while not impacting ADA requirements?
- Who will supply the seed?
- Is replacement planting during construction addressed?
- Are there adequate erosion and pollution control items and measures?
- Are sediment and erosion control devices located correctly and for the proper use?
- Do sediment and erosion control devices to match different phases of construction?

Drainage

- Are proposed drainage structures compatible with existing ditches?
- Are elevations shown in the plans and compatible with existing conditions?
- Are there provisions for temporary drainage, and drainage of the construction area?
- Are there provisions for and a proposed method of connecting new and old drainage facilities?
- Are outfall locations of temporary and permanent drainage facilities identified?
- Will proposed or existing drainage structures function during different phases of construction?
- Are temporary drainage devices needed during different phases?
- Have existing and proposed inverts been verified to assure tie-ins will fit?
- Have clearances above and below pipes and structures been verified?
- Is pipe in the pavement section and there are any conflicts between inlets and utilities?
- Have existing site conditions changed during design, such as a new development, and is the design sufficient to handle site changes?
- Is future development planned for the area? Has it been considered?
- If proposed, are pipe jacking methods or channel lining appropriate for given site conditions?
- Are the drainage specifications adequate?
- Are there provisions for maintenance cleanouts for drainage?

General Checks

- Are any special agreements needed between State and local government?
- The right of way agreements, environmental permits, utilities agreements and materials reports have been reviewed in conjunction with the plans and proposal for consistency?
- Have the impacts of construction windows required by environmental resource agencies been addressed?
- Is there any maintenance problems or procedures anticipated as a result of the proposed construction and has special attention been directed to each situation?
- Have all necessary permits been identified such as dewatering, hazardous materials and noise restrictions?
- Has the project identified critical culvert replacement or maintenance, bridge work, and/or other safety work into the projects?
- Has safety critical work been identified and included in the specifications?
- Are force accounts appropriate for the proposed work?

APPENDIX D

FHWA 13 CONTROLLING CRITERIA

The *Green Book* covers a wide range of geometric elements and design dimensions. In the interest of focusing the attention of the design profession on the most important or critical elements, FHWA performed a technical review of the adopted minimum criteria in the *Green Book*, with the understanding that requiring a design exception evaluation for every design element was impractical. Thirteen criteria, commonly referred to as the *13 controlling criteria*, have been identified by FHWA as having substantial importance to the operational and safety performance of any highway such that special attention should be paid to them in design decisions. FHWA requires a formal written design exception if design criteria on the NHS are not met for any of these 13 criteria, listed below.

1. Design speed
2. Lane width
3. Shoulder width
4. Bridge width
5. Horizontal alignment
6. Superelevation
7. Vertical alignment
8. Grade
9. Stopping sight distance
10. Cross slope
11. Vertical clearance
12. Lateral offset to obstruction
13. Structural capacity