

SCOPE OF SERVICES

Surveys, including staking of bridge sounding and ROW mounumentation, Preliminary Road Design, Preliminary Bridge Design, Section 404 Corps of Engineers Permit, Right of Way Plan Design, Geotechnical Investigation, Final Roadway Design, Final Bridge Design and Plans Production as outlined in the following table:

The consultant shall perform the following services, all in accordance with the standard practice of the Commission and AASHTO LRFD Design methods:

I Preliminary Roadway Design

The CONSULTANT'S attention is directed to Chapter 235 of the MoDOT Engineering Policy Guide (EPG) for general guidelines and requirements for preliminary design. Other chapters may be applicable for preliminary design preparation.

- (A) Upon approval of the design criteria memorandum by COMMISSION, the CONSULTANT shall undertake the following to develop the preliminary design phase:
- a. Prepare preliminary plans, as outlined in the MoDOT EPG.
 - i. The COMMISSION shall furnish the CONSULTANT traffic information for the construction and design years to be used in the preliminary plans.
 - ii. The COMMISSION shall furnish the CONSULTANT the latest accident data and traffic information used to calculate the project accident rate. The COMMISSION shall furnish the CONSULTANT the "statewide accident rate for a similar class of roadway" and any high hazard locations within the project limits.
 - iii. The CONSULTANT shall submit the preliminary plans to the COMMISSION for review and approval as shown in Exhibit IV.
 - b. The preliminary plans shall be prepared in accordance with the applicable sections of the MoDOT EPG, as to what shall be shown thereon, including proposed design features.
 - i. The plan view English scale shall be 1"=50' horizontal (or different scale as determined by MoDOT Project Manager for clarity) and extend 100 feet beyond project limits.
 - ii. The profile view English scale shall be 1"=50' horizontal, and 1"=10' vertical.

- c. The CONSULTANT may have to review preliminary cross sections sufficiently to make a cost comparison between using retaining walls versus acquiring additional right of way for all proposed wall locations.
- d. The CONSULTANT shall prepare the construction estimate. The COMMISSION shall prepare the right of way estimate based on the right of way requirements furnished by the CONSULTANT.
- e. The preliminary plans shall be submitted to the COMMISSION for review and approval. A letter of transmittal shall be provided with the preliminary plan submittal. The COMMISSION shall furnish the template for the letter of transmittal. The construction cost estimate shall also be submitted with the preliminary plans.
- f. The preliminary plans shall include the tentative additional easement and right of way limits, property lines and ownerships, section lines, township and ranges, any U.S. Surveys, city limits, and a general outline of the construction staging, critical design items and other items as outlined in the EPG.
- g. Traffic assignments shall be shown on the respective roadways or on a line sketch of the roadways.
- h. Typical sections shall indicate heavy, medium or light duty pavement for new roadways, along with descriptions of the existing roadway types remaining in place.

(B) A Preliminary Field Check will be arranged with the COMMISSION to discuss design features in the project area.

(C) The CONSULTANT shall provide the COMMISSION with information for proper environmental and cultural clearance including submittal of the preliminary stage RES, right of way stage RES (if needed) and final stage RES. Items that may need to be addressed include historical buildings, archaeological sites, historic bridges, conversion of farmland, endangered species, wetlands, parklands and historical sites.

(D) The CONSULTANT shall prepare and submit the Bridge Survey Report, Bridge Survey Sheets, and Bridge Survey Checklist.

(E) The CONSULTANT shall set horizontal and vertical control for the project and provide the COMMISSION the combined adjustment factor. All control furnished by the CONSULTANT shall use current datums and adjustments.

(F) The CONSULTANT shall provide all land boundary work and legal descriptions.

(G) The COMMISSION shall provide the pavement design and general Job Special Provisions related to the project but not special design elements.

- (H) The COMMISSION may hold a public meeting for this project, but the CONSULTANT will not be required to attend. The CONSULTANT shall provide exhibits for MoDOT public meeting as requested.
- (I) The CONSULTANT shall provide a land survey plat that is compliant with the current standards for property boundary surveys to be recorded. The CONSULTANT shall also provide survey plats and legal descriptions as defined in Section 236.4.6 of MoDOT's Engineering Policy Guide.

II Preliminary Bridge Design

- (A) Perform the geometric analysis at the proposed bridge site necessary to develop type, size and location drawings consisting of a general plan and elevation plan of the structures, typical roadway sections and roadway profiles. This includes preparation of the Bridge Memorandum & Layout (including the itemized preliminary bridge estimate).
- (B) The structure and/or box culvert type and size (if applicable) shall be based on roadway alignments, geometric analysis, hydraulic analysis, spill slope requirements, roadway grades and/or clear zone requirements.
- (C) The superstructure type shall be dependent upon site constraints and a detailed cost analysis comparison.
- (D) All requirements of the Federal Emergency Management Agency's National Flood Insurance Program shall be met.
- (E) Discharges will be estimated using USGS Regression Equations and available stream gauge data.
- (F) A 2-D model shall be used to model of the natural, existing and proposed conditions.
- (G) Scour calculations shall be performed in accordance with FHWA Hydraulic Engineering Circular No. 18.
- (H) The results of the hydrologic, hydraulic and scour analysis shall be documented in the Bridge Hydraulic and Scour Report.
- (I) All requirements outlined in the MoDOT Engineering Policy Guide (EPG) shall be met. The CONSULTANT shall follow MoDOT's "practical design" philosophy and submit any design exceptions as necessary.
- (J) Develop final detailed design criteria in the form of Bridge Memorandum and Bridge Design Layout documents.

III Section 404 Corps of Engineers Permit

The CONSULTANT shall provide the following information necessary to allow MoDOT staff to apply for any required Section 404 Corps of Engineer Permits. If the permit is required due to bridge construction, the application data shall be submitted no later than with the T.S.&L. drawings. All information should be provided to the MoDOT Project Manager who will forward the information to Central Office Design.

- (A) Provide the amount and type of excavation and material that will be used in streams, lakes, and wetlands below the Corps of Engineers' ordinary high water line (OHL) elevations.
- (B) Provide location and quantities of permanent berms and spill fills below OHL.
 - a. Earth fill, rock blanket (square feet and cubic yards)
 - b. Rock blanket along right descending bank and left descending bank (linear feet)
 - c. Rock ditch (square feet)
- (C) Provide location, excavation and size of pier below OHL.
 - a. Excavation (cubic yards)
 - b. Pier (square feet)
- (D) Provide channel realignment data.
 - a. Existing channel length of section to be modified (feet)
 - b. Average channel width of section to be modified (feet)
 - c. Realigned section, length and width (feet)
- (E) Provide temporary fill amounts in wetlands or below OHL in streams.
 - a. Earth fill (square feet and cubic yards)
 - b. Class C (square feet and cubic yards)
- (F) Provide information about temporary fills and shoring.
 - a. Location of temporary fills and shoring
 - b. Source of material
 - c. Final disposition of removed materials
- (G) Provide information about temporary culverts.
 - a. Number of culverts
 - b. Size (inches)
 - c. Length (feet)
- (H) Provide information on channel cleanout – excavation below OHL.
 - a. Cleanout upstream and downstream of structure (linear feet)
 - b. Total quantity of material to be removed below OHL (square feet and cubic yards)
- (I) Provide 8 ½-inch by 11-inch copies of any plan or profile sheets required for the permit application.
- (J) Provide bridge elevation and plan views with OHL indicated.

IV Right of Way Design (if required)

(A) The CONSULTANT shall prepare right of way plans, which may be separate drawings from those used for design and construction details. The right of way plans shall show alignment, geometric design, removal of improvements, drainage facilities, property lines and ownership, sub-division lot lines, other land survey information, street lines and existing right of way and easements. The CONSULTANT should also include any plan details, which will require additional right of way or permanent, temporary or utility easements during the construction phase of the project such as bypasses, temporary erosion control, etc. Right of way plans include title sheet, typical sections, profile sheets, and cross sections of the roadway, entrances and side roads. Areas of new right of way, permanent easements and/or temporary easements required from each individual property owner may be shown in tabular form on the respective sheets.

- a. The CONSULTANT shall finalize any previous review of the roadway cross sections sufficiently to determine the feasibility of constructing retaining walls versus obtaining additional right of way. This final review shall consist of construction estimates versus right of way estimates.
- b. Upon completion of the estimates by COMMISSION and CONSULTANT, the CONSULTANT shall recommend to the COMMISSION a choice at the various locations which warrant consideration of the alternate retaining wall versus right of way solutions. The COMMISSION shall make the final determination of purchasing right of way, or constructing retaining walls.

(B) Right of way plans shall be submitted to the COMMISSION for review and approval. The right of way plans shall be at the same scale as the construction plans. The right of way plans shall include any design details that will control the width of right of way and necessary easements.

- a. New right of way lines and all easements shall be dimensioned by station and offset distance from the centerline, or cross road centerlines, if necessary. Bearings and distances on the right of way lines may be required.
- b. The following minimum design features shall be included on the right of way plans:
 - i. Title sheet with appropriate project limits, access note and traffic data completed.
 - ii. Typical Sections
 - iii. Cross sections at 100' intervals, including additional sections at each entrance with new and existing entrance grades.
 - iv. Construction limits (slope lines); drainage facilities; entrances and their reference location, width and type along with their existing and future grade percentage; property owners, with areas of new right of way, easements and remaining property; centerline bearing, ties to legal land corners from centerline stations with notation for corner witness by a registered land surveyor; existing utility locations and easements, including replacement utility easements; horizontal curvature information;

and proper right of way symbolization for new right of way (access control) and easements, including areas which may be required to accommodate temporary erosion control.

- v. Township, Range, Section and/or U.S. Survey information broken down to $\frac{1}{4}$ $\frac{1}{4}$ section line level on each plan sheet near the title block or appropriate survey/section line.

- (C) The CONSULTANT shall provide an updated construction estimate for the Right of Way design stage.
- (D) The COMMISSION shall review, approve and certify the right of way plans as completed by the CONSULTANT. The CONSULTANT shall provide one (1) electronic set of fully signed and sealed right of way plans, for the COMMISSION'S use.
- (E) The CONSULTANT shall provide title insurance information for all parcels with new right of way acquisition and the last deed of record for any parcel with easements.
- (F) The COMMISSION will prepare right of way appraisals and secure the necessary right of way by negotiation or condemnation, if necessary, for construction of this project.
- (G) The CONSULTANT shall be responsible for staking and re-staking tentative right of way on individual properties, as required by MoDOT staff, during right of way negotiation and acquisition phase of the project. The CONSULTANT shall also set permanent monuments as shown on the recordable land survey.
- (H) The CONSULTANT shall be responsible for making all revisions to the right of way and construction plans due to negotiations with the property owners in an effort to acquire right of way.
- (I) The CONSULTANT shall write deed descriptions for all right of way acquisitions on MoDOT's approved Exhibit A form and complete MoDOT's Professional Land Surveyor Description Review form for this project. The CONSULTANT shall submit the legal descriptions at the same time that right of way plans are due.
- (J) The CONSULTANT will provide the COMMISSION with information for proper environmental and cultural clearance including submittal of the Right of Way stage RES. Items that may need to be addressed include historical buildings, archaeological sites, historic bridges, conversion of farmland, endangered species, wetlands, parklands and historical sites.

V Geotechnical Investigation

- (A) Perform all geotechnical work necessary for the project including the Preliminary Geotechnical Report and the final bridge soundings.

- (B) Consultant is responsible for attaining all necessary permits to perform the work.
- (C) Produce a preliminary geotechnical report which includes an initial geotechnical investigation of the site including recommended sides slopes and spill slopes. The site work for the preliminary geotech work and the final soundings may occur simultaneously.
- (D) Perform all necessary bridge soundings and testing and incorporate into a Foundation Investigation Report. The report shall include rock core photographs, recommended foundation types, recommended foundation capacities, applicable resistance factors and Lpile parameters for lateral load analysis of driven piles or drilled shafts. The report shall also include recommendations for site remediation to support MSE walls (if required) and recommendations for the use of driven piles due to soil acidity.
- (E) All boring holes shall be filled with grout.
- (F) Public utilities shall be notified via Missouri One-Call before drilling begins.
- (G) The cores shall be handled and labeled following MoDOT procedures.
- (H) Laboratory testing will be performed to estimate pertinent engineering properties of the soil overburden and soil and rock properties for design including analysis of the soil acidity.
- (I) MoDOT District to provide staking for boring locations as shown in above table.
- (J) The consultant shall provide, at a minimum, a geologist registrant in training (GRIT) or an engineer in training (FE) to log the borings in the field per MoDOT's logging protocol. The engineer or geologist shall have at least 2 years of experience logging boreholes. Logs shall be reported in gINT format. MoDOT will provide preferred gINT templates when requested. At final submittal, please provide a copy of the electronic gINT file, in addition to the final report deliverables.
- (K) The consultant will perform standard penetration testing (SPT) and split-barrel sampling in accordance with ASTM D1586 using an automatic hammer in accordance with section 7.4.1 Method A. The automatic hammers shall be calibrated in accordance with ASTM D4633 at least every 2 years or sooner as required therein. The calibration report shall be prepared in accordance with ASTM D4633 and shall be signed and stamped by a professional engineer.

VI Final Roadway Design

- (A) The COMMISSION shall coordinate utility company activities for any adjustments required to be included in the final design plans.

- (B) The COMMISSION will secure execution of municipal agreements with the cities and/or county agreements. A copy of the executed agreements will be furnished to the CONSULTANT for his information. The CONSULTANT shall conform to all design provisions of these agreements.
- (C) A final design field check shall be held with CONSULTANT and COMMISSION representatives prior to completing final design plan quantities. The CONSULTANT shall make any necessary revisions to the final plans as determined by this design field check.
- (D) The CONSULTANT shall prepare detailed temporary erosion control plans for review and approval before inclusion in the final design plans.
- (E) The CONSULTANT shall prepare computations for all design plan quantities. All plan quantities shall be shown on the Quantity Sheets, by construction stage, if applicable. The format for these sheets shall be furnished by the COMMISSION. Specialty items may have separate sheets for quantity tabulations.
- (F) The CONSULTANT shall prepare for review and approval by the COMMISSION all General Job Special Provisions, which are to supersede the Missouri Standard Specification for Highway Construction. A brief reason for the deviation from the standard plans and specifications should also be provided. The CONSULTANT shall prepare only Job Special Provisions related to design elements shown in the plans.
- (G) The following list shall be considered the minimum requirements for a complete set of Final Design Plans.
- a. Title Sheet
 - b. Typical Sections
 - c. Quantity Sheets
 - d. Plan Sheets at 1"=50' horizontal (or different scale as determined by MoDOT Project Manager for clarity). Plan sheets shall include all necessary adjustments to signing and proposed pavement marking.
 - e. Profile Sheets at 1"=50' horizontal and 1"=10' vertical
 - f. Culvert Sections at 1"=10', if needed
 - g. Special Sheets for geometrics, referenced points, grading plan, traffic control plan, temporary erosion control plan and any other sheets for special design features.
 - h. Earthwork Quantities, Cross Sections at 100' intervals, 1"=10' (1:100), horizontal and vertical, including entrance sections with existing and proposed grades
 - i. Tabulation of Quantity Sheets
 - j. Job Special Provisions in electronic format readable in COMMISSION'S current word processor

- k. File with the bid items and quantities as generated by COMMISSION'S Estimate Program
 - l. Construction Workday Study
 - m. Transportation Management Plan
 - n. Final Plans Checklist Form D-12
- (H) Additional plans and information may be required to complete the Final Design Plans. With the submittal of the Final Design the CONSULTANT shall also provide the COMMISSION a statement that an internal quality control check has been conducted and to the best of the CONSULTANT'S knowledge the final design plans are free of gross errors, misleading or confusing typos, and includes adequate information to construct the project.
- (I) The CONSULTANT shall prepare all plans through the use of a Computer Aided Drafting (CAD) program. The CONSULTANT shall conform to MoDOT's Specifications for Computer Deliverable Contract Plans as referenced in the MoDOT EPG. The CONSULTANT shall use Microstation and Geopak SS4.
- (J) The CONSULTANT shall furnish the COMMISSION the following completed sheets and documents, as applicable, for each separate construction project included in this contract, as follows:
- a. Preliminary Plans showing profile grades, geometric data, alignment data, etc.
 - b. One (1) electronic copy of the location sketch for Commission Approval submitted in electronic format.
 - c. Draft copy of the job special provisions related to design elements for review. After corrections, the job special provisions shall be furnished in electronic format utilizing the COMMISSION'S latest word processing program.
 - d. One (1) legible electronic copy of engineering calculations and analysis.
 - e. One (1) electronic copy of a complete summary of quantities and estimate of construction costs. The estimate shall be prepared using the latest version of MoDOT's ESTIMATE program.
 - f. One (1) electronic copy of the completed Standard Plans list, MoDOT Form D-2.
 - g. One (1) electronic copy of a workday study showing the estimated number of workdays required to construct each project.
 - h. The CONSULTANT shall provide a 3D model of the project exported from Geopak SS4 software for the COMMISSION'S use.

VII Final Bridge Design

Furnish to the COMMISSION fully checked design plans, job special provisions, design computations, quantity computations, final cost estimate, and a construction work day study for the structure(s). The CONSULTANT is expected to make the COMMISSION aware of more

economical design alternatives that may become apparent during the preparation of the final design.

- (A) The plans shall be complete and shall cover all parts of the structure they represent. The degree of detail shall be comparable to that furnished on typical plans prepared by the COMMISSION. High resolution final signed and sealed plans, will be submitted in Adobe Acrobat Reader format version 7 or higher. Final signed and sealed plans shall be in pdf full size (34" x 22") format. These deliverables shall use the file naming convention and be in accordance with the "Specifications of Computer Deliverable Contract Plans" requirement outlined in the Commission's Engineering Policy Guide, Section 237.13.3. The electronic plans in Microstation format cannot be signed and sealed. The electronic submittals shall be made in a method suitable to MoDOT.
- (B) All construction changes made to the plans during construction of the project shall also be submitted electronically in Adobe Acrobat and Microstation format.
- (C) The job special provisions shall be complete and describe all design features, construction procedures, or material requirements in the plans that are deviations from the latest edition of the Missouri Standard Plans for Highway Construction. Typical job special provisions that have been developed by MoDOT for previous jobs are posted on MoDOT's website and are available for use and modification as needed. The job special provisions shall include a table of contents sheet that is signed and sealed by a professional engineer registered in Missouri. The signed and sealed job special provisions shall also be submitted in Adobe Acrobat Reader format, version 7 or higher. Job Special Provisions shall also be submitted in Microstation Word format. The submittal letter shall explain the need for each provision.
- (D) The design computations and plans shall be acceptable to, and will become the property of the Commission. The CONSULTANT shall submit design computations in Adobe Acrobat Reader version 7.0 format or greater. The files shall be transferred in a manner acceptable to MoDOT. The design computations shall contain an index file, with electronic links to the files contained within. Submittals shall include a minimum of set of design computations for each project. The design computations shall not be combined with the Microstation or the Adobe Acrobat Reader submittals.
- (E) The final estimate submitted by the CONSULTANT shall include backup material that supports the estimates made for non-standard or lump sum pay items.
- (F) The CONSULTANT shall submit the hours and cost summarizing the design effort for each bridge. The summary shall include separate amounts for: Number of Hours for Bridge Preliminary Design, Cost of Bridge Preliminary Design, Number of Hours for Bridge Final Design, Cost of Bridge Final Design. Generally, the above amounts should include all hours and costs invoiced that are attributable to bridge design and plans

preparation up to the point of turning in the signed and sealed plans. It should not include hours attributable to preparing the bridge survey, final construction cost estimate, or workday study.

VIII Construction Support

- (A) The CONSULTANT shall be available to the COMMISSION to discuss and interpret plans and specifications during the bidding and construction phase of the project as determined necessary by the Engineer.
- (B) The CONSULTANT may be required to attend a pre-construction meeting, and a post construction meeting.
- (C) If issues arise during construction, there will be a direct line of communication established between the MoDOT Construction Office and the CONSULTANT. The CONSULTANT will immediately inform the MoDOT Bridge Division of any recommendations or clarifications made to the Construction Office.