STATE OF TEXAS §

COUNTY OF HAYS §

PROFESSIONAL SERVICES AGREEMENT

This Professional Services Contract ("Contract" or "Agreement") between the City of Kyle ("OWNER") and BGE, Inc. ("Professional"), collectively referred to as the "Parties", is an agreement for the Professional to provide the OWNER with the professional services described in this Contract, for and in consideration of the payment terms and performance obligations herein described.

The effective date of this Contract shall be the date set forth on the signature page.

Article 1. Work to be Provided

(a) Professional shall provide engineering and construction support services on an on-call basis and a project support capacity for the OWNER. Professional shall provide Work (the "Work") to OWNER under individual assignments. A general description of the Work that may be required by this Contract includes, but is not limited to, (i) technical review of applications and other proposals submitted to OWNER; (ii) analysis of development review standards and processes; (iii) surveying services, including computations and drafting; (iv) geotechnical services; (v) civil engineering services; (vi) and construction observation, assessment, and management support; and as further described in Exhibit A. Scope of Services attached to this Agreement.

(b) OWNER will provide a written Task Order in the form and format reflected in Exhibit B to this Agreement to Professional to initiate work assignments. The Task Order will include a description of the tasks to be performed and the compensation for the tasks. No Work is authorized unless authorized representatives of both parties sign such a Task Order. This Contract does not guarantee a minimum amount Professional will be paid or a minimum number of Task Orders.

(c) Notwithstanding anything to the contrary contained in this Agreement, OWNER and Professional agree and acknowledge that OWNER is entering into this Agreement in reliance on Professional's special and unique abilities with respect to performing the Work, and Professional's special and unique abilities with respect to engineering and construction support services. The Professional accepts the relationship of trust and confidence established between it and the OWNER by this Agreement. Professional covenants with OWNER to use normal and customary efforts, skill, judgment, and abilities to perform the Work and to further the interests of OWNER in accordance with OWNER's requirements and procedures, in accordance with the standards of Professional's profession or business. Professional acknowledges that to the best of their information, knowledge, and belief, that there are no undisclosed obligations, commitments, or impediments of any kind that will or could taint, limit, or prevent performance of the Work.

(d) Changes In Scope of Work. OWNER may request additional Work or changes in the Work as the project progresses. If so, changes in the Scope of Work shall be initiated by a written change order signed by an authorized representative of each party. The change order shall describe the Work to be added, changed, or deleted and shall state the additional cost or cost reduction and schedule changes, if any. Verbal change orders shall have no effect, except in cases of an emergency threatening personal injury or property damage, and in such cases the verbal change order shall be followed as soon as practicable by a writing to be executed by the parties hereto. The terms and conditions of this Contract may be modified only by a writing signed by an authorized representative of each party.

Article 2. Contract Documents

(a) General Definition. The Contract Documents, in order of precedence consist of:

(1) This Contract and the exhibits attached hereto:

(A) Scope of Work

(B) Form of Task Order

(2) All written Change in Scope of Work documents executed after the effective date of this Contract by authorized representatives of the parties.

(3) Each Task Order executed pursuant to this Contract by authorized representatives of the parties; and

(4) Each amended task order executed by authorized representatives of the parties.

(b) Exclusion from Contract Documents. No term, condition, or provision of any Task Order or other document that conflicts with the terms and conditions contained in this Agreement will be considered part of the Contract Documents, or otherwise valid, unless expressly provided and accepted in writing by the OWNER and Professional.

Article 3. Term

This Contract is for a five (5) year period subject to extension as provided in this Article, but not to exceed a maximum seven (7) year period. The primary term begins upon execution of this Contract by an authorized representative of the OWNER and expires in five years. OWNER shall thereafter have the option to extend the contract for up to, but not to exceed, two extended terms of one year each. Any extension by the OWNER shall be effective upon 30 days' notice to Professional prior to the end of the then current term. The extension shall be deemed automatically accepted by Professional unless Professional refuses the extension by written notice to OWNER within ten (10) days after the Professional receives the notice of extension from the OWNER.

Article 4. Schedule

Time is an important element of the performance of this contract. Professional will put forth efforts to complete the Work in a manner and as expeditiously as is consistent with the standard of care, and in accordance with any deadlines to which the parties agree in any Task Order. Professional agrees to perform all obligations and render the Work set forth in this Contract or

any Task Order issued pursuant hereto consistent with professional standards and in accordance with any timelines included in the Statement of Work, except as the Parties may hereafter mutually agree in writing otherwise. If required by the Statement of Work, a specific work progress schedule will be developed for each individual task in compliance with that Statement of Work.

Article 5. Price

The Price to be paid for Work under any Task Order shall be as agreed in a particular Task Order.

Article 6. Payment

(a) Anything in this agreement to the contrary notwithstanding, all payments to be made by the OWNER hereunder are subject to Ch. 2251 of the Texas Government Code, popularly known as the Prompt Payment Act, which shall control to the extent of any conflict with this paragraph. Payment in full for invoices shall be due within thirty (30) days from date the invoice is received by OWNER. Invoices paid more than thirty (30) days after the invoice is received are subject to a late charge of 1% per month (12% APR) on the amount of the undisputed past due balance.

(b) Invoices for payment under this Contract shall be sent via email to:

Jo Ann Garcia, P.E.
jgarcia@cityofkyle.com
Road Bond Project Manager
City of Kyle
100 W. Center Street
Kyle, Texas 78640

Payments may be based on completion of the Work, fulfillment of milestones, progress payments or any other method that is established in the agreed Statement of Work. In no event shall Professional invoice OWNER more than once monthly.

Article 7. Acceptance of the Work

When Professional can demonstrate that the Work is completed in general accordance with the acceptance criteria included in the Statement of Work and so notifies OWNER, OWNER shall review the Work for general compliance with the Contract. If the Work appears to comply with the Contract requirements, and Professional has furnished all required documentation, OWNER shall notify Professional in writing of OWNER's Acceptance of the Work. Acceptance of the Work shall not limit nor diminish Professional's responsibilities, duties, and acknowledgements with respect to the Work. The Work shall be performed by the Professional in a manner consistent with good practices for the profession, and the standards and skills of the professionals practicing such profession in Travis County and Hays County, Texas.

Professional shall observe workplace policies and procedures while performing Work at the Owner’s offices and facilities.

Article 8. Jobsite Inspection

If required by OWNER, Professional's representatives shall inspect the jobsite and clearly understand the requirements and risks of the Work to be performed, the jobsite conditions, traffic conditions, the proximity of high-voltage power lines, utilities, and other local conditions likely to affect Professional's performance before accepting any Task Order. Acceptance of a Task Order shall constitute the Professional's certification that it has by inspection satisfied itself with respect to all such local conditions and is willing to accept all risks they impose.

Article 9. Independent Contractor

(a) Professional shall perform in all respects as an independent contractor and not as an employee, partner, joint venture, or agent of the OWNER. The Work to be performed by Professional shall be subject to the OWNER's review, approval and acceptance as provided in the Contract Documents, but the detailed manner and method of performance shall be under the control of Professional. The accuracy, completeness, and scheduling of the Work and the application of proper means and methods for performance of the Work are entirely the responsibility of Professional. Professional shall be solely responsible for hiring, supervising, and paying its employees, subcontractors and suppliers. Professional shall be solely responsible for payment of all (i) compensation, including any employment benefits, to its employees, (ii) taxes, including withholding for federal income tax purposes, employment and unemployment taxes, and (iii) such other expenses as may be owed to Professional's employees. However, because Professional's Work may be associated in the minds of the public with OWNER, Professional shall ensure that all Work by its employees, subcontractors and agents is performed in an orderly, responsible, and courteous manner. Non-citizen workers shall be properly documented.

(b) Upon prior notification to and written approval of OWNER, Professional may hire subcontractors to perform work hereunder. Professional shall be responsible to OWNER for the performance of all such subcontractors. OWNER shall require all such subcontractors to sign agreements with Professional that bind the subcontractors to perform subcontracts in accordance with the Contract Documents. Upon the request of OWNER, Professional shall furnish OWNER with copies of such subcontracts. In addition, Professional agrees that it is Professional's responsibility to ensure that such subcontractors make all appropriate tax payments or tax withholding in relation to subcontractor's employees providing work to OWNER through Professional under this Contract. Professional represents that it and its subcontractors are fully trained to perform the tasks required by this Contract and that they need no training by the OWNER. Professional further understands and agrees that it will be responsible to OWNER for the quality and performance of any Work performed by any such subcontractor.

Article 10. Licenses and Permits

(a) Professional shall procure and maintain at its expense all licenses and permits necessary

for it to perform the Work.

(b) Professional shall endeavor to provide that its subcontractors and their employees are all properly licensed or otherwise lawfully authorized to perform their respective portions of the Work.

Article 11. Governing Laws, Regulations & Standards

(a) This Contract shall be governed, interpreted, and enforced under the laws of the State of Texas, without regard to its conflict of law principles. In the event of litigation between the Parties arising out of this Contract issued under it, venue for such litigation shall be in a court of competent jurisdiction in Hays County, Texas.

(b) Professional shall be aware of and shall comply with all applicable non-conflicting Federal, State, and local laws, ordinances, codes (including applicable Professional codes) and regulations applicable to the Work, any equipment to be fabricated and delivered and for compliance with standards and codes of technical societies that have been adopted by law or regulation or compliance with which is required in the Contract Documents. If any of the Work fails to comply with such laws, ordinances, codes, and regulations, Professional shall bear the costs to bring the Work into compliance.

(c) Without limiting the generality of the foregoing, during the performance of the Agreement, Professional agrees to comply with all applicable regulations of Executive Order No. 11246 of September 24, 1965, and the rules, regulations, and relevant orders of the Secretary of Labor as they may apply to Equal Employment Opportunity. Professional will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor pursuant thereto, and will permit access to its books, records, and accounts by the cognizant agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

Article 12. Intoxicants & Drugs: Employee Conduct

OWNER prohibits intoxicants or illegal drugs at its offices or on its jobsites. Professional shall not at any time allow personnel for whom it is responsible on the jobsite if they are under the influence of any substance that may impair their performance. Professional shall promptly remove from the jobsite any person who is or appears to be under the influence of any of these substances or is otherwise unsafe or disorderly. Professional shall ensure that its employees, subcontractors and their employees comport themselves in a professional and lawful manner while on OWNER property or on the jobsite.

Article 13. Risk of Loss

(a) Professional shall bear the expense and risk of loss or damage to work in progress, completed Work, materials, equipment, and all other incidents of the Work prior to Acceptance of the Work. Professional shall promptly replace or repair any loss or damage at its own expense. In the event of substantial delay, loss, or damage due to Force Majeure, the schedules

shall be equitably extended.

(b) Professional shall bear the expense of storage space for stored materials, whether on-site or off-site, and shall bear the risk of loss or damage to all such materials. Professional shall take reasonable precautions to protect the materials from weather damage, burglary, pilferage, and similar hazards.

(c) Professional shall bear the risk of loss or damage to its own equipment, tools, supplies and property and those of its subcontractors and suppliers, regardless of the cause of loss or damage throughout the project.

Article 14. Warranties and Representations

(a) **Warranty of Title.** Professional warrants the title to any goods it delivers to OWNER incidental to the performance of the Work and warrants that said goods will be free and clear of all liens, mortgages, security interests or other encumbrances.

(b) General Warranty of the Work. Professional represents that all Work shall be performed in a Professional manner consistent with the industry standards and the standards of the profession of Professional. Professional shall correct, without delay and at its own expense, any portion of the Work that does not meet the foregoing warranty and is discovered within one year after Acceptance of the Work by re-performing that portion of the Work. Any repair, replacement, or modification of the Work performed pursuant to the provisions of this paragraph shall be supplied or repaired on the same terms and conditions as provided for herein for the Work.

(c) **Intellectual Property Representation.** Professional represents that the Work and the processes used in performing it shall not infringe on any valid United States patent, registered United States copyright, trademark or trade secret.

(d) **Business Standing Warranty.** Professional warrants, represents, and agrees that if (i) it is a corporation or limited liability company, then it is a corporation duly organized, validly existing and in good standing under the laws of the State of Texas, or a foreign corporation or limited liability company duly authorized and in good standing to conduct business in the State of Texas, that it has all necessary corporate power and has received all necessary corporate approvals to execute and deliver the Agreement, and the individual executing the Agreement on behalf of Professional has been duly authorized to act for and bind Professional; or (ii) if it is a partnership, limited partnership, or limited liability partnership, then it has all necessary partnership power and has secured all necessary approvals to execute and deliver this Agreement and perform all its obligations hereunder; and the individual executing this Agreement on behalf of Professional has been duly authorized to act for and bind Professional.

Article 15. General Indemnity

(a) Professional shall hold the OWNER and its councilmember's, officers, employees, and professionals harmless from claims, damages, losses and expenses (jointly, "Claims"),

including reasonable attorneys' fees, arising out of, or resulting from or arising under this Agreement, to the extent such liabilities, damage, loss, or expense is caused by the negligent, grossly negligent or intentional act or willful misconduct of Professional, anyone directly or indirectly employed by it, or anyone for whose acts it is legally liable.

(b) If the parties are concurrently negligent, each party's liability shall be limited to that portion of negligence attributable to it as determined under the applicable proportionate responsibility rules of the state of Texas.

(c) Anything to the contrary herein notwithstanding, neither party shall be liable to indemnify the other for the negligence, gross negligence, or willful misconduct of the other.

(d) The foregoing indemnity provisions shall be deemed independent covenants and shall survive completion of or any termination of the Agreement or any claimed breach thereof. Professional's indemnity responsibility as specified in this clause shall not include special, incidental, punitive or consequential damages.

Article 16. Intellectual Property Indemnity

(a) Professional shall, at its own expense, defend all suits or proceedings instituted against OWNER, its officers, agents, employees, or professionals based upon any claim that the Work, or any part thereof, or the process performed thereby constitutes an infringement of either any patent or copyright of the United States or of any trademark or trade secret protected by either federal or state law. Professional shall pay all awards of damages assessed against OWNER which result from any such claim, suit, or proceeding and shall indemnify and save OWNER harmless against losses, expenses (including reasonable attorney's fees), and damages resulting from any such claim, suit, or proceeding, including obedience to resulting decrees and to resulting compromises for which Professional is legally liable.

(b) If, in any such suit, a restraining order or temporary injunction is granted, Professional shall make every reasonable effort, by giving a satisfactory bond or otherwise, to secure the suspension of any such restraining order or temporary injunction. If, in any such suit, the Work or any part thereof or the process performed thereby is held to constitute an infringement and its use be permanently enjoined, Professional shall at once make every reasonable effort to secure for OWNER a license at Professional's expense authorizing the continued use of the infringing portion of the Work. If Professional is unable to secure such license within a reasonable time, Professional shall, at its own expense and without impairing performance requirements, either provide non-infringing replacements or modify the Work to eliminate the infringement.

(c) Such indemnity shall not apply to infringement claims that are based upon patent, copyright, trademark, or trade secret violations where such information was supplied by OWNER or which were directed for use by OWNER.

Article 17. Indemnity Procedures

With respect to any claim for Indemnity, the following procedures shall apply:

(a) **Notice**. Promptly after receipt by any entity entitled to indemnification of notice of the

commencement or threatened commencement of any civil, administrative, or investigative action or proceeding involving a claim in respect of which the indemnitees shall seek indemnification, the indemnitees shall notify the indemnitor of such claim in writing. No failure to so notify an indemnitor shall relieve the Indemnitor of its obligations under this Agreement except to the extent that it can demonstrate damages attributable to such failure. Within fifteen (15) days following receipt of written notice from the indemnitee relating to any claim, but no later than ten (10) days before the date on which any response to a complaint or summons is due, the indemnitor shall notify the indemnitee in writing if the indemnitor elects to assume control of the defense and settlement of that claim (a "Notice of Election"). It is specifically provided that any indemnitee may by separate legal counsel participate in any proceeding brought by a third party and raise defenses available to indemnitees, without waiving or limiting the benefits of this article or any duty or responsibility of indemnitor; provided that such indemnitee shall not attempt to limit or waive any defenses raised by indemnitor.

(b) **Procedure for Notice of Election**. If the indemnitor delivers a Notice of Election relating to any claim within the required notice period, the indemnitor shall be entitled to have sole control over the defense and settlement of such claim; provided, however, that (i) the indemnitees shall be entitled to participate in the defense of such claim and to employ counsel at its own expense to assist in the handling of such claim, and (ii) the indemnitor shall obtain the prior written approval of the indemnitees before entering into any settlement of such claim or ceasing to defend against such claim. After the indemnitor has delivered a Notice of Election relating to any claim in accordance with the preceding paragraph, the indemnitor shall not be liable to the indemnitees for any legal expenses incurred by such indemnitees in connection with the defense of that claim. In addition, the indemnitor shall not be required to indemnify the indemnitees for any amount paid or payable by such indemnitees in the settlement of any claim for which the indemnitor has delivered a timely Notice of Election if such amount was agreed to without the written consent of the indemnitor.

(c) **Procedure Where No Notice of Election Is Delivered**. If the indemnitor does not deliver a Notice of Election relating to any claim within the required notice period, the indemnitees shall have the right to defend the claim in such manner as it may deem appropriate. If the indemnitor fails to deliver a Notice of Election for any claim for which indemnitor is obligated to indemnify the indemnitees pursuant to the terms of this Agreement, then the indemnitor will be solely responsible for any and all costs and expenses incurred by the indemnitees in defending such claim and the indemnitor shall promptly reimburse the indemnitees for all such costs and expenses.

Article 18. Insurance

Professional shall obtain and maintain the insurance coverage specified below and shall provide to Owner an insurance certificate listing the coverage before starting work on any OWNER property. **THE COVERAGE SHALL NOT BE CONSTRUED AS ESTABLISHING OR LIMITING PROFESSIONAL'S LIABILITY UNDER THE INDEMNITY PROVISION.** OWNER shall be listed as an "additional insured" on all policies other than the Workers Compensation and Professional Liability policies. Professional for itself and its insurers hereby waive subrogation against OWNER, its affiliates, their Boards of Directors, Directors, officers,

employees, and agents. Professional's failure to maintain the required insurance coverage at any time during the contract period may be grounds for OWNER to suspend the Contract and withhold payment until insurance coverage is satisfactory.

	Type of Insurance	**Minimum Coverage**
(a)	Workers' Compensation	
	Coverage A -	Statutory
	Coverage B -	$250,000 employer's liability
(b)	General Liability	
	Bodily Injury	$ 500,000 per person
	Bodily Injury	$1,000,000 per occurrence
	Property Damage	$1,000,000 per occurrence
(c)	Automobile Liability	
	(Including owned or leased vehicles and heavy equipment)	
	Bodily Injury	$1,000,000 per occurrence
	Property Damage	$ 500,000 per occurrence

The automobile liability coverage shall apply to owned, non-owned, hired and leased vehicles. Before work begins, a certificate of all required insurance shall be filed with Project Manager of OWNER.

(d)	Professional Liability	$1,000,000 per claim

Article 19. Force Majeure

(a) The nonperformance or delayed performance by Professional or OWNER of any obligation under the Agreement shall be excused if such nonperformance or delay is caused by an event beyond the control of the affected party ("Force Majeure"), except to the extent that Professional knew of or should reasonably have been able to foresee such an event and failed to take reasonable measures to avoid the event. Items beyond the control of the parties include, but are not limited to: acts of war, acts of a public enemy; acts of domestic or foreign terrorism, natural disasters; strikes, epidemics or quarantine restrictions; riot, or sabotage; and acts of civil or military authority having jurisdiction.

(b) Upon occurrence of a Force Majeure, the date for performance of the Work shall be extended for a period equal to the time lost by reason of the delay, provided Professional or OWNER has taken reasonable steps to proceed with the performance of the Agreement and has made written notification of such delay and of any corrective action taken. Professional shall not be entitled to any increase in compensation by reason of Force Majeure.

(c) The following delays shall not constitute excusable delays in performance by Professional and shall not constitute a reason for extending the date for performance of the Work:

(1) Delays by subcontractors or suppliers of Professional for reasons other than Force Majeure.

(2) Delays in approval of documentation because of inadequate performance by Professional.

(3) Delays caused by Professional's lack of sufficient personnel with the necessary skills.

Article 20. General Safety, Environmental and Site Operations Requirements

(a) **Safety.** All parts of this Contract shall be performed in strict accordance with the safety requirements of applicable codes and statutes, federal, state, and local requirements, and the industry practice. Professional is solely responsible in its procedures for the safety of its jobsite personnel, equipment, and properties involved in this project, including Professional's subcontractors. However, Professional is not responsible for jobsite safety of others, including Construction Contractor personnel or Construction Contractor means, methods, or procedures.

Article 21. Assignment

This Contract is to be considered a personal Work Contract. Professional may not assign this Contract without the consent of OWNER. Any permitted assignee must notify the OWNER in writing that it accepts the assignment on the same terms and conditions contained in this Contract. No permitted assignment shall limit Professional's responsibility for performance of this contract. Attempted assignment or delegation of this Contract, including obligations under it, without the written consent of OWNER shall be void, and not merely voidable.

Article 22. Termination for Convenience

(a) OWNER shall have the right to terminate this Contract for its convenience at any time. After receipt of the notice of termination, the Professional shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due at that point in the Contract:

(1) Stop all ongoing Work.

(2) Place no further subcontracts or orders for materials or Work.

(3) Terminate all subcontracts.

(4) Cancel all materials and equipment orders, as applicable.

(5) Take any action that is necessary to protect and preserve all property related to this Contract that is in the possession of the Professional.

(b) In the event of a termination under paragraph (a) of this Article, OWNER shall pay equitable termination charges, for all billable time expended or portions of Work completed (as applicable) and materials purchased, and out-of-pocket costs that have been reasonably incurred by Professional as a result of terminating this Contract. OWNER shall not be liable in

connection with any termination under this Article for special, incidental, consequential, or punitive damages, or for loss of anticipated future work, anticipated profits, administrative costs or overhead on anticipated work, or other indirect costs.

Article 23. Termination for Cause

(a) The occurrence of any one or more of the following events will constitute an event of default:

(1) Professional's persistent failure to perform the Work in accordance with Professional Standards and the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers, suitable materials or equipment, or to adhere to project schedules as adjusted from time to time pursuant by the parties);

(2) Professional's disregard of applicable laws or regulations;

(3) Professional's disregard of the authority of OWNER's Representative;

(4) Professional's violation in any substantial way of any provisions of the Contract Documents;

(5) Failure of Professional to pay subcontractors and/or material suppliers; or

(6) Professional's violation of OWNER's ethics policy.

(b) If one or more of the events identified in paragraph (a) occur, OWNER may terminate this Contract, after giving Professional seven (7) calendar days prior written notice, unless such event of default shall have been cured, or Professional has provided OWNER a corrective action.

(c) If this Contract has been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against Professional then existing, or which may thereafter accrue. No retention or payment of moneys due Professional by OWNER will release Professional from liability.

(d) In such a circumstance, OWNER shall notify Professional in writing of the termination, with copies of the notice to OWNER's jobsite personnel. Upon notice of termination, Professional and its subcontractors shall promptly stop the Work and allow OWNER to take possession of the jobsite including any equipment and materials identified to the project (whether stored on-site or off-site), after securing the jobsite from safety and environmental hazards.

Article 24. Work Product.

Upon termination of this Agreement for cause or for convenience, Professional shall deliver all work product and deliverables prepared under this Agreement, whether complete or not, to the City in a form acceptable to the City. The work product and deliverables shall be delivered to the City upon the earlier to occur of thirty days' notice from the City or the date of termination of the Agreement. This section shall survive termination of the Agreement, and the City may enforce this provision through specific performance.

Article 25. Suspension

(a) OWNER may, at any time and at its sole option, suspend all or any portions of the Work to be performed under this Agreement by providing ten (10) calendar days written notice to the Professional. Upon receipt of any such notice, Professional shall:

(1) Immediately discontinue the Work on the date and to the extent specified in the notice.

(2) Place no further orders or subcontracts for materials, Work, or facilities with respect to the suspended portion of the Work, other than to the extent necessary to protect any portion of the Work already performed.

(3) Promptly make every reasonable effort to obtain suspension, upon terms satisfactory to OWNER, of all orders, subcontracts, and rental agreements to the extent that they relate to performance of the portion of Work suspended by the notice.

(4) Continue to protect and maintain the portion of the Work already completed, including the portion of the Work suspended hereunder, unless otherwise specifically stated in the notice.

(5) Continue to perform Professional's obligations for the portions of the Work not suspended.

(b) As full compensation for such suspension, Professional will be reimbursed for the following costs, reasonably incurred, without duplication of any item, to the extent that such costs actually result from such suspension of Work.

(1) A reasonable standby charge to be negotiated between OWNER and the Professional sufficient to compensate Professional for keeping (to the extent required in the notice) its organization and equipment committed to the Work in a standby status.

(2) All reasonable costs associated with demobilization of Professional's facility, forces, and equipment.

(3) A reasonable amount to be negotiated between OWNER and the Professional to reimburse the Professional for the cost of maintaining and protecting that portion of the Work upon which activities have been suspended.

(4) All billable time reasonably extended, or portions of Work completed (as applicable) prior to the suspension, materials purchased, and out-of-pocket costs that have been reasonable incurred by Professional.

(c) Upon receipt of notice to restart the suspended portion of the Work, Professional shall immediately resume performance on the suspended portion of the Work to the extent required in the notice. Within 14 calendar days after receipt of notice to restart the suspended portion of the Work, the Professional shall submit a revised schedule for approval by OWNER. If, as a

result of any suspension, the cost to Professional of subsequently performing the Work or the time required to do so is changed, a claim for an adjustment in the contract price may be made. Any claim on the part of Professional for change in price or extension of time shall be made in accordance with this Agreement.

Article 26. Dispute Resolution

The Parties agree that in the event of a dispute concerning the performance or non-performance of any obligations flowing from or because of this Contract and prior to the initiation of any litigation, the Parties will voluntarily submit the dispute to the Travis County Dispute Resolution Center for mediation as though it were referred through the operation of the Texas Alternative Dispute Resolution Procedures Act, Title 7, Chapter 154, TEX. CIV. PRAC. & REM. CODE ANN. (Vernon 2019). No record, statement, or declaration resulting from or in connection with such alternate dispute resolution procedure may be used in evidence in subsequent litigation except to demonstrate that this article has been complied with in good faith by a party. The use of such center shall not be or constitute a waiver of venue.

Article 27. Notices

All notices or other communications required under this Contract may be made either by personal delivery in writing or by certified mail, postage prepaid, return receipt requested. Notice shall be deemed to have been given when delivered or mailed to the parties at their respective addresses as set forth below or when mailed to the last address provided in writing to the other party by the addressee.

Owner:	Leon Barba, P.E. City Engineer City Of Kyle 100 W. Center Street Kyle, TX 78640	Professional:	BGE, Inc. 1701 Directors Blvd Suite 1000 Austin, Texas 78744

Article 28. Titles and Section Headings

The titles and section headings of this Contract are included for convenience only and shall not be deemed to constitute a part of this Contract.

Article 29. Interpretation and Reliance

While this Contract form was initiated by OWNER, Professional had the opportunity to take exception to and seek clarification of it. Thus, this Contract is the product of negotiations between the Parties. No presumption will apply in favor of any party in the interpretation of this Contract or in resolution of any ambiguity of any provision.

Article 30. Failure to Act

No action or failure to act by either party shall be a waiver of a right or duty afforded under the Contract, nor shall such action or failure to act constitute a breach of this Contract, except as specifically agreed to in writing.

Article 31. Contract Non-Exclusive

The Contract is not exclusive. Professional has the right to perform Work for others during the term of the Contract, and OWNER has the right to hire others to perform the same or similar tasks.

Article 32. Third Party Beneficiaries

There are no third-party beneficiaries to this Contract and the provisions of this Contract shall not create any legal or equitable right, remedy or claim enforceable by any person, firm, or organization other than the Parties and their permitted successors and permitted assigns.

Article 33. Mitigation of Damages

In all cases the Party establishing or alleging a breach of contract or a right to be indemnified in accordance with this Contract shall be under a duty to take all necessary measures to mitigate the loss which has occurred, provided that it can do so without unreasonable inconvenience or cost.

Article 34. Severability

This Contract is severable and if any one or more part of it is found to be invalid, such invalidity shall not affect the remainder of this Contract if it can be given effect without the invalid parts.

Article 35. Integration & Contract Modification

This Contract contains the entire and integrated agreement between Professional and OWNER as to its subject matter and supersedes all prior negotiations, correspondence, understandings, representations, and agreements, written or oral, related to it. In case of conflict between the terms and conditions of this Contract and those of any standard sales forms presented by Professional or such forms appearing in or referenced by Professional's bid or proposal, the terms and conditions of this Contract shall prevail. The terms and conditions of this Contract can be modified only by a writing signed by an authorized representative of both Professional and OWNER.

EXECUTED to be effective as of the _____ day of _____, 2022.

City of Kyle, Texas:

By: _____

Name: Scott Sellers
Title: City Manager

BGE, INC.:

By: _____

Name: Brian Rice, PE
Title: Director

"Exhibit A" – Scope of Work

"Exhibit B" – Form of Task Order

"EXHIBIT A"

SERVICES TO BE PROVIDED BY THE ENGINEER

BGE, Inc. (Engineer) will provide staff to support the City of KYLE (Owner) with general construction and engineering support services. The Owner also includes the City's General Engineering Consultant (GEC), K Friese & Associates, which the Owner has secured to act on its behalf as an Owner's Representative. The Engineer is required to coordinate with the GEC for completion of this work. Specific tasks may include, but are not limited to, the following:

The work to be performed by the Engineer shall consist of providing preliminary engineering services, development of a design schematic, environmental documents, and PS&E. These services may include, but are not limited to, preparing a Preliminary Engineering Report, a design schematic to an equivalent 30% PS&E level of detail, environmental documents/studies in support of the schematic work, public involvement support, permit procurement, data collection analysis, mitigation and remediation, monitoring, drainage, conceptual traffic control, 3-D modeling, surveying and mapping, subsurface utility engineering (SUE), environmental clearance, utility coordination, storm drain design, bridge design, traffic control layout and cross sections.

Additionally, the Engineer shall provide engineering services required for the preparation of plans, specifications, and estimates (PS&E) and related documents, as requested by the Owner. These services may include, but are not limited to, preparing roadway design, hydrologic and hydraulic design, bridge design, survey and ROW mapping, and geotechnical data collection, and, if requested, provide design support and testify as the Engineer of Record at Right of Way hearings necessary to support the design process.

Construction support services to be provided by the Engineer may include: attending preconstruction and partnering meetings; attending field meetings and making site visits; calculating quantities and assisting the Owner in preparing change orders; reviewing and approving shop drawings; reviewing and approving forming details; responding to requests for information (RFIs); providing minor redesign; answering general questions; providing clarification; and other project-related tasks during construction.

The Engineer shall complete the services to be provided by the Engineer according to the milestone work schedule established in the task orders. The Engineer shall submit a written progress report to the Owner monthly indicating the actual work accomplished during the month, scheduled work to be accomplished for the month, and the estimated work to be accomplished for the coming month. The progress report will use a bar chart diagram to indicate the percentage complete of each task shown on the previous report and the percentage complete of each task. The Engineer is required to meet with the designated Owner project manager and environmental coordinator bi-weekly for progress tracking purposes unless prior agreement is made with Owner not to hold a scheduled meeting. The Engineer shall submit minutes of the meeting, summarizing the events of the meeting within seven calendar days after each meeting.

The Engineer shall prepare a project work schedule. The work schedule must incorporate an allocation of time for stage reviews of the design schematic, survey, ROW Mapping, PS&E and the environmental documents by Owner personnel. The Engineer shall present the work schedule to the Owner for review and acceptance and provide assistance in interpreting the proposed work schedule.

GENERAL REQUIREMENTS

1.1. Design Criteria.

Design Criteria. The Engineer shall prepare all work in accordance with the latest version of applicable Owner's procedures, specifications, manuals, guidelines, standard drawings, and standard specifications or previously approved special provisions and special specifications, which include:

- Kyle Connected 2040 Transportation Master Plan (2015)
- Kyle Transportation Master Plan Update (2021)
- The Vybe Kyle: Trail-Oriented Development (2021)
- Kyle Drainage Master Plan (2018)
- City of Kyle Roundabout Ordinance #1162 (2021)
- City of Kyle standard detail sheets and general construction notes
- Texas Department of Transportation (TxDOT) PS&E Preparation Manual
- TxDOT Roadway Design Manual
- TxDOT Hydraulic Design Manual
- Texas Manual on Uniform Traffic Control Devices (TMUTCD)
- Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges (latest Edition)
- Other Owner approved manuals

When design criteria are not identified in Owner's manuals or TxDOT criteria, the Engineer shall notify the Owner and refer to City of Austin policies and the American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Street, (latest Edition). In addition, the Engineer shall follow the Owner's guidelines in developing the PS&E package. The Engineer shall prepare each PS&E package in a form suitable for letting through the Owner's construction contract bidding and awarding process.

The Engineer shall identify, prepare exhibits and complete all necessary forms for each Design Exception and Waiver required within project limits prior to the 30% project completion submittal. The Engineer shall submit each exception and waiver to the Owner for coordination and processing of approvals. If subsequent changes require additional exceptions, the Engineer shall notify the Owner in writing as soon as possible after identification of each condition that may warrant a design exception or waiver.

The Engineer shall prepare a design time schedule and an estimated construction contract time schedule, using the latest version of MS Project, Primavera, or any Owner approved programs. The schedules shall indicate tasks, subtasks, critical dates, milestones, deliverables and review requirements in a format that depicts the interdependence of the various items. The Engineer shall provide assistance to Owner's personnel in interpreting the schedules. The Engineer shall schedule milestone submittals at 30%, 60%, 90% and final project completion phases unless directed by Owner otherwise. The Engineer shall advise the Owner in writing if the Engineer is not able to meet the scheduled milestone review date.

Once the project has been completed and accepted by the Owner, and goes to letting, the Engineer shall deliver all electronic files to the Owner within 30 calendar days of Owner's written request.

1.2. Right-of-Entry. The Engineer shall notify the Owner and secure permission to enter private

property to perform any surveying, environmental, engineering, or geotechnical activities needed off Owner right-of-way. In pursuance of the Owner's policy with the general public, the Engineer shall not commit acts which would result in damages to private property, and the Engineer shall make every effort to comply with the wishes and address the concerns of affected private property owners. The Engineer shall contact each property owner prior to any entry onto the owner's property and shall request concurrence from the Owner prior to each entry.

1.3. Progress Reporting and Invoicing. The Engineer shall invoice according to Function Code breakdowns shown in Exhibit "A" of the Professional Services Agreement and Attachment "B" - Fee Schedule, of each Task Order. The Engineer shall submit each invoice in a format acceptable to the Owner.

With each invoice the Engineer shall submit a monthly written progress report to the Owner's Project Manager regardless of whether the Engineer is invoicing for that month.

The Engineer's written progress report shall describe activities during the reporting period; activities planned for the following period: problems encountered and actions taken to remedy them; list of meetings attended; and overall status, including a percent complete by task.

The Engineer shall complete the services according to the milestone work schedule established in the task order. The Engineer shall submit a monthly written progress report to the Owner indicating the actual work accomplished during the month, scheduled work to be accomplished for the month, the estimated work to be accomplished for the coming month, problems encountered, and actions taken to remedy them, list of meetings attended, and overall status. The progress report must use a bar chart diagram to indicate the percentage complete of each task shown on the previous report and the percentage complete of each task. The Engineer is required to meet with the designated Owner project manager or environmental coordinator bi-weekly for progress tracking purposes unless prior written agreement is made with Owner not to hold a meeting in any given month. The Engineer shall submit minutes of the meeting summarizing the events of the meeting within seven calendar days after each meeting.

The Engineer shall prepare a project work schedule, using the latest version of Primavera software or another scheduling program approved by the Owner in writing. The schedules shall indicate tasks, subtasks, critical dates, milestones, deliverables, and review requirements in a format that depicts the interdependence of the various items. The work schedule must incorporate an allocation of time for stage reviews of the design schematic, environmental documents, and PS&E documents by Owner personnel. The Engineer shall present the work schedule to the Owner for review and acceptance and provide assistance in interpreting the proposed work schedule. The Engineer shall provide advance written notice to the Owner if the Engineer is not able to meet the scheduled milestone review date.

Condition precedents to final payment by the Owner are the Owner's receipt of all electronic files and confirmation by the Owner's Project Manager that (1) the electronic files can be opened and are usable by the Owner utilizing the Owner-owned version of the intended software, and (2) all of the Owner's review comments have been addressed.

The Engineer shall prepare a letter of transmittal to accompany each document submittal to the Owner. At a minimum, the letter of transmittal must include the project name, project limits, Owner's contract number, and Owner's task order number.

1.4. Traffic Control. The Engineer shall provide all planning, labor, and equipment to develop and to execute each Traffic Control Plan (TCP) needed by the Engineer to perform services under each task order. The Engineer shall comply with the requirements of the most recent edition of the TMUTCD. The Engineer shall submit a copy of each TCP to the Owner for approval prior commencing any work on any Owner roadway. The Engineer shall provide all signs, flags, and safety equipment needed to execute the approved TCP. The Engineer shall notify the Owner in writing five (5) days (in advance of executing each TCP requiring a lane closure and shall have received written concurrence from the Owner prior to beginning the lane closure. The Engineer's field crew shall always possess a copy of the approved TCP on the job site and shall make the TCP available to the Owner for inspection upon request. The Engineer shall assign charges for any required traffic control to the applicable function code. City requires Public Notice of lane and Road closure 7 days in advance of closure through use of message boards, thus notice to Owner would need to be about 10 days prior of closure.

1.5. State-Controlled Waters. The placement of a new structure or modification of an existing structure(s) within State-Controlled waters will require confirmation that said structure(s) lie within the General Land Office (GLO) state owned land and whether the crossing is tidally influenced or not. Consequently, the Engineer shall request, as early in the design process as possible, that the State determine whether the proposed improvements are found within the tidal GLO, is a submerged GLO property or a non-tidal GLO property. The Owner may request assistance from the Engineer to prepare an exhibit demonstrating the location of the proposed improvements on the GLO State Owned Map for the project location.

1.6. Coordination. The Engineer shall coordinate issues and communications with Owner's internal departments through the Owner's Project Manager. The Owner will communicate the resolution of issues and provide the Engineer direction through the Owner's Project Manager.

Where applicable, the Engineer shall notify the Owner and coordinate with adjacent engineers and surveyors on all controls at project interfaces. The Engineer shall document the coordination effort, and each engineer must provide written concurrence regarding the agreed project controls and interfaces. In the event the Engineer and the other adjacent engineers are unable to agree, the Engineer shall meet jointly with the Owner and each adjacent engineer to resolve disagreements. If the engineers are unable to resolve an issue with the Owner as mediator, the Owner may decide the issue and the decision will be final.

The Engineer shall prepare each exhibit necessary for approval by each railroad, utility, and other governmental or regulatory agency in compliance with the applicable format and guidelines required by each entity and as approved by the Owner. The Engineer shall notify the Owner in writing prior to beginning any work on any outside agency's exhibit.

1.7. Level of Effort. For each task order, the Engineer shall base the level of effort at each phase on the prior work developed in earlier phases without unnecessary repetition or re-study. As directed by the Owner, the Engineer shall provide written justification regarding whether or not additional or repeated level of effort of earlier completed work is warranted, or if additional detail will be better addressed at a later stage in the project development.

1.8. Quality Assurance (QA) and Quality Control (QC). The Engineer shall provide peer review at all levels. For each deliverable, the Engineer shall have some evidence of their internal review and mark-up of that deliverable as preparation for submittal. A milestone submittal is not considered complete unless the required milestone documents and associated internal red-line mark-ups are submitted. The Owner's Project Manager may require the Engineer to submit the Engineer's internal

mark-up (red-lines) or comments developed as part the Engineer's quality control step. When internal mark-ups are requested by the Owner in advance, the Owner, at its sole discretion, may reject the actual deliverable should the Engineer fail to provide the evidence of quality control. The Engineer shall clearly label each document submitted for quality assurance as an internal mark-up document.

The Engineer shall perform QA and QC on all survey procedures, field surveys, data, and products prior to delivery to the Owner. If, at any time, during the course of reviewing a survey submittal it becomes apparent to the Owner that the submittal contains errors, omissions, or inconsistencies, the Owner may cease its review and immediately return the submittal to the Engineer for appropriate action by the Engineer. A submittal returned to the Engineer for this reason is not a submittal for purposes of the submission schedule.

1.9. Use of the State's Standards. The Engineer shall identify and insert as frequently as is feasible the applicable, current City of Kyle Standard Details, TxDOT Statewide Standard Details, TxDOT Austin District Standard Details, or miscellaneous details that have been approved for use in the plan. The Engineer shall sign, seal, and date each Standard and miscellaneous detail if the Standard selected has not been adopted for use by the Owner. The Engineer shall obtain approval for use of these details during the early stages of design from the Owner Project Manager. In addition, these details shall be accompanied by the appropriate general notes, special specifications, special provisions, and method of payment. The Engineer shall retain the responsibility for the appropriate selection of each Standard identified for use within their design.

1.10. Organization of Plan Sheets. The PS&E shall be complete and organized in accordance with the latest edition of the TxDOT PS&E Preparation Manual. The PS&E package shall be suitable for the bidding and awarding of a construction contract, and in accordance with the latest TxDOT policies and procedures, and the Austin District's PS&E Checklist.

1.11. Organization of Design Project Folder and Files (Electronic Project Files). The Engineer shall organize the electronic project files in accordance with the Owner's File Management System (FMS) format. The Engineer shall maintain the project files in the Owner's file structure.

1.12. Personal Protective Equipment (PPE). The Engineer shall, and shall require its subcontractors to, (1) provide personal protective equipment (PPE) to their personnel, (2) provide business vehicles for their personnel, and (3) require their personnel to use PPE and drive only business vehicles while performing work on or near roadways. The PPE must meet all (1) current standards set by the Occupational Safety and Health Administration (OSHA) and (2) TxDOT requirements (e.g., safety glasses, Type 3 (TY 3) pants for night work). Each business vehicle must be clearly marked with the Engineer's business name, or the name of the appropriate subcontractor, such that the name can be identified from a distance.

1.13. Data Classification. Unless otherwise clearly labeled or otherwise specifically excepted through a provision of this contract or its attachments, all data provided to or generated by the Engineer under this contract is considered public data for the purposes of applying the Owner's data security standards. The Engineer shall manage all data and work products according to the terms of the contract, including specifically Attachment I, Information Resources and Security Requirements.

1.14. Preventative Measures to Prevent the Spread of Oak Wilt Disease Contamination.

The Engineer shall take the following preventive measures while cutting, pruning, or removing oak

trees in counties which have confirmed cases of oak wilt disease or when directed by the Owner:

A. When possible, employ alternative methods instead of pruning or cutting oak trees.
B. When possible, perform necessary pruning and cutting of healthy trees during January or February when sap beetles are least active.
C. Treat wounds with pruning paint in oak wilt disease infected counties to discourage insects, especially during warm weather.
D. Sterilize all pruning tools between each use on each tree with either Lysol spray or a 70 percent rubbing alcohol solution.
E. Dispose of the tree cuttings by burning, burying, or another approved method.

TASK DESCRIPTIONS AND FUNCTION CODES

The Engineer shall categorize each task performed to correspond with the Function Codes (FC) and Task Descriptions.

FUNCTION CODE 102(110) – FEASIBILITY STUDIES

ROUTE AND DESIGN STUDIES

The Engineer shall collect, review, and evaluate data described below. The Engineer shall notify the Owner in writing whenever the Engineer finds disagreement with the information or documents provided.

The Engineer shall prepare an alignment and proposed roadway schematic layout that includes projected traffic volumes, when available, and existing and proposed typical sections. The Engineer shall furnish Microsoft Office and MicroStation, GEOPAK, and OpenRoads computer generated media containing the roadway schematic layout to the Owner. All supporting attachments and exhibits must accompany the schematic layout. All MicroStation, GEOPAK, and OpenRoads computer generated files containing the roadway design schematic must be fully compatible with the software used by the Owner without further modification or conversion. The Engineer shall be required to convert files to AutoCAD if requested by the Owner.

The Engineer shall produce, obtain, review, and evaluate available existing and twenty-year projected traffic data for use in the preparation of the schematic design layout. The data must be utilized in accordance with the requirements for schematic development and consistent with the policies of the Owner.

The Engineer shall prepare preliminary drawings to identify any potential impacts and constraints within the project corridor, including impacts to the nature, cultural, and human environment. The potential impacts and constraints identified must include all existing and proposed utilities (both public and private), structures, burial grounds, neighborhood communities, historical landmarks, and undeveloped areas. Any potential utility conflicts and structural impediments must be identified as such. The Engineer shall propose alternative alignments that avoid or minimize displacements and damages and prepare any additional attachments or exhibits required to illustrate a preferred alternative alignment. The Engineer shall assist the Owner with agency meetings during the development of the schematic design as requested by the Owner. If requested by the Owner, the Engineer shall assist the Owner with stakeholder meetings, public meetings, and a public hearing.

An itemization of the schematic design and engineering work activity to be performed under this contract is detailed below. The Engineer shall prepare all designs in accordance with the latest version of:

A. Kyle Connected 2040 Transportation Master Plan (2015)
B. Kyle Transportation Master Plan Update (2021)
C. The Vybe Kyle: Trail-Oriented Development (2021)
D. Kyle Drainage Master Plan (2018)
E. City of Kyle Roundabout Ordinance #1162 (2021)
F. City of Kyle standard detail sheets and general construction notes
G. Texas Department of Transportation (TxDOT) PS&E Preparation Manual

H. TxDOT Roadway Design Manual
I. TxDOT Hydraulic Design Manual
J. Texas Manual on Uniform Traffic Control Devices (TMUTCD)
K. Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges (latest Edition)
L. Other Owner approved manuals and guides.

When design criteria are not identified in Owner manuals or TxDOT criteria, the Engineer shall notify the Owner and refer to City of Austin policies and the American Association of State Highway and Transportation Officials (AASHTO), A Policy on Geometric Design of Highways and Street, (latest Edition).

The design schematic horizontal layout must adhere to a design scale of 1 inch = 100 foot (or 1 inch = 200 foot, when directed by the Owner.) The Engineer shall develop the schematic layout, exhibits, and attachments in English units. All Microsoft Office, MicroStation, Keyhole Markup Language (KML), Keyhole Markup Language Zipped (KMZ), and Bentley OpenRoads computer graphic files furnished to the Owner must be uploaded to the Owner's file management system in their native format, which must be fully compatible with the programs currently used by the Owner. Schematics must follow TxDOT and Federal Highway Administration (FHWA) standards. The schematic must follow TxDOT's computer-aided design and drafting (CADD) standards. The Engineer shall submit the schematic as an original document, accompanied with an original MicroStation formatted graphics file. Final copies of the schematic design must be signed and sealed by a professional engineer licensed in the State of Texas.

110.1. Schematic Design Work Outline:

A. Develop Base Maps

The Engineer shall develop the base maps to be used for the analysis and proposed schematic layout from existing construction and right of way (ROW) plans as available. The Engineer shall re-establish the existing centerline horizontal alignments for all roadways, identify existing ROW and easements, property owners, and the approximate location of major utilities based on a Subsurface Utility Engineering (SUE) in the preparation of base maps.

B. Planimetrics and Aerial Mapping

The Engineer shall obtain planimetrics, digital terrain modeling (DTM), and aerial photographs from the Owner, if available.

C. Analyze Existing Conditions

Using collected data and base maps, the Engineer shall develop an overall analysis of the existing conditions to develop the schematic design. The written analysis must include the following:

2. ROW and easement determination
3. Horizontal alignment
4. Vertical alignment
5. Pavement cross slopes and pavement type

6. Soil exploration
7. Geotechnical testing
8. Highway-rail grade crossing studies, if applicable
9. Intersection design and analysis
10. Sight distance
11. Large guide signs and roadside signing
12. Level of service
13. Safety (i.e., crash data)
14. Locations of critical constraints
15. Drainage
16. Traffic control and construction phasing sequence

D. Schematic Alternatives

The Engineer shall identify and analyze schematic two (2) alternatives to minimize potential adverse operational impacts, crash impacts, ROW impacts, environmental impacts, major utility conflicts, structural impediments, or exceptions to the Owner, State and FHWA design criteria. Schematics will be developed to the 10% and 30% plans level of completion.

E. Deliverable Schematic

The Engineer shall evaluate and document the following in the analysis to optimize the design:

1. Efficient use of the allocated ROW
2. Control of access (COA) and driveway locations
3. Roadway and intersection geometry
4. Cross sections
5. Bicycle and pedestrian design
6. Drainage and hydraulic design
7. Stopping sight distance
8. Level of service
9. Safety
10. Traffic and signal operations
11. Construction, ROW, easement, and utility costs
12. Construction sequencing
13. Traffic control during construction
14. Roadside safety appurtenances
15. Large guide signage
16. Environmental mitigation (e.g., noise walls, storm water best management practices (BMPs))
17. Bridge layouts and clearance
18. Railroads (if applicable)
19. Roundabout Analysis
20. Accommodation of ultimate corridor configuration.
21. Accommodation of future cross street expansion as described in local thoroughfare plan (if applicable)
22. Avoidance of utility lines (if feasible)

23. Impact of construction delays from utility relocations

F. Project Management and Coordination

1. The Engineer shall direct and coordinate the various elements and activities associated with developing the design schematic.
2. The Engineer shall prepare the detailed graphic project work schedule indicating tasks, critical dates, milestones, deliverables, and Owner review requirements. The project work schedule must depict the order of the various tasks, milestones, and deliverables. The Engineer shall review the schedule monthly and provide updates regarding its progress on the schedule to the Owner.
3. The Engineer shall submit written monthly progress reports to the Owner.
4. The Engineer shall provide ongoing quality assurance and quality control to ensure completeness of product and compliance with the Owner procedures.
5. The Engineer shall conduct site visits in both the AM and PM peak hour and develop a technical report that includes photographs outlining the findings and observations.

G. Data Collection and Field Reconnaissance

The Engineer shall collect, review, and evaluate data described below. The Engineer shall notify the Owner in writing whenever the Engineer finds disagreement with the information or documents:

1. Data, if available, from the Owner, including "as-built plans", existing schematics, right-of-way maps, Subsurface Utility Engineering (SUE) mapping, existing cross sections, existing planimetric mapping, environmental documents, existing channel and drainage easement data, existing traffic counts, accident data, Bridge Inspection records, identified endangered species, identified hazardous material sites, current unit bid price information, current special provisions, special specifications, and standard drawings.
2. Documents for existing and proposed development along proposed route from local municipalities and local ordinances related to project development.
3. Utility plans and documents from appropriate municipalities and agencies.
4. Flood plain information and studies from the Federal Emergency Management Agency (FEMA), the United States Army Corps of Engineers (USACE), local municipalities, and other governmental agencies.
5. Conduct field reconnaissance and collect data including a photographic record of notable existing features.

The Engineer shall conduct field reconnaissance and collect data as necessary to complete the schematic design. Data must include the following information. Items 1 through 5 must be obtained from the Owner, if available. Items 6 through 13 must be obtained from other agencies as required.

1. Local major thoroughfare plan
2. Plat research for adjacent properties (if available)
3. Available corridor major investment studies
4. Design data from record drawings of existing and proposed facilities

5. Previously prepared drainage studies
6. Public and private utility information (It is necessary for the Engineer's Surveyor to locate public and private utilities, even if the City has permits)
7. Existing and future design year traffic data
8. Historical crash data
9. Roadway inventory information, including the number of lanes, speed limits, pavement widths and rating, bridge widths and ratings, and ROW widths
10. Aerial photos, planimetric mapping, and DTM
11. Environmental data
12. Adopted land use maps and plans (if available)
13. Federal Emergency Management Agency (FEMA) flood boundary maps and flood insurance studies and models

H. Roadway Design Criteria

The Engineer shall develop the roadway design criteria based on the City of Kyle Transportation Master Plan Update (2021), TxDOT Roadway Design Manual and AASHTO Policy on Geometric Design of Highways and Streets guidelines. The design criteria must include the following roadway design elements: design speed, lane and shoulder widths, pavement structure and slopes, horizontal curvatures, horizontal and vertical clearances, range of vertical profile grades, and side slopes. If there is a discrepancy between the two sources, the Roadway Design Manual will govern unless otherwise directed by the Owner.

The Engineer shall prepare and submit preliminary design criteria to the Owner for review and approval and shall attend an initial kick-off meeting to establish and agree on fundamental aspects, basic features, concepts, and design criteria. This meeting will be coordinated with any adjacent roadway projects to ensure continuity with the design of the adjacent roadway projects.

110.2. Schematic Design – General Tasks

A. ROW Property Base Map

The Engineer shall obtain information on existing ROW, easements, and property information from as-built plans, ROW maps, and tax records. The Engineer shall prepare a base map depicting the information.

B. Typical Sections

The Engineer shall develop both existing and proposed typical sections that depict the number and type of lanes, shoulders, median width, curb offsets, cross slope, border width, clear zone widths, and ROW limits.

C. Environmental Constraints

The Engineer shall evaluate and document impacts to environmentally sensitive sites (as identified by the Engineer and verified by the Owner) during the schematic design process. Environmentally sensitive sites include natural, cultural, and the human environment. Examples are historic and archeological resources, burial grounds, neighborhood communities

and residential areas, farmland, floodplains, wetlands, endangered species, rare habitats, wildlife corridors, wildlife crossings, parks and nature preserves, geologic features, undeveloped areas, and significant trees.

D. Drainage

The Engineer shall use data from as-built plans and FEMA maps to locate drainage out falls and to determine existing storm sewer and culvert sizes, design flows, and water surface elevations for use in the design of roadway geometry. The Engineer shall conduct a preliminary drainage study to determine and evaluate the adequacy of the ROW needed to accommodate the proposed roadway and drainage system. The drainage study must (1) identify the impacts to abutting properties and the 100-year floodplain due to proposed highway improvements; (2) identify the water surface elevations for the 2, 5, 10, 25, 50, and 100-year storm events; (3) identify and locate outfalls; (4) provide drainage outfall descriptions; (5) provide overall drainage area map, sub-drainage area map, and storm water detention facilities; and provide a drainage study report identifying the results of the study. The drainage report, which must be signed and sealed by a professional engineer licensed in Texas, must include applicable hydrologic and hydraulic models (e.g., HEC-1 and HEC-2, HEC-RAS, HEC-HMS, XP- SWMM). The models must be approved by the local TxDOT district hydraulic engineer prior to generating any reports. If requested, the Engineer shall prepare a final drainage study in accordance with one or more of the following: City of Kyle Drainage Master Plan, TxDOT Hydraulic Design Manual, local TxDOT district criteria, and any other specific guidance provided by the Owner. If requested by the Owner, the Engineer shall evaluate the adequacy of the existing drainage structures; otherwise, the Engineer shall not evaluate the adequacy of the existing drainage structures.

For projects located over the Edwards Aquifer Recharge Zone or Contributing Zone, the Engineer shall follow the Texas Commission on Environmental Quality (TCEQ) Edwards Aquifer rules. The Engineer shall design water quality Best Management Practices (BMP) in accordance with the latest editions of RG-348 – Complying with the Edwards Aquifer Rules Technical Guidance on Best Management Practices (July 2005); RG-348 Addendum Sheet (July 2012), or latest edition. As part of this work, the Engineer shall perform the following:

1. BMP analysis: The Engineer shall locate all BMPs previously permitted under the TCEQ Edwards Aquifer rules that might be impacted by the project. The Engineer shall determine the amount of total suspended solids (TSS) being treated under these permitted BMPs.
2. TSS load calculations: The Engineer shall develop TSS load calculations to determine the TSS amount required to be treated under the Edwards Aquifer rules. This calculation is based on the increase in the amount of impervious cover within the project area. The Engineer will determine 80% of the increase in TSS load resulting from the development on the project.
3. De facto water quality: The Engineer shall determine the amount of de facto water quality being treated via grassy swales (GS) and vegetative filter strips (VFS). These locations are generally in areas where the existing geometry meets TCEQ standards for water quality and were not permitted as TCEQ BMPs under the Edwards Aquifer rules.

4. TSS removal determination: The Engineer shall utilize the TCEQ calculation spreadsheet to determine the total amount of TSS removal required for the project.
5. Design coordination and water quality report: After the 30% submittal, the Engineer shall meet with the Owner to discuss the TSS removal required for the project and delineate the design approach for the water quality BMPs. As geometry allows, the Engineer shall first maximize treatment via features in the roadway section (vegetative filter strips and grassy swales). For all other permanent BMP treatment options, the Engineer shall coordinate with the Owner for preferred treatment options and determine any necessary drainage easements required for the water quality BMP. The Engineer shall identify and document BMP's in the schematic water quality report. The Engineer shall submit a draft schematic water quality report with the 60% submittal, and a final schematic water quality report with the 100% submittal. The Engineer shall provide cost estimates for the BMPs and necessary drainage easements.

E. ROW Requirements

The Engineer shall determine the ROW requirements based on the proposed alignment, typical sections, design cross sections, access control, terrain, construction requirements, drainage, clear zone, maintenance, intelligent transportation system (ITS), and environmental constraints and mitigation requirements.

F. Construction Sequence

The Engineer shall evaluate and document the requirements for construction staging and traffic control throughout the development of schematic design to ensure that the proposed design can be constructed. The Engineer shall provide construction phasing assumptions to the Owner as requested and provide preliminary traffic control plan (TCP) layouts.

G. Design Exceptions

The Engineer shall identify design exceptions and waivers. The Engineer shall determine the necessity for each design exception or waiver for approval. If the Owner agrees that design exception or waiver is necessary, the Engineer shall prepare the Owner's required design exception or design waiver documentation. The Engineer shall document the operational and safety analysis for comparison of the no-build, build with standard design, and build with proposed design alternatives.

H. Traffic Data and Projections

The Engineer shall obtain the base year traffic data from available traffic data available or new counts and develop the opening-year, design-year (opening year +20) and pavement design year (opening year + 30) travel forecasts, and related traffic analysis. The developed traffic projections must be utilized for design and environmental analysis. The Engineer shall develop traffic forecasts for the mainlanes, ramps, cross streets, interchanges, intersections, and frontage roads for no-build and build alternatives. These projections must include graphic representations of the anticipated daily movements along the corridor (suitable for inclusion in the design schematic and environmental document) and the traffic analysis for highway design table. The Engineer shall prepare a traffic projections methodology memo, based on the

information provided in the traffic analysis package. The Engineer shall review the proposed methodology with the Owner and refine it based on these discussions. The Engineer shall submit the traffic volumes developed by the Engineer to the Owner for review and approval. The Engineer shall revise the traffic volumes based on the Owner's comments.

I. Traffic and Operational Analysis

The Engineer shall develop and analyze traffic data (including percent trucks, design hourly volume, and directional distribution), existing roadway features (including ramp locations, weaving sections, number of lanes, offset to obstructions, lane widths, frontage road operations, and intersection operation and geometry), traffic flow patterns, and transit and traffic operations. The Engineer shall conduct capacity analysis studies for designated locations and sections of roadway and make recommendations for improving traffic flow.

The Engineer shall use the HCM to analyze and make appropriate recommendations. The analysis must be done for existing/base year, opening year, design year (opening+20 year), and interim year (if needed) for existing and future conditions. Results of this analysis must be incorporated into the schematic design. The Engineer shall develop and submit to Owner a traffic and operational analysis report summarizing all analysis performed. If microsimulation is used, the Engineer shall develop and calibrate an existing condition traffic model. The calibration memo must be included in the traffic analysis report. The analysis must be performed using the latest versions of TxDOT-approved software (e.g., HCS, Synchro, VISSIM, CORSIM, SIDRA).

J. Safety Analysis

The Engineer shall review and analyze historical crash data for latest 3 to 5 full calendar years (i.e., January 1 to December 31, inclusive) with respect to crash characteristics such as severity, crash types, frequency, rates, patterns, clusters, and their relationship to crash contributing factors. The purpose of the historical crash analyses is to determine safety performance of the existing conditions to understand any safety issues within the study area.

Predictive, or quantitative safety analysis, involves using HSM-based methods that use safety performance functions (SPFs) and crash modification factors (CMFs) to estimate anticipated change in crashes from existing condition to the proposed design. The predictive safety analysis must be done for no-build and build conditions for design year. The purpose of the predictive safety analysis is to compare the safety performance of the no-build and build alternatives to help determine the preferred alternative and to determine the countermeasures, if necessary, to improve safety.

Predictive safety analysis must be performed using HSM based tools including Interactive Highway Safety Design Model (IHSDM), Enhanced Interchange Safety Analysis Tools (ISATe), HSS, or other tools acceptable to the Owner. The Engineer shall develop and submit to the Owner a safety analysis report summarizing all analysis performed.

K. Bicycle and Pedestrian Accommodations

The Engineer shall comply with City of Kyle design criteria and planned improvements for bicycle and pedestrian accommodations, including the 2015 and 2021 Transportation Master

Plans and The Vybe Kyle: Trail Oriented Development, and the United States Department of Transportation Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations. The inclusion of bicycle and pedestrian facilities must be evaluated when the project is scoped.

110.3. Conceptual Design Schematics

The Engineer shall develop conceptual design schematics in MicroStation format to evaluate various methods of handling traffic while providing access in key areas. The Engineer shall develop a single recommended design alternative that optimizes traffic flow and access. The conceptual schematics are to be plan view only. Profile work must be done only to the extent necessary to lay out the proper horizontal geometry.

The schematics must contain the following design elements:

A. Mainlane roadway alignment
B. Pavement edges, face of curbs, and shoulder lines of mainlanes, intersections, interchanges, and connecting highways or streets
C. Typical sections of existing and proposed roadways
D. Anticipated structure locations (including wildlife crossings and fencing structures)
E. Anticipated retaining wall and sound wall locations
F. Anticipated conveyance of major drainage elements
G. Preliminary ROW and easement requirements and control-of-access locations
H. Direction of traffic flow and the number of lanes on all roadways
I. Existing and projected traffic volumes
J. Existing utilities
K. Waters of the United States (WOTUS)

110.4. Geometric Design Schematics

The Engineer shall develop geometric design schematics based on the conceptual schematics after the basic layout, lane arrangement, and anticipated ROW and easement impacts depicted on the conceptual schematics are approved. The Engineer shall use Bentley OpenRoads tools in performing this task. The geometric design schematics must include both a plan view and profile view.

A. The geometric schematic plan view must contain the following design elements:

    1. Bentley OpenRoads calculated roadway alignments for mainlanes, general purpose lanes, ramps, direct connectors, bridges, HOV lanes, managed lanes, express lanes, collector distributor roads, frontage roads and cross streets at major intersections and grade separations
    2. Horizontal curve data shown in tabular format
    3. Pavement edges, curb lines, sidewalks for all roadway improvements
    4. Typical sections of existing and proposed roadways
    5. Proposed bridge structures, including bridge deck, abutment, bent, and rail locations
    6. Proposed retaining walls and sound walls
    7. Proposed cross-drainage structures with outfall flow arrows and significant drainage features or waterways identified

8. Existing utilities and proposed utilities
9. Existing property lines and respective property ownership information
10. Existing ROW and easements
11. Proposed ROW and easements adequate for preparation of ROW maps
12. Waters of the US (WOTUS)
13. Control-of-access limits
14. Existing and projected traffic volumes
15. Location and text of the existing and proposed guide signs and the preliminary locations for changeable message signs
16. Lane lines, shoulder lines, and direction of traffic flow arrows indicating the number of lanes on all roadways

B. The geometric schematic profile view must contain the following design elements:

1. Calculated profile grade and vertical curve data including "K" values for all curves and sight distance values for crest vertical curves on the mainlanes
2. Existing ground line profiles along the mainlanes
3. Grade separations and overpasses including preliminary abutment and bent locations, girder type, and span lengths
4. Calculated vertical clearances at grade separations and overpasses
5. Anticipated cross-drainage structures with approximate inlet and outfall elevations
6. Proposed ditch grading (special grading), if it does not follow the typical section.
7. Approximate locations of existing and proposed major utility crossings
8. The calculated profile grade for frontage roads, connectors, ramps and cross streets will be shown on separate Supplemental Profile rolls

110.5. Cross-Sections

The Engineer shall use a Bentley 3D OpenRoads model to generate preliminary cross-sections at 50 feet intervals (unless otherwise directed by the Owner) and at culvert locations in conjunction with the geometric schematic. The Engineer shall determine earthwork volumes for use in the cost estimate. The Engineer shall prepare 11inch x17inch or roll plots of the cross-sections.

110.6. Retaining Walls

The Engineer shall prepare preliminary retaining wall concepts to be shown on schematics, typical sections, and cross sections.

A. The Engineer shall determine if any additional walls are required and verify the need for and length of the retaining wall as shown on the ultimate schematic.
B. The Engineer shall compute and tabulate retaining wall quantities for preliminary design milestone plans submittal.

110.7. Renderings and Traffic Simulation

The Engineer shall develop exhibits as a means of expression and understanding for what the owner of the project envisions and what the public perceives. In support of the public outreach effort, the Owner will choose reasonable build alternatives, which the Engineer shall carry forward

into creating exhibits for each of the various alternatives. The Engineer shall create a 3D model shall for the reasonable build alternatives from: horizontal and vertical alignments, existing and proposed DTMs, proposed typical sections, traffic counts, and ground photography.

The exhibits must give the public and stakeholders a clear awareness and appreciation for the reduction of traffic congestion and how traffic is to flow into and out of the project area.

110.8. Preliminary Construction Sequence

The Engineer shall prepare preliminary construction sequence layouts in conjunction with the geometric design schematic depicting the phasing and traffic detours anticipated to safely convey traffic. The layouts must demonstrate that adequate horizontal and vertical alignments are maintained, sufficient lane widths and shoulder widths or barrier offsets are feasible, and construction zones are adequate for constructability of all proposed features. Proposed construction detours must ensure that adequate superelevation is provided. The layouts must indicate how existing pedestrian and bicycle facilities are accommodated for each phase.

110.9. Preliminary Cost Estimate

The Engineer shall prepare a preliminary cost estimate for the project, including the costs of construction, required ROW and associated improvements, and eligible utility adjustments. Current TxDOT Austin District and Statewide unit bid prices must be used in preparation of the estimate.

110.10. Preliminary Engineering Report

The Engineer shall prepare an engineering summary report to summarize the design criteria, traffic analysis, preliminary cost estimate and basis of estimate, construction sequence description, and utility conflict issues.

Deliverables for the Preliminary Engineering Report will include:

- Refined project description
- Preliminary analysis of project challenges and opportunities
- Preliminary schedule for project development
- Identification of utility relocations and which of them are in conflict with the project
- Refined cost estimate (including estimate for city driven utility relocations and future engineering costs)
- Preliminary roll plot depicting horizontal and vertical alignment

110.12. Agency Coordination and Public Involvement

A. The Engineer shall assist the Owner in conducting meetings with property owners, stakeholders, and various agencies to discuss and review the schematic design. The Engineer shall document and respond to issues related to the schematic design.
B. The Engineer shall prepare necessary exhibits and meeting materials to support stakeholder coordination and public outreach efforts.

110.13. Schematic Design Project Deliverables

In conjunction with the performance of the services included under Function Code 110 of this exhibit, the Engineer shall provide the following draft and final documents and associated electronic files as applicable:

A. Draft and final copies of the agreed upon design criteria
B. Draft and final copies of the traffic and operational analysis report and safety analysis report
C. Draft copies of the preliminary drainage study
D. Draft and final copies of the geometric schematic layouts on 11inch x 17- inch cut sheets or rolls, as requested by the Owner
E. Draft and final copies of the conceptual design schematics roll plots
F. Draft and final copies of the geometric schematic layouts (1 inch = 100 feet)
G. Draft and final copies of the design schematic profile rolls
H. Draft and final copies of the design schematic cross-sections on 11-inch x 17-inch cut sheets or roll plot format, as requested by the Owner
I. Copy of the preliminary cross-sections in a roll plot format or 11-inch x 17-inch format, as requested by the Owner
J. Electronic 3D model copy of the preliminary cross-sections created using OpenRoads software
K. Six final copies of the preliminary drainage study
L. Electronic submittal of the hydrologic and hydraulic model digital files from the drainage study
M. Copies of the preliminary construction sequence layouts in a roll plot or 11-inch x 17-inch format, as requested by the Owner
N. Copies of the preliminary construction sequence typical sections in 11-inch x 17-inch format
O. Electronic files shall be uploaded to the Owner's Procore file management system
P. Traffic data schematics
Q. Traffic projections methodology memo
R. Average daily corridor traffic projections report
S. Risk management plan
T. Draft project management plan
U. Final project management plan
V. Line schematics with traffic data shown
W. Documentation of public involvement activities
X. Utility plan – electronic file in latest version of MicroStation fully compatible with OpenRoads civil design system
Y. Design exception and design waiver documents
Z. Hard copy of a draft hydraulic report for review and comment EE. Culvert hydraulic data sheets and preliminary culvert layouts
AA. Drainage report – one hard copy of final drainage report, one electronic copy of the entire drainage report in PDF format, and computer files of hydrologic and hydraulic modeling with appropriate labeling of location, and submittal date
BB. Retaining wall layouts HH. Geotechnical report
CC. Cost estimates for each milestone submittal
DD. KMZ or KML file of conceptual design schematic created from applicable DGN files for reviewing in Google Earth
EE. Final schematic 3D model created using OpenRoads software

FF. Draft and final copies of traffic analysis report

110.14. Preliminary Cost Estimates. The Engineer shall develop a preliminary cost estimate using the Average Low Bid Unit Price. The Engineer shall estimate the total project cost including preliminary engineering, final engineering, right-of-way (ROW) acquisition, environmental compliance and mitigation, construction, utility relocation, and construction engineering inspection (CEI).

110.16. Geotechnical Borings and Investigations: The Engineer shall determine the location of proposed soil borings for bridge design, embankment settlement analysis, retaining walls, slope stability and along storm drain alignment in accordance with the latest edition of TxDOT's Geotechnical Manual. The Owner will review and provide comments for a boring layout submitted by the Engineer showing the general location and depths of the proposed borings. Once the Engineer receives the Owner review comments they shall perform soil borings (field work), soil testing and prepare the boring logs in accordance with the latest edition of the State's Geotechnical Manual and State District's procedures and design guidelines.

A. The Engineer shall perform all geotechnical work in accordance with the latest version of TxDOT's Geotechnical Manual. All testing shall be performed in accordance with the latest version of TxDOT's Manual of Test Procedures. American Society for Testing Materials (ASTM) test procedures can be used only in the absence of Owner and TxDOT procedures. All soil classification shall be done in accordance with the Unified Soil Classification System.
B. If applicable, the Engineer shall perform any retaining wall analyses to include the settlement analysis. This analysis must include the computation of the factor of safety for bearing capacity, global stability, overturning and sliding. In addition, the Engineer shall include allowable bearing pressure, passive earth pressure, friction factor, settlement analysis (consolidation report) and lateral earth pressure for the retaining walls.
C. If applicable, the Engineer shall perform soil borings, rock coring, coring for pavement removal items, piezometric readings, testing and analysis to include slope stability analysis, settlement analysis, and foundation design recommendations for retaining walls, overhead sign structures, along proposed storm sewer alignments, bridges, embankments, and any temporary soil retaining systems.
D. The Engineer shall provide a signed, sealed and dated geotechnical report which contains, but is not limited to, soil boring locations, boring logs, laboratory test results, generalized subsurface conditions, ground water conditions, piezometer data, analyses and recommendations for settlement and slope stability of the earthen embankments, skin friction tables and design capacity curves including skin friction and point bearing. The skin friction tables, and design capacity curves must be present for piling and drilled shaft foundation.
E. If applicable, the Engineer shall perform scour analysis to include Grain Size distribution curves with D50 value.
F. The Engineer shall sign, seal and date soil boring sheets to be used in the PS&E package. The preparation of soil boring sheets must be in accordance with Owner and TxDOT standards.
G. Foundation Studies: The Engineer shall coordinate with the Owner to determine the location of soil borings to be drilled along the retaining wall alignments. The soil borings shall extend a minimum of 35 feet below the footing elevation or deeper as soil conditions warrant.

Spacing of soil borings shall not exceed 500 feet. The Engineer shall provide a boring layout for the Owner's review and comment.

H. The Engineer shall incorporate soil boring data sheets prepared, signed, sealed, and dated by the Geotechnical Engineer. The soil boring sheets shall be in accordance with WINCORE software as can be found on the Texas Department of Transportation (TxDOT) website.

FUNCTION CODE 120(120) – SOCIAL/ECON/ENVIRON STUDIES

SOCIAL, ECONOMIC AND ENVIRONMENTAL STUDIES AND PUBLIC INVOLVEMENT

120.1. Environmental Documentation Standards

Each environmental service provided by the Engineer must have a deliverable. Deliverables must summarize the methods used for the environmental services and the results achieved. The summary of results must be sufficiently detailed to provide satisfactory basis for thorough review by the Owner and (where applicable) other agencies with regulatory oversight. All deliverables must meet regulatory requirements for legal sufficiency and adhere to the requirements for reports enumerated in the State's National Environmental Policy Act of 1969 (NEPA) Memorandum of Understanding (MOU).

A. Quality Assurance/Quality Control Review

For each deliverable, the Engineer shall perform quality assurance quality control (QA/QC) reviews of environmental documents and on all supporting environmental documentation to determine whether documents conform with:

1. Current Environmental Compliance Toolkit guidance, documentation requirements, and templates published by TxDOT's Environmental Affairs Division (ENV) and in effect as of the date of receipt of the documents or documentation to be reviewed.
2. Current state and federal laws, regulations, policies, guidance, agreements, and memoranda of understanding between the Owner and applicable state or federal agencies; and
3. Guidelines contained in Improving the Quality of Environmental Documents, A Report of the Joint AASHTO/ACEC Committee in Cooperation with the Federal Highway Administration (May 2006) for:
    a. Readability, and
    b. Use of evidence and data in documents to support conclusions.

Upon request by the Owner, the Engineer shall provide documentation that the QA/QC reviews were performed by qualified staff.

B. The Engineer shall maintain the project environmental record in TxDOT's Environmental Compliance Oversight System (ECOS), including project review, completing the work development plan screens, uploading documents, and completing activities as assigned by the District.

C. Deliverables must contain all data acquired during the environmental service and be written to be understood by the public in accordance with TxDOT's Environmental Toolkit guidance, documentation standards, and current guidelines, policies, and procedures.

D. Electronic versions of each deliverable must be written in software that is fully compatible with the software currently used by the Owner and provided in the native format of the document for future use by the Owner. The Engineer shall supplement all hard copy deliverables with electronic copies in searchable Adobe Acrobat™ (.pdf) format unless another format is specified. Each deliverable must be a single, searchable *.pdf file that mirrors the layout and appearance of the physical deliverable. The Engineer shall upload the electronic files to the Owner's Procore file management system in both the document's native format and the PDF format.

E. When the environmental service is to apply for a permit (e.g., USCG permit or USACE permit), the Engineer shall provide the permit and all supporting documentation to the Owner as the deliverable.

F. Submission of Deliverables

1. Deliverables must consist of documentation to support a categorical exclusion (CE) determination, or the preparation of an Environmental Assessment (EA) or an Environmental Impact Statement (EIS), as applicable. Technical reports and documentation must be prepared to support the applicable environmental classification (e.g. CE, EA, or EIS). Additionally, an Open-Ended list Categorical Exclusion Classification Request Form must be prepared to classify the project as an Open-Ended list CE, if needed.
2. All deliverables must comply with all applicable state and federal environmental laws, regulations, procedures, and TxDOT's Environmental Compliance Toolkits, documentation requirements, and templates.
3. On the cover page of any environmental documentation, the Engineer shall insert the following language in a way that is conspicuous to the reader or include it in a CE project record:
   "The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried-out by the City pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated December 9, 2019, and executed by FHWA and TxDOT."

G. The Owner will provide the Owner's and other agency comments on draft deliverables to the Engineer. The Engineer shall revise the deliverable:

1. To include any Owner commitments, findings, agreements, or determinations (e.g., wetlands, endangered species consultation, Section 106, or Section 4(f)), required for the transportation activity as specified by the State.
2. To incorporate the results of public involvement and agency coordination.
3. To reflect mitigation measures resulting from comments received or changes in the transportation activity; and
4. To include with the revised document a comment response form (matrix) in the format requested by the Owner.

H. The Engineer shall provide photographs and graphics that clearly depict details relevant to an evaluation of the project area. Comparable quality electronic photograph presentations

must be at least 1200 x 1600-pixel resolution. The Owner can request images/graphics be provided in another format or quality.

120.2. Environmental Assessment (EA) Content and Format

A. The Engineer shall provide an EA and ensure that:

1. The EA meets the requirements of 23 CFR §771.119 and TAC, Title 43, Part 1, Chapter 2 and the EA content is sufficiently detailed to meet regulatory requirements for legal sufficiency and current (at the time of creation) TxDOT ENV guidance and Environmental Compliance Toolkits.
2. Exhibits to be included in reports or EAs must not exceed 11 inches x 17 inches and must be in color. Text pages must be 8.5-inch x 11 inch. Exhibits and text in reports or EAs must be reproducible via photocopying without loss of legibility. The EA documents must be reproduced on plain white paper unless otherwise approved in advance in writing by the Owner.
3. The EA must use quality maps and exhibits and must incorporate by reference and summarized background data and technical analyses to support the concise discussions of the alternatives and their impacts.

B. Minimum Deliverables: (Additional deliverables to be identified in a task order based on work assigned.)

1. Draft EA
2. Revised Draft EA
3. Draft EA for Public Hearing
4. Final EA with FONSI

120.3. Environmental Impact Statement (EIS) Content and Format

A. The Engineer shall provide an EIS and ensure that:

1. The EIS meets the requirements of 23 CFR §771.115 and 42 TAC §2.84 and the EIS content is sufficiently detailed to meet regulatory requirements for legal sufficiency, and current TxDOT ENV guidance and Environmental Compliance Toolkits
2. Exhibits to be included in reports or EISs must not exceed 11 inches x 17 inches and must be in color. Text pages must be 8.5-inch x 11 inch. Exhibits and text in reports or EISs must be neat and reproducible via photocopying without loss of legibility. Except as noted in specifications in this attachment, EISs must be reproduced on plain white paper unless otherwise approved in advance by the Owner in the task order.
3. The EIS must use quality maps and exhibits and must incorporate by reference and summarize background data and technical analyses to support the concise discussions of the alternatives and their impacts.
4. The format must meet all requirements as specified by TxDOT and comply with the TxDOT Writers Style Guide published by TxDOT's Communications Division.

B. Minimum Deliverables: (Additional deliverables to be identified in a task order based on work assigned.)

1. Draft EIS
2. Revised draft EIS
3. Draft EIS for public hearing
4. Final EIS with ROD

120.4. Environmental Re-evaluation Form

A. The Engineer shall provide an environmental re-evaluation form.
B. Minimum Deliverables:

1. Draft environmental re-evaluation form
2. Final environmental re-evaluation form

120.5. Environmental Technical Analyses and Documentation

A. Definition of technical analyses and documentation for environmental services

In general, technical analyses and documentation for environmental services might include a report, checklist, form, or analysis detailing resource-specific studies identified during the process of gathering data to make an environmental decision.

The Owner may determine what technical reports and documentation are necessary for any given project. The Engineer shall prepare all technical reports and documentation for the Owner with sufficient detail and clarity to support environmental determinations. All technical reports must be compliant with TxDOT's Environmental Compliance Toolkits, documentation requirements, and templates. The environmental document must reference the technical reports.

Environmental technical reports and documentation must include appropriate NEPA or federal regulatory language in addition to the purpose and methodology used in delivering the service. Technical reports and forms must use templates and documentation standards as applicable and include sufficient information to determine the significance of impacts.

B. Minimum Deliverables:

1. Draft technical analyses and documentation
2. Final technical analyses documentation

C. The exact environmental technical analyses and documentation must be determined at the task order level, but can include:

1. Section 4(f) Evaluations

The Engineer shall provide Section 4(f) Evaluations. The Section 4(f) Evaluation must conform to the appropriate TxDOT Section 4(f) checklist for exceptions, de minimums, and programmatic evaluations. For individual Section 4(f) Evaluations, the format and outline must be approved by the Owner beforehand. All Section 4(f) Evaluations must meet the requirements set forth in TxDOT's Environmental Compliance Toolkits.

The 4(f) Section of the environmental document states the reason a Section 4(f) evaluation is being completed. The 4(f) Section of the environmental document discusses the presence of all Section 4(f) properties located in the project area.

2. Section 6(f) Evaluation

The Engineer shall determine if Land and Water Conservation Fund Act funds were used for the Section 4(f) property in accordance with the regulatory requirements and TPWD guidelines and document.

3. Environmental Public Involvement (23 CFR §771.111)

The Engineer shall provide public involvement activities, which might include:

a. Developing a plan for public involvement activities, public involvement plan. The plan must specify all activities to be performed and alternatives to be discussed during public involvement activities. Public involvement activities must be carried out in compliance Attachment A, Article 38, sections J and K of the contract. The plan must also discuss outreach strategies for both the general public and targeted strategies for environmental justice and limited English proficiency populations
b. Compiling, maintaining, and updating a mailing list of people, agencies, and organizations interested in the transportation activity
c. Making all arrangements for public meetings and hearings, including the site of the meetings, mailing and publishing notices, preparation of exhibits, provision for taping or transcription of proceedings, security, and any other arrangements as directed by the Owner. The Engineer shall not hold public meetings or hearings in the absence of Owner personnel.
d. Submitting all legal notices to the Owner for review no less than three weeks prior to publication
e. Arranging a meeting with the Owner to review all exhibits and other materials to be used prior to public meetings or hearings
f. Obtaining the Owner's approval for all legal notices, exhibits, and other materials
g. Providing personnel to staff meetings and hearings; including, people to perform registration, make presentations, and answer questions. Staffing levels of personnel to be provided must be identified in the task order
h. Developing and submitting to the Owner a meeting or hearing documentation packet
i. Developing and sending acknowledgement or response letters to commenters at public meetings or hearings. The Engineer shall not distribute acknowledgement or response letters without prior approval by the Owner
j. Developing, publishing, and distributing a newsletter on the transportation activity, including compiling and maintaining a mailing list. The Engineer shall not distribute the newsletter without prior approval by the Owner
k. Submitting to the Owner a request for development and maintenance of a website to disseminate information on the transportation activity and to gather comments from the public.

l. Providing materials and information regarding the transportation activity to the Owner to be posted on the Owner's website.
m. Ensuring the website conforms to state law, Texas Department of Information Resources requirements, TxDOT policies and procedures, and TxDOT Brand Guidelines.

4. Community Impacts Analysis

The Engineer shall provide community impact analyses. Community impacts includes environmental justice, limited English proficiency, and other issues as addressed in TxDOT environmental guidance. The Engineer shall perform community impact assessments including environmental justice analysis in accordance with Attachment A, Article 38, Sections J and K of the contract. Community impact analyses might include:

a. Community Impacts Assessment Technical Report Form; or
b. Community Technical Report. The report must follow guidance provided in TxDOT's Community Impacts Assessment Toolkit. The assessment may include:
    i. Identification of environmental justice communities within the study area.
    ii. A community profile.
    iii. A displacement analysis.
    iv. An access and travel pattern analysis.
    v. A community cohesion analysis.
    vi. Determination if the project would have disproportionately high and adverse impacts on environmental justice communities. All impacts identified in the Community Impact Assessment and other relevant studies (i.e., noise analysis) must be considered to determine if the impacts disproportionately affect environmental justice communities.
    vii. Identification possible mitigation measures to avoid or minimize any adverse impacts to the environmental justice population within the project area.
    viii. Summary of public involvement process including methods used to accommodate persons with limited English proficiency; and
    ix. Identification of possible mitigation measures including those to avoid and minimize any adverse impacts to the environmental justice population within the project area.

5. Induced Growth Impact Analysis and Cumulative Impacts Analysis

The Engineer shall perform analysis to fulfill the requirements of NEPA and the most current version of TxDOT's Guidance on Preparing Impact Analyses and Cumulative Impacts Analysis Guidelines in TxDOT's Environmental Compliance Toolkits. The extent of the analyses must be determined in the task order.

6. Air Quality Studies

The Engineer shall prepare all required technical reports and the air quality section of all environmental documents in accordance with the current version of the TxDOT's Environmental Handbook for Air Quality and Air Quality Toolkit. The Owner may determine what technical reports and documentation are required for any given project. The required technical reports and documentation might include:

a. Transportation Conformity Report Form and applicable coordination
b. Hot-Spot Analysis Technical Report and applicable coordination,
c. Carbon Monoxide Traffic Air Quality Analysis technical report,
d. Qualitative mobile source air toxics (MSAT) analysis,
e. Quantitative MSAT technical report and conference call,
f. Congestion management process analysis,
g. Applicable disclosure statements in the environmental document as prescribed in the Guidance for Preparing Air Quality Statements,
h. Air quality cumulative and induced growth impacts analysis as specified above in paragraph 120.5, C, 5-Induced Growth Impact Analysis and Cumulative Impacts Analysis and included in the environmental document, and
i. Response to public comments received on air quality issues.

7. Noise Analysis Technical Reporting

The Engineer shall prepare all necessary noise analyses and technical reporting.

a. Noise Analysis Technical Reporting Requirements. At the task order level, the noise analysis technical reporting might include:
    i. Computer modeling of existing and predicted noise levels.
    ii. Field measurements of existing noise levels and validation of existing model.
    iii. Determining predicted noise impact contours for undeveloped property.
    iv. Barrier analysis for impacted receivers.
b. Noise Analysis General Requirements.
    i. The Engineer shall use TxDOT's .DGN file coordinate system for all traffic noise modeling, so that all design files and traffic noise modeling software coordinate systems are the same.
    ii. The Engineer shall provide Owner with all .DXF files used for the traffic noise model.
    iii. The Engineer shall review all proposed noise barrier locations as part of the traffic noise modeling process.
    iv. The Engineer shall not begin identification of noise sensitive land uses unless Owner has approved a Project Coordination Request (PCR).

8. Water Resources Analysis and Documentation

The Engineer shall provide environmental documentation, conduct field surveys, and provide analysis of water resources for compliance with state and federal regulations as described in the Environmental Guide: Volume 2 Activity Instructions, http://ftp.dot.state.tx.us/pub/txdot-info/env/toolkit/060-06-gui.pdf, and the associated

forms, templates, and guidance found in the Water Resources section of the Natural Resources Toolkit, https://www.txdot.gov/inside-txdot/division/environmental/compliance- toolkits/natural-resources.html. The applicable water resource studies must be determined at the task order level. In the case that field surveys are required, then the Engineer shall contact Owner for clearance prior to starting fieldwork. ENV-NRM will verify that approved methods and appropriately permitted and experienced staff will be used.

At the request of the Owner, the Engineer shall provide the following water analysis:

a. Surface Water Analysis Form, including analysis of:
    i. Section 404 of the Clean Water Act
    ii. Section 303(d) of the Clean Water Act
    iii. General Bridge Act/Section 9 of the Rivers and Harbors Act
    iv. Section 10 of the Rivers and Harbors Act
    v. Section 401 of the Clean Water Act
    vi. Executive Order 11990, Protection of Wetlands
b. b. TCEQ Edwards Aquifer Rules Analysis, including:
    i. Preparation of an Edwards Aquifer Protection Plan
    ii. Geologic Assessment for TCEQ Edwards Aquifer Water Pollution Abatement Plan. A Texas licensed Professional Geoscientist (P.G.) must prepare, sign, and seal the Geologic Assessment, according to current TCEQ standards.
    iii. Groundwater Technical Report - Edwards Aquifer. A Texas licensed Professional Geoscientist (P.G.) must prepare, sign, and seal the Groundwater Technical Report.
c. International Boundary Water Commission (IBWC) approval
d. Coastal Barrier Resources Act (CBRA) analysis
e. National Wild and Scenic Rivers Act (NWSRA) analysis
f. Texas Coastal Management Program (TCMP) analysis
g. WOTUS Delineation report prepared in accordance with ENV's Documentation Standard for Waters of the U.S. Delineation Report using ENV's Template: Waters of the U.S. Delineation Report including all supporting forms and exhibits
h. Section 404/10 Impacts Table prepared in accordance with TxDOT ENV's Section 404/10 Impacts Table and Instructions – Preparing a Section 404/10 Impacts Table
i. Section 404/10/9 Permitting Package, including:
    i. USACE PCN Permitting Application prepared in accordance with TxDOT ENV's Documentation Standard for PCN
    ii. USACE IP Permitting Application prepared in accordance with TxDOT ENV's Documentation Standard for IP
    iii. USACE LOP Permitting Application
    iv. USACE RGP Permitting Application
    v. Conditional/Functional Assessment
    vi. Permittee-responsible Mitigation Plan
    vii. Permittee-responsible Mitigation Plan Implementation
    viii. 401 Certification

ix. USCG Bridge Permit Application prepared in accordance with the USCG Bridge Permit Application Guide (BPAG)
x. USCG Exception Request
xi. USCG Navigational Lighting

j. For all WOTUS surveys, the Engineer shall:
   i. Provide the results of the land survey in electronic DGN file format to be incorporated into the schematic and plans. GIS and KMZ files of the land survey must also be provided.
   ii. Determine the acres of permanent and temporary impacts and linear feet of impacts at each WOTUS, and provide figures of the WOTUS and associated impacts overlaying the schematic and plan sheets.

9. Biological/Natural Resources Management Analysis and Documentation.

The Engineer shall provide environmental documentation, conduct field surveys, and provide analysis of biological natural resources for compliance with state and federal regulations as described in the Environmental Guide: Volume 2 Activity Instructions, http://ftp.dot.state.tx.us/pub/txdot-info/env/toolkit/060-06-gui.pdf, and the associated forms, templates, and guidance found in the Natural Resources Toolkit, https://www.txdot.gov/inside-txdot/division/environmental/compliance-toolkits/natural-resources.html. The applicable natural resource studies must be determined at the task order level. In the case that field surveys are required, then the Engineer must contact ENV-NRM for clearance prior to starting work.

ENV-NRM will verify that approved methods and appropriately permitted and experienced staff will be used. At the request of the Owner, the Engineer shall provide the following biological/natural resource analysis:

a. Species Analysis Form, including:
   i. Species Analysis Spreadsheet, which can include a habitat analysis for the entire project area, field surveys for protected species, and presence/absence surveys.
   ii. Tier 1 Site Assessment, which can include early coordination or administrative coordination with TPWD.
   iii. Bald and Golden Eagle Protection Act (BGEPA) analysis and coordination assistance.
b. Farmland Protection Policy Act (FPPA) analysis
c. Marine Mammal Protection Act (MPPA) analysis
d. Essential fish habitat (EFH) analysis
e. Preparation of USFWS/National Marine Fisheries Service (NMFS) species consultation, including: section 7 informal and formal consultation for USFWS/NMFS
f. For all projects within a USFWS Designated Karst Zone or Critical Habitat:
   i. A USFWS permitted biologist must perform the habitat assessment for listed karst invertebrates per USFWS protocols.

ii. A Texas licensed Professional Geoscientist (P.G.) must perform, sign, and seal the karst features survey. The Texas licensed P.G. must have experience in central Texas karst geology.

10. Initial Site Assessment (ISA) with Hazardous Materials Project Impact Evaluation Report

The Engineer shall provide an ISA with Hazardous Materials Project Impact Evaluation Report for the limits of the proposed project in accordance with Statement of Work for Hazardous Materials Processes related to NEPA in the TxDOT Hazardous Materials Management Toolkit (http://www.txdot.gov/inside-txdot/division/environmental/compliance-toolkits/haz-mat.html).

11. Archeological Documentation Services

The Engineer shall provide archeological studies and documentation. All archeological studies must be sufficient to satisfy the current TxDOT Archeological Sites and Cemeteries Toolkit. An archeological background study must be performed prior to field work. If the Engineer was provided with a background study by the State, a new background study is not required.

The Engineer shall provide archeological resource identification, evaluation, and documentation services. In compliance with TxDOT's Environmental Compliance Toolkits, the Engineer shall provide the following archeological services/deliverables:

a. Archeological background study
b. Archeological reconnaissance survey
c. Archeological intensive survey

An archeological survey (reconnaissance or intensive) must be sufficient to satisfy state and federal regulations. The applicable archeological survey must be determined at the task order level. The Engineer shall contact Owner for approval prior to starting field and survey work. ENV-ARCH will verify that approved methods and appropriately permitted and experienced staff will be used.

12. Historic Resource Identification, Evaluation, and Documentation Services

The Engineer shall provide historic resource identification, evaluation, and documentation services. In compliance with TxDOT's Environmental Compliance Toolkits, the Engineer shall provide the following historic resource services/deliverables:

a. Historic Resources PCR,
b. Historic Resources Research Design, and
c. Historic Resource Survey Report, including windshield, reconnaissance, or intensive level documentation.

All services, except the historic resource PCR, must have prior approval by Owner to be performed. The historic resource PCR must be accepted by ENV-HIST prior to survey field work.

13. Floodplain Impacts

The Engineer shall determine whether the transportation activity has the potential to affect floodplains. Studies for floodplain impacts must fulfill the requirements of Executive Order 11988 and 23 CFR 650, Subpart A. Documentation must:

a. Briefly describe the watershed characteristics of the study area in terms of land uses and changes in land use that may affect stream discharge.
b. Briefly describe the streams in the study area, including evidence of stream migration, down cutting, or aggradations.
c. Identify the presence and nature (e.g., zone A, zone AE, zone AE with floodway) of any FEMA mapped floodplains, including the panel number.
d. Indicate the existence of any significant development associated with the mapped area and identify the jurisdiction responsible for the floodplain.
e. Identify the locations where an alternative might encroach on the base (100-year) floodplain (encroachments), where an alternative might support incompatible floodplain development, and the potential impacts of encroachments and floodplain development. This identification must be included in the text and on a map.
f. Include a list of all jurisdictions having control over floodplains for each alternative.
g. Where an encroachment or support of incompatible floodplain development results in impacts, provide more detailed information on the location, impacts, and appropriate mitigation measures. In addition, if any alternative (1) results in a floodplain encroachment or supports incompatible floodplain development having significant impacts, or (2) requires a commitment to a particular structure size or type, the report must include an evaluation and discussion of practicable alternatives to the structure or to the significant encroachment. The report must include exhibits which display the alternatives, the base floodplains and, where applicable, the regulatory floodplains.
h. For each alternative encroaching on a designated or regulatory floodplain, provide a preliminary indication of whether the encroachment is consistent with or requires a revision to the regulatory floodplain. If the preferred alternative encroaches on a regulatory floodplain, the report must discuss the consistency of the action with the regulatory floodplain. In addition, the report must document coordination with FEMA and local or state agencies with jurisdiction indicating that a revision is acceptable or that a revision is not required.
i. If the preferred alternative includes a floodplain encroachment having significant impacts, the report must include a finding that it is the only practicable alternative as required by 23 CFR 650, Subpart A. The finding must refer to Executive Order 11988 and 23 CFR 650, Subpart A. In such cases the report must document compliance with the Executive Order 11988 requirements and must be supported by the following information:
    i. The reasons why the proposed action must be located in the floodplain.
    ii. The alternatives considered and why they were not practicable; and

iii. A statement indicating whether the action conforms to applicable state or local floodplain protection standards

14. Stormwater Permits (Section 402 of the Clean Water Act)

The Engineer shall:

a. describe the need to use the TPDES General Permit, TX 150000. The text must describe how the project will comply with the terms of the TPDES, including the Stormwater Pollution Prevention Plan; and
b. describe the need for Municipal Separate Storm Sewer System (MS4) notification. List MS4 participating municipalities.

120.6. Informal Meetings. The Engineer shall provide technical assistance with preparation of exhibits for, and minutes of informal meetings that are either requested by the public to discuss the pending impacts to neighborhoods and businesses due to roadway shutdowns, detours and access restrictions, or deemed necessary by the Owner. This is not to be confused with the formal public meetings held during the National Environmental Policy Act (NEPA) process during schematic approval for Public Involvement.

120.7. Public Involvement. Based upon the issues (as determined by the Owner), additional public involvement may be required. If required, public involvement may include: i) small group meetings with local officials; ii) stakeholder meetings; The Engineer shall use the following methods for the exchange of information.

1. Small Group and Stakeholder Meetings - The meetings shall be attended by the Engineer, at the request of the Owner, to informally discuss the project. The meetings may be conducted by the Owner or Engineer. Requests for such meetings will be coordinated prior to establishing a meeting date and time. The Engineer shall be responsible for providing the meeting location and contacting the small group members and stakeholders. The Engineer must attend each meeting.

120.8. Environmental Permits Issues and Commitments (EPIC) Sheets. The Engineer shall complete the latest version of the EPIC sheets per information provided by the State. These sheets must be signed, sealed and dated by the Engineer as indicated in signature block.

120.9. Cut and Fill Exhibits. If the information is available, the Engineer shall prepare cut and fill exhibits for delineated wetland.

FUNCTION CODE 130(130) – RIGHT-OF-WAY (ROW) DATA

For Function Codes 130 and 150, the term Surveyor means the firm (prime provider or subprovider) that is providing the surveying services shown in this scope.

The Engineer shall ensure that the following general standards for survey work are followed for Function Codes 130 and 150:

Unless otherwise indicated, any reference in this attachment to a manual, specification, policy, rule or regulation, or law means the version in effect at the time the work is performed. TxDOT manuals are available at: http://onlinemanuals.txdot.gov/manuals/. All surveys must meet or exceed all applicable requirements and standards provided by:(1) Professional Land Surveying Practices Act, (2) General Rules of Procedures and Practices promulgated by the Texas Board of Professional Engineers and Land Surveyors (TBPELS), and (3) the TxDOT Survey Manual. The Surveyor shall perform all work in an organized and professional manner. All surveys are subject to the approval of the Owner.

The Surveyor shall use TxDOT's ROW Preliminary Procedures for Authority to Proceed Manual and TxDOT Survey Manual as the basis for the format and preparation of all right of way (ROW) documents produced, including ROW maps, written parcel descriptions, parcel plats, and other ROW work products, unless otherwise specified by the Owner. Unless otherwise directed by the Owner, the Surveyor shall use (1) the North American Datum of 1983 (NAD83), Texas Coordinate System of 1983 (State Plane Coordinates) applicable to the zone or zones in which the work is performed, with values in U.S. survey feet, as the basis for all horizontal coordinates derived and (2) the datum adjustment currently in use by TxDOT.

Project or surface coordinates must be calculated by applying a combined adjustment factor (CAF) to State Plane Coordinate values. If provided by the Owner, the Surveyor shall use a project specific CAF.

Elevations must be based on the North American Vertical Datum 88 (NAVD88), unless otherwise specified by the Owner.

All work using the Global Positioning System (GPS), whether primary control surveys or other, must meet or exceed the requirements provided by the TxDOT Survey Manual to the order of accuracy specified in the categories listed below or in a task order. If the order of accuracy is not specified in this attachment or in a task order, the work must meet or exceed the order of accuracy specified in the publication listed in this paragraph.

All conventional horizontal and vertical control surveys must meet or exceed the order of accuracy specified in the TxDOT Survey Manual unless specified otherwise in the contract.

All boundary determination surveys, whether for ROW acquisition, ROW re-establishment, or other boundary needs, must meet or exceed the accuracy specified in the TxDOT Survey Manual unless specified otherwise in the contract.

The Owner may authorize the Surveyor to use an Unmanned Aircraft System (UAS) to perform services under this contract. The use of UAS is regulated by the Federal Aviation Administration (FAA). All UAS operators must comply with Federal Aviation Administration (FAA) regulations and the TxDOT Unmanned Aircraft System (UAS) Flight Operations and User's Manual.

The survey data must be fully compatible with the Owner's computer system and with programs in use by the Owner at the time of the submission, without further modification or conversion. The current programs used by TxDOT are Microsoft Word, Bentley MicroStation, Bentley OpenRoads civil design system, Bentley GEOPAK Survey, Excel, and ESRI ArcGIS. Data collection programs must be compatible with the current import formats allowed by GEOPAK Survey and be attributed with current feature codes. These programs may be replaced at the discretion of the Owner.

Drawing sizes are defined, based on American National Standards Institute (ANSI) standard paper sizes, as follows: A-size means 8.5 inches by 11.0 inches, B-size means 11.0 inches by 17.0 inches, C-size means 17.0 inches by 22.0 inches, and D-size means 22 inches by 34.0 inches.

Variations from these software applications or other requirements listed above shall only be allowed if requested in writing by the Surveyor and approved by the Owner.

The Surveyor shall perform quality control/quality assurance on all procedures, field surveys, data, and products prior to delivery to the Owner. The Owner may also require the Surveyor to review the survey work performed by others. If, at any time, during the course of reviewing a submittal of any item it becomes apparent to the Owner that the submittal contains a substantial number of errors, omissions, and inconsistencies, the Owner may cease its review and return the submittal to the Surveyor immediately for appropriate corrective action. A submittal returned to the Surveyor for this reason is not a submittal for purposes of the submission schedule.

The standards for services that are not boundary-related but that relate to surveying for engineering projects may be determined by the construction specifications, design specifications, or as specified by the Owner.

130.1. RIGHT-OF-WAY SURVEYS (15.1.1)

Right-of-Way Surveys includes the performance of surveys to establish land boundaries, preparation of parcel descriptions and parcel plats, and the preparation of right-of-way (ROW) maps.

The Surveyor shall prepare:

A. boundary surveys and create Property Descriptions (metes and bounds plus plats);
B. create GIS files for ROWD/ Real Property Asset Map system; and
C. traditional ROW map as requested by Owner

The standards and deliverables are detailed in Chapter 4, Section 8 of the TxDOT ROW Preliminary Procedures for the Authority to Proceed Manual.

130.2. RIGHT OF WAY MAPPING – TRADITIONAL ROW MAP

If requested in a task order, the Surveyor shall conduct traditional ROW mapping.

Traditional ROW mapping includes ground surveying and preparation of parcel maps, legal descriptions also known as metes and bounds descriptions, and ROW maps.

A. PURPOSE

The purpose of traditional ROW mapping is:

1. To prepare mapping documents suitable for use in the acquisition of real property and the issuance of a title policy.
2. To prepare a map of a resurvey of existing ROW where it is necessary to update or redefine ROW lines.

B. DEFINITIONS

In this attachment, the following definitions shall apply:

1. Abstract Map means a scale drawing prepared from record documents depicting proposed ROW lines, existing ROW lines, easement lines, and private property lines with relevant grantee names, recording data, and recording dates.
2. Closure/Area Calculation Sheet means a computer-generated print-out of the area and the perimeter bearings, distances, curve data, and coordinates of an individual parcel of land to be acquired, including the degree of angular and distance mis-closure for each individual parcel.
3. Denial of Access Line means a line that indicates specific location where access to the roadway is denied.
4. Owner means the current title holder of record as determined by the Real Property Records.
5. Parent Tract means a unit or contiguous units of land under single ownership, comprising a single marketable tract of land consistent with the principle of highest and best use. A parent tract may be described by a single instrument or several instruments. A single parent tract cannot be severed by a public ROW easement, or separate ownership which destroys unity of use.
6. Parent Tract Inset means a small map to an appropriate scale, of the parent tract perimeter placed upon the ROW map in the proximity of the respective parcel. Parent tract insets are used in cases where the parent tract cannot be shown to the same scale as the ROW map. Since parent tract insets are used to identify the limits and location of parent tracts, they must include public ROW, utility easements and fee strips, and identifiable water courses which bound the parent tract.
7. Point of Beginning or POB means a corner of the parcel of land to be acquired, located on the proposed ROW line and being the beginning terminus of the first course of the written property description or plat.
8. Point of Commencing or POC means a monumented property corner identifiable in the real property records that is located outside the proposed ROW corridor. For title purposes, the POC must be a monumented back corner of the parent tract. In the event a monumented back corner of the parent tract cannot be recovered, the nearest identifiable monumented property corner located outside the proposed ROW corridor may be used.
9. Preliminary ROW Layout means a scaled drawing depicting proposed ROW lines, existing ROW lines, proposed pavement, access denial lines, the proposed centerline alignment, private property lines, easement lines, visible improvements, visible utilities, and the station and offset from the centerline alignment to each point of curvature (PC), point of tangency (PT), and angle point in the proposed ROW lines and to each PC, PT, and the angle point in the existing ROW lines in areas of no proposed acquisition.
10. Property Description means a document prepared as an exhibit for the conveyance of a property interest and issuance of a title policy, reflecting the results of a boundary survey, and signed and sealed by a registered professional land surveyor (RPLS), attached to an acquisition deed as Exhibit A, and consisting of the following two parts:

a. Written metes and bounds description delineating the area and the boundary and describing the location of an individual parcel of land unique to all other parcels of land.
b. Parcel plat, which is an ANSI A-size (8.5" x 11") scaled drawing depicting the information recited in the metes and bounds description in 10 a. above, which represents the parcel(s) of land to be acquired.

11. ROW Maps means a series of ANSI D-size (22" x 34") scaled drawings depicting the results of relevant elements of records research, field work, analysis, computation, and mapping required to determine title, delineate areas and boundaries, and locate and describe utilities and improvements to the extent necessary to appraise the value and negotiate the acquisition of individual parcels of private land for a proposed ROW project.

C. PROCEDURE

All standards, procedures, and equipment used by the Surveyor must be such that, at a minimum, the results of the survey is in compliance with the precision and accuracy requirements set forth by the Texas Board of professional Engineers and Land Surveyors (TBPELS) rules.

1. Abstract Map

The Surveyor shall prepare an Abstract Map sufficient to determine the following:

a. All interests of public record held in the land to be acquired.
b. The total record holdings to be acquired from an owner contiguous to a land.
c. All interests in land held in common to be acquired (shopping mall parking lots, subdivision reserves, etc.)
d. All improvements proposed by other agencies that might have a bearing on project development.
e. All called monuments, bearings, and distances in recorded information.

2. ROW Map

The Surveyor shall field locate items such as: property corners, existing ROW markers, improvements, and visible utilities. The Surveyor shall verify and update the planimetric file as directed by the Owner.

Using the Owner's standard title, index, and plan sheets, the Surveyor shall prepare a ROW map for each proposed ROW project. A ROW map must include a title sheet, an index sheet, a survey control index sheet, a horizontal control data sheet, and sufficient plan sheets to cover the proposed project. If requested by the Owner, the Engineer shall prepare additional sheets.

Per the TBPELS and the State, ROW maps need not be signed and sealed by a RPLS.

Plan sheets must include the following:

a. Proposed ROW lines. Proposed ROW lines must be labeled with appropriate bearings, distances, and curve data. Curve data must include the radius, delta angle, arc length, and long chord bearing and distance.
b. Existing ROW lines. Existing ROW lines must be labeled with appropriate bearings, distances, and curve data to the extent necessary to describe the individual parcels of land to be acquired. Curve data must include the radius, delta angle, arc length, and long chord bearing and distance.
c. Proposed project baseline alignment. The proposed project baseline alignment must be labeled with appropriate bearings, distances, and curve data. Curve data must include the station of the curve, point of intersection (PI), radius, delta angle, arc length, tangent length, long chord bearing and distance, and the northing (N) and easting (E) coordinates of the curve PI. All alignment PCs, PTs, and even 500-foot stations must be labeled with its station value.
d. Proposed paving lines. Proposed paving lines combined with relevant existing paving lines must be shown to the extent necessary to compile a complete picture of proposed traffic movements. Proposed paving on the final map submitted to the Owner must be shaded with a dot pattern or highlighted by some other means acceptable to the Owner.
e. Denial of Access lines. Denial of Access lines must be drawn to clearly indicate areas where access is to be denied permitted.
f. Private property lines. Private property lines must be delineated with appropriate bearings, distances, and curve data to the extent necessary to describe the individual parcels of land to be acquired. Curve data must include the radius, delta angle, arc length, and long chord bearing and distance.
g. League lines and survey lines. League lines and survey lines must be shown and identified by name and abstract number.
h. County lines and city limit lines. County lines and city limit lines must be located and identified by name.
i. North arrow. A north arrow must be shown on each sheet, in the upper right corner of the sheet.
j. Monuments. Monumentation must be shown with a description of material and size and if the monument is found or set.
k. PC, PT, and angle points. Station and offset must be shown for each PC, PT, and angle point in the proposed ROW lines. Stations and offsets must be shown with respect to the proposed centerline alignment.
l. Intersecting and adjoining public ROW. Intersecting and adjoining public ROW must be shown and identified by name, ROW width, and recording data.
m. Railroads. Railroads must be shown and identified by name, ROW width, and recording data.
n. Utility corridors. Utility corridors must be identified as to easement or fee.
o. Easements and fee strips. Easements and fee strips must be shown and identified by width, owner, and recording data.
p. Set-back lines. Set-back lines (e.g., building lines) must be shown and identified.
q. Improvements. Visible improvements located within the proposed ROW corridor or within 50 feet of a proposed ROW line must be shown and identified.
r. Structures

i. Structures must be identified as commercial or residential, by number of stories, and as to construction material type (e.g., brick, wood frame).
ii. Structures that are severed by a proposed ROW line must be dimensioned to the extent necessary to completely delineate the severed parts.
iii. Parking areas, billboards, and other on-premise signs that are severed by a proposed ROW line must be dimensioned to the extent necessary to delineate that portion of the parking area, billboard, or sign that is located within the proposed ROW corridor.
iv. For a structure outside of, but within ten feet of, the proposed ROW line, the distance of the structure to the proposed line must be shown. If the location of the structure is determined using a TxDOT supplied planimetric map, any structure within three feet of the proposed ROW line must be verified by field survey.

s. Utilities. Visible utilities located within the proposed ROW corridor or within 50 feet of a proposed ROW line must be shown and identified.
t. Underground fuel storage tanks. Visible location of vents and filler caps of underground fuel storage tanks situated within the proposed ROW corridor or within 50 feet of the corridor must be determined and shown.
u. Points of commencing and points of beginning. POCs and POBs must be shown and labeled. POBs must be shown with their respective N and E surface coordinates. As an exception, a POC will not be required in the case of a total taking without a remainder.
v. Parcels. Each parcel of land to be acquired must be identified by a parcel number, which must appear in the ownership tabulation and on the ROW map in the proximity of the respective parcel. If the Surveyor is unfamiliar with the criteria used by the Owner to assign parcel numbers, the Surveyor shall seek the assistance of the Owner at the time the Abstract Map is complete.
w. Ownership tabulation. An ownership tabulation must be shown that includes the parcel number, existing area of the parent tract, lots and blocks constituting the parent tract when applicable, owner's name, type of conveyance, film code, county clerk's file number, taking area, and remaining area of the parent tract located left or right of the centerline alignment or both. The Surveyor shall provide several blank lines in the tabulation block to facilitate future map additions.
x. Parent tract inset. A parent tract inset must be shown for each parent tract that cannot be shown to scale on the ROW map. When parent tract insets are used, the point of commencing with the appropriate bearing and distance to the point of beginning may be shown on the parent tract inset.
y. Data sources. A note must be included on the title sheet and each map sheet stating the source of bearings, coordinates, and datum used. The note must also include the National Geodetic Survey (NGS) or other basis monument(s) name or identification number, Texas Coordinate System Zone information, epoch information, grid or surface values and the combined adjustment factor or surface adjustment factor.
z. Notes. Appropriate notes must be included on the title sheet and each map sheet stating the following:

i. Month (or months) and year of the abstracting upon which the map is based.
ii. Month (or months) and year the field surveys were conducted upon which the map is based.
iii. Month and year the map was completed by the Surveyor.

aa. Tick marks. The Surveyor shall place four tick marks, one in each quadrant of the map sheet, showing the latitude and longitude (Lat/Long) in decimal degrees and the surface coordinate of each mark. The tick marks may be placed on the match lines of each map sheet, if convenient. A foot note must also be placed on the sheet defining the tick marks as Lat/Long in decimal degrees.

3. Property Descriptions

The Surveyor shall prepare a Property Description for each parcel (or tract for surplus property) consisting of two parts: (1) a metes and bounds description of the property and (2) a parcel plat. Each part of a Property Description must be signed and sealed by a RPLS.

a. Metes and bounds description
The Surveyor shall prepare a metes and bounds description for each parcel of land to be acquired. The Surveyor shall use the TxDOT standard format for metes and bounds descriptions. Metes and bounds descriptions must be submitted in Microsoft Word format and must include the following information:
i. State, county, and original land grant survey within which the proposed parcel of land to be acquired is located.
ii. Reference to unrecorded and recorded subdivisions by name, lot, block, and recording data to the extent applicable.
iii. Reference by name to the grantor and grantee, date and recording data of the most current instrument(s) of conveyance describing the parent tract.

The Surveyor shall use the execution date when citing deed references. The Surveyor shall use the recording or filing dates, making clear which date is being used if the execution date is not explicit on the face of the document.
iv. A POC.
v. A POB with the N and E surface coordinates.
vi. A series of courses, identified by number and proceeding in a clockwise direction, describing the perimeter of the parcel of land to be acquired, and labeled with appropriate bearings, distances, and curve data.
vii. Curve data must include the radius, delta angle, arc length, and long chord bearing and distance.
viii. Each course must be identified either as a proposed ROW line, an existing ROW line, or a property line of the parent tract. Each property line of the parent tract must be described with an appropriate adjoiner call.
ix. A description of all monumentation set or found, which must include size and material.
x. A reference to the source of bearings, coordinates, and datum used.

b. Parcel plat
The Surveyor shall prepare a parcel plat for each parcel of land to be acquired using the Owner's standard format. Parcel plats must include each and every item of information 1) written in the metes and bounds description and 2) shown on the ROW map (if requested by the Owner) for the individual parcel.

D. ADHERENCE TO STANDARDS

For purposes of clarity, consistency, and ease of understanding, the Owner as an acquiring agency of private property for public use, has adopted TxDOT's standards and formats for a ROW map to facilitate the processes of negotiation, appraisal, relocation assistance, and condemnation. The Surveyor shall adhere to these standards and formats to every extent possible.

E. GENERAL SPECIFICATIONS

The following general specifications for 1) description, 2) plat, and 3) ROW mapping apply:

1. Completed ROW maps must be submitted to the Owner in both Bentley MicroStation Design File (DGN) and Adobe Portable Document Format (PDF) format. The maps must have a layout that will produce a D-size final print with a 0.5-inch border.
2. Parcel plats must be submitted to the Owner on A-size bond paper with a 0.5-inch border. Match lines must be used where more than one sheet is required.
3. ROW maps must be drawn to a scale of 1 inch = 50 feet. Scales other than 1 inch = 50 feet may be used with prior approval by the Owner.
4. The minimum lettering size for ROW maps is 0.1 inches at print scale.
5. Parcel plats must be drawn to a scale of 1 inch = 50 feet. Scales other than 1 inch = 50 feet may be used with prior approval by the Owner. In the case of large parcels which are difficult to fit on a single A-size sheet, the Surveyor shall use multiple A-size sheets with match lines.
6. The minimum size lettering for a parcel plat is 0.3 inches at print scale.
7. Property Descriptions shall be submitted on A-size bond paper.

F. GENERAL REQUIREMENTS

The Surveyor shall adhere to the following general requirements:

1. Copies of instruments of record submitted to the Owner must be indexed by parcel number.
2. Coordinates appearing on ROW maps, on parcel plats, and in written property descriptions must be surface coordinates based on the Texas State Plane Coordinate System. The appropriate combined adjustment factors (sea level factor multiplied by the scale factor) for each zone of the coordinate system, which have been developed by TxDOT, must be noted.
   To obtain surface coordinates, the Surveyor shall multiply grid coordinates by the appropriate combined adjustment factor for each zone, as provided by TxDOT.
3. Line and curve tables may be used when necessary.

4. The number of centerline alignment stations shown on a single plan sheet shall be limited to allow approximately four inches between match lines and sheet borders for future details and notes.
5. A minimum four-inch by four-inch space must be reserved at the bottom right corner of each map sheet for future revision notes.
6. If requested by the Owner, the Surveyor shall set a 5/8-inch rebar with a TxDOT aluminum ROW cap (or other appropriate monument) on the proposed ROW line and replace the rebar later with a TxDOT Type II ROW marker.

When the 5/8" rebar with a company rod cap is set for PCs, PTs, PIs, and 1500 foot stations, the double asterisk symbol (**) must be shown on the map sheets and written into and shown in the Property Description and must be accompanied by the following note:

**The monument described, and set may be replaced with a Type II ROW marker upon the completion of the construction project, under the supervision of a RPLS, either employed or retained by the Owner.

When new ROW lines intersect boundary lines of properties creating new boundary corners in the new ROW line, the Surveyor shall place a 5/8- inch rebar with the State's 2-inch aluminum property corner rod cap.

G. GIS SUBMISSION REQUIREMENTS AND STANDARDS

All ROW mapping project task orders are subject to the standards and required ArcGIS deliverables detailed in Chapter 4, Section 8 of TxDOT's ROW Preliminary Procedures for the Authority to Proceed Manual.

H. ELECTRONIC ROW MAP STANDARDS

The primary purpose of this section is to provide instructions on the graphics standards, file management structure, and naming conventions, for ROW mapping electronic deliverables submitted to the TxDOT Right of Way Division by surveying services providers, as part of the ROW package.

The Surveyor shall adhere to the following requirements for electronic map submittals:

1. Bentley MicroStation
   All graphic files for map sheets and parcel plats must be native Bentley MicroStation DGN files created using Bentley OpenRoads civil design system with TxDOT's current seed files, resource files, workspace environment, and settings.

2. Level Library Files
   The Surveyor shall use the TxDOT's current MicroStation level library files for ROW mapping. The files contain all the predefined levels that are typically needed for ROW mapping and include levels for existing utilities.

3. Separate DGN Files for Each Map Sheet
   The Surveyor shall provide one DGN file for each map sheet. Each file must be spatially registered to the project coordinate system.

The sheet file naming convention is "Highway Name Sheet Number.dgn(e.g., ROAD_S01.dgn).

4. Naming convention for the Master Design File or Master ROW Files and Map Sheet.

The recommended naming prefix for design files is MDF (for master design file). Therefore, the prefix must be different for the ROW files because the location of the existing and proposed ROW in the design files from the schematic will change to some degree after an on-the- ground survey is made for a ROW map. Therefore, the prefix might be MRF for master ROW file.

The Surveyor shall provide the corrected Master ROW Files to the design engineer to be used in the final plans, specifications, and estimate (PS&E) so that all features of construction and the relocation of utilities will be correctly placed in relation to the highway ROW and the ROW of cross streets or roadways.

The master ROW file naming convention is: "MRF ROW Logical Name.dgn", with examples as follows:

MRF212104065_Schematic90.dgn (for schematic layout 90% submittal)

MRF212104065_Schematic100.dgn (for schematic layout 100% submittal)

MRF212104065_SchemApprov.dgn (for City projects on State ROW)

MRF212104065_PSEDesign.dgn (for final PS&E design)

MRF212104065_ExROW.dgn (for existing ROW determined by RPLS)

MRF212104065_PropROW.dgn (for proposed ROW of final design) MRF212104065_DeedPlot.dgn (for deed record) MRF212104065_Planimetric.dgn (for aerial mapping topography) MRF212104065_ROWTopo.dgn (for improvements data collection) MRF212104065_DesignTopo.dgn (for design level data collection topography)

MRF212104065_ExUtil.dgn (for existing utilities)

All sheet files with a plan view must have the MRF referenced to allow more than one sheet file to be worked on at the same time.

5. File Structure of Master and Reference DGN Files

If possible, the file structure should not contain subfolders.

6. Lines Weights, Line Styles, Colors, Text Size, Text Fonts, Scale, and Annotations

Legibility is the primary concern when choosing the scale, line weights and text size. Sheets must be legible at full scale sheet size (i.e., D-size drawing) and when reduced to half scale sheet size (B-size drawing size). It is not sufficient that originals or first-generation plots are legible, reproductions (copies) must retain legibility.

The normal scales for a full-sized sheet (i.e., D-size) is 1 inch = 50 feet (urban) and 1 inch = 100 feet (rural). For a half-sized sheet (i.e., B-size) the scale is 1 inch = 100 feet (urban) and 1 inch = 200 feet (rural).

The standard cell library is: TxdotSurv_04.cel or current State cell files; The standard font is Leroy. The standard State color table is: V256COLR.ctb or Txgpk.ctb.

The Surveyor shall use the TxDOT's current GEOPAK Survey SMD file that sets up new feature codes in SMD file for alignment chains, parcel chains and survey chains that can be drawn by GEOPAK Survey from the GPK file with the correct line styles, colors and weights to the designated levels loaded into the DGN by the TxDOT's current level library files.

The Surveyor shall use MicroStation Packager for the submission of electronic deliverables, which captures any non-State standard files (e.g., rsc, cel, text) that were used in the map that look and plot differently in the TxDOT's MicroStation workspace.

7. Text and Line Color considerations

Text and line colors must be legible when using background imagery.

8. Required Data in the GEOPAK ROW GPK File

Alignments, chains of proposed and existing ROW lines, parent tracts and taking parcels, and all other points collected in the field (start with schematic or design GPK file) are required.

If the design GPK file is too detailed for ROW use, the Engineer shall create input files for the information needed for the design GPK file to load into the ROW GPK file.

9. Surface Coordinate and the ROW GIS Geo-Database

Surface adjustment factors and basis of datum must be well documented in the electronic deliverables "file structure/deliverables read me" file.

10. Requirements for Electronic Deliverables
    a. Native MicroStation DGN files (reference files, sheets files, and parcel plats files);
    b. GEOPAK Survey GPK files.
    c. Separate comma delimited point files (ASCII file) in the following coordinate systems: Surface or Projected Coordinates, Grid Coordinates (Texas Coordinate System of 1983 in U.S. Survey feet) and Geographic Coordinates (WGS-84 in decimal degrees). The file will have the following format: point number, northing or latitude, easting or longitude, elevation, feature code, and point description. File naming convention is: Road Name_Type of Coordinates.csv (e.g., Road_Surface.csv, 212101065_Grid.csv, and 212101065_WGS84.csv);
    d. PDF files created in MicroStation of map sheets (both D-size and B-size sheets), one set in black and white and another set-in color if there is orthoimagery for the background.
    e. PDF files and Microsoft Word documents of signed and sealed Property Descriptions and Surveyor's Reports.
    f. Raw and processed GPS files including adjustment reports.

I. ROW MAPPING TASKS TO BE COMPLETED

The Surveyor shall perform the following tasks:

1. Abstracting

The Surveyor shall obtain copies of all existing ownership documents for the parent tracts along with all subdivision plats and recorded documents defining existing easements within, along or intersecting the existing ROW, and prepare an Abstract Map.

2. Field Surveys

The Surveyor shall locate and set additional horizontal and vertical control points, as necessary, at the maximum spacing distance of 1,500 feet; field locate property corners, existing ROW markers, improvements, and visible utilities; verify and update the planimetric file; and as directed by the Owner, perform the following:

a. Obtain right-of-entry to survey on private property and prepare a spreadsheet of the information.
b. Locate existing horizontal and vertical control and verify the control information, locate property corners, and update the planimetric information with any missing visible improvements or visible utilities.

The Surveyor shall base all field work and calculations on the current controls and datum provided by the Owner.

3. Property Description
   a. The Surveyor shall prepare a Property Description(s) for each parcel or tract in the form of a preliminary and a final deliverable(s). Each part of a Property Description shall be signed and sealed by an RPLS. The Surveyor shall prepare preliminary Property Description(s)- for review by the Owner.

      Metes and bounds descriptions

      The Surveyor shall prepare a metes and bounds description for each parcel of land to be acquired. The Surveyor shall follow the standard formats for metes and bounds descriptions that TxDOT has developed.

      Parcel plats

      The Surveyor shall prepare a parcel plat for each parcel of land to be acquired. The Engineer shall follow the standard formats for parcel plats that the State has developed.

      Parcel plats must include all items of information shown on the ROW map that concerns the individual parcel.

   b. The Surveyor shall prepare final deliverables.

The Surveyor shall set appropriate monuments on the proposed ROW lines at intersecting property lines, and at all points of curvature (PC), points of tangency (PT), angle points, intersecting ROW lines of side streets, and at 1,500-foot stations.

The Surveyor shall set appropriate monuments on the existing ROW lines in areas of no acquisition at all PCs, PTs, angle points, and 1,500-foot stations, and as directed by the Owner.

The Surveyor shall set appropriate monuments at intersecting property lines with the new ROW lines.

The Surveyor shall prepare the final ROW (ArcGIS) database template "ROW_Parcels_Edits" populated with the final parcels, final alignment, and project control points in ArcGIS 10.6.1 format or the current version in use by the Owner.

The Surveyor shall prepare final, signed, sealed, and dated Property Descriptions.

4. Traditional ROW Map

The Surveyor shall prepare a traditional ROW map for the specific work location consisting of the existing and proposed ROW lines.

The Surveyor shall work closely with adjoining surveyors to incorporate all relevant information.

The Surveyor shall provide the following:

a. The Surveyor shall prepare a preliminary ROW map for review purposes.
b. The Surveyor shall prepare an initial ROW map for review purposes
c. The Surveyor shall prepare a final ROW map.

5. The Surveyor shall prepare a ROW project cover sheet using the Microsoft Word document template. The ROW project cover sheet must contain the highway, project limits, county, length of project, equations and exceptions, begin and end project information, datum statement, utility table, and signature lines for acquisition.

6. Quality Assurance and Quality Control (QA/QC)

The Surveyor shall conduct a QA/QC review and prepare a check list for each task performed.

The Surveyor shall prepare a surveyor's report regarding their survey procedures, findings, and decisions made.

J. ROW MAPPING DELIVERABLES

The Surveyor shall provide the following:

7. Scanned copies of the ownership documents and one D-size paper copy of the Abstract Map and the associated MicroStation graphics files for review purposes.

8. Field Survey Data
    a. A spreadsheet of the property owners and right-of-entry information.
    b. Scanned copies of the field notes, control data sheets, and a graphics file of all field survey data.

9. Property Description Submittals
    a. Preliminary Property Description Submittals

    One paper copy of the preliminary Property Description(s) for review purposes marked "Preliminary – Not to be used for recording purposes", and an electronic copy of each Property Description in PDF format.

    The ROW (ArcGIS) database template "ROW_Parcels_Edits" populated with the preliminary parcels, alignment, and project control points in ArcGIS 10.6.1 format or the current version in use by TxDOT.

    b. Final Property Description Submittals

    Two paper sets of the final Property Description(s) showing the metes and bounds descriptions and parcel plats, signed and sealed by a RPLS, and the associated electronic files in PDF and Word formats.

    Bentley MicroStation parcel plat graphics files and master reference files (MRF).

    The ROW (ArcGIS) database template "ROW_Parcels_Edits" populated with the final parcels, final alignment, and project control points in ArcGIS 10.6.1 format or the current version in use by the Owner.

10. ROW Map Submittals
    a. Preliminary ROW Map Submittals
    Two ANSI D-size (22" x 34") paper copies and one ANSI B-size (11" x 17") half-scale paper copy of the preliminary ROW map with the note "Preliminary – Not to be used for recording purposes", and the associated MicroStation graphics files.

    b. Initial ROW Map Submittals
    One D-size paper copy of the initial ROW map with the note "Preliminary – Not to be used for recording purposes", and the associated Bentley MicroStation and GIS graphics files.

    c. Final R.O.W. Map Submittals
    Two D-size paper copies and one B-size half-scale paper copy of the final ROW map, and the associated Bentley MicroStation and GIS graphics files.

    PDFs of the final ROW map.

11. Two ANSI A-size (8.5" x 11") paper copies of the ROW project cover sheet and the associated Word document file.

12. QA/QC

Documentation stating that the appropriate monuments were set on the proposed ROW lines at intersecting property lines, PC's, PT's, angle points, ROW lines of side streets and at 1,500-foot stations.

Documentation stating that the appropriate monuments were set on the existing ROW lines in areas of no acquisition at intersecting property lines, PC's, PT's, angle points, ROW lines of side streets and at 1,500- foot stations.

A copy of TxDOT's ROW map checklist signed by the surveyor, if required.

A copy of the surveyor's report signed by the surveyor.

130.4. ROW Hearing Services

A. ROW Hearing Services

The Engineer shall prepare color exhibits for eminent domain hearing cases (assume 8 exhibits). The exhibits must depict the subject property boundaries and the proposed ROW acquisition shown on an aerial map background. The exhibits must also show the pavement edges, drainage or other structures, and driveways.

The Engineer shall prepare for the eminent domain hearings by reviewing the approved design schematic and associated reports, cross-sections, ROW maps, and pertinent plan sheets provided by others, including those showing roadway, bridge, grading, drainage, signals, signs, intelligent transportation systems (ITS), illumination, traffic control plan and other elements or data.

The Engineer shall attend by teleconference pre-hearings (assume 8 meetings) for eminent domain proceedings. The Engineer shall also attend, in person, pre-hearings (assume 8 meetings) for eminent domain proceedings near the project location.

Deliverables include all services and documents stated in this section.

B. Expert Witness Services

The Engineer shall attend and provide expert witness services for eminent domain hearings (assume 8 hearings) at the TxDOT Area Office near the project location. Assume that hearings, on average, last no longer than four hours.

The Engineer shall prepare for and provide expert testimony in eminent domain trial cases (assume 8 trials) at the county courthouse near the project location. Preparation includes the developing color exhibits, reviewing material, and providing depositions.

Assume that depositions, on average, last no longer than four hours and that trial cases, on average, last no longer than two days.

Deliverables include all services and documents stated in this section.

130.5. Utility Engineering Investigation

Utility engineering investigation includes utility investigations subsurface and above ground prepared in accordance with ASCE/CI Standard 38-02 [(http://www.fhwa.dot.gov/programadmin/asce.cfm)] and Utility Quality Levels.

A. Utility Quality Levels (QL)

Utility Quality Levels are defined in cumulative order (least to greatest) as follows:

1. Quality Level D - Quality level value assigned to a utility segment or utility feature after a review and compilation of data sources such as existing records, oral recollections, One-Call markings, and data repositories.
2. Quality Level C - Quality level value assigned to a utility segment or utility feature after surveying aboveground (i.e., visible) utility features and using professional judgement to correlate the surveyed locations of these features with those from existing utility records.
3. Quality Level B - Designate: Quality level value assigned to a utility segment or subsurface utility feature whose existence and position is based upon appropriate surface geophysical methods combined with professional judgment and whose location is tied to the project survey datum. Horizontal accuracy of Designated Utilities is 18" (including survey tolerances) unless otherwise indicated for a specific segment of the deliverable. Quality Level B incorporates quality levels C and D information. A composite plot is created.
4. Quality Level A – Quality level value assigned to a portion (x, y, and z geometry) of a point of a subsurface utility feature that is directly exposed, measured, and whose location and dimensions are tied to the project survey datum. Other measurable, observable, and judged utility attributes are also recorded (per District Best Practices). The utility location must be tied to the project survey datum with an accuracy of 0.1 feet (30-mm) vertical and to 0.2 feet (60-mm) horizontal. As test holes may be requested up front or during the project, test holes done prior to completion of QL D, C, or B deliverables must be symbolized on the QL B deliverable with a call out indicating test holes number. This is in addition to and not in lieu of the test hole.

B. Utility Investigations Methodology

1. Utility Investigation Quality Level D The Engineer shall:
    a. Perform records research from all available resources. Sources include, but are not limited to: Texas811, Railroad Commission of Texas (Texas RRC), verbal recollection, as-built information from plans, plats, permits and any other applicable information provided by the utility owners or other stakeholders.
    b. Document utility owners and contact information.
    c. Create a utility drawing of information gathered.

2. Utility Investigation Quality Level C

The Engineer shall:

a. In combination with existing Quality Level D information, utilize surveyed above-ground utility features and professional judgement to upgrade Quality Level D information to Quality Level C. For those utilities unable to be upgraded, retain as Quality Level D.
b. Overhead utilities information must be gathered and depicted. Sag elevations of lowest utility must be documented at road crossings, per best practices document.
c. Storm and sanitary sewer information must be gathered from Level D and upgraded to Level C as possible, unless otherwise directed by the Owner.
d. Mapping of underground vaults may be requested by the Owner.
e. Create composite utility drawing of information gathered.

3. Designate (Quality Level B)

Designate means to indicate the horizontal location of underground utilities by the application and interpretation of appropriate non- destructive surface geophysical techniques and reference to established survey control. Designating (Quality Level B) services are inclusive of Quality Levels C and D.

The Utility Engineer must:

a. As requested by the Owner, compile "as-built" information from plans, plats and other location data as provided by the utility owners.
b. Coordinate with utility owner when utility owner's policy is to designate their own facilities at no cost for preliminary survey purposes. The Engineer shall examine utility owner's work to ensure accuracy and completeness.
c. Designate, record, and mark the horizontal location of the existing utility facilities using non-destructive surface geophysical techniques.
d. Using both active and passive scans to attempt to locate any additional utilities, including unrecorded and abandoned storm and sanitary sewer facilities, at the direction of the Owner, utilities maybe investigated using additional methods such as rodding that would then classify them as Quality Level B. A non-water based pink paint or pink pin flags must be used on all surface markings of underground utilities.
e. Correlate utility owner records with designating data and resolve discrepancies using professional judgment. The Utility Engineer must prepare and deliver to Owner a color-coded composite utility facility plan with utility owner names, quality levels, line sizes and subsurface utility locate (test hole) locations. The Utility Engineer and Owner acknowledge that the line sizes of designated utility facilities detailed on the deliverable will be from the best available records and that an actual line size is normally determined from a test hole vacuum excavation. A note must be placed on the designate deliverable only that states "lines sizes are from best available records". All above-ground utility feature locations must be included in the deliverable to the Owner. This information must be provided in the latest version of OpenRoads civil design system used by the

Owner. The electronic file will be uploaded to the Owner's Procore file management system, as required by the Owner. A hard copy is required and must be signed, sealed, and dated by the Utility Engineer. When requested by the Owner, the designated utility information must be over laid on the Owner's design plans.

f. Determine and inform the Owner of the approximate electronic utility depths at critical locations as determined by the Owner. The limits of this additional information should be determined prior to the commencement of work. This depth indication is understood by both the Engineer and the Owner to be approximate only and is not intended to be used preparing the right of way and construction plans.
g. Provide a monthly summary, with weekly updates, of work completed and in process with adequate detail to verify compliance with agreed work schedule.
h. Provide documentation to show that permits have been closed out as required.
i. Clearly identify all utilities that were discovered from Quality Levels C and D investigation but cannot be depicted in Quality Level B standards. These utilities must have a unique line style and symbology in the designate (Quality Level B) deliverable.
j. Comply with all applicable TxDOT policy and procedural manuals.

4. Subsurface Utility Locate (Test Hole) Service (Quality Level A)

Locate is the process used to obtain precise horizontal and vertical position, material type, condition, size, and other data that may be obtainable about the utility facility and its surrounding environment through exposure by non-destructive excavation techniques that ensures the integrity of the utility facility. Subsurface Utility Locate (Test Hole) Services (Quality Level A) are inclusive of Quality Levels B, C, and D.

The Utility Engineer must:

a. Review requested test hole locations and advise the Owner in the development of an appropriate locate (test hole) work plan relative to the existing utility infrastructure and proposed highway design elements.
b. Coordinate with utility owner inspectors as may be required by law or utility owner policy.
c. Place Texas 811 ticket 48 hours prior to excavation.
d. Neatly cut and remove existing pavement material, such that the cut does not exceed 0.10 square meters (1.076 square feet) unless unusual circumstances exist.
e. Measure and record the following data on an appropriately formatted test hole data sheet that has been sealed and dated by the Engineer:
    i. Elevation of top of utility tied to the datum of the furnished plan.
    ii. Minimum of two benchmarks utilized. Elevations must be within an accuracy of 15mm (.591 inches) of utilized benchmarks.
    iii. Elevation of existing grade over utility at test hole location.
    iv. Horizontal location referenced to project coordinate datum.

v. Outside diameter of pipe or width of duct banks and configuration of non-encased multi-conduit systems.
vi. Utility facility material(s).
vii. Utility facility condition.
viii. Pavement thickness and type.
ix. Coating/wrapping information and condition.
x. Unusual circumstances or field conditions.

f. Excavate test holes in such a manner as to prevent any damage to wrappings, coatings, cathodic protection or other protective coverings and features. Water excavation can only be utilized with written approval from the Owner.
g. Be financially responsible for any damage to the utility during the locating process. In the event of damage, the Utility Engineer must stop work, notify the appropriate utility facility owner, the Owner and appropriate regulatory agencies. The regulatory agencies include: The Texas Railroad Commission and the Texas Commission on Environmental Quality. The Utility Engineer must not resume work until the utility facility owner has determined the corrective action to be taken. The Utility Engineer must be liable for all costs involved in the repair or replacement of the utility facility.
h. Back fill all excavations with appropriate material, compact backfill by appropriate mechanical means, and restore pavement and surface material. The Engineer is responsible for the integrity of the backfill and surface restoration for a period of three years.
i. Furnish and install a permanent above-ground marker (as specified by the Owner), directly above center line of the utility facility.
j. Provide complete restoration of work site and landscape to equal or better condition than before excavation. If a work site and landscape is not appropriately restored, the Utility Engineer must return to correct the condition at no extra charge to the Owner.
k. Plot utility location position information to scale and provide a comprehensive utility plan signed and sealed by the responsible Engineer. This information must be provided in the latest version of MicroStation and be fully compatible with the OpenRoads civil design system used by the Owner. The electronic file will be uploaded to the Owner's Procore file management system as requested. When requested by the Owner, the locate information must be over laid on the Owner's design plans.
l. Return plans, profiles, and test hole data sheets to the Owner. If requested, conduct a review of the findings with the Owner.
m. Close-out permits as required.

130.6. Utility Adjustment Coordination. (18.3.1)

Utility Adjustment Coordination shall include utility coordination meetings with individual utility companies, communication and coordination with utilities, and preparation of utility agreement assemblies including utility agreements, joint use agreements, and advanced funding agreements.

The Engineer is responsible for designating and providing the services of the following individuals or entities:

1. Utility Coordinator: individual or entity performing Utility-related Services that are not required to be performed by a licensed engineer under Texas law.
2. Utility Engineer: individual or entity performing Utility-related Services that are required to be performed by a licensed engineer under Texas law.

A. Utility Coordination

The Utility Coordinator shall perform utility coordination and liaison activities with involved utility owners, their consultants, and the Owner to achieve timely project notifications, formal coordination meetings, conflict analysis and resolution.

a. The Utility Coordinator shall coordinate all activities with the Owner, or their designee, to facilitate the orderly progress and timely completion of the project design phase. The Utility Coordinator shall be responsible for the following:
    i. Work Plan. Coordinate a work plan including a list of the proposed meetings and coordination activities, and related tasks to be performed, a schedule and an estimate. The work plan must satisfy the requirements of the project and must be approved by the Owner prior to commencing work.
    ii. Orientation. Prepare and present, in collaboration with Owner staff, instruction and orientation sessions as required by the Owner. The instruction shall introduce the subsurface utility engineering process, demonstrate the technology, and facilitate the preparation of work orders, billings, and contract related documentation.
    iii. Initial Project Meeting. Attend an initial meeting and an on-site inspection (when appropriate) to ensure familiarity with existing conditions, project requirements and prepare a written report of the meeting.
    iv. External Communications. The Utility Coordinator shall coordinate all activities with the Owner and its consultants or other contractors or representatives, as authorized by the Owner. Also, the Utility Coordinator shall provide the Owner copies of diaries, correspondence, and other documentation of work- related communications between the Utility Coordinator, utility owners and other outside entities when requested by the Owner.
    v. Permits and rights of entry. Obtain all necessary permits from city, county, municipality, railroad, or other jurisdiction to allow the Engineer to work within existing streets, roads or private property for additional designating and/or subsurface utility locating.
    vi. Progress Meetings. The Utility Coordinator shall implement a schedule of periodic meetings with each utility company and owner or owner's representatives for coordination purposes. Such meetings shall commence as early as possible in the design process and shall continue until completion of the project. The Utility Coordinator shall notify the Owner at least two (2) business days in advance of each meeting to allow the Owner the opportunity to participate in the meeting. The Utility Coordinator shall provide and produce meeting minutes of all meetings

with said utility companies, owners or owners' representatives within seven (7) business days. The frequency of such meetings shall be appropriate to the matters under discussion with each utility owner.

b. As required by the Owner the Utility Coordinator shall coordinate with the local utilities committees to present a footprint of the Owner's projects with represented utility companies and owners. The Utility Coordinator shall also coordinate with any other utility committees which may include county, city, or other officials, if needed.
c. The Utility Coordinator shall provide initial project notification letters to all affected utility companies, owners, and other concerned parties.
d. The Utility Coordinator shall provide the Owner and all affected utility companies and owners a Utility Contact List for each project with the following information: (i) Owner's Name; (ii) Contact Person; (iii) Telephone Numbers; (iv) Emergency Contact Number; (v) E-mail addresses; (vi) as well as all pertinent information concerning their respective affected utilities and facilities, including but not limited to: size, number of poles, material, and other information which readily identifies the utilities companies' facilities.
e. The Utility Coordinator shall advise utility companies and owners of the general characteristics of the Project and provide an illustration of the project footprint for mark-up of the utility facility locations that occupy the project area.

B. Utility Agreements for Utility Adjustments.

The Utility Coordinator shall coordinate with utilities that conflict with highway construction or the "Utility Accommodation Rules" (UAR) and make the utility company aware of these conflicts. The Utility Coordinator shall assist the utility companies in the preparation of required agreements associated with the funding of adjustments and the occupation of Owner right of way.

a. Utility Agreement Assemblies: A packaged agreement consisting of a Utility Joint Use Acknowledgement, Standard Utility Agreements, Plans on 11x17 sheets, Statement of contract work form, Affidavit form and copy of recorded easement, schedule of work and various attachments as detailed in the UAR and the State's Utility Manual.
b. The Utility Coordinator shall submit the required number of executed copies of the Utility Agreement assemblies, which include the appropriate Forms as detailed in the UAR and available by the State, a copy of the recorded easement Deed, plans, and estimate to the Owner by letter recommending approval. <u>The utility should be reimbursed eligible costs incurred within their easement limits for replacement in kind</u>, as detailed in the UAR. The transmittal should also provide a description of the work being done as well as the estimated cost and schedule of work. The Utility Coordinator shall not perform engineering of relocation plans relative to a particular Utility Agreement under this supplemental as this is a cost of Right of Way that is subsidiary to the specific Utility Agreement.

c. The Utility Coordinator shall be solely responsible for determining which utilities will be installed by Agreement. The Utility Coordinator shall Process all form ROW-U-JUAA's and Utility Agreements, determine necessity of any Escrow Agreements, and forward to the Owner for final approval.
d. The Engineer, with the assistance of the Utility Coordinator, shall be responsible for the timely coordination, review, and submittal of all documentation to be included in all the Utility Agreements, with such documents conforming to the requirements of 23 C.F.R. Section 645A. The Engineer, with the assistance of the Utility Coordinator, shall assist in the preparation, compilation, gathering, and collection of all required and supporting documents to be included with the Utility Agreements.
e. For each Utility, the Utility Coordinator shall obtain the records for all utility owners' costs in accordance with 23 C.F.R. Section 645A, in a format that is compatible with the estimate attached to the Utility Adjustment Agreement and with sufficient detail for analysis. The totals for labor, overhead, construction costs, travel, transportation, equipment, materials, supplies and other services shall be shown in such a manner as to permit comparison with the approved estimate.
f. The Engineer shall maintain a complete set of records for all Utility Adjustment Costs for each Utility for a period sufficient to complete all final payments to the utility companies or owners.

130.7. Access Management.

The Engineer shall coordinate and evaluate access management within the project limits in accordance with the latest State Access Management Manual or as directed by the Owner.

FUNCTION CODE 145(145, 164) – MANAGING CONTRACTED/DONATED PE

CONTRACT MANAGEMENT AND ADMINISTRATION

145.1. Contract Management and Administration

The Engineer shall:

A. Act as an agent for the Owner when specified in a task order.
B. Produce a complete and acceptable deliverable for each environmental service performed for environmental documentation.
C. Incorporate environmental data into identification of alternatives.
D. Notify the Owner of its schedule, in advance, for all field activities.
E. Notify the Owner as soon as practical, by phone and in writing, if performance of environmental services discloses the presence or likely presence of significant impacts (in accordance with 40 Code of Federal Regulations (CFR) 1500-1508). Inform the Owner of the basis for concluding there are significant impacts and the basis for concluding that the impacts might require mitigation.
F. Notify the Owner as soon as practical, by phone and in writing, if performance of environmental services results in identification of impacts or a level of controversy that might

elevate the transportation activity's status from a categorical exclusion or environmental assessment. The Owner will reassess the appropriate level of documentation.

145.2. Project Management and Administration

The Engineer, in association with the Owner's Project Manager shall be responsible for directing and coordinating all activities associated with the project to comply with Owner policies and procedures, and to deliver that work on time.

Project Management and Coordination. The Engineer shall coordinate all subconsultant activity to include quality of and consistency of plans and administration of the invoices and monthly progress reports. The Engineer shall coordinate with necessary local entities.

The Engineer shall:

- Prepare monthly written progress reports for each project.
- Develop and maintain a detailed project schedule to track project conformance to Exhibit C, Work Schedule, for each task order. The schedule submittals shall be hard copy and electronic format.
- Meet on a scheduled basis with the Owner to review project progress. Prepare, distribute, and file both written and electronic correspondence.
- Prepare and distribute meeting minutes.
- Document phone calls and conference calls as required during the project to coordinate the work for various team members.
- Provide QC/QA documentation for all submittals, including the sub consultants.

FUNCTION CODE 160(150) – ROADWAY DESIGN

150.1. DESIGN AND CONSTRUCTION SURVEY

A. DEFINITIONS

1. Design Survey (15.2.1)

A design survey gathers data in support of transportation systems design. A design survey includes the research, field work, analysis, computation, and documentation necessary to provide detailed topographic (3- dimensional) mapping of a project site (e.g., locating existing ROW, surveying cross-sections or developing data to create cross-sections and digital terrain models, horizontal and vertical location of utilities and improvements, collecting details of bridges and other structures, review of ROW maps, establishing control points).

2. Construction Survey (15.2.2)

A construction survey provides data in support of transportation systems construction. A construction survey may include reconnaissance, field work, analysis, computation, and documentation necessary to provide horizontal and vertical positions of specific ground

points to establish lines or grades or for the validation of quantities of materials placed or removed. Construction layout and staking is included in this category.

B. TECHNICAL REQUIREMENTS FOR DESIGN AND CONSTRUCTION SURVEYS

1. Design surveys and construction surveys must be performed under the supervision of a RPLS currently registered with the TBPELS.

2. All control must meet the of accuracy requirements of TxDOT.

   The Surveyor shall comply with the standards of accuracy for control traverses provided in the TxDOT Survey Manual or the TSPS Manual of Practice for Land Surveying in the State of Texas, as may be applicable.

3. Short traverse procedures used to determine horizontal and vertical locations must meet the following criteria:
   a. Short traverses must begin and end on horizontal and vertical ground control as described above.
   b. Required horizontal accuracy (unless otherwise stated):
      i. Bridges and other roadway structures: less than 0.1 feet.
      ii. Utilities and improvements: less than 0.2 feet.
      iii. Cross-sections and profiles: less than 1 foot.
      iv. Bore holes: less than 3 feet.
   c. Required vertical accuracy:
      i. Bridges and other roadway structures: less than 0.02 feet.
      ii. Utilities and improvements: less than 0.1 feet.
      iii. Cross-sections and profiles: less than 0.2 feet.
      iv. Bore holes: less than 0.5 feet.

C. DATA REQUIREMENTS FOR DESIGN AND CONSTRUCTION SURVEYS

1. Planimetric DGN files must be fully compatible with the version of the MicroStation graphics program currently used by TxDOT without further modification or conversion.
2. Electronically collected and processed field survey data files must be fully compatible with TxDOT's computer systems without further modification or conversion. All files must incorporate only those feature codes currently being used by TxDOT.
3. Digital terrain models (DTMs) must be fully compatible with the version of the Bentley OpenRoads civil design system currently used by TxDOT without further modification or conversion. All DTM must be fully edited to provide a complete digital terrain model with all necessary break lines.

150.2. DESIGN SURVEY (15.2.1)

A. TASKS TO BE COMPLETED

Design Surveys

If requested by the Owner, the Surveyor shall perform one or more Design Surveys. Design Survey tasks include the following:

1. Collect data to create cross-sections and DTMs.
2. Locate existing utilities.
3. Locate existing improvements.
4. Provide details of existing bridge structures, including bridge limits, bents, columns, retaining walls, and natural ground elevations.
5. Locate details of existing drainage features including culverts, manholes, retention and detention ponds, flowlines, and associated features.
6. Locate all waters of the United States (WOTUS), including wetlands.
7. Review existing ROW maps and locate the existing ROW.
    a. Review existing ROW maps
    The Surveyor shall review ROW maps prepared by others for completeness using the current schematic and the checklist provided by the TxDOT district.
    b. Locate existing ROW
    The Surveyor shall resurvey the existing ROW where it is necessary to update or redefine ROW lines. All standard surveying procedures must be adhered to including record research, recovering existing monuments, and replacing monuments as appropriate. The Surveyor shall prepare an abstract map, preliminary map, final map, GIS graphics file, and a Surveyor's report. The final map must also include a monument table showing the property monuments that were found and set and certified by the Surveyor. The Surveyor shall prepare maps either in standard map sheets format or roll map format as requested by the Owner.
8. Locate boreholes.
9. Perform hydrographic surveys, according to details requested by the Owner
10. Verify the condition and usefulness of existing control points including verification of the values. Establish additional control as needed. Tie to other control points in the project vicinity including points established by the NGS, the Federal Emergency Management Agency (FEMA), and any other local entities as directed by the Owner.
11. Update existing control information and prepare new survey control data sheets, as directed by the Owner to be included in the construction plan set as described below:
    a. a. The Surveyor shall prepare, sign, seal, and date a survey control index sheet and horizontal and vertical control sheet(s) to be inserted into the plan set.
    b. b. The survey control index sheet provides an overview of the primary project control and must include:
        i. An unscaled vicinity map showing the general location of the project in relation to nearby towns or other significant cultural features.
        ii. A scaled project map showing the extents of the project and the location of the primary control points. The map must show street networks, selected street names, control point identification, and significant cultural features necessary to provide a general location of the primary control.
        iii. A table containing the primary control point values including the point number, northing, easting, elevation, stationing, and stationing offset values.

iv. Map annotation including a graphic scale bar, north arrow, and standard title block. The title block shall contain a section for the OWNER, city, and highway name. The title block shall also contain a section for a Texas registered engineer to sign, seal and date the sheet to include the following statement, "The survey control information has been accepted and incorporated into this PS&E." The required format of the survey control index sheet can be downloaded from the TxDOT website.

v. In the title block under the heading "Notes", identification of the horizontal and vertical datum on which the primary control is based with the date of the current adjustment, the surface adjustment factor used, and unit of measure. The Surveyor shall include a note stating that the coordinates re State Plane and a notation specifying either grid or surface adjusted coordinates.

c. The Surveyor shall prepare horizontal and vertical control sheets providing detailed information about the construction, location, and monumentation of the primary control, which must include:

i. An unscaled location map for each primary control point showing the location of the monument in relation to physical features located in the vicinity. The location map must include a north arrow, the monument designation, the monument northing, easting, and elevation.

ii. Directly below the location map a text description of the monument including size, material and construction followed by a description of the location of the monument starting with the county and state followed by a description suitable to locate the monument on the ground.

iii. Map annotation including a graphic scale bar, north arrow, and a standard title block. The title block must contain a section for the Owner, city, and highway name and contain a section for a Texas registered engineer to sign, seal and date the sheet to include the following statement, "The survey control information has been accepted and incorporated into this PS&E." The required format of the survey control index sheet can be downloaded from the TxDOT website.

iv. In the title block under the heading "Notes", identification of the horizontal and vertical datum on which the primary control is based with the date of the current adjustment, the surface adjustment factor used, and unit of measure. The Surveyor shall include a note stating that the coordinates are either grid or surface adjusted coordinates.

150.3. CONSTRUCTION SURVEY (15.2.2)

A. TASKS TO BE COMPLETED

If requested by the Owner, the Surveyor shall perform Construction Surveying. Construction Surveying tasks include the following:

1. Recover and check existing control points.
2. Establish additional control points.
3. Stake existing or proposed ROW.

4. Stake existing or proposed baseline/centerline.
5. Stake proposed bridge structures.
6. Stake proposed drainage structures (e.g., manholes, culverts, etc.).
7. Set grade stakes.
8. Check elevations and locations of structures.
9. Determine and resolve conflicts within the survey data.

150.4. DELIVERABLES FOR DESIGN AND CONSTRUCTION SURVEYS

The Surveyor shall prepare and submit the deliverables as specified in individual task orders for design surveys and construction surveys. The deliverables might be any combination of the following:

A. Digital terrain models (DTM) and the triangular irregular network (TIN) files in a format acceptable by the Owner.
B. Maps, plans, or sketches prepared by the Surveyor showing the results of field surveys.
C. Computer printouts or other tabulations summarizing the results of field surveys.
D. Digital files or media acceptable by the Owner containing field survey data (ASCII data files).
E. Maps, plats, plans, sketches, or other documents acquired from utility companies, private corporations, or other public agencies, the contents of which are relevant to the survey.
F. Field survey notes, as electronic and hard copies.
G. TxDOT Form 2462 for each primary and secondary control point. This form must be submitted in printed format on letter (i.e., A-size) and submitted electronically in PDF format.
H. A digital and hard copy of all computer printouts of horizontal and vertical conventional traverses, GPS analysis and results, and survey control data sheets.
I. All GEOPAK files and OpenRoads files.
J. Survey reports in a format requested by the Owner.

150.5. MAPPING (15.3)

Mapping includes the geospatial data collection and mapping by means of aerial photogrammetry, terrestrial (close range) photogrammetry, terrestrial LiDAR, mobile LiDAR, and other remote sensing technologies.

A. PURPOSE

The purpose of mapping is to provide map and related data to support transportation projects including project design and other uses.

B. DEFINITIONS

1. Aerial Photogrammetry (15.3.1) – Aerial Photogrammetry means the collection and processing of photography acquired from an airborne platform to develop DGN and DTM files.

2. Terrestrial Photogrammetry (15.1.2) – Terrestrial Photogrammetry means the collection and processing of photography acquired at or near ground level to develop DGN and DTM files.
3. Airborne LiDAR (15.3.4) – Airborne LiDAR means laser scanning equipment mounted on a helicopter or other airborne platform to collect data to process for DGN and DTM files.
4. Terrestrial LiDAR (15.3.3) – Terrestrial LiDAR means laser scanning equipment operated from a stationary base on the earth's surface to collect data to process for DGN and DTM files.
5. Mobile LiDAR (15.3.4) – Mobile LiDAR means laser scanning equipment mounted on a moving vehicle operating on the earth's surface to collect data to process for DGN and DTM files.
6. UAS means Unmanned Aircraft Systems (e.g., drones).
7. UAS LiDAR means laser scanning equipment on an unmanned aerial vehicle (e.g., drones) to collect data to process for DGN and DTM files.

150.6. AERIAL MAPPING USING A METRIC CAMERA AND MANNED AIRCRAFT

Aerial mapping using a metric camera and manned aircraft includes the collection of digital aerial imagery using a calibrated large-format metric aerial camera, performing relative orientation of the imagery through the collection of tie and pass points between adjacent aerial photo frames, performing a least- squares bundled absolute orientation adjustment using ground control points supplemented with airborne GPS and inertial measurement unit (IMU) data, and deriving data from the processed imagery including compilation of planimetric and topographic maps, creation of point cloud digital elevation model (DEM) and digital terrain model (DTM) data, and production of orthophotography.

The Surveyor shall provide the services of a certified Photogrammetrist to perform or oversee the tasks under function code 150.6. The Surveyor remains ultimately responsible and shall ensure that the work is performed as required.

A. PURPOSE

The purpose of aerial mapping using a metric camera and manned aircraft is to provide map and related data to support transportation projects including project design and other uses.

B. DEFINITIONS

In 150.6, 150.7, and 150.8 the following definitions apply:

1. Photogrammetrist means an American Society for Photogrammetry and Remote Sensing (ASPRS) Certified Photogrammetrist with a current certification.
2. Mapping Scientist means an American Society of Photogrammetry and Remote Sensing (ASPRS) Certified Scientist-UAS with a current certification.
3. Metric Aerial Photograph means a vertical photograph taken from a manned aircraft using a large format calibrated digital metric aerial mapping camera.

4. Non-Metric aerial photograph means a vertical or oblique photograph taken from a fixed- or rotary-wing unmanned aircraft system (UAS) aircraft using a non-metric small format consumer-grade digital camera.
5. Large-format digital metric camera means a camera using charge- coupled device (CCD) or complementary metal oxide semiconductor (CMOS) technology to capture an image with a minimum final image size of 11500 by 7500 pixels.
6. Analytical triangulation means the process of developing absolute orientation parameters for individual photogrammetric stereo models through the use of image tie and pass points combined with ground control in a fully weighted least-squares bundle adjustment. Airborne GPS and IMU data may be used to reduce the number of ground control points.
7. Ground control means points established on the ground by the Surveyor and for which the Northing, Easting, and Elevation coordinates have been determined sufficient in number and geospatial distribution to allow analytical triangulation and mapping to meet the required project accuracy. Ground control can be targeted using paint or other marker material or can be non-targeted.
8. Airborne GPS/IMU – An airborne GPS receiver on-board the aircraft recording GPS and orientation data to be included in the analytical triangulation with the purpose of reducing the number of ground control points required for a metric aerial mapping task. IMU data to supplement the analytical triangulation is optional and its use is at the discretion of the Certified Photogrammetrist or Mapping Scientist.
9. KML means an uncompressed Google Keyhole Markup Language file, which is a two- or three- dimensional map showing a location on the earth.
10. KMZ means a compressed Google Keyhole Markup Language file, which is a two- or three-dimensional map showing a location on the earth.
11. DEM means digital elevation model, which is a three-dimensional DGN and/or point cloud in ASPRS LAS 1.2 file format containing all features located in the project area including features both on and above the ground surface.
12. DTM means digital terrain model, which is a three-dimensional DGN and/or point cloud in ASPRS LAS 1.2 format containing only features located on the ground surface.
13. Field Check means a ground survey validation of the deliverable map product with the purpose of ensuring that the required mapping accuracy has been met.
14. Flight Map means a map depicting the flight line and ground control layout over the project area.
15. Low Altitude Metric Aerial Photography means a metric aerial photography with a nominal ground pixel size of 5 cm or less.
16. DGN means a two or three-dimensional graphics file produced using Bentley MicroStation. The file may contain features and improvements plotted in a horizontal plane along the N and E axes which correspond to the Texas Coordinate System. The file may contain 2D or 3D elements representing topographic, existing, proposed, schematic, and general layout features.
17. Medium Altitude Photography means aerial photography with a film photo scale of 1:12,000 or a digital image with ground pixel size of 20 cm.
18. Project Photo Length means the distance over which photographs are required to be taken.

C. PROCEDURE FOR AERIAL MAPPING USING A METRIC CAMERA AND MANNED AIRCRAFT

1. Ground Control

The positioning and density of ground control is at the discretion of the Photogrammetrist. Ground control is required to be sufficient to meet the accuracy standard required for the final mapping products. Chapter 3 of the TxDOT Survey Manual provides guidance for the location and density of the ground control. The Photogrammetrist must determine the approximate position for ground control points. The Surveyor shall locate and mark the ground control points in the field using surveying methods.

2. Metric Digital Aerial Photography

The Photogrammetrist must acquire metric digital aerial photography using a large format calibrated metric aerial mapping camera. Unless otherwise stated, the imagery will be low altitude with a maximum nominal ground sampling distance of 5.0 cm. The Photogrammetrist must ensure that all imagery acquisition requirements including all flight parameters are met such that the imagery is suitable for intended use.

3. Analytical Triangulation

The Photogrammetrist must process the metric digital aerial photography, ground control, and airborne GPS/IMU data (if collected) to develop an absolute orientation of the imagery suitable for map compilation at the required accuracy.

4. Aerial Mapping

The Photogrammetrist must prepare the following:

a. A two-dimensional DGN file containing planimetric map features.
b. A three-dimensional DGN file containing DTM features.
c. Orthophotography

The Photogrammetrist must provide orthorectified aerial imagery covering the project area.

5. TECHNICAL REQUIREMENTS

Aerial mapping using a metric camera and manned aircraft must be performed under the direct supervision of an ASPRS Certified Photogrammetrist.

6. Unless otherwise stated, aerial mapping must meet or exceed the requirements for ASPRS Class 1 mapping at a 1 inch = 40 feet equivalent scale with a one-foot indicated contour interval.

D. DATA REQUIREMENTS

1. Planimetric DGN files must be fully compatible with the current Bentley MicroStation version graphics program used by the Owner without further modification or conversion.

2. Electronically collected and processed field survey data files must be fully compatible with the Owner's computer systems without further modification or conversion. All files must incorporate only those feature codes currently being used by the Owner.
3. DTM must be fully compatible with the current version of Bentley OpenRoads civil design system used by the Owner without further modification or conversion. All DTM must be fully edited to provide a complete digital terrain model with all necessary break lines.
4. File features and level structure must be in accordance with TxDOT's current photogrammetry mapping legend.
5. Minimum text size is 0.1 inches when plotted at a scale of 1 inch = 40 feet.

E. DELIVERABLES FOR AERIAL MAPPING USING A METRIC CAMERA AND MANNED AIRCRAFT

The Photogrammetrist must submit the following:

1. Digital orthophotography uploaded to Owner's Procore file management system in Tagged Image File format (TIF) compatible with Bentley MicroStation software and including georeferenced world files.
2. A photo index map in DGN and KMZ format showing the location of each digital image frame. The index map must be overlaid on a base map to provide general location information.
3. An orthophoto index map uploaded to Owner's Procore file management system showing the location of each orthophoto panel. The PDF format index map must be overlaid on a base map to provide general locational information.
4. An analytical triangulation report signed and sealed by the Photogrammetrist providing a narrative of the aerial photography project and processing results. The report must include the number of flight strips, overall number of photo frames, the number of ground control points used, the use of airborne GPS and IMU data, and the results of the fully weighted least-squares bundled adjustment. The Photogrammetrist must include a description and results of the analytical triangulation.
5. DGN files for the planimetric and DTM mapping.

150.7. AERIAL MAPPING USING A NON-METRIC CAMERA AND UNMANNED AIRCRAFT SYSTEM (UAS)

Aerial mapping using an Unmanned Aircraft System (UAS) includes the collection of digital aerial imagery using either a fixed- or rotary-wing aircraft; the use of a non-metric small-format consumer-grade camera; performing relative orientation of the imagery through the collection of tie and pass points between adjacent aerial photo frames; performing a least-squares bundled absolute orientation adjustment using ground control points supplemented with airborne GPS and IMU data; and deriving data from the processed imagery including compilation of planimetric and topographic maps, creation of point cloud digital elevation model (DEM) and digital terrain model (DTM) data, and production of orthophotography as required.

The Surveyor shall provide the services of a certified Photogrammetrist or Mapping Scientist to perform or oversee the tasks under function code 150.7. The Surveyor remains ultimately responsible and shall ensure that the work is performed as required.

A. PURPOSE

The purpose of aerial mapping using UAS is to provide map and related data to support transportation projects including project design and other uses.

B. PROCEDURE FOR AERIAL MAPPING USING A NON-METRIC CAMERA AND UNMANNED AIRCRAFT SYSTEM (UAS)

1. Ground Control

The positioning and density of ground control is at the discretion of the Photogrammetrist or Mapping Scientist. Ground control is required to be sufficient to meet the accuracy standard required for the final mapping products. The Photogrammetrist or Mapping Scientist must determine the approximate position for ground control points. The Surveyor shall locate and mark the ground control points in the field using surveying methods.

2. Aerial Photography

The Photogrammetrist or Mapping Scientist must acquire digital aerial photography using a non-metric small-format consumer-grade digital camera. The Photogrammetrist or Mapping Scientist is responsible for ensuring that all imagery acquisition requirements including all flight parameters are met such that the imagery is suitable for intended use.

3. Analytical Triangulation

The Photogrammetrist or Mapping Scientist must process the non-metric digital aerial photography, ground control, and airborne GPS/IMU data (if collected) to develop an absolute orientation of the imagery suitable for map compilation at the required accuracy.

4. Aerial Mapping

The Photogrammetrist or Mapping Scientist must prepare the following:

a. A two-dimensional DGN file containing planimetric map features.
b. A three-dimensional DGN file containing DTM features.

5. Orthophotography

The Photogrammetrist or Mapping Scientist must provide orthorectified aerial imagery covering the project area.

C. TECHNICAL REQUIREMENTS

1. Aerial mapping using a non-metric camera UAS must be performed under the direct supervision of an ASPRS Certified Photogrammetrist or Certified Mapping Scientist-UAS.
2. Aerial mapping using a non-metric camera and UAS must be performed in compliance with the TxDOT Unmanned Aircraft System (UAS) Flight Operations and User's Manual.

3. Unless otherwise stated, aerial mapping must meet or exceed the requirements for ASPRS Class 1 mapping at a 1 inch = 40 feet equivalent scale with a one-foot indicated contour interval.

D. DATA REQUIREMENTS

1. Planimetric DGN files must be fully compatible with the Owner's current Bentley MicroStation version graphics program without further modification or conversion.
2. Electronically collected and processed field survey data files must be fully compatible with the Owner's computer systems without further modification or conversion. All files must incorporate only those feature codes currently being used by the Owner.
3. DTM must be fully compatible with the current version of Bentley OpenRoads civil design system used by the Owner without further modification or conversion. All DTM must be fully edited to provide a complete digital terrain model with all necessary break lines.
4. File features and level structure must be in accordance with the Owner's current photogrammetry mapping legend.
5. Minimum text size is 0.1 inches when plotted at a scale of 1 inch = 40 feet.

E. DELIVERABLES FOR AERIAL MAPPING USING A NON-METRIC CAMERA AND UNMANNED AIRCRAFT SYSTEM (UAS)

The Photogrammetrist or Mapping Scientist must submit the following:

1. Digital orthophotography uploaded to Owner's file management system in Tagged Image File format (TIF) compatible with Bentley MicroStation software and including georeferenced world files.
2. A photo index map in DGN and KMZ format showing the location of each digital image frame. The index map must be overlaid on a base map to provide general location information.
3. An orthophoto index map in DGN, KMZ, and PDF format showing the location of each orthophoto panel. The PDF format index map must be overlaid on a base map to provide general locational information.
4. An analytical triangulation report signed and sealed by the Photogrammetrist or Mapping Scientist providing a narrative of the aerial photography project and processing results. The report must include the number of flight strips, overall number of photo frames, the number of ground control points used, the use of airborne GPS and IMU data, and the results of the fully weighted least-squares bundled adjustment. The Photogrammetrist or Mapping Scientist must include a description and results of the analytical triangulation.
5. DGN files for the planimetric and DTM mapping.

150.8. FIELD CHECK SURVEY FOR AERIAL MAPPING USING MANNED AIRCRAFT OR UAS

Field checking of aerial mapping projects involves surveying a statistical sampling of discreet features shown on the map. It is a collaborative effort between the Photogrammetrist or Mapping Scientist-UAS and the Surveyor to validate that the map derived photogrammetrically meets the required accuracy standard. Because not all features shown on the map are good candidates for

checking, it is necessary for the Photogrammetrist or Mapping Scientist to select discreet and unambiguous points that can then be surveyed and effectively evaluated between both the photogrammetric and field survey data sets.

The Photogrammetrist or Mapping scientist-UAS will provide a minimum of twenty 20 check point locations randomly distributed throughout the mapping area. The descriptions of the points must be sufficient to eliminate any ambiguity of the exact point to be surveyed.

A. PURPOSE

The purpose of a field check for aerial mapping is to validate that map accuracy requirements have been met.

B. DEFINITIONS

In 150.8, the following definition applies:

Check Point – A randomly distributed point captured in the DGN mapping file selected by the Photogrammetrist or Mapping Scientist and provided to the Surveyor to be used to verify that the mapping accuracy requirement has been met.

C. PROCEDURE TO FIELD CHECK SURVEY FOR AERIAL MAPPING USING MANNED AIRCRAFT OR UAS

1. The Photogrammetrist or Mapping Scientist-UAS must prepare and provide the Surveyor a listing of points to be validated in the field. Sufficient detail and description of the point is required to eliminate the possibility of a misidentification of the point during the field survey. A minimum of 20 horizontal and 20 vertical check points are required. Any single point can be used for both horizontal and vertical data as appropriate. A check point must not be part of the analytical triangulation least-squares adjustment.
2. The Surveyor shall locate and measure the provided validation points on the ground using equipment and methodologies with a higher level of accuracy than the map being checked.
3. Using the results from the field survey, the Surveyor shall prepare a map accuracy assessment report detailing the results of the field check. The report must include the number of check points used, the field surveying technique used for validation, and the results of the root mean square error (RMSE) and 95% confidence computations.
4. Using the validation data provided by the Surveyor, the Photogrammetrist or Mapping Scientist must prepare a final report detailing the results of the map check. The report must include both the following Statements of Accuracy, if applicable:
    a. “This map was compiled to meet the ASPRS Standard for Class 1 map accuracy.”
    b. “This map was checked and found to conform to the ASPRS Standard for Class 1 map accuracy.”

D. TECHNICAL REQUIREMENTS The Surveyor shall:

1. Determine the northing, easting, and elevations of the check points provided by the Photogrammetrist or Mapping Scientist using a surveying method of greater accuracy than that used to produce the map being checked.

2. Perform RMSE and 95% confidence computations on the check points using the following methodology:

For each horizontal coordinate, the Surveyor shall subtract the Northing value of the map coordinate from the Northing value derived from the field survey and square the resulting value. The Surveyor shall perform the same operation for the Easting coordinate and then add the two squared values. The Surveyor shall repeat the procedure for each

check point. The Surveyor shall add up all the resulting squared values and divide the sum by the number of check points used (i.e., average the squares). Finally, the Surveyor shall calculate the square root of the average. The Surveyor shall report the resulting value as the RMSE value for the horizontal check point analysis. The Surveyor shall multiply the final RMSE value by 1.7308 and shall report the resulting value as the 95% confidence value for the horizontal check point analysis.

For each vertical coordinate, the Surveyor shall subtract the elevation value of the map coordinate from the elevation value derived from the field survey and square the resulting value. The Surveyor shall repeat the procedure for each check point. The Surveyor shall add up all the resulting squared values and divide the sum by the number of check point used (i.e., average the squares). Finally, the Surveyor shall calculate the square root of the average. The Surveyor shall report the resulting value as the RMSE value for the vertical check point analysis. The Surveyor shall multiply the final RMSE value by 1.96 and shall report the resulting values as the 95% confidence for the vertical check point analysis.

3. Provide the results of the RMSE and 95% confidence computations to the Photogrammetrist.

E. DATA RQUIREMENT

The Surveyor shall deliver the result of the field check as a report in PDF format.

F. DELIVERABLES

The Photogrammetrist or Mapping Scientist must provide a map accuracy assessment report detailing the methodology used and results of the map accuracy assessment.

150.9. HORIZONTAL AND VERTICAL CONTROL FOR AERIAL MAPPING

Placement and survey of horizontal and vertical control for aerial mapping establishes ground control for aerial mapping projects.

A. PURPOSE

The purpose of an aerial photography control survey is to provide ground control for aerial mapping projects.

B. DEFINITIONS

In 150.9, Aerial Photography Control Survey means reconnaissance, field work, analysis, computation, and documentation necessary to provide horizontal and vertical position of specific ground points. The ground control points are used in photogrammetric processing.

C. PROCEDURE FOR HORIZONTAL AND VERTICAL CONTROL FOR AERIAL MAPPING

The Surveyor shall:

1. Prepare and submit for approval an aerial ground control layout in DGN and KML format based on the target positions selected by the Certified Photogrammetrist. The layout must show the location of the proposed primary project control and aerial ground control points.
2. Establish and determine the horizontal and vertical coordinates of the primary project control points and aerial ground control points.
3. Place aerial ground control targets at the point location and maintain the targets until the aerial flight has been completed.

D. TECHNICAL REQUIREMENTS

1. Aerial photography control surveys must be performed under the direct supervision of a RPLS currently registered with the TBPELS.
2. The horizontal and vertical coordinates of the aerial control points must be based on acceptable methods, conducted by the Surveyor, and must meet the standards of accuracy as set forth below:

   Survey Level 3 accuracy, as described in the TxDOT Survey Manual, latest edition, or the equivalent level of accuracy described in the TSPS Manual of Practice for Land Surveying in the State of Texas.

E. DATA REQUIREMENT

The Surveyor shall perform post processing of field data, which will be reviewed by the Owner. Data processed by standard calculators, computers, and other business hardware and software normally maintained and used by the Surveyor will be considered acceptable.

F. DELIVERABLES

The Surveyor shall submit the following:

1. A final aerial control point layout in DGN and KML format showing the location of the primary control and target points labeled with their respective alpha-numeric designation.
2. A plot and computer graphics of a B-size index map showing an overall view of the project and the relationship of primary monumentation and control used in the preparation of the project, signed and sealed by a RPLS, and as directed by the Owner.
3. A plot and computer graphics of a B-size horizontal and vertical control sheet showing the primary survey control monumentation used in the preparation of the project, signed and sealed by a RPLS, and as directed by the Owner.

4. An A-size data sheet for each aerial ground control point, which must include a location sketch, a physical description of the point, surface coordinates, elevation, and datums used.
5. Graphics files and scanned images of the control data sheets, uploaded to Owner's file management system.
6. A written statement describing the datum used along with copies of all relevant NGS and data sheets.
7. A written tabulation of all aerial control points with their respective alphanumeric designations and horizontal and vertical coordinates.

150.10. MAPPING SERVICES TO BE PROVIDED

The Surveyor shall provide the following mapping services as requested by the Owner:

A. AERIAL PHOTOGRAMMETRY

The Surveyor shall prepare planimetric design (DGN), digital terrain model (DTM), and triangulated irregular network (TIN) MicroStation graphics files and orthophotography files covering the specific work location, meeting standards and specifications as required.

B. TERRESTRIAL PHOTOGRAMMETRY

The Surveyor shall prepare planimetric design (DGN), digital terrain model (DTM), and triangulated irregular network (TIN) MicroStation graphics files covering the specific work location, meeting standards and specifications as required.

C. TERRESTRIAL LIDAR

The Surveyor shall prepare planimetric design (DGN), digital terrain model (DTM), and triangulated irregular network (TIN) MicroStation graphics files covering the specific work location, meeting standards and specifications as required.

D. MOBILE AND AERIAL LIDAR

The Surveyor shall prepare planimetric design (DGN), digital terrain model (DTM), and triangulated irregular network (TIN) MicroStation graphics files covering the specific work location, meeting standards and specifications as required.

E. MAPPING TASKS TO BE COMPLETED

The Surveyor shall perform the following tasks as requested for each mapping service.

1. Horizontal and Vertical Control for Aerial Mapping
    a. The Surveyor shall prepare and submit an aerial ground control layout showing the proposed aerial ground control points, for approval by the Owner.
    b. The Surveyor shall establish and determine the coordinates of the aerial ground control points.

c. The Surveyor shall establish and determine the elevations of the aerial control points.
d. The Surveyor shall place aerial ground control target material at the established points and maintain until the photographs from the flight are approved.
e. The Surveyor shall prepare, to scale, a survey control index sheet for the aerial control points.
f. The Surveyor shall be prepared to locate additional points, as determined by the American Society for Photogrammetry and Remote Sensing (ASPRS) certified Photogrammetrist, if any panel points are not visible from the air.

2. Deliverables for Horizontal and Vertical Control for Aerial Mapping The Surveyor shall provide the following deliverables:
    a. A final aerial control point layout showing the location of the points and labeled with their respective alpha-numeric designations.
    b. A plot and computer graphics of a B-size index map showing an overall view of the project and the relationship of primary monumentation and control used in the preparation of the project, signed and sealed by a RPLS, and as directed by the Owner.
    c. An A-size data sheet for each aerial ground control point, which must include a location sketch, a physical description of the point, surface coordinates, the elevation, and datums used.
    d. Graphics files and scanned images of the control data sheets, uploaded to Owner's file management system.
    e. A written statement describing the datum used along with copies of all relevant NGS and data sheets.
    f. A written tabulation of all aerial control points with their respective alpha-numeric designations, surface coordinates (for center panel points only), and elevations.

3. Prepare Planimetric and DTM Data
   The Surveyor shall perform the following tasks for each requested mapping service:
    a. The Surveyor shall provide low altitude aerial mapping to cover an area 1,200 feet wide centered on the roadway unless otherwise specified, with cross flights as directed by the Owner.
       The Surveyor shall follow all standards and specifications in accordance with established guidelines and recommended or approved by the Owner.
    b. The Surveyor shall prepare planimetric design (DGN), digital terrain model (DTM), and triangulated irregular network (TIN) Bentley MicroStation graphics files and orthophotography files covering the specific work location, meeting standards and specifications as required.
        i. The Surveyor shall collect supplemental planimetric and DTM survey data.
        ii. The Surveyor shall update aerial 2D and 3D mapping with ground surveys.
        iii. The Surveyor shall maintain the current DGN level structure and legend used by TxDOT.

iv. The Surveyor shall maintain the current DTM level structure and legend used by TxDOT.
v. The Surveyor shall use file features and level structures in compliance with TxDOT's current photogrammetry mapping legend.
vi. The Surveyor shall locate, and field check random points.

c. The Surveyor shall conduct quality assurance and quality control (QA/QC) for each task performed and prepare a Surveyor's Report.

4. Deliverables for Planimetric and DTMs The Surveyor shall provide the following:
   a. Certification that the photographs or LiDAR imagery were taken on the date indicated, signed by the airplane pilot or aerial photographer.
   b. The DGN, DTM, and TIN files on a medium and in a format acceptable to the Owner, uploaded to Owner's Procore file management system .
      i. Orthophotography (created using the DTM) uploaded to Owner's Procore file management system in tiff format (3 banded) with world files.
      ii. TxDOT's photogrammetry mapping legend and supplements.
   c. A tabulation showing the field-check points.
   d. Quality Assurance and Quality Control (QA/QC) and Statement of Map Accuracy.
      i. Statement of map accuracy.
      ii. A surveyor's report signed and sealed by an RPLS.

150.11. HORIZONTAL AND VERTICALCONTROL (15.3.5)

This includes the establishment of horizontal and vertical control for survey projects.

A. OVERVIEW OF HORIZONTAL AND VERTICAL CONTROL

A horizontal control survey is performed for the purpose of placing geographic coordinates of latitude and longitude on permanent monuments for referencing lower levels of surveys. A projection is used to place the coordinates on a plane of northing and easting values for simplified measurements. Scale and elevation factors are applied to make the distance measurements applicable to the exact location on the working surface and the type of projection chosen is an "equal angle" type.

A vertical control survey is performed for accurately determining the orthometric height (elevation) of permanent monuments to be used as benchmarks for lower quality leveling. Spirit leveling is the usual method of carrying elevations across country from "sea level" tidal gauges. However, Global Positioning System (GPS) can be used indirectly but with less accuracy. Height measurements from the ellipsoid (as opposed to the "sea level" geoid) can be determined very accurately with GPS and only GPS. Trigonometric leveling, with a total station, is not acceptable for vertical control work.

B. DEFINITIONS

1. BM means benchmark, which is a relatively permanent object whose elevation above or below an adopted datum is known.

2. CORS means continuously operating reference station, which is a network of the highest quality horizontal stations, forming the National Spatial Reference System (NSRS).
3. Control Survey means a survey providing positions (horizontal or vertical) of points to which supplemental surveys are adjusted.
4. Datum means a mathematical model of the earth designed to fit part or all of the geoid.
5. Datum Point Rod or Deep Rod Monument means a monument driven to refusal by a power driver, used for major project control.
6. GPS means the Global Positioning System, which is based on a constellation of 24 satellites orbiting the earth at a very high altitude.
7. Horizontal Control Survey means placing geographic coordinates of latitude and longitude on permanent monuments.
8. Level 1 survey means RFP, CORS or major control densification.
9. Level 2 Survey means primary project control.
10. Level 3 Survey means secondary project control.
11. NGS – National Geodetic Survey
12. Type II Monument means a disk driven onto a length of 5/8-inch rebar with the hole filled flush with concrete.
13. Vertical Control Surveys means a survey performed for accurately determining the orthometric height (elevation) of permanent monuments to be used as benchmarks for lower quality leveling.

C. PROCEDURE FOR HORIZONTAL AND VERTICAL CONTROL

1. The Surveyor shall establish horizontal and vertical control points, including offsite points. The Surveyor shall prepare signed survey control data sheets, a survey control index sheet, and a composite layout of the horizontal and vertical controls, and as directed by the Owner.
2. The Surveyor shall update existing control information and prepare new survey control data sheets, as directed by the Owner, to be included in the construction plan set as described in Item 150.11, D.

D. TECHNICAL REQUIREMENTS FOR HORIZONTAL AND VERTICAL CONTROL

The Surveyor shall adhere to the following technical requirements.

1. Horizontal and vertical controls must be performed under the supervision of a RPLS currently registered with the TBPELS.
2. Horizontal ground control used for design surveys and construction surveys, furnished to the Surveyor by the Owner, or based on acceptable methods conducted by the Surveyor, must meet the standards of accuracy required by the Owner.
   The Surveyor shall comply with the standards of accuracy for horizontal control traverses, as described in the TxDOT Survey Manual or the TSPS Manual of Practice for Land Surveying in the State of Texas, as may be applicable.
3. Vertical ground control used for design surveys and construction surveys, furnished to the Surveyor by the Owner or based on acceptable methods conducted by the Surveyor, must meet the standards of accuracy required by the Owner.

The Surveyor shall comply with the standards of accuracy for vertical control traverses, as described in the TxDOT Survey Manual or the TSPS Manual of Practice for Land Surveying in the State of Texas, as may be applicable.

4. Monuments
   The Surveyor shall install survey monuments for a horizontal and vertical control survey that are reasonably permanent and substantial. The monuments shall be easily identified and afforded reasonable protection against damage and or destruction.
   a. Offsite primary control points whether set by GPS or conventional survey methods must be set in pairs approximately 2000 feet apart outside of the project on side roads. Offsite points must be constructed approximately every 2 miles and set approximately 6 inches below natural ground and must be inter-visible between each pair of points.
   b. Secondary control points must be set approximately 6 inches below ground at a maximum distance of 1,500 feet apart.
5. Side shots or short traverse procedures for total stations used to determine horizontal and vertical locations must meet the following criteria:
   a. Short traverses and instrument setups for side shots must begin and end on horizontal and vertical ground control as described above.
   b. Standards, procedures, and equipment (e.g., GPS Equipment, LiDAR, Total Stations) used must be such that horizontal locations relative to the control can be reported within the specification to allow the engineer to accurately create the design to the following limits:
      i. Bridges and other roadway structures: less than 0.02 feet.
      ii. Utilities and improvements: less than 0.2 feet.
      iii. Cross-sections and profiles: less than 0.2 feet.
      iv. Bore holes: less than 0.5 feet.
   c. Standards, procedures, and equipment (e.g., GPS Equipment, LiDAR, Total Stations) used must be such that vertical locations relative to the control may be reported to within 0.02 feet.
6. The Surveyor shall update existing control information and prepare new survey control data sheets, as directed by the Owner, to be included in the construction plan set as described below:
   a. The Surveyor shall prepare, sign, seal, and date a survey control index sheet and horizontal and vertical control sheets to be inserted into the plan set.
   b. The Surveyor shall prepare a survey control index sheet that provides an overview of the primary project control and must include:
      i. An unscaled vicinity map showing the general location of the project in relation to nearby towns or other significant cultural features.
      ii. A scaled project map showing the extents of the project and the location of the primary control points. The map must show street networks, selected street names, control point identification, and significant culture features necessary to provide a general location of the primary control.
      iii. A table containing the primary control point values including the point number, northing, easting, elevation, stationing, and stationing offset values.

iv. Map annotation including a graphic scale bar, north arrow, and standard TxDOT title block. The title block must contain a section for the district name, city, and highway name. The title block must also contain a section for a Texas registered engineer to sign, seal, and date the sheet to include the following statement, "The survey control information has been accepted and incorporated into this PS&E".
The Surveyor shall download the required format of the survey control index sheet from the TxDOT website.

v. In the title block under the heading "Notes", identification of the horizontal and vertical datum on which the primary control is based with the date of the current adjustment, the surface adjustment factor used, and unit of measure. The surveyor shall include a note stating that the coordinates are State Plane and a notation specifying either grid or surface adjusted coordinates.

E. DATA REQUIREMENTS

The Surveyor shall perform post processing of field data, which will be reviewed by the Owner. Data processed by standard calculators, computers, and other business hardware and software normally maintained and used by the Surveyor will be considered acceptable.

F. TASKS TO BE COMPLETED

The Surveyor shall perform the following tasks:

1. The Surveyor shall establish horizontal and vertical control points, including offsite points. The Surveyor shall prepare signed survey control data sheets, a survey control index sheet, and a composite layout of the horizontal and vertical controls, or as directed by the Owner.
2. The Surveyor shall set primary offsite control points in pairs, approximately 2 miles apart outside of the project area.
3. The Surveyor shall set secondary control points approximately 6 inches below ground at a maximum distance of 1,500 feet apart.
4. The Surveyor shall establish horizontal and vertical control from the TxDOT Virtual Reference Station (VRS) Network, or as directed by the Owner.
5. The Surveyor shall tie and tabulate horizontal and vertical control to other control points and datums in the vicinity established by other sources such as the National Geodetic Survey (NGS), the Federal Emergency Management Agency (FEMA), TxDOT VRS Network, or as directed by the Owner.

G. DELIVERABLES

The Surveyor shall provide the following:

1. A B-size plot and MicroStation graphics files of the index map showing an overall view of the project and the relationship of the primary monuments and control points established for the project, signed and sealed by a registered professional land surveyor (RPLS), or as directed by the Owner.

2. One A-size data sheet for each control point which shall include, but need not be limited to, a location sketch, a physical description of the point, surface coordinates, the elevation, and the datum used.
3. Graphics files and scanned images of the control data sheets uploaded to Owner's file management system.
4. A written statement describing the datum used, signed and sealed by a RPLS, along with copies of all relevant NGS and TxDOT data sheets.

FUNCTION CODE 160(160) - ROADWAY DESIGN

ROADWAY DESIGN CONTROLS

The Engineer shall inform the Owner of changes made from previous initial meetings regarding each exception, waiver, and variance that may affect the design. The Engineer shall cease all work under this task until the exceptions, waivers, and variances have been resolved between the Engineer and the Owner unless otherwise directed by the Owner to proceed. The Engineer shall identify, prepare exhibits, and complete all necessary forms for Design Exceptions and Waivers within project limits prior to the 30% Submittal. These exceptions shall be provided to the Owner for coordination and processing of approvals.

160.1. Geometric Design.

The Engineer shall:

A. Preliminary Geometric Project Layout.

The Engineer shall develop a preliminary geometric project layout (Layout) and a preliminary 3D corridor model for the full length of the project to be reviewed and approved by the Owner prior to the Engineer proceeding with the 30% milestone submittal package.

The Layout must consist of a planimetric file of existing features and the proposed improvements within the existing and any proposed ROW. The Layout must also include the following features: existing and proposed ROW, existing and proposed horizontal and vertical alignment and profile grade line, cross culverts, lane widths, cross slopes, ditch slopes, pavement structure, clear zone, dedicated right turn lanes, corner clips, retaining walls (if applicable) guard rail (if applicable), and water surface elevations for various rainfall frequencies, etc. Existing major subsurface and surface utilities must be shown on the Layout.

The Engineer shall develop the proposed alignment to avoid the relocation of existing utilities as much as possible. The Engineer shall consider Americans with Disabilities Act (ADA) requirements when developing the Layout. The Layout must be prepared in accordance with the current Roadway Design Manual. The Engineer shall provide horizontal and vertical alignment of the project layout in English units for main lanes and cross streets. Minor alignment alternatives must be considered to provide for an optimal design. The project layout must be coordinated with the Owner and adjacent Engineers, if any. The Engineer shall also

provide proposed and existing typical sections with the profile grade line (PGL), lane widths, cross slopes, ROW lines, ditch shapes, pavement structures and clear zones depicted, etc.

The 3D corridor model must be created using Bentley's OpenRoads and GEOPAK tools. The 3D corridor model must have enough details to verify the feasibility of the proposed design.

Prior to proceeding with the final preliminary geometric layout, the Engineer shall also present to the Owner for review and approval, alternatives for the design (e.g., flush or raised curb median) with recommendations and cost estimates for each alternative. The Engineer shall also attend all necessary meetings to discuss the outcome of the evaluations of the study.

160.2. Roadway Design.

The Engineer shall use Bentley's OpenRoads 3D Design technology in the design and preparation of the roadway plan sheets.

The Engineer shall use the current versions of MicroStation and GEOPAK at the time the task order is executed. However, the Owner may approve the use of other versions.

The Engineer shall provide roadway plan and profile drawings using CADD standards as required by TxDOT. The drawings must consist of a planimetric file of existing features and files of the proposed improvements. The roadway base map must contain line work that depicts existing surface features obtained from the schematic drawing. Existing major subsurface and surface utilities must be shown if requested by the Owner. Existing and proposed right-of-way lines must be shown. Plan and Profile must be shown on separate or same sheets (this depends upon width of pavement) for main lanes, frontage roads, and direct connectors.

The plan view must contain the following design elements:

1. Calculated roadway centerlines for mainlanes, ramps, cross streets and frontage roads, as applicable. Horizontal control points must be shown. The alignments must be calculated using OpenRoads horizontal geometry tools.
2. Pavement edges for all improvements (mainlanes, direct connectors, ramps, cross streets, driveways, and frontage roads, if applicable).
3. Lane and pavement width dimensions.
4. The geometrics of ramps, auxiliary and managed lanes.
5. Proposed structure locations, lengths, and widths.
6. Direction of traffic flow on all roadways. Lane lines and arrows indicating the number of lanes must also be shown.
7. Drawing scale shall be 1" =100'
8. Control of access line, ROW lines, and easements.
9. Begin and end superelevation transitions and cross slope changes.
10. Limits of riprap, block sod, and seeding.
11. Existing utilities and structures.
12. Benchmark information.
13. Metal beam guard fence locations
14. Radii call outs, curb location, Concrete Traffic Barrier (CTB), crash safety items and American with Disabilities Act Accessibility Guidelines (ADAAG) compliance items.

The profile view must contain the following design elements:

1. Calculated profile grade for proposed mainlanes (cite direction), direct connectors, ramps, cross streets, and frontage roads, if applicable. Vertical curve data, including "K" values must be shown. The profiles must be calculated using OpenRoads vertical geometry tools.
2. Existing and proposed profiles along the proposed centerline of the mainlanes, the outside shoulder line of ramps, and the outside gutter line of the designated (north, south, east, or west) bound frontage roads.
3. Water surface elevations at major stream crossing for 2, 5, 10, 25, 50, and 100-year storms.
4. Calculated vertical clearances at grade separations and overpasses, considering the appropriate superelevation rate, superstructure depth and required clearance.
5. The location of interchanges, mainlanes, grade separations and ramps (shall include cross sections of any proposed or existing roadway, structure, or utility crossing).
6. Drawing vertical scale to be 1" =10'.

160.3. Typical Sections: The Engineer shall prepare typical sections for all proposed and existing roadways and structures. Typical sections must include width of travel lanes, shoulders, outer separations, border widths, curb offsets, managed lanes, and ROW. The typical section must also include Proposed Profile Grade Line (PGL), centerline, pavement design, longitudinal joints, side slopes, sodding or seeding limits, concrete traffic barriers and sidewalks, if required, station limits, common proposed and existing structures including retaining walls, existing pavement removal, riprap, limits of embankment and excavation, etc.

160.6. Cross Streets. The Engineer shall provide an intersection layout detailing the pavement design and drainage design at the intersection of each cross street. The layout must include the horizontal and vertical alignments, curb returns, geometrics, transition length, stationing, pavement, drainage details, and Americans with Disabilities Act Accessibility Guidelines (ADAAG) compliance items. The Engineer shall design for full pavement width to the ROW and provide a transition to the existing roadway. The Engineer shall follow the Owner's Roundabout Policy, documenting and requesting Owner approval when roundabouts are not applicable.

160.7. Cut and Fill Quantities. The Engineer shall develop an earthwork analysis to determine cut and fill quantities and provide final design cross sections at 100 feet intervals. Cross sections must be created from the 3D corridor model and must be delivered in the standard TxDOT format on 11"x17" sheets or roll plots and electronic files. The Engineer shall provide all templates and corridors used to generate the design cross sections. Cross sections and quantities must include existing pavement removals. Annotation shall include at a minimum existing and proposed ROW, side slopes (front & back), profiles, etc.

The Engineer shall submit electronic files for each submittal at the 30%, 60%, and 90%. For final submittals 1 large set 24"x36" & 2 sets 11"x17". The Engineer shall also submit the current OpenRoads generated 3D corridor model for each submittal.

160.8. Plan Preparation. The Engineer shall prepare roadway plans, profiles and typical sections for the proposed improvements. Prior to the 30% submittal, the Engineer shall schedule a workshop to review profiles, OpenRoads 3D corridor models and cross-sections with the Owner. The Owner will approve the proposed profiles, 3D corridor models, and cross sections before the Engineer continues with the subsequent submittals. This scope of services and the corresponding cost proposal are based on the Engineer preparing plans to construct main lanes and cross streets at intersections. The roadway plans must consist of the types and be organized in the sequence as described in the PS&E Preparation manual.

160.9. Wetlands Information. The wetland areas are to be staked, fenced and the delineation surveyed by the Engineer. The survey data must be electronically transferred to the Plan and Profile (P&P) sheets and the volumes calculated for the delineated areas.

160.10. Pavement Design.

The Engineer shall prepare pavement designs for this project in accordance with the latest edition of TxDOT's Pavement Manual. Proposed pavement designs include permanent pavement, interim condition transition pavement, and temporary detour pavement. The latest edition of TxDOT's Pavement Manual may be accessed at http://www.txdot.gov/business/resources.html.

The Engineer shall submit a signed and sealed pavement design report to the Owner. The pavement design report must be reviewed and approved by the Owner prior to its implementation. The pavement design report must document assumptions and design considerations. The pavement design report must include the following:

- Cover sheet with roadway name, geographical limits, and signatures of persons involved in the preparation and approval
- Existing and proposed typical sections
- Soils map of the project area with a brief description of each type of soil located within the project area
- Design input values and output
- Conclusion consisting of recommended pavement design or designs based on the data, analyses, and procedures included in the report.
- Pavement design details specified for each location that includes structural layer materials, general specifications, and layer thicknesses
- Relevant pavement evaluation data (structural and functional) and condition information on adjacent roads
- Site conditions that might influence the design and performance of pavements
- Relevant geotechnical data and drainage requirements including boring logs, laboratory soil test results, active or passive drainage system design, ground

penetrating radar (GPR) data, falling weight deflectometer (FWD) data, dynamic cone penetrometer (DCP) data, pavement coring and report log (up to 5-foot depth), and soil classifications with Atterberg limits

- Results of the field explorations and testing of pavement sections
- Recommended pavement rehabilitation methods and designs for new pavements
- Design criteria used in determining pavement designs, including traffic loads, pavement material characterization, environmental conditions, and pavement design life
- Design summary from the program used to design (e.g., FPS 21, DARWin, TxCRCP - ME, MODULUS 6.1)
- Life-cycle cost analysis, as required by TxDOT's Pavement Manual, including the periods for resurfacing, reconstruction, and other rehabilitation measures and what these activities are likely to entail
    - Traffic control plans required for subsurface geotechnical and pavement investigations
- Other considerations used in developing the pavement designs, including subgrade preparations and stabilization procedures

160.11. Pedestrian and Bicycle Facilities. The Engineer shall coordinate with the Owner to incorporate pedestrian and bicycle facilities as required or shown on the project's schematic. All pedestrian and bicycle facilities must be designed in accordance with the latest Americans with Disabilities Act Accessibility Guidelines (ADAAG), the Texas Accessibility Standards (TAS), and the AASHTO Guide for the Development of Bicycle Facilities. The Engineer shall design the Owner's Vybe Trail if within the project limits. Certain Vybe details will be provided by the Owner.

FUNCTION CODE 160(161) - ROADWAY DESIGN

DRAINAGE

161.1. Data Collection.

The Engineer shall provide the following data collection services:

1. Conduct field inspections to observe current conditions and the outfall channels, the cross-drainage structures, drainage easements, the tributary channel, and land development projects that contribute flow to the tributary. Document field inspections with digital photos.
2. Collect available applicable data including GIS data and maps, site survey data, construction plans, previous reports and studies, and readily available rainfall history for the area. Sources of data collected must include, but are not limited to, the City, State, County, and Federal Emergency Management Agency (FEMA).
3. Collect available Flood Insurance Rate Maps (FIRMs), Flood Insurance Study (FIS) study data, and models.
4. Review survey data and coordinate any additional surveying needs with Owner.
5. Present existing drainage structures in a 3D corridor MicroStation model.

6. Meet with local government officials to obtain historical flood records. Interview residents or local government employees to obtain additional high-water information if available. Obtain frequency of road closure and any additional high- water information from the Owner.
7. Submit a letter report to the Owner Project Manager detailing completion of data collection.

161.2. Hydrologic Studies.

The Engineer shall provide the following services:

1. Incorporate in the hydrologic study a thorough evaluation of the methodology available, comparison of the results of two or more methods, and calibration of results against measured data, if available.
2. Calculate discharges using appropriate hydrologic methods and as approved by the Owner.
3. Consider the pre-construction and post-construction conditions in the hydrologic study, as required in the individual task order.
4. Obtain the drainage area boundaries and hydrologic parameters such as impervious covered areas, and overland flow paths and slopes from appropriate sources including, but are not limited to, topographic maps, GIS modeling, construction plans, and existing hydrologic studies. The Engineer shall not use existing hydrologic studies without assessing of their validity. If necessary, obtain additional information such as local rainfall from official sites such as airports.
5. Include, at a minimum, the "design" frequency to be specified in the task order and the 1% Annual Exceedance Probability (AEP) storm frequency. The report must include the full range of frequencies (50%, 20% 10%, 4%, 2%, 1%, and 0.2% AEP).
6. Compare calculated discharges to the effective FEMA flows. If calculated discharges are to be used in the model instead of the effective FEMA flows, full justification must be documented.

161.3. Complex Hydraulic Design and Documentation.

The Engineer shall provide the following services:

1. Gather information regarding existing drainage facilities and features from existing plans and other available studies or sources.
2. Perform hydraulic design and analysis using appropriate hydraulic methods, which may include computer models such as HEC-RAS, unsteady HEC-RAS or 2D models such as SWMM. 2D models shall not be developed without the express permission of the Owner. Data entry for appropriate hydraulic computer programs shall consist of a combination of both on-the-ground survey and other appropriate sources including but not limited to topographic maps, GIS modeling, and construction plans and existing hydrologic studies.
3. Use the current effective FEMA models, where appropriate, as a base model for the analysis. If a "best available data" model is provided by the local floodplain administrator,

it must be utilized accordingly for this analysis. Review the provided base model for correctness and updated as needed. If the provided effective model is not in a HEC-RAS format, convert it to HEC- RAS for this analysis.

4. If the appropriate hydrologic model requires storage discharge relationships, develop HEC-RAS models or other Owner's approved models that will compute these storage discharge relationships along the channel.
5. Consider pre-construction, present and post-construction conditions, as well as future widening, as determined in the task order.
6. Quantify impacts, beneficial or adverse, in terms of increases in peak flow rates and water surface elevations for the above listed hydraulic conditions and hydrologic events. Impacts will be determined both upstream and downstream of the bridge crossings.
7. If required in the individual task order, compute right of way corridor 1% AEP flood plain volumes for existing and proposed roadway elevations. The Engineer shall provide mitigation to offset a decrease in 1% AEP flood plain volumes.
8. Use hydrograph calculations and peak flows to determine the storage required.
9. If necessary, present mitigation measures along with the advantages and disadvantages of each. Each method must consider the effects on the entire area. Include approximate construction costs in the report.
10. Provide hand calculations which quantify the cut and fill within the 1% AEP flood plain, if any.

161.4. Storm Drains.

The Engineer shall provide the following services:

1. Design and analyze storm drains using software as approved by the Owner.
2. Size inlets, laterals, trunk line and outfall. Develop designs that minimize the interference with the passage of traffic or incur damage to the highway and local property in accordance with local drainage ordinances, the TxDOT Hydraulic Design Manual, and any specific guidance provided by the Owner. Storm drain design software shall be selected as directed by the task order.
3. Determine hydraulic grade line starting at the outfall channel for each storm drain design. Use the design water surface elevation of the outfall as the starting basis (tailwater) for the design of the proposed storm sewer system.
4. Calculate manhole head-losses. Compute manhole head losses as per FHWA's HEC-22.
5. Limit discharge into existing storm drains and existing outfalls to the capacity of the existing system, which will be determined by the Engineer. Evaluate alternate flow routes or detention, if necessary, to relieve system overload. Determine the amount of the total detention storage to control storm drain runoff for the design frequency based on hydrograph routing for the full range of frequencies (50%, 20% 10%, 4%, 2%, 1%, and 0.2% AEP), as well as a rough estimate of the available on-site volume. When oversized storm drains are used for detention, the Engineer shall evaluate the hydraulic grade-line throughout the whole system, within project limits, for the design frequency or frequencies. The Engineer shall coordinate with the Owner any proposed changes to the detention systems.

6. Identify areas requiring trench protection, excavation, shoring, and de-watering.

161.5. Cross-Drainage Structures.

The Engineer shall provide the following services:

1. Determine drainage areas and flows for cross culvert drainage systems.
2. Determine the sizing of the drainage crossings. The scope may include extending, adjusting or replacing non-bridge-class culvert crossing or crossings as specified in the task order. Develop designs that minimize the interference with the passage of traffic or cause damage to the highway and local property in accordance with local ordinances, TxDOT's Hydraulic Design Manual, and any specific guidance provided by the Owner. Cross drainage design shall be performed using HY-8 or HEC RAS.

161.6. Temporary Drainage Facilities.

The Engineer shall develop plans for all temporary drainage facilities necessary to allow staged construction of the project and to conform with the phasing of adjacent construction projects without significant impact to the hydraulic capacity of the area. Drainage area maps are not required for temporary drainage.

161.7. Scour Analysis.

The Engineer shall provide the following services:

1. Perform a scour analysis for each proposed bridge structure.
2. Prepare each scour analysis using an Owner-approved methodology listed in the task order. The Engineer shall select the methodology based on the site conditions such as the presence of cohesive or cohesionless soil, rock or depth of rock, proposed foundation type, and existing site performance. The Engineer shall follow the methodology outlined in the TxDOT Geotechnical Manual. The Engineer shall coordinate with the Owner prior to commencing any work on any Stream Migration Study. This coordination must include consultation with the appropriate Owner technical expert.
3. Provide the Owner the potential scour depths, envelope and any recommended countermeasures including bridge design modifications and revetment.

161.8. Environmental Permits.

The Engineer shall notify the Owner project manager when site conditions may require environmental permits such as Nationwide Permit, §404 Individual Permits (including mitigation and monitoring) and U. S. Coast Guard and U.S. Army Corps of Engineers §10 Permits.

161.9. Plans, Specifications and Estimates (PS&E) Development for Hydraulics.

The Engineer shall provide the following services:

1. Prepare the PS&E package in accordance with the applicable requirements of the Owner's specifications, standards, and manuals, including the TxDOT PS&E Preparation Manual. Include the following sheets and documents, as appropriate:
    a. Hydrologic Data Sheets
    b. Hydraulic Data Sheets
    c. Scour Data Sheets (if applicable)
    d. Culvert Layout Sheets
    e. Storm Drain Plan/Profile Sheets
    f. Detention Pond Layouts
    g. Detention Pond Details
    h. Roadway Plan & Profile Sheets including profile grade line of parallel ditches, if applicable.
    i. All other relevant sheets
2. Prepare culvert cross sections and identify each cross-section's station location.
3. Identify areas requiring trench protection, excavation, shoring and de- watering.
4. Prepare drainage area maps.
5. If applicable, prepare plan and profile sheets for storm drain systems and outfall ditches.
6. Select any necessary standard details from the TxDOT, City of Kyle, or City of Austin lists of standards for items such as inlets, manholes, junction boxes and end treatments.
7. Prepare details for non-standard inlets, manholes and junction boxes.
8. Prepare drainage details for outlet protection, outlet structures and utility accommodation structures.
9. Identify pipe strength requirements.
10. Prepare drainage facility quantity summaries.
11. Identify potential utility conflicts and, if feasible, design to mitigate or avoid those identified conflicts.
12. Consider pedestrian facilities, utility impacts, driveway grades, retaining wall and concrete traffic barrier drainage impacts.
13. Identify existing ground elevation profiles at the ROW lines on storm sewer plan and profile sheets.
14. Locate soil borings every 500 feet along the storm sewer alignment and take piezometric readings at 2000 feet intervals.
15. Prepare Hydraulic Data Sheets for any bridge or cross drainage structures at the outfall channel and indicate site location (e.g., station and name of creek or bayou), if applicable.
16. Develop a 3D model of the proposed drainage structures using the SUDA capabilities of the GeoPak/OpenRoads Product.
17. Develop layouts for the following:
    a. Subsurface drainage at retaining walls.
    b. Outfall channels within existing ROW.
    c. Bridge deck drainage systems, including internal drainage piping within the bents where required on structures.

d. Detention ponds, associated outlet structures, and details, if applicable. If information is not available at the time of initial scoping, this work shall be considered as additional work.

FUNCTION CODE 160(162) - ROADWAY DESIGN

SIGNING, PAVEMENT MARKINGS AND SIGNALIZATION (PERMANENT)

162.1. Signing. The Engineer shall prepare drawings, specifications, and details for all signs. The Engineer shall coordinate with the Owner (and other Engineers as required) for overall temporary, interim and final signing strategies and placement of signs outside contract limits. The Engineer shall:

- Prepare sign detail sheets for large guide signs showing dimensions, lettering, shields, borders, corner radii, etc., and shall provide a summary of large and small signs to be removed, relocated, or replaced.
- Designate the shields to be attached to guide signs.
- Illustrate and number the proposed signs on plan sheets.
- Select each sign foundation from State Standards.

162.2. Pavement Marking. The Engineer shall detail both permanent and temporary pavement markings and channelization devices on plan sheets. The Engineer shall coordinate with the Owner (and other Engineers as required) for overall temporary, interim, and final pavement marking strategies. The Engineer shall select Pavement markings from the latest City and Owner standards.

The Engineer shall provide a 3D corridor model with the proposed pavement marking stenciled onto the model.

The Engineer shall provide the following information on sign and pavement marking layouts:

- Roadway layout.
- Center line with station numbering.
- Designation of arrow used on exit direction signs
- Culverts and other structures that present a hazard to traffic.
- Location of utilities.
- Existing signs to remain, to be removed, to be relocated or replaced.
- Proposed signs (illustrated, numbered and size).
- Proposed overhead sign bridges to remain, to be revised, removed, relocated, or replaced.
- Proposed overhead sign bridges, indicating location by plan.
- Proposed markings (illustrated and quantified) which include pavement markings, object markings and delineation.
- Quantities of existing pavement markings to be removed.
- Proposed delineators, object markers, and mailboxes.
- The location of interchanges, mainlanes, grade separations, frontage roads and ramps.

- The number of lanes in each section of proposed highway and the location of changes in numbers of lanes.
- Right-of-way limits.
- Direction of traffic flow on all roadways.

162.3. Traffic Warrant Studies. The Engineer shall prepare a traffic signal warrant study to support their recommendation for the continuous activation of an existing traffic signal or a proposed traffic signal based on projected volumes. Each warrant study must include addressing pedestrian signals along with obtaining both traffic and pedestrian counts.

The Engineer shall implement each proposed traffic signal improvement within existing Owner ROW unless otherwise approved by the Owner. The Engineer shall refer to latest version of the TMUTCD, Traffic Signal Manual, and the Owner and TxDOT's roadway and traffic standards for work performed for either temporary or permanent traffic signals. The Engineer shall develop and include a timing plan for each signal improvement.

162.4. Traffic Signals. Based upon the results of the Traffic Warrant Studies, the Engineer shall identify and prepare Traffic Signal Plans for all warranted traffic signals. The Engineer shall confirm the power source for all signals and coordinate with the appropriate utility agency. Traffic Signal Plans must be signed and sealed by a Texas Registered Professional Engineer. The Engineer shall develop all quantities, general notes, specifications and incorporate the appropriate agency standards required to complete construction. Traffic signal poles, fixtures, signs, and lighting must be designed per the Green Ribbon Report recommendations and standards.

The Engineer shall provide the following information in the Traffic Signal Plans:

1. Layout
    a. Estimate and quantity sheet
        i. List of all bid items
        ii. Bid item quantities
        iii. Specification item number
        iv. Paid item description and unit of measure
    b. Basis of estimate sheet (list of materials)
    c. General notes and specification data.
    d. Condition diagram
        i. Highway and intersection design features
        ii. Roadside development
        iii. Traffic control including illumination
    e. Plan sheet(s)
        i. Existing traffic control that will remain (signs and markings)
        ii. Existing utilities
        iii. Proposed highway improvements
        iv. Proposed installation
        v. Proposed additional traffic controls
        vi. Proposed illumination attached to signal poles.

vii. Proposed power pole source

f. Notes for plan layout

g. Phase sequence diagram(s)
   i. Signal locations
   ii. Signal indications
   iii. Phase diagram
   iv. Signal sequence table
   v. Flashing operation (normal and emergency)
   vi. Preemption operation (when applicable)
   vii. Contact responsible Agency to obtain interval timing, cycle length and offset

h. Construction detail sheets(s)
   i. Poles (State standard sheets)
   ii. Detectors
   iii. Pull Box and conduit layout
   iv. Controller Foundation standard sheet
   v. Electrical chart

i. Marking details (when applicable)

j. Aerial or underground interconnect details (when applicable)

2. General Requirements
   a. Contact local utility company (1) Confirm power source
   b. Prepare governing specifications and special provisions list
   c. Prepare project estimate
   d. Conduct traffic counts and prepare Traffic Signal Warrant Studies for all proposed and existing traffic signals at designated locations.

3. Summary of Quantities
   a. Small signs tabulation
   b. Large signs tabulation including all guide signs

4. Sign Detail Sheets
   a. All signs except route markers
   b. Design details for large guide signs
   c. Dimensioning (letters, shields, borders, etc.)
   d. Designation of shields attached to guide signs

FUNCTION CODE 160(163) - ROADWAY DESIGN

MISCELLANEOUS (ROADWAY)

The Engineer shall provide the following services:

163.1. Utility Engineering

Utility Engineering includes the identification of utility conflicts, coordination, compliance with the UAR, and resolution of utility conflicts. The Engineer shall coordinate all activities with the Owner to facilitate the orderly progress and timely completion of the project design phase.

A. Coordination of Engineering Activities

1. Utility Layout:

The Utility Engineer must maintain a utility layout in the current approved version of OpenRoads Civil Design system used by the Owner. This layout must include all existing utilities which are to remain in place or be abandoned, and all adjusted utilities. This layout must be utilized to monitor the necessity of relocation and evaluate alternatives. The Utility Engineer must utilize the layout of existing utilities as prepared, if available, and make a determination of the following:

a. Facilities in conflict with the proposed project that are to be relocated.
b. Facilities to be removed or abandoned in place.
c. Facilities that are going to be moved underground.
d. Facilities to remain in service and in place because of roadway design adjustments and meeting the current UAR.
e. If there are additional facilities, not shown in the SUE documents, which require relocation, the Engineer shall coordinate this information with the Owner immediately upon discovery.
f. For facilities with unknown owner that require utility accommodation, the Utility Engineer must coordinate with the Owner for possible hot tap and removal. Engineer shall furnish all documents and exhibits to the Owner. When construction sequence and adjustments will be included in the PS&E package; the Utility Engineer must coordinate with the PS&E design engineer for the construction sequence in regard to the utility adjustments. The Utility Engineer must include this in the PS&E package.

B. Public and Individual Meetings with Utility Companies

As required, to facilitate utility conflict identification and resolution, the Engineer shall:

1. Establish contact with all existing utilities within and adjacent to the project limits and set up utility coordination meetings to discuss concepts and options for construction.
2. Schedule all utility coordination meetings and ensure compatibility with the schedule of the Owner.
3. Set agenda for all coordination meetings as directed by the Owner.
4. Establish and promote the desired agenda and methodologies for utility construction within the project limits. Typical strategies include Avoid- Minimize-Accommodate (AMA). The agenda and methodologies may allow the construction of utilities as a part of the highway contract.
5. Orientation: Prepare and present, in collaboration with the Owner, instruction and orientation sessions as required. The instruction must introduce the SUE Plans, the proposed utility layout, processes, demonstrate the technology, and facilitate the

preparation of work orders, billings, and contract related documentation as it pertains to utility adjustment work.

6. Initial Project Meeting following the Notice of Proposed Construction (NOPC): Attend an initial meeting and an on-site inspection (when appropriate) to ensure familiarity with existing conditions and project requirements and prepare a written report of the meeting.
7. Work Plan: Develop a work plan including a list of the tasks to be performed, a schedule, and an estimate. The work plan must satisfy the requirements of the project and must be approved by the Owner prior to commencing work.
8. Progress Meetings: Meet with the Owner and, if applicable, design consultants, periodically to coordinate the work effort and resolve problems. Prepare a written report of all progress meetings and provide the report to the Owner. During the progress meetings, the Utility Engineer must review:
    a. Activities completed since the last meeting
    b. Problems encountered.
    c. Late activities.
    d. Activities required by the next progress meeting.
    e. Solutions for unresolved and/or anticipated problems.
    f. Information or items required from other agencies/consultants.

C. Review of Utility's Proposed Adjustments

1. Evaluate alternatives: The Utility Engineer must evaluate alternatives in the adjustment of utilities balancing the needs of both the Owner and the Utility. The Utility Engineer must use the AMA strategy as part of evaluating the alternatives.
2. Review estimates and schedules: The Utility Engineer must review the utility adjustment estimates for reasonableness of cost and the timely scheduling of the adjustment.
3. The Utility Engineer must review plans for compliance with UAR, Buy America materials, and proposed location data.
4. The Utility Engineer must ensure that utility owners are receiving updates for project design development so that utility owners are reviewing the most current plans, quality and accuracy of utility adjustment data, as well as compliance of UAR, as it pertains to the plans. The responsibility for compliance, quality, and accuracy of utility adjustment plans will remain with the utility company.
5. The Utility Engineer must ensure compliance with the regulations of the most recent edition of the TMUTCD. The Utility Engineer must obtain approval from the Owner concerning the proposed method of handling traffic prior to allowing commencement of work.

D. The Engineer shall not provide services under this contract that are for the sole benefit of a party or parties other than the Owner. The Engineer shall not invoice the Owner for any such services.

E. The Engineer shall prepare signed and sealed proposed utility plans in the latest version of OpenRoads Civil Design system used by the Owner that can be overlaid (11" x 17") on the base file with drainage. The Utility Engineer must:

1. Ensure all facilities conflicts have been resolved.
2. Ensure all stakeholders have concurred with the various alignments.
3. Establish the sequence of construction for all utility relocation work whether it is included as a part of the roadway construction or not. Ensure that the sequence of work is included in the traffic control plan and incorporated in the contract time determination schedule.
4. Determine which utilities will be built as part of the contract.
5. Determine which facilities will be relocated prior to construction or during construction. The Utility Engineer is responsible for assisting in the creation and maintenance of the utility management plan.

F. The Engineer shall coordinate, and/or review PS&E for all utilities included in the construction contract.

G. Utility Certification or Special Provisions: The Utility Engineer must submit, upon request from the Owner, Utility Certifications or Special Provisions. The Utility Certifications or Special Provisions will certify that all utilities are clear for roadway construction. However, if the utility adjustments are not complete prior to highway project letting, the Utility Engineer must provide a Special Provision outlining all outstanding utility conflicts and their effects on roadway construction. The Utility Engineer is responsible for ensuring that the utility management plan, utility certifications, and special provisions interface appropriately. With the certification and special provisions as noted above, the Utility Engineer must monitor the completion of the work, according to the utility clearance schedule signed by the utility owner. The formats for the certification and the clearance schedule will be provided by the Owner.

H. The Utility Coordinator must submit the required executed copies of the Utility Agreement assemblies, which include the appropriate Forms as detailed in the UAR and supplied by the Owner, a copy of the recorded easement deed, plans, and estimate to the Owner by transmittal letter recommending approval. The transmittal letter must include the following statement "The proposed utility adjustment will not conflict with proposed highway construction and will comply with UAR. The utility should be reimbursed, based on the establishment of the eligibility ratio and betterment ratio, as applicable for eligible costs." The transmittal letter must also provide a description of the work being done as well as the estimated cost and schedule of work. The Utility Engineer must not perform engineering of relocation plans relative to a particular utility agreement under this contract as this is a cost of Right of Way that is subsidiary to the specific Utility Agreement.

I. Utility Engineering VFP-

End Result: Fully reviewed and approved engineering plans (done by utility owners) of constructible utility accommodations.

The Utility Engineer must:

1. Identify potential conflicts using the AMA process, the design, and SUE.
    a. Avoid – work with designers to avoid conflicts.

b. Minimize – Cost analyzed of safe available options to minimize cost and project delay.
c. Notice of Required Accommodation (NORA) sent out and acknowledgement of receipt obtained.

2. Hold meetings with utilities requiring (NORA) to strategize and program the accommodation
3. Document all activities.
4. Track all ROW acquisitions to assist with scheduling accommodations.
5. Review documentation and justifications for Utility Exceptions.

J. Deliverables:

The Engineer shall submit the following deliverables to the Owner:

1. Identification of utility conflicts.
2. Composite DGN file showing all utilities with abandoned, removed, and added utilities.
3. Documentation showing review of engineering plans created by utility owners to ensure compliance with UAR, Buy America, etc.
4. Scheduling of accommodation to minimize issues (downtime, etc.) while maximizing the use of resources (e.g., Traffic Control) in a manner consistent with overall project timelines.
5. Documentation showing that exceptions were reviewed for viability.

163.2. Utility Design

This task includes the design of water, wastewater, and reclaimed water utility facilities eligible under Transportation Code §203.092 and performed in support of necessary utility relocations, adjustments, modifications, or abandonment. The Utility Engineer must coordinate all activities with the Owner, or its designee, to design select utility facilities in a manner that will facilitate the orderly progression and timely completion of the Owner's project development effort.

As directed by the Owner, the Utility Engineer must prepare detailed plans, specifications, quantities, and estimates for, water, wastewater, and reclaimed water utility facilities that require relocation, adjustment, modification, or abandonment due to a conflict with the highway improvement project.

The Utility Engineer's activities must conform with those specified under Texas Administrative Code, Title 43, Part 1, Chapter 21, Subchapter C, Section 21.37, relating to the specified utility types, eligibility requirements, agreements, and approvals.

The Utility Engineer must provide documentation of the location and manner by which a utility installation, adjustment, or relocation work will be performed within the right of way to the Owner for review and approval.

A. Data Collection

Prior to the start of utility design, the Engineer shall investigate and verify ownership, size, construction method, depth, location, number of lines, and other details of the conflicting or noncompliant utility facility that are necessary to design the relocation, adjustment, modification, or abandonment of the utility facility.

B. Plan Preparation

1. The Utility Engineer must overlay the utility design plan onto the highway design plan to show existing and proposed highway features, including existing and proposed highway right of way lines, all control of access lines, and all applicable reference information.
2. The Utility Engineer must prepare the utility design plans to depict sufficient information that will enable the Owner to verify compliance with UAR including depth of cover, casing requirements, vent locations, manhole sizes, etc., for each utility design. At the Owner's request, the Utility Engineer must represent the existing and proposed utilities in a 3D utility model that is compatible with the Owner's MicroStation graphics program and OpenRoads civil design system.
3. The Utility Engineer must evaluate and resolve any conflict with existing and proposed utilities or highway facilities as a result of the utility design.
4. The Utility Engineer must review and verify that the utility design plans are consistent and compatible with, but not limited to, the following:
    a. ROW acquisition schedule
    b. Utility adjustments with ROW acquisition schedule
    c. Design and construction of the project
    d. Final highway design
    e. Any existing utility or any other utilities being installed in the same vicinity
    f. Highway design Traffic Control Plan (TCP)
    g. Sequence of work to define contract time determination
5. The Engineer shall gain approval of the utility design plans from the utility owner, operator, or other party authorized by the utility owner.
6. The Engineer shall develop utility design, standards, and specifications in a manner acceptable to the Owner for inclusion in highway construction plans for bid purposes. The utility design plans must be signed, sealed, and dated by the responsible Engineer.
7. At the request of the utility owner the Engineer shall assist the utility owner in the development of a utility exception request.

C. Estimates

The Utility Engineer must provide a detailed estimate of quantities that accurately correlates with the material types, denotes Buy America compliant material, and reflects the quantities on the utility design plans. The Engineer shall design the utility facility in a cost-effective and feasible manner.

D. Utility Design VFP-

End Result: The Engineer shall provide engineering plans of constructible utility accommodations showing compliance with safety, UAR, and Buy America.

The Engineer shall work with the Owner to create the engineering plans.

Examples of circumstances requiring this service may include, but are not limited to:

1. Utility does not have in-house capabilities for design and will pay for the Owner to complete this design work.
2. Owner takes over for unknown utilities requiring accommodation.

E. Deliverable(s):

The Engineer shall submit the following deliverables to the Owner:

1. Documentation of initial investigation of the site in question to verify requirements and spot potential issues.

163.3. Geotechnical Borings and Investigations

A. The Engineer shall determine the location of proposed soil borings for bridge design, embankment settlement analysis, retaining walls, slope stability and along storm drain alignment in accordance with the latest edition of TxDOT's Geotechnical Manual. The Owner will review and provide comments for a boring layout submitted by the Engineer showing the general location and depths of the proposed borings. Once the Engineer receives the Owner's review comments, the Engineer shall perform soil borings (field work), soil testing, and prepare the boring logs in accordance with the latest edition of TxDOT's Geotechnical Manual and the local TxDOT district's procedures and design guidelines.

B. All geotechnical work must be performed in accordance with the latest version of TxDOT's Geotechnical Manual. All testing must be performed in accordance with TxDOT's Test Procedures, which are available at https://www.txdot.gov/business/resources/testing.html. American Society for Testing Materials (ASTM) test procedures may be used only in the absence of the TxDOT procedures. All soil classification must be done in accordance with the Unified Soil Classification System.

C. If applicable, the Engineer shall perform any retaining wall analyses including the settlement analysis. This analysis must include the computation of the factor of safety for bearing capacity, global stability, overturning and sliding. In addition, the Engineer shall include allowable bearing pressure, passive earth pressure, friction factor, settlement analysis (consolidation report), and lateral earth pressure for the retaining walls.

D. If applicable, the Engineer shall perform soil borings, coring for pavement removal items, piezometric readings, testing and analysis to include slope stability analysis, settlement analysis, and foundation design recommendations along storm drain alignment, retaining walls, overhead sign structures, bridges, embankments and any temporary soil retaining systems.

E. The Engineer shall provide a signed, sealed, and dated geotechnical report that contains soil boring locations, boring logs, laboratory test results, generalized subsurface conditions, ground water conditions, piezometer data, analyses and recommendations for settlement and slope stability of the earthen embankments, skin friction tables and design capacity curves including skin friction and point bearing. The skin friction tables and design capacity curves must be present for piling and drilled shaft foundation.

F. If applicable, the Engineer shall perform scour analysis to include Grain Size distribution curves with D50 value.
G. The Engineer shall sign, seal, and date soil boring sheets to be used in the PS&E package. The preparation of soil boring sheets must be in accordance with TxDOT's District standards.
H. Foundation Studies: The Engineer shall coordinate with the Owner to determine the location of soil borings to be drilled along the retaining wall alignments. The soil borings must extend a minimum of 35 feet below the footing elevation or deeper as soil conditions warrant. Spacing of soil borings shall not exceed 500 feet. The Engineer shall provide a boring layout for the Owner's review and comment.
I. The Engineer shall incorporate soil boring data sheets prepared, signed, sealed, and dated by the geotechnical engineer overseeing the work. The soil boring sheets shall be in accordance with the WINCORE software available on the TxDOT website.
J. Pavement Design: If applicable, the Engineer shall incorporate the pavement design developed by the Owner. If the pavement design is not available, the Owner may request the Engineer perform pavement design and submit to Owner for review and approval.
K. Deliverables

    1. Preliminary Pavement Design Report
    2. Geotechnical Report
    3. DGN flies containing drilling log data from Geotechnical analysis

163.4. Retaining Walls and Miscellaneous Structures. The Engineer shall develop each retaining wall design and determine the location of each soil boring needed for the foundation design of each retaining wall in accordance with the Geotechnical Manual. Prior to preparation of retaining wall layouts, the Engineer shall prepare a comparative cost analysis of different types of retaining walls versus roadway embankment, pavement, soil stabilization, retaining walls type, and available ROW to determine optimum selection based on economics, construction time duration, ROW encroachments (need for construction easements) and construction feasibility. The Engineer shall submit early in the plan preparation the retaining wall layouts to obtain approval from the Owner. The Engineer shall incorporate all necessary information from above referenced manuals and respective checklists into the retaining wall layouts. For stage construction, the Engineer shall indicate limits of existing retaining walls for removal and reconstruction and determine limits of temporary retaining walls to be shown on the TCP.

For projects that have retaining walls, the Engineer shall develop retaining wall layouts in the 3D corridor model.

The approximate limits of each retaining wall shall be based on Station or length. The Engineer shall notify the Owner the type of retaining walls that will be used for and Cut and Fill location. Retaining wall types must include:

- Spread Footing Walls (High Footing Pressure Design and Low Footing Pressure Design). The Engineer shall select a spread footing wall for fill situation when considerable room behind the walls is available for forming, constructing, and backfilling the footings and stem. The Engineer shall notify the Owner when the

quantity is less than 1000 square feet to have as option in the plans to cast in place a spread footing wall design. This selection has to be approved by the Owner.

- Mechanically Stabilized Earth (MSE) Walls. The Engineer shall prepare the retaining wall layouts showing plan and profile or retaining walls for design by an Owner approved vendor. The Engineer is responsible for design of geometry and wall stability. The Engineer shall incorporate a slope of 4:1 or flatter from the existing and finished ground line elevation to the face of the retaining wall.
- Concrete Block Walls (Structural and Landscape)
- Tied Back Walls
- Soil Nailed Walls
- Rock Nailed Walls
- Drilled Shaft Walls
- Temporary MSE Walls.

The Engineer shall provide layouts (scale 1" = 100'), elevations, quantity estimate, summary of quantities, typical cross sections, and structural details of all retaining walls within the project. Approximate lengths of the retaining walls as shown on the schematic are listed as below. The Engineer shall determine if any additional walls are required and verify the need for and length of the retaining walls as shown on the schematic.

The specific requirements for each item are as follows:

1. Layout Plan
    a. Designation of reference line
    b. Beginning and ending retaining wall stations
    c. Offset from reference line
    d. Horizontal curve data
    e. Total length of wall
    f. Indicate face of wall
    g. All wall dimensions and alignment relations (alignment data as necessary)
    h. Soil boring locations
    i. Drainage, signing, lightning, etc. that is mounted on or passing through the wall
    j. Subsurface drainage structures or utilities which could be impacted by wall construction.

2. Elevation
    a. Top of wall elevations
    b. Existing and finished ground line elevations
    c. Vertical limits of measurement for payment
    d. Type, limits, and anchorage details of railing (only if Traffic Railing foundation standard is not being used on this project)
    e. Top and bottom of wall profiles plotted at correct station & elevation
    f. Underdrains
    g. Any soil improvement, if applicable
    h. Drainage, signing, lighting etc. as noted above
    i. Drainage structures and utilities as noted above

3. Sectional View
    a. Reinforced volume
    b. Underdrain location
    c. Soil improvements, if applicable.

4. General Guidelines for Retaining Walls
    a. The Engineer shall perform design calculations to check the external stability of the walls including slope stability, bearing, sliding and overturning and detail drawings in accordance with the standard requirements of the Owner.
    b. For retaining wall submittals, the Engineer shall check TxDOT's Bridge Division website for current requirements.

163.5. Traffic Control Plan, Detours, Sequence of Construction. The Engineer shall prepare Traffic Control Plans (TCP) including TCP typical sections, for the project. A detailed TCP must be developed in accordance with the latest edition of the TMUTCD. The Engineer shall implement the current Barricade and Construction (BC) standards and TCP standards as applicable. The Engineer shall interface and coordinate phases of work, including the TCP, with adjacent Engineers. The Engineer shall:

1. Provide a written narrative of the construction sequencing and work activities per phase and determine the existing and proposed traffic control devices (regulatory signs, warning signs, guide signs, route markers, construction pavement markings, barricades, flag personnel, temporary traffic signals, etc.) to be used to handle traffic during each construction sequence. The Engineer shall show proposed traffic control devices at grade intersections during each construction phase (stop signs, flag person, signals, etc.). The Engineer shall show temporary roadways, ramps, structures (including railroad shoo-fly) and detours required to maintain lane continuity throughout the construction phasing. If temporary shoring is required, prepare layouts, and show the limits on the applicable TCP.
2. Coordinate with the Owner in scheduling a Traffic Control Workshop and submittal of the TCP for approval by the Traffic Control Approval Team (TCAT). The Engineer shall assist the Owner in coordinating mitigation of impacts to adjacent schools, emergency vehicles, pedestrians, bicyclists, and neighborhoods.
3. Develop each TCP to provide continuous, safe access to each adjacent property during all phases of construction and to preserve existing access. The Engineer shall notify the Owner in the event existing access must be eliminated and must receive approval from the Owner prior to any elimination of existing access.
4. Design temporary drainage to replace existing drainage disturbed by construction activities or to drain detour pavement. The Engineer shall show horizontal and vertical location of culverts and required cross sectional area of culverts.
5. Prepare each TCP in coordination with the Owner. The TCP must include interim signing for every phase of construction. Interim signing must include regulatory, warning, construction, route, and guide signs. The Engineer shall interface and coordinate phases of work, including the TCP, with adjacent Engineers, which are responsible for the preparation of the PS&E for adjacent projects.

6. Maintain continuous access to abutting properties during all phases of the TCP. The Engineer shall develop a list of each abutting property along its alignment. The Engineer shall prepare exhibits for and attend meetings with the public, as requested by the Owner.
7. Make every effort to prevent detours and utility relocations from extending beyond the proposed Right-of-way lines. If it is necessary to obtain additional permanent or temporary easements and Right-of- Entry, the Engineer shall notify the Owner in writing of the need and justification for such action. The Engineer shall identify and coordinate with all utility companies for relocations required.
8. Describe the type of work to be performed for each phase of sequence of construction and any special instructions (e.g., storm drain, culverts, bridges, railing, illumination, signals, retaining walls, signing, paving surface sequencing or concrete placement, ROW restrictions, utilities, etc.) that the contractor should be made aware to include limits of construction, obliteration, and shifting or detouring of traffic prior to the proceeding phase.
9. Include the work limits, the location of channelizing devices, positive barrier, location and direction of traffic, work area, stations, pavement markings, and other information deemed necessary for each phase of construction.
10. Identify and delineate any outstanding ROW parcels.
11. Delineate areas of wetlands on traffic control plans.
12. Design the TCP phasing by creating a phased 3D corridor model.
13. Road closures should be avoided. If a road closure is determined to be necessary a Detour Layout and estimated closure duration shall be provided to the Owner for approval.

163.6. Temporary Traffic Signals and Illumination: The Engineer shall immediately notify the Owner if the Engineer determines that an existing traffic signal or roadway illumination will be affected by the project. The Engineer shall address the adjustment or realignment of traffic signal heads and the use of detection for mainlanes and side streets on the plans as directed by the Owner. The Engineer shall obtain traffic movement counts to address any new timing plans to minimize the impact during construction and to determine the storage length needed for left and right turn movements. The Engineer shall address lighting of signalized intersections and shall coordinate with local utilities as approved by the Owner.

163.7. Illumination. The Engineer shall refer to TxDOT's Highway Illumination Manual and other deemed necessary Owner approved manuals for design of continuous lighting and safety lighting for all conventional, high-mast, and underpass lighting. The Engineer shall include safety lighting as part of each design on each flashing beacon and traffic signal. The Engineer shall provide a preliminary layout for initial review and approval by the Owner. The Engineer shall prepare circuit wiring diagrams showing the number of luminaries on each circuit, electrical conductors, length of runs, service pole assemblies. Underpass lighting must be used on all structures within each project. The Engineer shall integrate existing illumination within the project limits into the proposed design. The Engineer shall coordinate with the Owner to determine the location of proposed high-mast, conventional, and underpass lighting.

Routes selected by Owner will install City approved, Dark Sky-compliant lighting with aesthetically pleasing poles per City code.

163.8. Storm Water Pollution Prevention Plans (SWP3). The Engineer shall develop SWP3, on separate sheets from (but in conformance with) the TCP, to minimize potential impact to receiving waterways. The SWP3 must include text describing the plan, quantities, type, phase and locations of erosion control devices and any required permanent erosion control. The SW3P sheets must also include blanks to indicate placement and removal dates of all BMPs within the plan.

163.9. Compute and Tabulate Quantities. The Engineer shall provide the summaries and quantities within all formal submittals.

163.10. Special Utility Details (Water, Sanitary Sewer, etc.) The Engineer shall develop special details to accommodate or adjust utilities. Prior to developing any special utility detail, the Engineer shall notify the Owner in writing regarding each utility conflict that may require an accommodation. As directed by the Owner the Engineer shall coordinate with each utility to develop each special detail. The Engineer shall develop each utility detail or accommodation in compliance with the State's Utility Accommodation Rules. The Engineer shall prepare each plan sheet, detail sheet, special specification, special provision, and special note required to incorporate the details into the Owner's plans.

163.11. Miscellaneous Structural Details. The Engineer shall provide necessary details required to supplement standard details.

163.12. Agreements (Railroad, etc.) and Layouts. The Engineer shall prepare each railroad or other agency agreement, exhibit, and layout sheet in accordance with the requirements of each railroad and as directed by the Owner. The Engineer shall coordinate with each railroad or agency and the Owner to determine submittal requirements, processing schedules, and exhibit formats. The Engineer shall submit each exhibit to the Owner for review and processing.

163.13. Testimony for Right of Way Hearings. If required, the Engineer shall support and testify in possible Right of Way hearings. As requested by the Owner or the City Attorney, the Engineer shall be required to do the following:

1. Research, study, analyze and review the project and the assigned parcels for acquisition.
2. Prepare litigation designs and standard 8.5 x 11-inch, 11 x 17 inch or 24 x 36-inch paper exhibits. These deliverables are considered to be litigation documents and not engineering documents requiring a P.E. seal.
3. Be available to prepare for and testify at hearings, depositions and trials, and.
4. Be available to assist and consult with the Attorney General's Office, with case preparation.

163.145. Estimate. The Engineer shall independently develop and report quantities necessary to construct the contract in standard Owner bid format at the specified milestones and Final PS&E submittals. The Engineer shall prepare each construction cost estimates using TxDOT, City of Kyle, and/or City of Austin bid items and recent bid tabs. The estimate shall be provided at each milestone submittal.

163.156. Contract time determination. The Engineer shall prepare a detailed contract time estimate to determine the approximate time required for construction of the project in calendar and working days (based on the TxDOT standard definitions of calendar and working days) at the 95% and Final PS&E milestone. The schedule must include tasks, subtasks, critical dates, milestones, deliverables, and review requirements in a format which depicts the interdependence of the various items and adjacent construction packages. The Engineer shall provide assistance to the Owner in interpreting the schedule.

163.167. Specifications and General Notes. The Engineer shall identify necessary standard specifications, special specifications, special provisions, and the appropriate reference items. The Engineer shall prepare General Notes from the TxDOT Austin District's Master List of General Notes, Special Specifications and Special Provisions for inclusion in the plans and bidding documents. In addition, the Engineer shall include applicable Owner general notes. The Engineer shall provide General Notes, Special Specifications and Special Provisions in the required format.

163.18. Constructability Review. The Engineer shall provide Independent Quality Review of the constructability of the PS&E sets.

The Engineer shall perform constructability reviews at major project design milestones (e.g. 30%, 60%, 90%, and final plan) to identify potential constructability issues and options that would provide substantial time savings during construction. The constructability review must be performed for all roadway and structural elements such as Sequence of Work and Traffic Control, Drainage (Temporary and Permanent), Storm Water Pollution Prevention Plan (SWP3), Environmental Permits, Issues and Commitments (EPIC) addressed, identify Utility conflicts; ensuring accuracy and appropriate use of Items, Quantities, General Notes, Standard and Special Specifications, Special Provisions, Contract Time/Schedule, Standards; and providing detailed comments in an approved format. Reviews must be captured in a Constructability Log identifying areas of concern and potential conflict. The Engineer shall provide the results of all Constructability reviews and recommendations to the Owner at major project design milestone submittals.

FUNCTION CODE 160(165) – ROADWAY DESIGN

Traffic Management Systems (Permanent)

The Engineer shall design and provide details as a part of the State's Intelligent Transportation System to be managed from the Combined Transportation, Emergency and Communications Center (CTECC). The design must include elements such as lane-use control signals, variable message signs, closed-circuit Television (TV) cameras, and loop or other vehicle detection devices. The Engineer shall prepare the design and details including conduit and cable, support structures (control equipment, etc. necessary to implement the system). Design specifications shall be defined in the task order. The Engineer shall also coordinate with the State Computerized Transportation Management Systems (CTMS) Section should the State have a computerized traffic management system under construction or in place and operating within the project limits.

FUNCTION CODE 160(170) – ROADWAY DESIGN

BRIDGE DESIGN

170.1. Bridge Layout. The Engineer shall prepare a bridge layout plan sheet for each bridge and bridge class culvert. The Engineer shall determine the location of each soil boring needed for foundation design in accordance with the Geotechnical Manual.

Prior to preparation of each bridge layout, the Engineer shall prepare a comparative cost analysis of bridge structures to determine: (1) the optimum bridge beams for vertical clearance over railroads, roadway, or waterways, (2) the optimum bridge structure versus roadway embankment, pavement, soil stabilization, and retaining walls, and (3) to determine optimum in bridge beams for the direct connectors.

The Engineer shall submit a bridge layout for each structure early in the plan preparation process to obtain approval from the Owner. The Engineer shall also render each bridge, to the appropriate level of detail, in the 3D corridor model. The Engineer shall comply with all relevant sections of the latest edition of the State's LRFD Bridge Design Manual, Bridge Project Development Manual, Bridge Detailing Guide, and AASHTO LRFD Bridge Design Specifications and respective checklists. Each bridge layout sheet must include bridge typical sections, structural dimensions, abutment and bent locations, superstructure, and substructure types. The Engineer shall locate and plot all soil borings and utilities, show proposed retaining walls, and, for staged construction, indicate limits of existing bridge for removal and reconstruction.

170.2. Bridge Detail Summary. The Engineer shall prepare total bridge quantities, estimates, and summary sheets for each bridge or bridge class culvert.

170.3. Bridge Structural Details. The Engineer shall prepare each structural design and develop detailed structural drawings of all required details in compliance with above- listed manuals and guidelines. The Engineer shall assemble and complete all applicable Standard Details sheets.

Additionally, the Engineer shall:

- Perform calculations for design of bridge abutments.
- Perform calculations for bridge slab design.

- Perform calculations to determine elevations of bridge substructure and super structure elements.
- Perform calculations for bridge box beam design.
- Prepare necessary foundation details and plan sheets.
- Prepare plan sheets for abutment design.
- Prepare plan sheets for additional abutment details.
- Prepare framing plan and slab plan sheets.
- Compute and prepare tables for slab and bearing seat elevations, dead load deflections, etc.
- Design beams and prepare beam design tables.
- Prepare special provisions and special specifications in accordance to the above-listed manuals and guidelines.

FUNCTION CODE 300(351) – DESIGN VERIF/CHANGES/ALTER

CONSTRUCTION PHASE SERVICES

The Engineer shall provide Construction Phase Services at the written request of the Owner's Project Manager. The written request must include a description of the work requested, a mutually agreed upon time limit, and any special instructions for coordination and submittal. These services shall include, but are not limited to the following:

1. Attend preconstruction meeting
2. Attend partnering meeting
3. Attend field meetings and make visits to site
4. Calculate quantities and assist the Owner in preparing change orders
5. Review and approval of shop drawings
6. Review and approval of forming details
7. Responding to requests for information (RFIs)
8. Providing minor redesign (major redesign should be handled with a contract supplement), which will include changes to the affected plan sheets and an updated copy of the 3D corridor model.
9. Answering general questions
10. Providing clarification
11. Other project related tasks in support of the Owner during construction

UTILITY CONSTRUCTION MANAGEMENT AND VERIFICATION

351.1. Utility Construction Management and Verification

A. The Utility Engineer must provide a Utility Coordinator to coordinate all activities with the Owner, or the Owner's designee, for the orderly progress and timely completion of the Owner construction phase.
B. The Utility Engineer must provide a Utility Coordinator to perform non-engineering utility coordination services consisting of coordinating with Owner, or Owner's designee, regarding

all utility-related activities for the orderly progress and timely completion of the construction phase of the project. At a minimum, the Utility Coordinator must prepare the following:

1. Work Plan. The Utility Coordinator must create and maintain a work plan that includes a list of the proposed meetings, coordination activities, and related tasks to be performed; a schedule; and an estimate. The work plan must satisfy the requirements of the project and must be approved by the Owner prior to commencing work.
2. Conflict Matrix. The Utility Coordinator must create and maintain a list of utility conflicts and their impact to the project. The Utility Coordinator must update the list following each progress meeting.
3. Utility Conflict Exhibit. When requested by the Owner, the Utility Coordinator must create and maintain a utility conflict exhibit that correlates with the utility conflict matrix. The format of the exhibit must be consistent with the District's latest Example Utility Conflict Exhibit.
4. Initial Project Meeting. The Utility Coordinator must attend an initial meeting and an on-site inspection (when appropriate) to ensure familiarity with existing conditions and project requirements. The Utility Coordinator must prepare a written report of the meeting.
5. External Communications. The Utility Coordinator must coordinate all activities with the Owner, contractors, and agents as specified by the Owner. The Utility Coordinator must provide the Owner copies of diaries, correspondence, and other documentation of work-related communications between the Utility Coordinator, utility owners, and other outside entities when requested by the Owner.
6. Progress Meetings. The Utility Coordinator must implement a schedule of periodic meetings in the field with each utility company and owner or owner's representatives for coordination purposes. These meetings must commence as early as possible and continue until completion of the project. The Utility Coordinator must notify the Owner at least two business days in advance of each meeting to allow the Owner the opportunity to participate in the meeting. The Utility Coordinator must provide and produce meeting minutes of all meetings between Owner (or Owner's representatives) and utility companies within seven business days. The frequency of these meetings must be appropriate to the matters under discussion with each utility owner.

C. Utility Construction Management and Verification VFP-

End Result: The Utility Coordinator must perform communication and coordination that allows orderly progress and timely completion of the Owner's construction phase.

D. Deliverables:

The Utility Coordinator must submit the following deliverables to Owner as requested:

1. Documentation that work plan was developed and followed
2. Utility Conflict matrix
3. Utility Conflict exhibit
4. Documentation of project meetings (including regularly scheduled and as-needed meetings)

5. Documentation of external communications and management of communications
6. Documentation of progress meetings
7. Documentation of any "lessons learned" on the completed work plan (for the purpose of continuous improvement)

Notes:

These deliverables must be maintained throughout the construction phase.

Documentation of meetings includes documentation for notification of meetings, agenda, sign in sheets, and meeting minutes.

FUNCTION CODE 160(160) - ROADWAY DESIGN

Deliverables

Plans

The Engineer shall provide the following information at each submittal:

1. 30% Plans Submittal
    a. Electronic submittal
    b. Estimate of construction cost.
    c. Engineer's internal QA and QC markup set.
    d. Design Exceptions with existing and proposed typical sections, location map and design exception exhibits.
    e. A Preliminary 3D corridor model, in the most current format, created using Bentley's OpenRoads tools, and with detail to verify the design of the 30% plan sheets.
2. Between 30% Submittal and 60% Submittal:
    a. Electronic bridge and retaining wall layouts for the Owner review.
    b. External stability analysis for retaining walls.
    c. Engineer's internal QA and QC marked up set.
    d. One set of a roll format TCP phasing layouts and one .pdf of plan sheets for TCP concept.
    e. Electronic copy of a roll format of illumination plan concept to Owner review.
    f. Electronic set–Bridge Class Culvert Plan and Profile sheets and Hydrology & Hydraulics sheets, include project title sheet and project layout sheet.
    g. A preliminary 3D corridor model, in the most current format, created using Bentley's OpenRoads tools, and with detail to verify the design of the Bridge and Retaining Wall layouts.
3. 60% Plans Submittal:
    a. Electronic set for owner review
    b. Estimate of construction cost.
    c. Engineer's internal QA and QC marked up set.
    d. Electronic roll format TCP phasing layouts and one .pdf of plan sheets for TCP concept.

e. A preliminary 3D corridor model, in the most current format, created using Bentley's OpenRoads tools, and with detail to verify the design of the 60% plan sheets. The level of detail of the surface and subsurface features will be at the direction of the Owner.

4. Owner Bridge Review
    a. Electronic set of Bridge Layouts
       A preliminary 3D corridor model, in the most current format, created using Bentley's OpenRoads tools, and with enough detail to verify the design of the Bridge layouts.
5. Review Submittal (90%)
    a. Electronic set for review
    b. Estimate of construction cost.
    c. Marked up general notes
    d. Construction schedule.
    e. New Special Specifications and Special Provisions
    f. Engineer's internal QA and QC marked up set.
    g. Other supporting documents.
    h. A detailed 3D corridor model, in the most current format, created using Bentley's OpenRoads tools, and with detail to verify the design of the 90% plan sheets. The level of detail of the surface and subsurface features will be at the direction of the Owner.
6. District Review Submittal (95%) for projects requiring TxDOT participation:
    a. 2 sets of 11" x 17" plan sheets for the Owner review
    b. List of governing Specifications and Special Provisions in addition to those required.
    c. Marked up general notes.
    d. Plans estimate.
    e. New Special Specifications and Special Provisions
    f. Triple Zero Special Provisions.
    g. Engineer sign, seal and date supplemental sheets (8 ½" x 11").
    h. Contract time determination summary.
    i. Significant project procedures form.
    j. Right-of-Way and utilities certification.
    k. Temporary road closure letters.
    l. Construction speed zone request.
    m. Engineer's internal QA and QC marked-up set.
    n. Other supporting documents.
    o. A detailed 3D corridor model, in the most current format, created using Bentley's OpenRoads tools, and with detail to verify the design of the 95% plan sheets. The level of detail of the surface and subsurface features will be at the direction of the Owner.
7. Final submittal (100%).
    a. 1 paper set 24" x 36" and 1 set 11" x 17"
    b. Revised supporting documents from 95% review comments.

c. A final 3D corridor model, in the most current format created using Bentley 's OpenRoads tools. The level of detail of the surface and subsurface features will be at the direction of the Owner.
d. A final 3D earthwork model in either .XML or. ICM format (as directed by the Owner) created using Bentley's OpenRoads tools. The level of detail of the surface and subsurface features will be at the direction of the Owner.

Electronic Copies

- The Engineer shall furnish the Owner with a flash drive or USB hard drive of the final plans in the format of current CADD system used by the Owner, and shall also provide as a .pdf format and upload to the file management system.
- The Engineer shall also provide a separate flash drive or USB hard drive containing cross section information (in dgn, XLR, & ASCII formats) for the contractor to use.
- The Engineer shall provide an electronic copy of MS Project, Primavera, or the latest scheduling program used by the Owner for construction time estimate.
- With the approval of the Owner, and in lieu of the above, the Engineer may maintain the project files in the Owner's file management system.

Calculations

The Engineer shall provide the following:

- A 3-ring binder with all quantity and non-structural design calculations.
- A bound copy of all engineering calculations, analysis, input calculations, quantities, geometric designs (GEOPAK GPK files), etc. relating to the project's structural elements. Project structural elements include, but are not limited to: bridges, retaining walls, overhead sign foundations, high-mast illumination foundations, non-standard culverts, custom headwalls and drainage appurtenances.
- Working copies of all spreadsheets and output from any programs utilized on a flash drive or USB hard drive in a universally reliable format and uploaded to the Owner's Procore file management system.
- The Engineer may provide the calculations in .pdf format in lieu of the bound hard copies. The .pdf file will be submitted on a flash drive or USB hard drive, and uploaded to the Owner's Procore file management system.

"EXHIBIT B"

TASK ORDER NO. _____

This Task Order is issued pursuant to that Professional Services Agreement (Agreement) between the City of KYLE, Texas (Owner) and BGE, Inc. (Professional) effective _____, 2022 and constitutes authorization by Owner for Professional to proceed with the following described construction and engineering design services.

Construction and Engineering Design Services

A. PROJECT DESCRIPTION

The scope of the Agreement is to provide professional construction and engineering design services (Services) for the Owner based on the scope of services listed below in Item B. Professional services may include performing preliminary engineering and planning; generating plans, specifications and estimates; researching, analyzing, and providing technical recommendations; providing construction phase services; and providing general consulting services in the areas identified herein.

B. SCOPE OF SERVICES AND DELIVERABLES

Pursuant to the Agreement, this Task Order authorizes Professional to perform the Services shown in Attachment A.

C. BASIS OF COMPENSATION

The total compensation for the Services shall be based on the hourly rates as defined in Compensation Table provided on page 3 of this document, and on the corresponding rates and hours in the Fee Estimate attached as Attachment B. Attachment B shall use the template provided by the Owner. Owner will make payments to Professional for performing the Services described on a monthly billing basis in accordance with monthly statements submitted by the Professional and approved by Owner. Final payment shall be due upon completion of the Services described.

D. TIME FOR COMPLETION

Professional will work expeditiously to complete the Services described herein by _____, 202__.

BGE, Inc. shall begin work as soon as authorized in this Task Order No. _____..

APPROVED:	**ACCEPTED:**
CITY OF KYLE, TEXAS	**BGE, INC.**
By _____	By _____
Title: City Manager	Title _____
Attest _____	Attest _____
Date _____	Date _____

COMPENSATION

Compensation for the services provided pursuant to the Professional Services Agreement between the City of Kyle and BGE, Inc. executed the _____ day of _____, 2022 will be paid on a lump sum basis and calculated based on the amounts reflected below.

Professional Staff	Hourly Bill Rate	Example Staff
Construction Technician		
Sr. Construction Technician		
ENG I (EIT I)		
ENG II (EIT II)		
ENG III (EIT III)		
ENG IV (Project Engineer I)		
ENG V (Project Engineer II)		
ENG VI (Sr. Engineer I)		
ENG VI (Sr. Engineer II, PM)		
ENG VII (Sr. Engineer III, Sr. PM)		
ENG VIII (Principal / Director)		