

## SCOPE OF WORK

### Front Range Non-Project Specific Traffic Engineering Services

#### Procurement

- Assist CDOT in procuring specialized related data, hardware, software, and training.
- Provide oversight and assistance in procurement programs, such as sponsorship programs for the procurement of equipment and services, and assistance with RFP development.
- Provide support for public-private partnerships and innovative contracting.

#### Training

- Perform, review, train, and provide technical support on various travel demand and traffic operation models, including but not limited to, VISSIM, CORSIM, SYNCHRO, TruTraffic (formerly TSPP-Draft), HCS/FreeVAL, and TransModeler.
- Train CDOT personnel on use of specialized traffic, transportation engineering, and telecommunications/network related software in addition to any training requested.
- Provide multi-user multi-scenario simulation training programs. This includes training, such as ICS and TIMS readiness, software, program, and process training.
- Provide and conduct research on innovative ideas/implementations and demonstrate how they could be implemented at CDOT.
- Provide support to the Maintenance Training Manager to coordinate all training, including standardizing the training and development of maintenance employees across the state.

#### Manuals, Procedures, and Guidance

- Support, prepare, and update Traffic Incident Management Plans, Operations Plans, Lane Closure Strategies, and Managed Lane Strategies as requested, including the development of actual plans or strategies, manuals, training, and meeting documents.
- Provide Emergency Management operations and support by supporting the development of CDOT's Incident Management Team, expanding CDOT's All-Hazard and Wildfire response capability, and updating the 2017 CDOT Emergency Operations Plan.
- Assist in the development of policies, procedures, and guidelines for the administration of various CDOT engineering programs.
  - Help develop and write procedures, processes, and guideline documents that explain criteria, factors, scoring for selection, prioritization, and weighting of safety and operations projects.
  - Prepare executive summaries and presentations for use by CDOT staff for executive meetings, management briefings, Transportation Commission presentations, etc.
  - Write, edit, and revise technical specifications and standard plans.

#### Data Collection, Surveying, Inspection, and Locates

- Perform the collection of various traffic and maintenance related data and physical information, using field instrumentation, unmanned aerial systems (UAS), photography, LiDAR, and other methods.

- Develop data collection requirements, including identification of specific data fields, and perform field inventories of traffic control devices, ITS infrastructure assets, and maintenance infrastructure assets.
- Provide underground fiber optic, power cable, and other utility locating services for traffic and ITS communications backbone and devices. Perform potholing for locates and conduct Subsurface Utility Engineering (SUE) surveys.
- Provide structural inspections and reports of traffic signal poles and mast arms, ITS structures, and sign structures.
- Provide roadway surveying plans with a PLS Stamp as required. Traffic control and permits will be required.
- Perform pavement marking and signage retroreflectivity measurements.

#### **Data Management and Asset Management**

- Assist in warehousing and managing data in SAP, ArcFM/Fiber Manager, ARCGIS, and other warehousing applications.
- Assist in the development of a centralized data repository for sensor, field, and asset data.
- Provide database management, system architecture, integration, interfaces, general support, application development, reporting, and dashboard development.
- Collect, review, process, and perform Quality Control/Quality Assurance on traffic and safety data.
- Support and represent the asset manager by providing data analysis, quality assurance, report development, asset inventory data management, and budgeting.
- Assist with budget setting workshops and analyze inventory data to support funding requests.
- Provide support with asset management functions for signals and other ITS devices, signs, markings, guardrails, and fiber optic communications.
- Assist in the development of technical plans for various asset categories.
- Develop functional requirements for operational performance measures for automated reporting using available CDOT systems and reporting tools.

#### **Studies / Analysis**

- Perform traffic operations and maintenance studies or analyses.
  - Analyze various types of transportation data, including crash, traffic operations, asset condition information, maintenance operations, and roadway characteristics.
  - Summarize and visualize findings in various formats for public use and understanding in decision-making.
- Perform field studies, such as speed, curve, signing, operations, ITS applications, strip map updates, and safety.
- Perform Access Management/Control studies and analyses, including preparing traffic impact studies and public meeting presentations, staff coordination with local agencies, reviewing traffic impact studies from developers and other consultants, and providing technical support.

- Develop individual signal timing plans, corridor signal timing progression plans, and optimization plans, including ramp metering studies.
- Assist in the evaluation and implementation of traffic signal/ramp metering related technologies and systems including adaptive/responsive systems, automated performance measures, and deployment of V2X (cellular and/or DSRC) infrastructure in support of the Signal Phasing and Timing (SPaT) data broadcast.
- Conduct analyses needed for consideration of safety measures in the designs and planning of transportation projects.
- Perform traffic analysis to implement construction phasing to optimize traffic flow during construction.
- Assist in the full implementation of the operations clearance process, including operational assessment creation, study, and review. Assist with Systems Engineering Analysis (SEA) and Safety processes in SharePoint.
- Provide Geotechnical recommendations and reports relating to test hole boring, classifications analyses, concrete and asphalt testing, pavement design, and foundation analysis and design.
- Conduct traffic engineering, safety, and operations support work for region and headquarters staff, including conducting inventories, polls, surveys, research, literature reviews, and program evaluations and audits; providing technical, policy, and procedural writing; providing SEA documentation support; etc.
- Provide staff to conduct traffic studies regarding speed, progression, congestion, incidents, removal of vehicles, etc.

#### **Review and Technical Support**

- Conduct program and project management oversight, coordination, and facilitation activities, and assist region and headquarters staff to deliver safety, traffic engineering, ITS, and operations programs.
- Assist staff with developing, integrating, and reporting safety, traffic engineering, and operations performance measures, metrics, and KPI's.
- Assist staff with developing standard specifications and details related to traffic items.
- Conduct before and after studies for projects funded by safety programs, using crash data to assess the effectiveness of project selection and mitigation strategies.
- Provide staff as needed to compliment the Region operations offices in all capacities.
- Perform Local Agency project plan reviews and structural reviews, and provide comments and recommendations as needed.
- Review, attend meetings and provide technical assistance on traffic impact studies, NEPA, 1601's, Interchange Access Requests (IAR), Minor Interchange Modification Requests, Environmental Assessments, Environmental Impact Studies, and maintenance studies as requested, including independent review of other's designs.
- Attend, provide visual aids, take minutes, and prepare reports as needed for meetings.
- Provide technical assistance with traffic engineering, ITS, and maintenance-related issues as requested and create white paper write-ups.

- Provide technical assistance in researching and preparing federal grant applications for traffic engineering projects, including writing, graphics, photographs, layout, traffic modeling, and benefit-cost analysis.
- Provide technical support in the areas of planning, design, operations, maintenance, and integration of toll roads, managed lanes, Connected & Autonomous Vehicles (CAV), Innovative Mobility initiatives, and other technical areas as directed.
- Assist in the deployment, testing, and evaluation of ITS- and CAV-related technologies and applications, including operationalizing cutting-edge mobile and roadside technologies that enable multiple V2V & V2I applications.
- Provide expert testimony regarding maintenance and traffic operations.
- Review and design structural shop drawings for traffic signals, ITS structures, overhead signs (cantilevers, butterfly, two posts), bridge attachments for conduit, light poles, etc. as requested.
- Provide miscellaneous services regarding traffic operations and ITS to help with the day-to-day operations of the Regions, the Colorado Traffic Management Center (CTMC), and regional traffic management centers.
- Provide assistance with statewide planning, agreements, and public or private coordination activities for current and future ITS, traffic, congestion management, and other CDOT activities.
- Conduct modeling, simulation, analysis, and alternatives analysis for various roadway segment and intersection configurations for traffic engineering, operations, and safety scenarios using current modeling software, including VISSIM, CORSIM, SYNCHRO, TruTraffic, Rodel, SIDRA, Dynus-T, Vision Zero Suite, and HCS.
- Provide web-based support to develop new web applications or pages, or edit existing pages.
- Assist in the implementation and management of the Corridor Operations and Bottleneck Reduction Assistance (COBRA) program including identification of locations, research of innovative solutions, and evaluation of measures.
- Provide hydraulics engineering services and support.
- Assist in support, explorations, and evaluations of emerging technologies, including aerial support for operations, connected vehicles, autonomous vehicles, big data tools, LiDar, etc.
- Provide technical guidance and support for various maintenance programs, including Winter Operations Program, Tunnel Asset Management, Maintenance Project Program (M-Projects), Deicer Quality Assurance Program, Avalanche Control Program, Noxious Weed Program, and sign shop manufacturing facility.
- Coordinate, manage, and oversee programs such as the Bridge Parolee Program, Adopt-A-Highway Program, and Commercial Driver's License (CDL) Program.

### Design

- Design and prepare preliminary and final plans, specifications, quantities, and estimates (using CDOT required software) for all types of traffic, MLOS, and ITS projects to meet CDOT, City, County, COG, or FHWA requirements, including:

- Roadway design (including construction phasing and traffic control plans)
- Intersection design (including Alternative Intersection Design)
- Roadway pavement markings (tape, thermoplastic, water-based, etc.)
- Traffic signals (LED displays, mast arm designs, adaptive signals/controllers, etc.)
- Vehicle detection systems (video, loop microwave, radar, ultrasonic, etc.)
- Interconnect systems (hardware, phone, cellular phone, spread spectrum, radio, etc.)
- Sign layouts, signing plans, and sign support systems, including sign structure design and analysis and sign sequences on the highway, which shall be consistent with the MUTCD and CDOT's practices and policies
- ITS devices (variable message boards, closed-circuit television, fiber optic infrastructure or other devices, other communications media, etc.)
- Fiber optic networking drawings and fiber optic splicing plans
- ITS Fiber Network plans for interconnection to the CTMC, Nodes/Regions, tunnels, EJMT, HLT, and Traffic Management Centers, including network design, fiber assignments, and studies and reports
- ITS Network Support Plans
- Utility plans that comply with federal and state legislated SUE requirements
- Construction (temporary) geometric design, capacity analysis, signing, pavement marking, and signal design plans and schedules
- Lighting design (intersection, roadway, underdeck/tunnels, and electric/power system)
- Furnish detailing and drafting services.
- Provide a Colorado Licensed Professional Engineer (PE) Stamp to certify designs, changes to designs, and Plans, Specifications, and Estimates (PS&E) packages.
- Provide railroad crossing design and coordination services, railroad flagging, railroad permitting for utilities, railroad signal design and consulting services, railroad crossing diagnostics, inspections, and construction oversight.

### **Construction**

- Oversee construction management, inspection, and completion of appropriate CDOT paperwork as required, including ITS construction and field management, and materials (LIMS) data entry. Prepare monthly estimates for approval.
- Perform construction traffic control management and coordination activities.
- Perform material testing in accordance with CDOT Field Materials & Construction Manuals.
- Prepare sample test and material documentation to CDOT Central or Region laboratory.
- Provide design support during construction to address changes to design elements due to constructability issues or plan errors.
- Prepare and review change orders for CDOT and local agency construction projects to ensure they are in accordance with CDOT standards and requirements.

### Utility Investigation Activities

- Conduct and document an investigation of the project area to determine existing utility conditions within the project limits.
- Meet with all utility providers and collect utility key maps for all utilities in the project area, identify all known utilities, ownership, type, size and special conditions should utility relocation be required, and research and obtain copies of utility easements (public and private) and utility franchise agreements to determine conditions under which the utility was established in its present location (e.g. by revocable permit or by a privately owned easement). The utility investigation requirements are to meet Quality Levels A and/or B as required under CI/ASCE 38.
- Shall employ Professional Engineers who are able to stamp plans, when applicable.
- Deliverables shall include:
  - The end product (the CADD file or project plans) that contain the horizontal location of utilities, ownership, type, and size of the line including any special conditions of the line. The plans should depict the lines following CDOT utility line type standards and colors, include all utility easements, and power source locations with easements.
  - Easements shown on plans
  - Produce a utility contact list: Including utility provider, contact name, email address, work & cell phone numbers.
  - The utility plan sheets will include the utility line work with proper designation colors.
  - Complete scoping design for utility plans.
  - Include service line locations for water, sewer, electrical, communications and natural gas.
  - Show transmission main lines and secondary feed lines with labels.
  - Distinguish lines between CDOT owned facilities, local agency facilities and utility provider facilities.
  - Produce utility plan sheets for review with utility providers including an oversize plan sheet for coordination and meetings.
  - Include known easements for the utility providers; inside, adjacent to and outside CDOT ROW on the utility plans.
  - Provide a table for each utility provider that includes size and type of the providers' facilities.
  - Include manhole rim labels and inverts in and out labels that match CDOT project datum elevations.
- FIR (Field Inspection Review)
  - Provide a matrix of potential utility conflicts.
  - Provide for and manage the potholing services.
  - Provide a potholing map for survey locates.
  - Provide a potholing chart and incorporate pothole location into the FIR Utility Plans. In the event there is insufficient design available to perform the potholing



activities pre FIR, the consultant shall coordinate the final potholing work into the FOR plan level submittal

- Produce utility plan sheets for review with utility providers including an oversize plan sheet for coordination and meetings
- Sewer/Storm manholes will be verified; rim elevations, inverts in and inverts out, include pipe size and pipe material. Include labels for other sewer appurtenances, lift stations, drop manholes, vents and force mains.
- Water lines to be verified; elevations for valve boxes including size, pipe size and pipe material. Include labels for other water appurtenances, air vacs, PRV vaults, vents and curb stops.
- Dry utility labels for vaults, pull boxes, manholes, drop down transformers and other providers attached to all overhead utility line poles.
- Complete FIR design for utility plans
- The utility plan sheets will include the utility line work with proper designation colors.
- FOR (Final Office Review)
  - Produce Utility notification letters to utility providers for acknowledgment of potential conflicts or relocations.
  - Calculate quantities and produce a tabulation of utility pay items.
  - Incorporate notes on the utility plan sheets describing the anticipated relocation work.
  - Provide Utility 3-D modeling in high conflict areas where precision placement of utilities is deemed essential.
  - The utility plans sheets will include the utility line work with proper designation colors.
  - Include utility notes and specifications.
  - Complete FOR design for utility plans.
  - The consultant will finalize the identification of existing utilities (both wet and dry) that will be impacted by design and finalize the existing utility plans with call-outs indicating which existing utilities are impacted
  - Produce and/or obtain from the owner utility cost estimates to be used for utility reimbursement agreements.
  - Cross sections will show the utility location both vertically and horizontally and will include existing and proposed ROW lines.
  - Drainage profiles will show the utility location both vertically and horizontally and will include existing and proposed ROW lines.
  - Wall and bridge profiles will show the utility location both vertically and horizontally.
  - Landscape plans will include utility locations.
  - Signal and lighting plans will include utility locations.
- Utility Coordination
  - Coordinate the utility permit.

- Coordination of scoping meetings with all utility providers and meeting minutes.
  - Request and receipt of utility maps and easements from utility companies will be coordinated with CDOT project manager and with CDOT region utility engineer.
  - Conduct a review of utility information, obtain existing utility mapping from the utility providers.
  - Request franchise agreements from the local agencies.
  - Request identification for any secondary utility provider attachments to the main utility provider's facility.
  - Work with surveyor to adjust datum to match CDOT project.
- FIR (Field Inspection Review)
    - Coordination of FIR meetings with all utility providers and meeting minutes. (Office and Field)
    - Review utility matrix conflicts with CDOT RUE and work on plan of action.
    - Review potholing map with CDOT.
    - Coordinate with CDOT, potholing company and survey company on potholing schedule.
    - Coordinate with the CDOT region utility engineer on utility notes and specifications.
    - Coordinate the utility permit.
    - Coordinate with project manager and CDOT RUE and affected utility companies on the FIR utility plans for distribution.
  - FOR (Final Office Review)
    - Coordination of FOR meetings with all utility providers and meeting minutes. (Office and Field)
    - Coordination with the wet and dry utility providers on the potential relocation areas
    - Coordination with surveyor on the potential relocation areas
    - The consultant will coordinate with project manager and CDOT region utility engineer and affected utility companies on the FOR design.