SECTION 8

ADDITIONAL PROJECT DEVELOPMENT CONSIDERATIONS

8.01 AMERICANS WITH DISABILITIES ACT STANDARDS

Through the implementation of the provisions of the document "ADA Accessibility Requirements in CDOT Transportation Projects," CDOT has established uniform standards to ensure projects on new and existing transportation facilities conform with the Americans with Disabilities Act (ADA) and are made accessible to persons with disabilities, including wheelchair and limited-sight users.

Facility design shall be in compliance with the 1991 Americans with Disabilities Act Accessibility Guidelines (ADAAG) or standards that may replace the 1991 ADAAG. ADAAG applies to safety rest areas, designated interest points, curb cuts with truncated domes, pedestrian overpasses, underpass structures, pedestrian ramps, and designated points of pedestrian concentration for controlled roadway crossing. In addition, the Resident Engineer should seek to eliminate hazards within sidewalk areas such as poles, signs, and vertical edge drop-offs. Signing and pavement marking for persons with disabilities and van accessible parking shall be added in new and reconstructed parking areas.

New facilities shall meet the current standards for persons with disabilities whenever a new highway project is constructed. When an existing highway is to be reconstructed, all new facilities will accommodate persons with disabilities. If a facility is altered through resurfacing or other means, the alterations must meet current ADA standards provided in the document *ADA Accessibility Requirements in CDOT Transportation Projects*: *http://www.coloradodot.info/business/designsupport/policy-memos/ADA%20Accessibility%20Requirements%20in%20CDOT%20Transportation%20Projects%2010-20-2003%20.pdf/* . During construction, ADA temporary access and facilities shall be addressed.

If the Resident Engineer is uncertain about whether, or to what extent, a particular accessibility feature is required, the Resident Engineer will consult with the CDOT ADA Coordinator. All decisions regarding compliance with ADA Accessibility Requirements will be documented in the project file.

In consultation with the CDOT ADA Coordinator in the Center for Equal Opportunity (Headquarters), the Resident Engineer will be responsible for incorporating the design and implementation of all facilities in compliance with the ADA. These requirements should be identified in the early stages of design, such as the Design Scoping Review and be included in the design plans for both new facilities and existing facilities to be reconstructed.

The Resident Engineer will provide proper plans, checklists, standards, and details as required by CDOT and federal guidelines related to accommodations for persons with disabilities.

Additional References:

1. 42 USC, Subchapter 2--Public Services (Title II), Americans With Disabilities Act of 1990
2. 28 CFR Part 35, Nondiscrimination on the Basis of Disability in State and Local Government Services
3. *CDOT M&S Standard Plans*
4. *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)*
5. *CDOT Policy Directive 605.0 Comprehensive Accessibility for Persons with Disabilities*
6. *ADA Accessibility Requirements in CDOT & Local Agency Transportation Projects, October 2003.*
7. *U.S. Architectural and Transportation Barriers Compliance Board (Access Board), Americans With Disabilities Act Accessibility Guidelines for Buildings and Facilities*
8. *Designing Sidewalks and Trails for Access – FHWA-HEP-99-006 HEHE/8-99/(5M)E*
9. Americans With Disabilities Act Access Board, http://www.access-board.gov

8.02 DETOUR DESIGN

Detours are any temporary routing of traffic off its usual course, including the use of existing alternate routes or use of modified lanes on available pavement. Detours are designed to safely and efficiently move traffic while providing an adequate construction work area.

Detour design should include speed, clear zone, horizontal and vertical alignment, typical section (e.g., lane width, superelevation and shoulder design), horizontal and vertical sight distance, clearance, curve radii, any needed temporary barrier with properly designed end terminals, surfacing requirements, approach ties, environmental mitigation and construction traffic control.

The designer should consider vertical clearance to overhead structures such as bridges or false work, especially when utilizing shoulders where clearance is often less.

A detour should provide adequate area for the construction work around which the detour is being built. Adequate space should be provided for the Contractor to work without impeding the flow of detour traffic. When planning a detour, the designer should consider running speed, barrier widths, required offset to barriers, and clear distance to construction activities including typical construction sign placement. Temporary drainage is also an integral aspect of a detour design. The length of detour should be designed according to the surrounding topography considering duration of detour and amount of traffic demand.

Detours should be designed so that the motorists pass safely through the construction when work is taking place next to the travel way, and so that construction workers are provided with a safe work area. Construction work area should be large enough that work does not delay or impact traffic whenever conditions and economics permit. Priorities for providing a proper detour are:

1. Safety of motorists and workers
2. Adequate construction work area
3. Reasonable detour design speeds
4. Adequate roadway capacity
5. Economical detour design
6. Consideration of vehicles that exceed legal weight and height limitations
7. Proper drainage during construction to prevent hydroplaning

The transitions between the roadway alignment and the detour alignment should be as smooth as possible. It is desirable to maintain the lane width and geometric design speed properties of the main roadway. The detour should be designed with a speed as close to the original speed of the main roadway as is reasonably possible. The designer should anticipate the level of motorist compliance with the reduced speed in a detour zone, when deciding on the detour design speed. When safety consideration warrants, the detour posted speed may be lower than the design speed.

A higher detour design speed will increase the likelihood that vehicles that are not in compliance with the lower detour posted speed can traverse the work zone without causing a crash or endangering highway workers and other motorists. The design speed should not be used to control motorist behavior, when this can be more safely accomplished with regulatory signs and enforcement. The location of the detour and the likelihood of the drivers' anticipating reduced speed in the detour should be considered. The maximum speed differential and details of detour design presented in Section 3.5 of *The CDOT Roadway Design Guide* should be followed. A procedure for determining work zone speed limits is explained in a memo by J. Siebels and W. Reisbeck dated April 4, 1997, and should be followed. Also see the September 25, 2009 Policy Memorandum on Work Zone Safety for guidance on completion of the CDOT Form 568 and reduction of speed limits in work zones (http://www.coloradodot.info/library/traffic/traffic-manuals-guidelines/lane-close-work-zone-safety/work-zone-safety-mobility/WZ-Safety-Improvments_9-25-09_%20FINAL.pdf/view).

The Resident Engineer is responsible for scoping and designing the detour. For proper project documentation, the Form 518, Detour Design Data, will be completed. The design should include all proper pay items for the detour, including provisions for maintenance, removal, and disposal of the detour. For consultant or entity projects, the engineer of record shall complete the Form 518. On projects with federal oversight, the designer shall meet all federal standards and obtain FHWA concurrence with the design. If the detour includes temporary detour pipes to allow the passage of flow during construction, then Region Hydraulics Engineer should be consulted on the size of the pipes to minimize the possibility of overtopping during construction.

Signing and striping for the detour should be included in the Traffic Control Plan (see Section 4.10 of this manual). The Region's Traffic Engineering Unit should be informed of the detour design and posted speed, and should receive adequate plan sheets after the Field Inspection Review to allow a proper Traffic Control Plan to be developed.

The AASHTO Policy on Geometric Design of Highways and Streets provides useful information for maintenance of traffic through construction areas.

For projects that require construction of temporary drainage detour structures over streams and waterways, refer to the *CDOT Drainage Design Manual*.

Additional References:

1. CDOT Standard Plan S-630-1
2. *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)*
3. CDOT *Drainage Design Manual*
4. *NCHRP – Report 581 – Design of Construction Work Zones on High Speed Highways*
5. For forms, see CDOT on-line forms library http://www.coloradodot.info/library/forms

8.03 AIRPORT AND HELIPORT CLEARANCES

Airway-highway flight area clearances must be adequate for the safe movement of air and highway traffic. The expenditure of public funds for any related airport and highway improvement must be in the public interest.

Airport flight area clearance should be considered when a highway project is within 20,000 feet of an airport or within 5,000 feet of a heliport or exceeds 200 feet in height above the ground.

The Resident Engineer will seek to eliminate existing and avoid new substandard airway-highway clearances when developing the PS&E. The clearances apply to such objects as overhead signs, light standards, vehicles moving on the highway, over-crossing structures, and fencing adjacent to the airport or heliport. Impacts of construction operation activities such as crane placement should be considered.

The Resident Engineer will notify the airport or heliport of any conflict that might apply and coordinate with airport officials in notifying the Federal Aviation Administration (FAA) of these potential conflicts. This notification should occur as early in the design process as possible. The Resident Engineer may need to file a FAA Form 7460-1 as required by Federal Aviation Regulation (FAR) Part 77 (77.17) for those locations off the airport where construction may impact airport operations or access. The FAA will determine if there is any hazard to air navigation and respond accordingly to the person who submitted the FAA Form 7460. The Resident Engineer should contact the CDOT Division of Aeronautics for assistance or questions regarding the FAR Part 77 or the process of filing a FAA Form 7460. A copy of the form can be accessed from the FAA website at http://www.faa.gov/forms/ .

Documentation shall be provided by the coordinating airport official to the FAA; all information submitted by the official will be reviewed by the Federal Highway Administration (FHWA) to determine if clearances provided are sufficient. The FHWA will advise the FAA of its findings and give its concurrence. When conflicts cannot be resolved, the region FHWA shall refer its recommendations to the Federal Highway Administrator.

The FHWA issues a Finding in the Public Interest based on compliance with flight area clearances that conform to FAA standards. FAA guidelines also apply to military and private airports with the same rules and regulations as apply to public airports/heliports.

The FAA notifies the Resident Engineer of acceptable mitigating actions.

Additional References:

1. 23 CFR Part 620 A, Highway Improvements in the Vicinity of Airports
2. *CDOT Roadway Design Guide*
3. 14 CFR Part 77, Objects Affecting Navigable Air Space
4. Federal Aviation Administration Advisory Circular AC 70/7460-2K *Proposed Construction or Alteration of Objects that May Affect the Navigable Airspace* http://www.faa.gov/regulations_policies/advisory_circulars/

8.04 SAFETY REST AREAS

Safety rest areas with parking facilities separated from the highway are provided as a place for the motorist to stop and rest for short periods of time. The Resident Engineer is responsible for scoping and design of safety rest area projects.

Safety rest areas usually provide one or more of the following: drinking water, toilets, tables and benches, telephones, information facilities, and other facilities for travelers. The facility may be located at a scenic location and include historic or scenic information.

Safety rest areas will provide full consideration and accommodation for persons with disabilities. They should have controlled entrance and exit highway connections with proper signing, restroom facilities, parking areas for both passenger cars and large semi-trailer vehicles, adequate lighting, adequate source of water, and proper disposal of sewage. The designer should consider environmental issues in the design process and implement pollution prevention and energy efficiency (P2/E2) in the operation and maintenance of rest areas. Examples include installation of low-water-use toilet and sink facilities; energy efficient lighting, cooling, and heating; and collection and detention of stormwater runoff using appropriate water quality BMPs. A multi-disciplinary team of design, construction, environmental, maintenance, landscaping, and right of way personnel should select the optimal site based on factors such as safety, materials, utility, drainage, water quality, energy efficiency, economy, and scenic value. These factors may be determined by examination of aerial photos and by ground reconnaissance.

The Resident Engineer shall coordinate the buildings for Rest Areas with the State Buildings Program delegate at the CDOT Property Management Office for the review and coordination of plans and contractual procedures for the construction, management, and maintenance of CDOT owned buildings. Compliance with local and State Building codes can be coordinated with the architects in the CDOT Property Management Office.

The Resident Engineer shall coordinate with the Region's Traffic Engineer to incorporate in the rest area any chain-up or chain-down stations that may be needed nearby.

Consideration for a public-private partnership with a local government or chamber of commerce for inclusion of an information kiosk as part of the building may be of benefit for travelers and the surrounding community.

FHWA oversight may apply to safety rest area development.

Additional References:

1. 23 CFR Part 752.5, 752.7 and 752.8 Safety Rest Areas
2. Americans with Disabilities Act Guidelines
3. AASHTO Guide for Development of Rest Areas on Major Arterials and Freeways
4. CDOT Lighting Design Manual
5. CDOT New Development and Redevelopment Stormwater Management Program Manual, 2004
6. CDOT webpage for information on existing CDOT Rest Area Locations http://www.dot.state.co.us/TravelInfo/Facilities/RestAreas/
7. Safety Rest Areas: Planning, Location and Design, USDOT, FHWA, 1981
8. CDOT Policy Directive 605.0 Comprehensive Accessibility for Persons with Disabilities

8.05 RAILROAD DESIGN

Railroad-Highway projects fall into two specific categories based upon the origin of the project: The first category includes projects whose sole purpose is to improve the safety at an at-grade crossing. These are commonly known as Section 130 projects, named after their original federal legislation in 23 U.S.C. 130. The second category includes projects in which the crossing improvements are part of a larger, primarily highway construction, project. Examples include the replacement of an overpass, or the widening of an existing roadway, which then requires a widened at-grade crossing. This second category of projects is the subject of this section of the manual.

Highway projects that have a railroad component or will involve railroad participation are developed with the primary emphasis on the highway improvements and only secondarily on railroad involvement. The proper methodology is more fully set out in Section 7.04 *Railroad Involvement* of this manual.

The Resident Engineer's responsibilities for railroad-highway projects are:

1. Develop preliminary and final railroad plans.
2. Prepare documents and specifications to assure compliance with railroad agreement requirements.
3. Obtain approvals and appropriate signatures from the railroad company, the Department, and other agencies (such as Attorney General or State Controller).
4. Prepare railroad flagging, coordination, and railroad insurance specifications.

The Railroad Program Manager, in the Safety and Traffic Engineering Branch, is responsible for preparing the railroad contract for review by the railroad and other agencies. Coordination among the CDOT Railroad Program Manager, Resident Engineer, and Region Utility Engineer is necessary in the preparation of preliminary and final plans. Contact the Railroad as soon as possible and discuss with them the project schedule and scope. The Railroads have a detailed process for executing agreements with outside agencies, so allow extra time for these steps. Currently the Union Pacific Railroad (UPRR) is the only railroad that requires payment for their review of CDOT's design. See Section 7.04 *Railroad Involvement* of this Manual for guidance on what needs to be included in the project costs and addressing the review time for railroads in the project schedule.

The Resident Engineer is responsible for review of railroad work that impacts the state highway system, including the design and traffic control. When projects are off the state highway system, the involved local agency is responsible for these activities. Any work on railroad property, by railroad forces, will be done by the force account method of

construction, the procedures for this type of construction will apply (see Section 1.11 of this manual). Work done on railroad property by a contractor selected by CDOT will be handled by normal contractor procedures.

The documentation required for railroad-highway projects is:

1. Approved Form 463, Design Data
2. Executed Contracts between CDOT, the local agency, and the railroad, as applicable
3. Railroad flagging insurance protection certificate
4. Public Utilities Commission application
5. Force account justification and Finding in the Public Interest, when required
6. Project Special Provisions
7. Cost Estimate and general plan sheet from involved railroad company
8. Right of way and utility clearances, as appropriate
9. Notice to Proceed letter

Railroad-highway projects shall follow similar development processes as regular highway projects (scoping, Field Inspection Review and the Final Office Review). At a minimum, an abbreviated plan set of project plans will be prepared for the project and will include a cost estimate and general plan sheet for the railroad work. Plans for the railroad work may be incorporated into a larger project.

It is recommended that the Resident Engineer:

1. Allow adequate lead time since the contract process may take more than a year for clearance. The railroads will require submission and approval of 100% plans before any contract can be successfully executed.
2. Make early communication with the Railroad Program Manager and the railroad company and recognize that railroads have specific rights that trump CDOT's rights in most cases.
3. Do not presume an existing contract will cover new work. Typically, even if the scope of work for a new project is covered by an existing agreement, the railroads will require a new agreement to be prepared and executed.

Additional References:

1. 23 CFR Parts 140 I, Reimbursement for Railroad Work; 646 A, Railroad-Highway Insurance Protection; 646 B, Railroad-Highway Projects
2. 23 USC 109, Standards; 130, Railway-Highway Crossings
3. *FHWA Railroad-Highway Grade Crossing Handbook, USDOT FHWA-Revised Second Edition, August 2007* (available from the FRA website) http://www.fra.dot.gov/downloads/safety/HRGXHandbook.pdf
4. *CDOT Roadway Design Guide*
5. *AASHTO Policy Guide for Geometric Design of Highways and Streets*
6. *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)*
7. [Joint] *BNSF Railway / Union Pacific Railroad Guidelines for Railroad Grade Separation Projects* (available from either railroad website in PDF format) http://www.uprr.com/aboutup/operations/specs/attachments/grade_separation.pdf
8. For forms, see CDOT on-line forms library http://www.coloradodot.info/library/forms

8.06 TRANSIT ACCOMMODATIONS

Transit accommodations for the purpose of increasing capacity can include the construction of lanes or other improvements for the exclusive use of buses, trucks, trains, emergency vehicles, and high-occupancy modes of transportation. The intent is to reduce single occupancy vehicle usage and encourage the use of multi-modal transportation that is linked as a system to move people in high-occupancy vehicles.

Parking facilities are an important means to accommodate individuals using transportation services and must meet the needs of persons with disabilities.

On federal aid projects, the Federal Highway Administration (FHWA), CDOT, metropolitan planning organizations, and the Federal Transit Administration (FTA) shall coordinate with each other on any projects involving public transit to facilitate project selection, approval, and completion.

Transit should be considered in both the planning and the design processes. The planning process would focus on major capital investments and issues, such as light rail or commuter rail lines, high-occupancy vehicle lanes, or major expansions to bus systems. The design process would not only consider project decisions made in the planning process but would also scope smaller items that would help accommodate and facilitate transit service delivery, such as park and ride lots and bus stops, pads, and shelters.

At the scoping stage, the Resident Engineer should be thinking about future mass-transit needs and incorporating elements into the plans. It is important to be careful not to construct a project in a way that precludes future options. At this stage, the Resident Engineer should be talking with the Region Program Engineer, Planning Manager, Region Transportation Director, and other Regions on long-range planning necessary to incorporate transit elements into the plans.

The Resident Engineer is responsible for the completion of any highway construction plans that involve high-occupancy vehicle lanes, parking facilities, bus pull-outs, etc.

The decision to implement transit accommodations is usually a joint effort between the FHWA, FTA, the metropolitan planning organizations, the local transit agency, responsible local officials, and CDOT.

Appropriate design standards and plans, and project decision type documentation should be sent to the FHWA when appropriate and to transportation agencies for review and advisement.

Additional References:

1. 23 CFR Part 810A, Mass Transit and Special Use Highway Projects, General and 810B, Highway Public Transportation Projects and Special Use Highway Facilities
2. 23 USC Section 134, Metropolitan Planning; Section 137, Fringe and Corridor Parking Facilities; Section 142, Public Transportation
3. *AASHTO Policy on Geometric Design of Highways and Streets*
4. *Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD)*
5. *Pedestrian Safety Guide for Transit Agencies, February 2008, FHW A Report No. FHWA-SA-07-017.*

8.07 IRRIGATION COMPANY AGREEMENT

An irrigation company agreement is required to document the owner's consent to proposed highway construction within the company's right of way. The agreement authorizes CDOT to enter upon the property and to construct and maintain the proposed structure or ditch shown on the CDOT plans.

An irrigation company agreement is a legal document signed by the irrigation company owner and CDOT, that describes the proposed work and sets forth the applicable terms and conditions of the agreement.

An agreement is required for all CDOT projects on which an irrigation (or ditch) company is present and whose facilities will be affected by the proposed construction.

The work is usually at project expense because:

1. The owner may hold prior or overlapping property rights within state right of way, or
2. The owner is protected by statute from actions that would permanently impair the facility.

The Resident Engineer is responsible for the design of the irrigation structure and ditch. The Region Utilities Engineer (RUE) pursues and coordinates the signing of the agreement between the ditch company and CDOT. The RUE may assist with any special terms and conditions of the agreement. The Hydraulics Engineer performs or reviews the hydraulic structure design and may recommend alternative structure designs.

Documentation necessary (attached):

1. Form 1028a, Irrigation Company Agreement for Construction
2. Structure Selection Costs
3. Ditch Company Coordination Information
4. The Resident Engineer needs to adhere to the Procedure for Irrigation Company Agreement (included below).
5. An original copy of the Irrigation Company Agreement shall be sent to CDOT HQ Central File

Additional References:

1. CRS 37-86-101 ff, Rights-of-Way and Ditches
2. CDOT *Roadway Design Guide*

PROCEDURE FOR IRRIGATION COMPANY AGREEMENT

1. At the scoping stage of the project:

   a. Identify all irrigation structures involved and their owners.

   b. Determine the water rights of these irrigation structures and their characteristics such as capacity, freeboard, and/or other operating requirements.

   c. Meet with the representatives of these structures, discuss the proposed CDOT construction and the possible impact on or conflict with their existing structures and customer obligations.

   d. Record and retain pertinent data (see "Ditch Company Coordination Information").

2. Develop a preliminary structure design plus one or more structure alternates, together with cost comparisons (see "Structure Selection Costs"). Support with adequate survey data and hydraulic analysis for each design alternate. Present to the irrigation company board of directors and obtain their verbal consent to begin developing plans for the facility. Be prepared to discuss the following for each alternate:

   a. Estimated costs and cost differences between types of structures that will impact the tax paying public.

   b. Safety problems such as guardrail, "narrowing of roadway" illusion or ditch cleaning activity near roadway.

   c. Maintenance problems, snow problems with guardrail, deck rehabilitation, abutment backfill stabilization, etc.

   d. Operating requirements such as debris, freeboard, scour, and project schedule vs. ditch operating schedule.

   e. Other terms and conditions as may be requested by the owner. Unusual requests such as liquidated damages, insurance coverage, or indemnification, may require legal advice (coordinate with Attorney General via HQ Utilities Unit, Safety and Traffic Engineering Branch).

3. When the structure plan is finalized, prepare and submit for owner's approval for the following:

   a. CDOT Form 1028, Irrigation Company Agreement for Construction, referring to attached exhibits, and including any other terms and conditions requested by the owner and acceptable to the Department.

   b. Structure plan (identified as Exhibit A) depicting only structure information of interest to the company. The plan sheet note, and schematic of the structure on the plan sheet, should suffice. Avoid details subject to change during design or construction, which technically may void the agreement.

   c. If the agreement imposes a further contractual responsibility on the State's construction contractor, such as work schedule restrictions or liability for delays, attach a copy of the Project Special Provision (identified as Exhibit__).

d. If requested by the owner, a structure cross-section, which should not be attached to, nor referenced as part of the agreement.

4. After the owner has signed the agreement, obtain signature of Region Transportation Director or designated representative. Execute two original-signature agreements if the owner requests an original. Forward one original agreement including all attachments to CDOT Records Center (legal). Furnish copies to the Resident Engineer, Region Utility Engineer, HQ Utilities Unit, and others as needed.

5. If the owner will not sign the Form 1028 agreement (for example, if they demand cash compensation over and above the cost of the improvements), consult the Region Right of Way Manager and HQ Utilities for guidance on whether to pursue a condemnation action, or negotiate a specialized agreement.

STRUCTURE SELECTION COSTS
EXAMPLE

BRIDGE:

Average cost of bridge per square foot x required size	= $_____
Required guardrail at bridge site	= $_____
Rough Detour Costs	
PLACE embankment required cu. yd. x average cost	= $_____
REMOVE embankment cu. yd. x average cost	= $_____
Ditch drainage structures (temporary pipe)	= $_____
Additional signing required for detour estimates	= $_____
Total Cost of Bridge	$_____

CONCRETE BOX CULVERT:

Average cost of CBC per sq ft x required size and length	= $_____
Guardrail not required if clear zone is addressed	= N/C
Detour not required if use of roadway embankment is used	= N/C
Total Cost of CBC	$_____

IMPRESS ON DITCH COMPANY THAT THEY ARE TAXPAYERS AND YOU ARE TRYING TO GET THE MOST ROADWAY SURFACE FOR THE TAX DOLLARS SPENT.

DITCH COMPANY COORDINATION INFORMATION

PROJECT NUMBER/CODE_____ DATE_____

PROJECT LOCATION _____

NAME OF DITCH COMPANY _____

NAME OF DITCH (if not same as company) _____

MAILING ADDRESS _____

_____

TELEPHONE NUMBER _____

DITCH COMPANY CONTACT PERSON _____ PHONE_____

DESIGN FLOW _____ NORMAL FLOW _____ STORM RUNOFF _____

REQUIRED FREEBOARD _____TIME OF YEAR DITCH IS DRY _____

IF DITCH HAS OVERFLOWED, WHERE AND WHAT WAS DISCHARGE _____

SPECIAL MAINTENANCE PROBLEMS: _____

_____

WHEN IS CANAL DREDGED? (I.E., YEARLY, ONCE EVERY TWO YEARS) _____

ANTICPATED DEPTH OF DREDGE FROM EXISTING _____

REQUIRED ACCESS TO DITCH RIDER'S ROAD _____

TYPE OF VEHICLES _____

IS THE CANAL ON FEE TITLE OWNERSHIP OR AN EASEMENT? _____

WIDTH _____

ENGINEER FOR DITCH COMPANY _____

ATTORNEY FOR DITCH COMPANY _____

TYPE AND SIZE OF EXISTING STRUCTURE _____

IS EXISTING SIZE ADEQUATE? _____

TYPE & APPROXIMATE SIZE OF PROPOSED STRUCTURE (CLEAR SPAN, PIER OF WEBB WALL) _____

CANAL CROSS-SECTION REQUIRED? _____ DITCH LINING REQUIRED? _____

DECREED FLOW _____

8.08 CLIMBING AND PASSING LANES

Climbing lanes are extra lanes provided on highways with long, steep grades for slow moving vehicles. A passing lane can be provided where sight distances or traffic conditions limit passing opportunities on two-lane highways, including rolling and flat terrain. A highway section with a climbing or passing lane is not considered a three-lane highway, but a two-lane highway with an extra lane. Climbing lanes generally are not used on freeways and multi-lane highways because these highways usually have the capacity to handle the traffic volume with slow moving vehicles.

The requirements for establishing climbing lanes are usually based on traffic volume, capacities, percent of trucks, grades, speeds, and level of service. Climbing lanes should be considered when a 10 mile per hour or greater speed reduction is expected for a typical heavy truck provided the percentage of trucks and traffic volumes justify the expenditures as outlined in the CDOT *Roadway Design Guide* and in the *AASHTO Policy Guide on Design of Highways and Streets*. Safety is a primary justification for the addition of passing lanes. Accident history should be reviewed for climbing and passing lanes. The *Highway Capacity Manual* is used for these analyses of grades on two-lane highways.

Where terrain conditions permit, a passing lane should be added when there are high traffic volumes or significant segments of passing sight distance restrictions due to vertical and horizontal curves. Passing lanes should have the same lane width as the travel lanes and should be tapered in and out as prescribed in the *Roadway Design Guide*.

When a climbing or a passing lane is required, a plan and profile will be developed. A graph showing the relationship between rate and length of grade for several reductions in speed will be used to develop the plan and profile. A sketch of the profile with the grades is needed to find the length and location of the climbing lanes, together with a deceleration and acceleration chart (see the *CDOT Roadway Design Guide*). Justification for climbing lanes where the critical length of grade is exceeded may be considered from the standpoint of highway capacity. Critical length of grade is the maximum length of a designated upgrade on which a loaded truck can operate without an unreasonable reduction in speed.

Additional References:

1. Transportation Research Board (TRB) Highway Capacity Manual - Special Report 209
2. AASHTO Policy on Geometric Design of Highways and Streets

8.09 STOCKPASSES, LANDOWNERS' ACCESS, WILDLIFE CROSSINGS AND MACHINE PASSES

Stockpasses, landowner accesses, wildlife crossings, and machine passes provide a safe passage of livestock, wildlife or farm machinery from one side of the highway to the other side by means of an underpass.

A stockpass usually consists of a standard box culvert at least 6 feet wide and 7 feet high; an 84-inch culvert; or a 5'-10" x 7'-8" structural plate arch culvert. The stockpass allows livestock to move beneath the roadway for grazing or transporting. In addition, wildlife movement for mid and large size animals may benefit from the placement of a stockpass or wildlife undercrossing. The Region's Environmental Program Manager should be consulted for proper sizing of structures to accommodate wildlife in the area. A machine pass should be large enough for the expected farm machinery or vehicles that will use the underpass.

Economic justification should be determined for all proposed stockpasses. Property appraisals should be obtained both with and without the proposed structures. All federal aid projects require stockpass justifications when stockpasses are constructed on the project. The designer should determine if the required stockpass facility could be consolidated with a drainage culvert or bridge, if these features exist on the project. It is desirable to extend the required structure outside of the clear zone to eliminate the need for guardrail.

The Resident Engineer is responsible for justifying the need for stockpasses, wildlife crossings and machine passes in the Design Scoping Review, and for providing all necessary support data.

Justification data should include:

1. Number of livestock that would use the stockpass.
2. Frequency of crossing by the livestock or machinery.
3. Whether the stockpass or machine pass will also be used for drainage.
4. If a stockpass or machine pass were not provided, would a large drainage structure still be required.
5. The cost of the stockpass, owner access, wildlife crossing, or machine pass, excluding savings on eliminating or reducing the drainage structure.
6. Type of wildlife crossing the roadways.

Additional References:

1. CDOT *Roadway Design Guide*
2. CDOT *Drainage Design Manual*
3. CDOT *M & S Standard Plans*
4. Report No. CDOT-DTD-UCD-2003-9 *Identifying the Best Locations along Highways to Provide Safe Crossing Opportunities for Wildlife*

8.10 EXPERIMENTAL ITEMS

This section provides guidelines for the use of experimental features on CDOT construction projects. An experimental item is a method, material, or practice that is not a CDOT or an industry standard. A minor change to adapt specifications to a single project is not considered an experimental feature.

An experimental feature must have preliminary approval by a Program Engineer, the Research Engineer, or a technical committee. The experimental feature must be monitored after construction and reports made to a technical committee for a decision on future use.

The Resident Engineer must confirm that the requirements of *CDOT Procedural Directive 1401.1, Product Evaluation and Experimental Features,* are met before an experimental feature is incorporated into a CDOT construction project.

A proposed experimental feature is documented by a statement of purpose, the specifications affected, a description of the field monitoring to be conducted, and the extent of use (number and size of projects). After the experimental feature is constructed and monitored, the results and recommendations are reported to the appropriate technical committee. Documentation responsibility is outlined in *Procedural Directive 1401.1*.

The Department of Transportation Development, Research Branch, must review proprietary items used as an experimental feature, for research, or as a distinctive type of construction in the highway process.

Refer to *Procedural Directive 1401.1* for details on this process.

Additional References:

1. 23 CFR Part 635D, General Material Requirements
2. Propriety Items (see Section 2.24 of this manual)

8.11 DISPOSAL OF EXCESS MATERIAL OFF PROJECT SITE

Usually soil and aggregate materials developed on a construction project should be used during construction or placed within the project boundaries. The intent is to provide an efficient use of the material and avoid excessive hauls. This can allow the Contractor to best determine use of the material.

Whenever a project has provisions for a mandatory site for the disposal of excess material off the project right of way or beyond a reasonable distance from the project limits, a Finding in the Public Interest by the Department must be documented.

If the Department procures a disposal site for excess material, the Resident Engineer is responsible for obtaining an economical site, considering environmental impact. Whenever the Department mandates a disposal site, the Resident Engineer must assure there is adequate area or volume available to accommodate the disposal. If there is not, the disposal site should be selected by the Contractor. The Resident Engineer must also address erosion control requirements and any royalty fees imposed by the U.S. Government, when disposing of material from public lands. When the Contractor procures a disposal site, it will be his responsibility to obtain a site that will comply with all federal, state and local laws.

The mandatory disposal site designated by the Department will be documented by the Resident Engineer with a Finding-in-the-Public-Interest letter approved by the Program Engineer. The plans and agreements shall provide for any required restoration, erosion control features, and site improvements.

Additional References:

1. 23 CFR Part 635.407, Use of Materials Made Available by a Public Agency

8.12 MANDATORY SOURCE OF MATERIALS OR MATERIALS FURNISHED BY A PUBLIC AGENCY

Usually, contracts for highway projects specify that the Contractor furnishes all materials to be incorporated in the work.

When it is in the public's interest, CDOT can require the Contractor to use material furnished by CDOT or a public agency or obtained from sources designated by the public agency.

Materials can be natural materials from local sources, such as borrow or aggregates used for roadway construction, or any material purchased by the Department and furnished to the Contractor for mandatory use on the project.

To be eligible for federal participation costs, any material, other than local natural materials made available by a public agency, must be acquired by a competitive bidding process (23 CFR Part 635.407 explains natural materials).

Material furnished by a public agency for a construction project shall meet the specification requirements on the project. Material furnished that has a monetary value to the project must be approved as being in the public interest. If the project has CDOT oversight, use of such materials must be approved by the Department, and if Federal oversight, by FHWA.

When the Department or other public agency requires the Contractor to use material furnished to them, the Resident Engineer is responsible for preparing a Finding in the Public Interest justifying the use of this mandatory source, and for monitoring, inspecting, and approving the public agency's material sources.

The Resident Engineer is responsible for assuring that the use of public agency furnished materials follows the rules and regulations applicable to such use (see 23 CFR Part 635 B&D). A Finding-in-the-Public-Interest letter documenting the cost effectiveness, specifications, location, and reasons that the material furnished to the project is in the best interest of the public shall be placed in the project file.

Requirements for creating a mandatory source of materials are:

1. Natural materials (borrow/embankment) must be based on environmental considerations and meet specifications.
2. The location and unit prices of natural material must be stated on the plans or in the special provisions.

3. Materials other than natural material must have been acquired on the basis of competitive bidding and must be listed in the special provisions of the project for the benefit of all prospective bidders.
4. Federal participation will be limited to the unit cost of such material to the Department.
5. The Contractor must use the designated source of materials to be eligible for federal participation.
6. All costs of material shall be reviewed and approved by the Engineering Estimates and Market Analysis Unit.

FHWA Contract Administration Core Curriculum Participant's Manual and Reference Guide offers the following:

Current FHWA policy requires that the contractor must furnish all materials to be incorporated in the work, and the contractor shall be permitted to select the sources from which the materials are to be obtained. Exceptions to this requirement may be made when there is a definite finding, by the STA and concurred in by the Division Administrator, that it is in the public interest to require the contractor to use materials furnished by the STA or from sources designated by the STA. The exception policy can best be understood by separating State-furnished materials into the categories of manufactured materials and local natural materials.

Manufactured Materials. When the use of State-furnished manufactured materials is approved based on a public interest finding, such use must be made mandatory. The optional use of State-furnished manufactured materials is in violation of our policy prohibiting public agencies from competing with private firms. Manufactured materials to be furnished by the State must be acquired through competitive bidding, unless there is a public interest finding for another method, and concurred in by the Division Administrator.

Local Natural Materials. When the STA owns or controls a local natural materials source such as a borrow pit or a stockpile of salvaged pavement material, etc., the materials may be designated for either optional or mandatory use; however, mandatory use will require a public interest finding and the Division Administrator's concurrence.
In order to permit prospective bidders to properly prepare their bids, the location, cost, and any conditions to be met for obtaining materials that are made available to the contractor shall be stated in the bidding documents.

Summarizing FHWA policy for the mandatory use of borrow or disposal sites:

1. *Mandatory use of either requires a public interest finding and the Division Administrator's concurrence,*
2. *mandatory use of either may be based on environmental consideration where the environment will be substantially enhanced without excessive additional cost, and*
3. *where the use is based on environmental considerations, the discussion in the environmental document may be used as the basis for public interest finding.*

Factors to justify a public interest finding should include such items as cost effectiveness, system integrity, and local shortages of material.

When an agency is recovering reimbursement of cost, it is important to follow the force account construction method procedures in Section 1.11. The following items are preparatory to documenting the use of public agency material, including state furnished materials:

1. A letter of intent from the entity requesting a Finding in the Public Interest to purchase materials or equipment through its own bidding procedures, if applicable.
2. A submittal of a price or cost proposal for the items.
3. A technical and audit evaluation by the Engineering Estimates and Market Analysis Unit for cost effectiveness.
4. A Form 895, Force Account Construction Method - Finding in the Public Interest, certifying the entity's qualifications with concurrence by the Region Program Engineer.
5. A Notice to Proceed issued by Agreements in the Contracts and Markets Analysis Branch and administered by the Resident Engineer, if reimbursement is applicable and only when executed in a proper and timely manner prior to purchase of the material.

The Region will notify the agency with clearance to proceed with "advance purchase of materials," if appropriate.

Force account construction method is defined in Section 1.11.

Additional References:

1. 23 CFR Part 635D, General Material Requirements
2. FHWA Contract Administration Core Curriculum Participant's Manual and Reference Guide 2006
   http://www.fhwa.dot.gov/programadmin/contracts/coretoc.cfm
3. 23 CFR Part 635B, Force Account Construction
4. 23 USC 112, Letting of Contracts
5. Traffic Data (See Section 4.01 of this manual)

8.13 Context Sensitive Solutions

Incorporate *Context Sensitive Solutions* (CSS) into your design processes. CSS is a project development approach in which designers recognize and evaluate the affected community's values and objectives in relation to the design of the project. These community values may be scenic, aesthetic, historic, environmental, etc. in nature.

Key elements of CSS (from NCHRP Report 480):

1. The project satisfies the purpose and needs as agreed to by a full range of stakeholders. This agreement is forged in the earliest phase of the project and amended as warranted as the project develops.
2. The project is a safe facility both for the use and the community.
3. The project is in harmony with the community and preserves environmental, scenic, aesthetic, historic, and natural resource values of the area.
4. The project exceeds the expectations of both the designers and stakeholders and achieves a level of excellence in people's minds.
5. The project involves efficient and effective use of resources (such as time, budget, and community) of all involved parties.
6. The project is designed and built with minimal disruption to the community.
7. The project is seen as having added lasting value to the community.

CDOT's design professionals determine which design solutions best fit, given the site's condition and context.

Additional References:

1. National Cooperative Highway Research Program (NCHRP) Report 480

8.14 PROVIDING SUPPLEMENTAL DATA TO CONTRACTORS

On 3D designed projects, CDOT provides supplemental 3D data to Contractors for information only at Project Advertisement. Referencing Transportation Research Board (TRB) Report SPR 1680 prepared for the Michigan Department of Transportation, CDOT has determined that the overall benefit of the statewide policy of providing 3D data at Project Advertisement for information only and not part of the Contract outweigh the risks to the Department. The central benefit of this practice as documented in SPR 1680 is the reduction of bid prices stemming from all bidders being supplied with better bidding information.

When Contractors are not supplied with available 3D data, they often allocate significant resources towards recreating a 3D project model based off cross sections either before Award for bidding or after to facilitate construction. After using designer data to more efficiently create their own 3D model, Contractors gain efficiencies during construction through reduced staking by loading the data directly to an automated machine or into a machine operator.

CDOT has deep experience with 3D modeling and determining which projects are good candidates for 3D modeling. As a result, the Resident Engineer or Project Manager will continue to determine which projects are good candidates for 3D design. Electronic information beyond the Contract package is not expected to be provided to Contractors on projects that are not deemed as good candidates for 3D modeling by CDOT staff.

To provide additional information about the 3D data being provided when it is available and make clear that the supplemental 3D data is not part of the Contract, CDOT staff is to include project special provision worksheet 102ppod or Revision of Section 102 - Project Plans and Other Data.

For file distribution, it is recommended that Project Staff place the supplemental files in a central location like Google Drive in lieu of attempting to distribute flash or hard drives to all bidders. To streamline file distribution, project staff may create a PDF for posting to B2G with the drive link or download instructions if staff decide to use an FTP site rather than Google Drive.

8.14.1 DESIGN CONSIDERATIONS

1. 3D Modeling Quality Assurance:

   The Quality Assurance (QA) of 3D models is critical just as QA is with all other elements of design. CDOT is developing the suggested QA procedure specific to OpenRoads Designer (ORD) projects. Once complete, this procedure will be posted at:

   https://www.codot.gov/business/designsupport/cadd

2. Data Density for 3D Engineered Models

   Template Drop Intervals:

   a. Everywhere along the alignment (Except complex design areas) - 10-foot intervals,
   b. Complex design areas (Intersections, etc.) – one-foot intervals,
   c. Additional template drops should occur at:
      i. Event Points defined in the horizontal alignment.
      ii. External Control Points - (Point Control, location where multiple corridors interact, locations where the proposed alignment tie with the existing alignment, Parametric Constraints, template transition, superelevation transition stations, and End Condition Exception).

3. Electronic Deliverables:

   a. Project Alignments
      i. LandXML file generated of all Proposed Geometry, including proposed Horizontal & Vertical geometry.

   b. Surfaces – LandXML files of the following:
      i. Existing Terrain Model – Triangles Only
      ii. Finished Grade Terrain Model – Both Triangles and Features
      iii. Subgrade Terrain Models – Both Triangles and Features

c. DGN files:
   i. 3D Components of the Project Design Model
   ii. ROW
   iii. Topo
   iv. Additional files include – Discipline Design Files
   v. Other Files – As needed per project

4. File Naming Convention:
   LandXML Files

   a. Alignments – JPC#_Alignments.xml
   b. Surfaces:
      i. JPC#_Existing Ground.xml
      ii. JPC#_Finished Grade.xml
      iii. JPC#_Subgrade_Alignment Name.xml

   CADD Drawing Files

   c. DGN files:
      i. 3D Components - JPC#RDWY_3DModel_Components.dgn
      ii. Topo – JPC#SURV_Topo.dgn
      iii. ROW – JPC#ROW_Design.dgn

   d. Additional files include – Discipline Design Files:
      i. Roadway:
         - Roadway Design - JPC#RDWY_Design.dgn
         - Alignments – JPC#RDWY_Alignments_GEO.dgn
         - Stationing – JPC#RDWY_Stationing.dgn
         - Cross Sections – JPC#RDWY_Design_XSEC.dgn
      ii. Drainage – *JPC*#HYDR_Design.dgn
      iii. Bridge – *JPC*#BRDG_Design.dgn
      iv. Utilities – *JPC*#UTIL_Design.dgn
      v. Striping – *JPC*#TRAF_Striping.dgn
      vi. Other Files – As needed per project