Scope of Work (SOW)

COOT Bridge Design Manual (BDM)
Project # BR NBIS - 220 (20400)

The current Bridge Design Manual (BDM) was published in 1992 and some of the Subsections were written back in 1988. The original version of the 80M prior to year 1987 was completed in a piece-meal fashion dating back from mld-1970s through early-1980s. Design examples were Included at the end of some sections to enhance design issues. The current and the pre-1987 original version were written and maintained by Staff Bridge in-house engineers, COOT's current BDM is out of date and does not meet applicable codes, i.e. AASHTO LRFO, MBE, AREMA and FHWA regulations and falls to address Colorado specific design and construction practices learned over the past decades.

In the fall of 2013, COOT's Staff Bridge and local Consultants formed a committee and have been meeting monthly to develop an RFP for an updated and revised BDM, Based on recommendations of the committee, the overall goals of the new manual shall be as follows:

• BDM shall meet all current AASHTO Standards
• 80M will supersede or supplement codes not covered by AASHTO Other Codes
• The Manual will lead us to build durable, functional and cost effective structures
• For ease of use, the Contractor shall consider usage by both EITs and experienced designers
• For sake of maintainability and adaptability, the BDM will need to efficiently update to and incorporate changes in COOT policy and design codes AASHTO interims, Technical Memorandums and FHWA guidelines.

Critical Issues the Proposals need to address:
1. Collaboration and Stakeholder Involvement
The Bridge Design Manual is used by not only COOT, but also several consultants and local agency jurisdictions throughout the state; all of which have a vested interest in the outcome of the manual.

The proposal shall address how the Consultant (or, together with sub-consultants) plans to manage the abundance of opinions from all stakeholders and generate plans or solutions to fit Colorado's unique circumstances on key policy decisions, including estimated range of hours and budgets, time of Delivery for the entire manual or in segments, preferably not to exceed 3-phases.

Annual maintenance items through June 2021 will be completed under a separate Phase I Task order.

SCOPE OF WORK
1) Project Management
a. COOT Project Manager (PM) will be M. Mac Hasan, Staff Bridge Branch.
2) COOT Coordination
a. The Non-Project specific (NPS) Consultant will set-up meetings to resolve concerns and interests of all parties, prepare meeting agenda and minutes, track progress, establish specific goals for each chapter, prepare delivery schedule based on priorities, hold review meetings with COOT and electronically deliver draft/final copies of Chapters to PM *for* distribution.
b. Progress Notifications are required at the end of each month following the Notice to Proceed (NTP). All notifications will be sent by the Consultant to PM via e-mail.
3) Task Orders
a. The PM will prepare the Task Orders. No more than three (3) task orders will be utilized for the entire Manual including miscellaneous chapters. Annual maintenance items will be under a separate Task Order. This arrangement provides some lead time before codes and other ongoing research materials can be made available for use and will make the project more manageable considering available budget, time for final review and publication.
Example: 1)
AASHTO Standard Specifications for Highway Signs, Luminaires and Traffic Signals – LRFO version is still in draft format; and 2) COOT's EO research and recommendations on force or displacement based approach 10 be used as a *reference is still ongoing.*

a. Format
a. In collaboration with COOT, the Consultant shall develop final format for the BDM.
b. Content
In general, the BDM *format* shall follow the Rhode Island Bridge Design Manual

1. Sections shall align with AASHTO LRFO, though not necessarily by specific code. Outlines of Chapters produced from group discussions by BDM Committee members in their areas of interest will be used as a guide unless the Consultant has sensible reason to exclude items from or add to the list for a list of Outlines of Chapters / write-ups, see Attachment- 1.

2. Consultant shall submit format to COOT *for* review and comment.
Manual will be in a PDF downloadable format and available on CDOTs internal and external websites.

Complete Manual Individual Chapters
3. Revision Dates (See NY State)The Consultant shall review the suggested list of contents below including Attachment -1 and identify additional items / deletions to be Included in the BDM. The content for the chapters that mirror the AASHTO LRFD code need only supplement, revise or clarify the existing code and need not repeat all content. Other chapters such as Chapters 0-2 and Chapters 33-38 will require more extensive writing.

The following summarizes a starting list of Chapters, identified by the BDM committee that needs to be addressed in the manual. Miscellaneous chapters including examples will be shown In Appendices.

- **Policies and Procedures**
- Chapter 1 -Introduction
- Chapter 2 - General design and Location Features
- Chapter 3 - Loads and Load Factors
- Chapter 4 - Structural Analysis and Evaluation
- Chapter 5 - Concrete Structures
- Chapter 6 - Steel Structures
- Chapter 7 - Aluminum Structures
- Chapter 8 - Wood Structures
- Chapter 9 - Decks and Deck Systems
- Chapter 10 - Foundations
- Chapter 11 - Abutment Piers and Walls
- Chapter 12 - Buried Structures and Tunnel liners
- Chapter 13 - Railings
- Chapter 14 - Joints and Bearings
- Chapter 15 - Design of Sound Barriers
- Chapter 31 - Pedestrian Structures
- Chapter 32 - Signs, Luminaires and Traffic Signals
- Chapter 33 - Rehabilitation
- Chapter 34 - Plans
- Chapter 35 - Cost Estimating and Quantities
- Chapter 36 - Construction
- Chapter 37 - QA/QC
- Chapter 38 - Alternative Delivery (DB, MOB & CMGC)
- Chapter 39 - Accelerated Bridge Construction (ABC)
- Appendix X - Miscellaneous Chapter (i.e. examples & other items)

Note: Chapters 16 thru 30 will be reserved for future additions. For Chapters 0-2 and 33-38, the following additional resources should be utilized (I.e. Survey results from other state DOTs, COOT's Construction, Design, Local Agency & Materials Bulletins; COOT's existing Bridge Design, Construction, Local Agency, Project Development, Design Build (DB), Materials /Geotechnical, Drainage Design Manuals /Technical Bulletins and applicable FHWA regulations.

As of this writing, a separate Geotechnical Manual is being developed by the COOT Geotechnical Unit. It is anticipated that some coordination would be necessary between the authors of the two manuals and COOT, specifically Chapters 10 and 11.

Survey of other BDM:
Survey of state DOTs for content have been completed by the 80M Committee Members. No additional work will be required. Format shall still remain as mentioned above.

a. Examples and Calculations:
Consultant shall identify which calculations and examples are important based on local practices and where these deviate from AASHTO recommendations.
Calculations and examples shall be included In the Appendix section.
b. Consultant shall develop example calculations for the following topics at a minimum:
I. Deck Design, Camber for Pre-stressed Girders, Expansion Joints
ii. Sign Structures, Bearing Examples

b. Maintenance (Annually):
Consultant shall provide annual maintenance of the BDM (next S-years, June 2021) to keep the manual current with changes in COOT Policy, AASHTO Design Codes and FHWA guidelines.

The following outlines the general annual maintenance procedure:
Schedule:
I. Review Interims
il. Identify Variance and Changes
iii. Submit List of Changes to COOT Project Manager and Stakeholders/Consultants for Review and Comment
iv. Hold Review Meeting with COOT
v. Complete Updates
vi. Final COOT Review
vii. Publish revisions online

Consultant shall develop and submit a schedule outlining the following milestones at a minimum:

The completed BDM shall be online by June 2016; but, no later than specified In the Task Order or Order(s). The schedule shall also address staggered delivery and roll-out of individual chapters.
Deliverables:
1. Preliminary Format and Outline Submittal ("FIR")
• Submit Preliminary Format and Outline
• COOT and Consultant Review Period
• Comment Resolution Meeting
2. Completed DRAFT Chapters or as required in the Task Order submittals ("FOR")
• Submit Draft Completed Manual or as required in the Task Order submittals
• COOT and Consultant Review Period
• Comment Resolution Meetings
3. Published Final BDM
• Chapter or Chapters to COOT for posting on Websites
a. Schedule of Key Events
b. Preliminary Format and Outline ("FIR")
c. Completed DRAFT Chapter(s) or as required in the Task Order or Orders ("FOR")
d. Published Final BDM by Chapters or as required in the Task Orders

Outlines of Chapters/write-ups prepared by the BDM Committee members.
Attachment 1
RFP for CDOT Bridge Design Manual

Attachment – 1 Outlines of Chapters

RFP for CDOT Bridge Design Manual

Policies and Procedures

Outlines are not available.

Chapter 1 - Introduction

1.2 Definitions:
Define Culvert vs. Bridge; define how limns are measured (B.F. to B.F. Abutment vs. inside face to inside face).
1.3.3 Ductility:
Provide CDOT's policy and requirements for ductility.
1.3.4 Redundancy:
Provide COOT's policy and requirements for redundancy.
Single Column bents?
What is "exceptional" redundancy?
Will COOT allow 0.95?
1.3.5 Operational Importance: Address
Provide CDOT's policy and requirements for Operational Importance.
Will CDOT allow 0.95?

Chapter 2 - General Design and Location Features

1. Location Features
a. Alignments
b. Clearances
c. Environmental Considerations
d. Utilities
e. Inspection access
2. Foundation Investigation
a. All geotechnical design information must be provided in LRFD format. Preliminary design information may be provided in ASD format, but shall not be used for final design.
b. Define the minimum requirements necessary for geotechnical reports for bridges, retaining walls, and box culverts.
c. Define the design requirements for stability analysis
d. Identify the final geotechnical report as a deliverable to CDOT Staff Bridge
3. Design Objectives
a. Identify and define the CDOT Structure type selection process for major structures. Provide the different steps necessary for structure selection of new structures versus replacement structures versus rehabilitation of existing structures. Identify the requirements and process necessary for evaluation of Accelerated Bridge Construction (ABC) techniques. Identify the requirements and process necessary for bridge life cycle cost analysis. Define the different steps necessary for bridges and retaining walls.
b. Identify and define all design deliverables necessary for Major Structures
c. Define the design requirements for minor structures.
d. Define COOT's policy on the incorporation of aesthetic features on bridges and retaining walls.
4. Hydrology and Hydraulics
a. Define the minimum requirements necessary for inclusion into the drainage report for a structure for any stream crossing, foundations that may be susceptible to scour, and on deck drainage.
5. Bridge Security
a. Identify that the bridge security measures, if necessary, will be included in the structure selection report for all major structures. When security measures are required, the measures will be provided by the COOT to the designer for inclusion in design.

Chapter 3 - Loads and Load Factors

AASHTO LRFO design method shall be used for all COOT projects. AASHTO Standard Specifications ASO method shall be used for timber Structures. AASHTO Standard Specifications LFO method may be used for repairs and rehab projects where the use of other design methods is not feasible.
Clarify COOT's policy on ductility, redundancy and operational importance (eta factors).
Should design for blast loads be included in this chapter?
Clarify the use of SHVs and NRL vehicles for design and rating bridge structures including the Colorado Permit and Modified Tandem Vehicles.

Revise collision load (CT) policy to meet 600K load (ref: Section 3.3 of the Bridge Design Manual).
Construction Loads (Loads to be considered and when / where to be used) need to be addressed in Section-3 of the proposed BDM. Construction loads are not well defined in AASHTO and the current

Bridge Design Manual. It's a difficult task since the Contractor's method of construction is unknown during Preliminary engineering and final design.

For the earthquake load (EO), clarify if the design should be based on Force Method or Displacement Method or allow both methods. A simplified method for computing EO forces is preferred. Should EO be Considered in design of retaining wall, MSE and GRS abutments?
Force effects due to uniform temperature (TU) needs to be addressed here or in the Miscellaneous Section - Design Procedure for expansion bearing Devices.
Earth Horizontal (EH), Earth Surcharge (ES), Live Load Surcharge (LS) and Down-Drag Force (DO) will be Covered in the Retaining Wall Section.
Force effects on superstructure and substructure elements need to be considered due to foundation Settlements especially where flexible foundation system is used. This may be critical when GRS Abutments are considered in design.

Chapter 4 - Structural Analysis and Evaluation

Possible subjects to include in a BDM chapter for Colorado, potential changes to AASHTO LRFD Application:
4.5.1 Mathematical Modeling
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Member stiffness shall reflect shear deformation for members with low LID if the load distribution is Largely indeterminate (Commentary: Some programs and methods Ignore shear deformation, which can Be large compared to other deformations for short members resulting in erroneous seemingly high order Evaluations).
Member live load moments, shears, and reactions determined from a 3D structure model, if less than Would be calculated from the simplified distribution formulas (4.6.2), shall be increased 10% to reflect the Bias of the simplified formulas assumed in the LRFD calibration. (Commentary: This is covered in the MBE, Manual for Bridge Evaluation. Ignoring it could result in a decreased rating for a structure both Designed and evaluated [rated] by high order methods.)
Sliding bearings are a problem with global structural modeling of actual structures for global thermal, Creep, and shrinkage forces and displacements. The issue can be conservatively dealt with by assuming Maximum bearing friction force in all bearings on one side of the center of motion and zero or minimum Opposing friction force for bearings on the other side.
4.5.2.1 Elastic VS. Inelastic Behavior
While elastic analysis for modeling is simpler and faster, it can lead to excessively conservative forces, And excessively un-conservative deformations. Generally speaking, stiffness of non-pre-stressed Concrete columns should be reduced to reflect cracking for all bending loads, and to reflect the creep of The concrete relaxing the moments and reducing member stiffness for earth pressure, dead load, Superstructure and cap shortening and lengthening from elastic shortening, shrinkage, temperature Rise or Fall, and other long term loads. The change in stiffness for temperature rise and fall can be taken as Intermediate between that for live load and that for dead load. Care needs to be taken to appropriately reflect the differences in behavior for different load duration.
4.5.3.2.2b Moment Magnification
Internal moments arising from volume or length changes, or those from a fixed deformation are not Subject to sideway and can be considered as sideway restrained.
Moment magnification at the ends of columns from these moments arising from volume changes is Normally less than 1.0. Moment magnification at other locations on the column is normally greater than 1.
4.6.2.2.2b U-Girder live load distribution
U girders may be designed using either the criteria for live load distribution of spread concrete box beams, Or spread steel box beams, or, with a 10% increase in live load effect, an LDFAC analysis as a skewed Spread box, or another 3d analysis. Note that the first two methods are historic and have considerable Limitation on their application due to the limitations of the research they are based, and reflect the Multiple Presence factors of the standard specifications, not the LRFD specifications.
4.6.2.2.2d Exterior girder live load distribution
The need for equation C4.6.2.2.2d-l arises due to the simplification of the exterior girder distribution Factor, especially the lever rule, which can be slightly un-conservative for some cases where there is a Transverse positive moment at the assumed hinge point and deck transverse flexural deformations are Small compared to girder deformations. In general there is no need to investigate distribution based on Rigid section rotation if the superstructure consists of tortionally rigid girders, or if the diaphragms and Deck considered compositely are no more than 20% stiffer than the deck alone. If in doubt run LDFAC With the deck thickness increased to reflect the increased transverse stiffness due to the diaphragm System.

4.6.2.2 Skewed Bridges
Several effects of skew on moments and shears are not covered by the LRFD provisions.
A. dead load. For structures built with the girders not supported on false-work and with
Relatively flexible diaphragm systems. The changes in moment and shear due 10 skew are low.
B. For structures with a large skew and a stiff transverse system in the mid-span area,
Significant load may be shed from interior girders to exterior girders.
C. Transverse elements such as decks and diaphragm systems will pick up substantial movements and shears, due to skew, proportional to their stiffness, and the tangent of the Skew. This effect is heightened when girders are torsionally rigid and at locations where the slope of the girder deflection curve is greatest.

D. Torsionally rigid girders will induce large movements into skewed end diaphragms, shifting Reactions.
4.6.2.9.1 Analysis of "Segmental' Concrete Bridges
In general, consideration of the sensitivity of structures to the effects of variations in design parameters Over a plausible range should be made for all concrete structures (not just segmental) that do not have a Significant history of predicted behavior in the spans, depths, live load, structure types, analysis methods, And materials to be used. Besides maintaining a reasonable margin against structural failure', some Serviceability conditions require consideration, especially deflection prediction. For the most part this is Not intended as a refinement of design of a structure, but detection that a particular structure configuration And *type* is impractical. Due to this, this consideration should be evaluated early in the selection process. To reject a type for further consideration if too sensitive, and to alert the designer to potential issues if a Type is close to limits and is later changed in an adverse way (say a 10-15% increase in span length or Adverse change In span ratios is requested).
In particular with the longer and more slender spans practical with current concrete and pre-stress, built into analysis methods, it is possible or even easy, especially in Colorado where we have a history of successfully pressing pre-s-tress spans and span to depth ratios.

In general, In the worst plausible variations. Deflection should be maintained at planned grade +/- (UBDD *+112").* If not overlaid in initial service the limit on elevations can be increased to U6DO+1I2' high, with the Thought if it runs high with time it can be overlaid (and may be anyway for other reasons) to correct any Poor ride. This Is not likely to be effective if deflections run low with time due to the additional deflection From an overlay, both short and long term. Note that some situations call for closer control of deflection Sensitivity for aesthetic or fit up reasons.
Comments on deflection sensitivity:
Current code long term deflection models are based on constant load creep tests of concrete that differs From current concretes used for PS structures. Also they tend to be based on a principle of superposition That may not be quite true, especially for creep recovery. As a result it is improbable that deflection Predictions, especially long term, and even with accurate data reflecting the actual timing, environment and materials used, will be within 30% of the deflections seen in service.
The following structure type is unlikely to have long term deflection problems:
Simple span made composite and continuous for live load is unlikely to have tong term deflection Problems due to the substantial increase in stiffness with composite action and continuity, but may have Serious camber variability and predictability problems.
The following structure types may have long term deflection problems and should be checked for Sensitivity;
A. Any concrete structure requiring a significant camber correction for dead load camber. The Plausible maximum error In deflection prediction Is at least - +-50% for RC structures, for fully Pre-stressed structures is perhaps -+/-25% of the required camber correction +/. 10% of the Pre-stress deflection.
B. Long span reinforced concrete structures
C. Long span structures with hinges in the superstructure
D. Cantilever structures
E. Slender concrete arches
F. Structures built in cantilever, especially those that are haunched, and /or ctp
G. Structures with poor (unbalanced) span ratios
H. Structures with elements thinner «B" total. Or < 4'in the non-composite part) or thicker (24')
Than those envisioned by the code writers.
Colorado example (possible local examples If problems)
The restructuring of the manual in parallel with the LRFD code which has a
Chapter on analysis makes covering these issues as a more general analysis issue practical.
'It is not necessary to fully compound the effects of the assumed variations on the load factors and Resistance factors in the code, as many of the factors will be the same ones used to justify the load and Resistance factors in the code.

Chapter 5 - Concrete
1. Material Properties
A. Define COOT's standard concrete types, their intended use and the boundary conditions for Non-standard concrete mixes used for design (High strength concrete, lightweight concrete)
B. Define the COOT standard parameters for reinforcing steel. Define where COOT will allow Welded wire reinforcing steel, stainless steel, MMFX, and Glass FRP rebar. Provide References to design aids for innovative materials.
C. Define the COOT standard parameters for pre-stressing steel strands and bars
D. Provide COOT standard parameters for the following Post-Tensioning System Properties:
I. Anchorages and Couplers
Ii. Ducts
Iii. Grout
Iv. Un bonded Tendon Requirements
1. Mono-Strands
2. External Post-Tensioning
2. Lima States
Define any known concrete Fatigue Limit State issues and guidance on how to mitigate.
3. Design Considerations
4. Design for Flexural and Axial Force Effects
5. Shear and Torsion
6. Pre-stressing
A. Define COOT's policy on partial pre-stressing.
B. Document COOT's policy on the use of transformed section properties in pre-stressed elements.
C. Define COOT's design methodology for handling camber in girders.
7. Details of Reinforcement
If necessary, define the locations where seismic detailing is needed.
8. Development and Splices of Reinforcement
Define the splice lengths on the COOT Standard Worksheets.
9. Durability
A. Define COOT's policy on concrete cover and the use of epoxy coated reinforcing steel.
B. Provide similar labels for alternative reinforcements
10. Specific Members
A. Document the design parameters and limitations of COOT's Partial-Depth Precast Concrete Panels
B. Define CDOT's policy on the use of Full-Depth Precast Concrete Panels
C. Address shear in pier footings
11. Provisions for Structure Types
Where applicable, provide COOT policy on the following structure types:
A. Bridges Composed of Simple Span Precast Girders Made Continuous (specifically address COOT's policy for establishing continuity and the impacts to ratings)
B. Cast-In-Place Girders and Box and T-Beams
C. Segmental Construction
D. Arches
E. Slab Superstructures
F. Precast Deck Bridges
G. Box Culverts (specifically address shear issues in CBC's)
Chapter 6 - Steel Structures
The minimum requirements for steel structures shall be in accordance with the MSHTO LRFD Bridge Design Specifications unless otherwise noted in this chapter.
1. Performance Requirements
Identify useful service life and address maintenance, safety and aesthetic goals for steel design.
2. Material Properties
A. Identify acceptable materials and how they are to be protected under mild to severe Environments.
B. Identify any components not recognized by MSHTO. Specify requirements when painting of Girders is required and when weathering steel can be used.
3. Design requirements
A. Follow MSHTO LRFD Bridge Design Specifications and any other documents to be Followed for special cases (Railroad, curved girders, etc.)
B. Limit states -Identify limit states for design and any factors not consistent with MSHTO. Identify any unique dead or live loading requirements unique to COOT
C. Fatigue and Fracture - Identify acceptable fatigue cases for new and existing structures.

Identify fracture critical members. COOT may have specific configurations that are
Considered fracture critical.
D. Design and detailing references -Identify references for good design and detailing
Practices. Specify items that COOT does not allow such as field welding, and cover plates,
Pins or hangers on new structures.
E. Structural steel parameters -Identify elements unique to COOT such as minimum plate or
Member sizes; minimal box girder depths (for Inspections); economical diaphragm
Detailing; preferred detailing practices by the Department; emphasize detailing practices that promote economical design; composite design allowances; girder tolerances; acceptable hybrid design practices; acceptable spliced connections; and acceptable type(s) of high
Strength bolts.
F. Constructability
Design must consider constructability related issues such as construction Loads and lateral stability.
Bridges must be erectable.
G. Live load deflection requirements are defined by MSHTO

Chapter 7 - Aluminum Structures

The minimum requirements for aluminum structures shall be in accordance with the AASHTO lrfo
Bridge Design Specifications unless otherwise noted in this chapter.
Generally, COOT does not allow the use of aluminum for main (or primary) load carrying bridge members.

Chapter 8 - Wood Structures

The minimum requirements for wood structures shall be in accordance with the AASHTO LRFO Bridge
Design specifications unless otherwise noted in this chapter.
Generally, COOT does not allow the use of wood for on-system bridges. Identify where wood is allowed,
Secondary road bridges?, formwork, false-work, timber-decks, piling, pile caps.
Identify if wood is allowed for temporary structures. Laminated beam requirements.
Clarify that wood piling is not allowed for any permanent structures but can be used for temporary
Bridges.
Performance Requirements -Identify useful service life and address maintenance, safety and aesthetic
Goals for design.
Material Properties - Identify acceptable materials, treated solid and laminated members, fasteners and
Hardware and what they shall be designed to. Identify acceptable wood products such as graded
Douglas fir etc.
Identify Base resistance values and elasticity values.
Identify treatment requirements.
Identify coefficient of the normal expansion of wood parallel to its fibers.
Limit states - Identify limit states for design and any factors not consistent with AASHTO.
Transverse stiffener requirements for laminated decks and beams.
Any modeling requirements for spans?

Chapter 9 - Decks

The minimum requirements for Decks shall be in accordance with the AASHTO LRFD Bridge Design
Specifications unless otherwise noted in this chapter.
Clarify that the Empirical Method is not allowed.
Define skew limit to allow main transverse reinforcement to be placed parallel to skew. (25' max).
Clarify requirement of doubling reinforcement in the end zones of deck for skew" 25' per 9.7.2.5.
Clarify cantilever requirements, maximum, minimum, set to balance Distribution Factor for exterior and
Interior girders.
Attachment 1
RFP for COOT Bridge Design Manual
Identify clearance requirements to reinforcement, top and bottom mat.
Identify the concrete classification to be used in decks. (Class 0, H) and when to use each.
Identify when waterproofing membranes are required.
Identify that all reinforcing that touches the deck concrete shall be epoxy coated.
Identify when alternatives to epoxy can be used, galvanized, stainless, etc.
Identify when to use a sacrificial wearing surface and design thickness / weight.
Identify the required design loadings for wearing surface and stay-In-place metal forms.
Clarify when stay-in-place metal forms are allowed and if the flutes need to be filled or if additional load design is required.
Clarify deck pouring sequence requirements, when to provide details, pouring rates, direction of pour,
Emergency deck joint locations, joint requirements for skew. Pour positive moment regions first, then
Negative to reduce potential cracking. Maximum pour widths. Contractor required to submit a pour plan
To Engineer prior to pouring? Note effects of cold on curing times during large pours.

Clarify that Class C splices are required in the deck unless approved otherwise
Identify when precast panels are used and if allowed in the cantilever.
Integral abutment diaphragms and pier diaphragms for continuous for live load bridges must be placed Monolithically with the deck slab concrete. Poured within 2 hours of each other?
Identify collision load design requirement for each type of rail.
Identify when an overlay and waterproofing membrane is required and when a deck sealer with saw cuts Is used.
Identify minimum deck thickness for all girder types.
Identify requirements and details for overlay types such as low slump, epoxy overlay, polymer.
Clarify decking requirements for pedestrian truss bridges.
Clarify when alternative design methods such as finite element are acceptable.
Define minimum and maximum longitudinal reinforcement requirements.
Identify exposure requirements for cracking check.
Identify limit states and importance factors to be used in deck design.
Identify when CDOT can use permanent deck forms and PC/PS panels. Can the panels be used in the Cantilever.
Determine procedure to address effect of slab drains / scuppers in the bridge deck.
Clarify design criteria for light poles, sign poles, etc. On the deck.
Haunching Requirements ~ minimum and maximum.
Clarify what preferred option when can't meet the Typical requirements.
Provide conduit and junction box requirements.
Are timber decks allowed? (Reference to wood chapter)
What specialized decking systems are allowed and when can they be used.
Include deck drainage requirements in this chapter.

Chapter 10 - Foundations

1. Subsurface explorations
A. Requirements for exploration methods (e.g., use of Hollow Stem Auger Rock Coring, etc.)
Eventually COOT desires to require calibrated auto-hammers for SPT sampling to improve the consistency and quality of field data.
B. Boring spacing/location requirements,
C. Sampling frequency / type requirements.
I think the manual should address the use the Modified California (MC) sampler. This “sampler” is a unique part of local practice. The more data we get from the field, the more we see that blow counts from the MC sampler are not equivalent to SPT blow counts. Although,
Many local consultants treat SPT and MC blow counts as being equivalent.
2. Drilled Shafts
A. Determination of axial resistance parameters (acceptable design methods) and Corresponding resistance factors for rock socketed drilled shafts.
This is a critical item. There are many design methods for rock socketed shafts. It would be Good for specific guidance on what design methods COOT wants consultants to use.
B. Maybe more appropriate for specs, but OAIQC testing requirements (e.g., CSL testing, TIP Testing, etc.).
C. Procedure to address anomalies/defects identified by post-construction testing.
D. Criteria for projects where COOT would require load testing (e.g., based on project cost, Anticipated drilled shaft footage, square feet of bridge, etc.)
3. Driven Piles
A. Acceptable design methods and resistance factors.
B. Better define PDAJCAPWAP testing requirements, including addressing re-strike after end of Initial driving (EOID).
C Strengthen requirements for drivability analyses.
D. Implement use of Grade 50 steel for an piles.
E. Loading in weak axis versus strong axis for piles at integral abutments.
4. Shallow Foundations
A. Acceptable design methods and resistance factors,
B. GRS abutments,
I. Settlement criteria,
II. Suggestions for phasing.
C. Guidance on when / where COOT prefers and allows footings,
D. Guidance acceptable ground improvement techniques, including swell mrtigation, particularly For MSE walls.

Chapter 11 - Abutments, Piers, and Walls

Abutment, pier, and wall design shall follow AASHTO Section 11 with the exceptions outlined In this Chapter.

This chapter shall include:

1, Design limits and requirements for integral abutments and detailing therein
2, Abutment layout requirements for inspection and embedment
3. Wing Wall layout methods and limits for cantilever wing walls
4. Use of an approach slab and specific detailing therein
5. Reference of collision load (back to Chapter 3)
6, Identify fatigue issue for pin connections at piers with continuous superstructure
7. GRS abutments
8. Earth retaining wall classification and selection
9. Acceptable use of some wall types, particularly MSE block walls
10. Design criteria for global stability (including appropriate resistance factors/factors of safety),
11, Resistance factors for failure modes and wall types.
12. Drainage requirements for retaining structures.
13, Seismic design requirements and guidance,
14. Design roles for MSE walls (define who is responsible for evaluating global stability, external stability, internal stability, etc.)
15. Minimum embedment requirements for MSE walls.
16. Swell mitigation requirements and guidance for MSE walls.
17. Retaining wall classification and selection.

Chapter 12 - Buried Structures and Tunnel Liners

Clarify the requirements for the field geotechnical Investigation for box culverts and other buried Structures.

Clarify the use of AASHTO LRFD equation 12.10.4.2.4a-l for the computation of A s for cast-in-place and Precast box beams. Specifically. Can precast box suppliers use the Nu term (axial thrust) In the Computation of the required flexural steel?

Chapter 13 - Railings

Use the current versions of AASHTO LRFD Bridge Design Specifications, AASHTO Manual for Assessing Safety Hardware (MASH), and FHWA Bridge Rail Requirements to:

Update the current COOT bridge rail guidance as defined In: COOT Bridge Design Manual Subsection 2.1, Bridge Rails, dated *5/1/1992;* COOT Bridge Technical Memorandum - Bridge Rail Dated *217/1994;* and COOT Bridge Technical Memorandum - Evaluating Existing Structures for Rail Replacements dated *9120/1999.*

Include COOT specific guidance for. Combination rails used to separate vehicular traffic from Pedestrian or bicycle traffic; and bridge rails in low speed locations.

Update previously unpublished 1995 Bridge Design Manual Subsection 2.8 that has the common COOT Bridge Rails geometry and strength evaluations.

Chapter 14 - Joints and Bearings

14.5 Bridge Joints'

Goal - To eliminate joints on bridges, and if possible eliminate joints on rehab projects.

Define Selection Criteria, movement capacities, skew angles, design life and other policies for:

Asphaltic Plug
Silicone Seals
Compression Seals
Strip Seals
Oversized Strip Seals
Modular Joints
Bridge Joints vs. Pavement Joints
Other
Other Design Guidelines
Snow Plows and Skew Effects
Maintenance Considerations
Shop Drawing Procedures
Sidewalks
Cover Plates
Phasing
Temperature Ranges
Thermal Modeling and temperature movement
Construction support (drawing reviews etc.) Location differences (e.g. Mountain climate vs. Plains)

14.6 &14.7 Bearings:
General Selection Guidelines (Type I, II, III, IV, & V)
Type I to Type II Criteria
Type III
Type IV and Type V
Sliding Bearings and modeling
14.6.3 Force Effects and Movements
Downward Force - Girder Reactions
Transverse and Longitudinal Forces
Uplift Forces
Longitudinal Movements
Other
14.7.2 PTFE Sliding Surfaces (TYPE II)
Coefficient of Friction (14.7.2.5) - coots is 8%
14.7.5 and 14.7.6 Elastomeric Bearings: (TYPE I)
Method A or Method B?
Elastomer Grades
Hardness
Shear Modulus
Different Criteria for Pre-stressed and Steel Girders
Bearing Details
Reinforcing Grade and Min Thicknesses
Sole Plate Thicknesses *3/4"* min
Plain Bearing Pads for Pre-stressed Girders
14.7.4 Pot Bearings (TYPE III)
Applicable Design Criteria
Other (TYPE IV and TYPE V)
Appendix:
Thermal Movement Calculation Examples
Design Procedures and Examples
Strip Seals (0-4") (Revise COOT BDM Section 15.2)
Modular Joints (revise COOT BDM Section 15.2)
Bearing Design Examples
Elastomeric (TYPE I)
Method A (if applicable)
Method B
PTFE (TYPE II)
Pot Bearings (TYPE JII) (Start with COOT Example)

Chapter 15 - Design of Sound Barriers

Chapter 15 shall contain any preferences or practices in Staff Bridge regarding sound-walls, I.e. Aesthetic Preferences, style preferences.
Main design should be per AASHTO Chapter 15.
Need definition of clearance on anchor bolts, I.e. Per post-tension requirements or not.
Practice should be designated for barrier mounted sound barriers versus barrier in front of sound walls,
Any setback criteria, etc.

Chapter 31- Pedestrian Structures

1. General
2. Codes
3. Geometry and Clearances
4. Loads and Deflections
A. Define additional loading requirements for the following:
I. Collision
II. Maintenance Vehicle
B. Define the desired deflection limits
C. Define COOT's policy on vibration limitations
5. Fracture Critical Designation
A. Define COOT's policy on fracture critical members and measures necessary to avoid designation.
6. Railings and Fencing ~ Define the minimum fencing requirements for pedestrian bridges over state facilities.
7. Covered Structures ~ A. Define the requirements for enclosed or covered bridges

Chapter 32 - Signs, Luminaires and Traffic Signals
Outlines are not available.
Chapter 33 - Rehabilitation
Outlines are not available.
Chapter 34 - Plans
Outlines are not available.
Chapter 35 - Quantity and Cost Estimating
Attachment 1
RFP for COOT Bridge Design Manual
This chapter shall provide guides for quantities and cost estimating of structures and structural elements Based on the COOT Cost Data and industry standards, using a low, average, and high cost ranges for Complexity of the structure and substructures
This chapter will include:
1. Quantify computation procedure (including QC/QA)
2. Quantity pay items for structural elements that include several items
3. Accuracy of quantities
4. Cost Data for structure type
5. Cost Data for typical structural elements
Chapter 36 - Construction
Outlines are not available.
Chapter 37 - Quality Control and Quality Assurance
The purpose of the quality control assurance (QC/QA) procedures is to assist the project team with Creating designs that are safe, economical, constructible, maintainable, aesthetically acceptable and Appropriate for their location.
This chapter will specify the minimum procedure requirements for the quality control, quality assurance And associated activities for structure work on projects.
Following the QC/QA procedures will be required on every project regardless of schedule constraints.
Ac/QA Procedures shall be implemented on all aspects of a project including design, plan preparation, Reports, and cost estimates.
The relationships between the Department and the Engineer should be defined. These minimum Requirements will be included in an overall project quality management plan (QMP).
Development of the amp will not be included in this scope of work.
Chapter 38 - Alternative Delivery (DB, MOB & CMGC)
Outlines are not available.
Chapter 39 - Accelerated Bridge Construction (ABC)
This chapter will identify elements required to be addressed for an accelerated bridge construc1ion using Launching, sliding, or transporting into place from a staging area.
The travel path, staging area, temporary structures, monitoring structure during movement, movement Plan, design of the permanent superstructure are critical elements that should be addressed in this Chapter.
References to case histories and other DOT ABC manuals may be appropriate references until the Department can develop their own manuals. UDOT, for example, has an ABC manual on their web-site that can provide guidance. Include guidelines to assist Engineer with preparing a Project Special Provision for ABC construction.
Development of an ABC Manual will not be included in this scope of work.

Appendix X - Miscellaneous Chapter (i.e. Examples & other items)