

FOREWORD

The *Alaska Bridges and Structures Manual* presents the Department of Transportation & Public Facilities' (DOT&PF's) typical structural design policies and practices. All bridge engineers should meet the criteria presented in the *Manual* and must request exceptions to the *Manual* criteria when conditions warrant. Engineers should consider economic impacts, aesthetics, and the social and cultural resources of the project area and fulfill DOT&PF's mission of providing a safe and efficient transportation system. Because it is impossible to address every issue that bridge engineers will encounter, exercise sound engineering judgment when conditions arise that are not specifically covered in the *Manual*.

The term "bridge engineer" and "bridge designer" are used interchangeably throughout the *Manual*. If needed, any distinction between these two terms should be based on context.

The *Alaska Bridges and Structures Manual* was initially prepared based on the 6th Edition of the AASHTO *LRFD Bridge Design Specifications* and has been updated to conform with the 9th Edition.

REVISION PROCESS

The *Alaska Bridges and Structures Manual* is intended to provide current structural design policies and practices for use in developing DOT&PF projects. Revisions to this Manual will be released on an annual basis as needed and after approval by FHWA. The format of the revisions will be in the form of replacement or insert pages to the existing Manual. The updated pages will include the date of the release in the bottom footer of the page. The revisions will be handled as interims and the Manual will be republished as deemed necessary.

It is the responsibility of the *Manual* holder to keep the *Manual* updated.

The DOT&PF Bridge Section will evaluate changes in the structural design literature (e.g., updates to the *LRFD Specifications*, the issuance of new research publications, revisions to federal regulations) and will ensure that those changes are appropriately addressed through the issuance of revisions to the *Manual*. Bridge engineers have a responsibility to remain current with the AASHTO *LRFD Bridge Design Specifications* revisions until the *Manual* is updated. It is important that users of the *Manual* inform DOT&PF of any inconsistencies, errors, need for clarification, or new ideas to support the goal of providing the best and most up-to-date information practical. Comments and proposed revisions may be forwarded to the Chief Bridge Engineer using the Revision Proposal Form.

Alaska Bridges and Structures Manual

Revision Proposal Form

To propose a revision to the *Alaska Bridges and Structures Manual*, complete and return this Revision Proposal Form to:

Chief Bridge Engineer
Bridge Section
Alaska DOT & Public Facilities
P. O. Box 112500
Juneau, Alaska 99811-2500

Identification

Date Submitted: _____

Submitted By (name, agency/firm): _____

Contact Information (phone #, e-mail): _____

Description of Proposed Revision (attach additional sheets as necessary)

Applicable *Manual* Section Number(s): _____

Proposed Revision: _____

Justification for Revision: _____

Table of Contents

Part I – Administration and Procedures

| | |
|------------------------------------------------------------|------|
| 1. DOT&PF Organization (Reserved) | 1-1 |
| 2. Bridge Project Development Process (Reserved)..... | 2-1 |
| 3. Administrative Policies and Procedures (Reserved) | 3-1 |
| 4. Bridge Type Selection Report | 4-1 |
| 4.1. Bridge Type | 4-1 |
| 4.2. Procedures | 4-3 |
| 4.3. Report Format and Content | 4-4 |
| 5. Drafting Guidelines | 5-1 |
| 5.1. CADD File Requirements | 5-1 |
| 5.2. Drafting Standards..... | 5-3 |
| 5.3. Plan Sheets | 5-7 |
| 6. Plan Preparation..... | 6-1 |
| 6.1. General Layout Sheet..... | 6-1 |
| 6.2. Site Plan Sheet..... | 6-4 |
| 6.3. Abutment Sheet..... | 6-6 |
| 6.4. Wingwall Sheet..... | 6-8 |
| 6.5. Pier Sheet..... | 6-10 |
| 6.6. Framing Plan and Typical Section Sheet | 6-12 |
| 6.7. Girder Sheet | 6-14 |
| 7. Construction Contracts | 7-1 |
| 7.1. Contract Documents | 7-1 |
| 7.2. Special Provision Preparation..... | 7-2 |
| 8. Quantity Calculations and Cost Estimates..... | 8-1 |
| 8.1. Planning Stage (Level 1) | 8-1 |
| 8.2. Bridge Type Selection (Level 2)..... | 8-3 |
| 8.3. PS&E Stage (Level 3)..... | 8-10 |
| 9. Design Quality Control (QC) Procedures | 9-1 |
| 9.1. General | 9-1 |

Part II – Structural Design

| | |
|----------------------------------------------------|-------|
| 10. Introduction to Part II | 10-1 |
| 10.1. Overview | 10-1 |
| 10.2. Manual Application | 10-2 |
| 10.3. Design Variances | 10-4 |
| 10.4. Structural Design Literature (National)..... | 10-6 |
| 10.5. Alaska Highway Preconstruction Manual | 10-12 |

| | |
|--------------------------------------------------------|-------------|
| 10.6. Bridge Identification..... | 10-13 |
| 11. Structural Systems and Dimensions..... | 11-1 |
| 11.1. Introduction | 11-1 |
| 11.2. Bridge Location | 11-1 |
| 11.3. Span Length and Configuration..... | 11-11 |
| 11.4. General Design Considerations..... | 11-12 |
| 11.5. Superstructures..... | 11-16 |
| 11.6. Substructures..... | 11-19 |
| 11.7. Foundations | 11-22 |
| 11.8. Roadway Design Elements | 11-24 |
| 12. Loads and Load Factors | 12-1 |
| 12.1. General | 12-1 |
| 12.2. Permanent Loads..... | 12-4 |
| 12.3. Transient Loads | 12-5 |
| 13. Structural Analysis and Evaluation | 13-1 |
| 13.1. Distribution of Live Load..... | 13-1 |
| 13.2. Refined Analysis | 13-5 |
| 14. Structural Concrete | 14-1 |
| 14.1. Materials | 14-1 |
| 14.2. Reinforcement..... | 14-3 |
| 14.3. Structural Concrete Design | 14-7 |
| 14.4. Prestressed Concrete Girders | 14-9 |
| 14.5. References..... | 14-23 |
| 15. Structural Steel Superstructures..... | 15-1 |
| 15.1. General | 15-1 |
| 15.2. Materials | 15-7 |
| 15.3. Horizontally Curved Members | 15-9 |
| 15.4. Fatigue Considerations | 15-10 |
| 15.5. General Detail Requirements | 15-11 |
| 15.6. I-Sections in Flexure | 15-16 |
| 15.7. Connections and Splices..... | 15-18 |
| 16. Bridge Decks and Rails | 16-1 |
| 16.1. General | 16-1 |
| 16.2. Design Details..... | 16-2 |
| 16.3. Approach Slabs..... | 16-13 |
| 16.4. Deck Drainage | 16-14 |
| 16.5. Bridge Deck Appurtenances..... | 16-16 |
| 17. Foundations | 17-1 |
| 17.1. General | 17-1 |
| 17.2. Structural Foundation Engineering Report | 17-3 |
| 17.3. Footings and Caps | 17-10 |
| 17.4. Driven Piles..... | 17-11 |
| 17.5. Drilled Shafts..... | 17-14 |
| 17.6. Lateral Loading of Deep Foundation Elements..... | 17-17 |

| | |
|-------------------------------------------------------------------|-------------|
| 18. Substructures..... | 18-1 |
| 18.1. Abutments/Wingwalls | 18-1 |
| 18.2. Piers | 18-9 |
| 18.3. Cold Climate Effects on Earthquake Resisting Elements | 18-14 |
| 18.4. References | 18-15 |
| 19. Expansion Joints and Bearings | 19-1 |
| 19.1. Expansion Joints | 19-1 |
| 19.2. Bearings | 19-4 |
| 20. Bridges in Remote Sites | 20-1 |
| 20.1. Design Objectives..... | 20-1 |
| 20.2. Limit States..... | 20-3 |
| 20.3. Live-Load Analysis | 20-4 |
| 20.4. Design Details | 20-5 |
| 21. Miscellaneous Structural Elements | 21-1 |
| 21.1. Retaining Walls..... | 21-1 |
| 21.2. Mechanically Stabilized Earth (MSE) Walls | 21-6 |
| 21.3. Other Structures | 21-7 |
| 22. Reserved | 22-1 |

Part III – Existing Bridges/Bridge Operations

| | |
|--------------------------------------------------------|-------------|
| 23. Bridge Rehabilitation | 23-1 |
| 23.1. Introduction..... | 23-1 |
| 23.2. Documentation | 23-2 |
| 23.3. Bridge Condition Surveys and Tests | 23-13 |
| 23.4. Bridge Deck Rehabilitation | 23-19 |
| 23.5. Concrete Superstructures..... | 23-23 |
| 23.6. Steel Superstructures | 23-26 |
| 23.7. Substructures/Foundations | 23-29 |
| 23.8. Seismic Retrofit | 23-31 |
| 23.9. Bridge Widening | 23-34 |
| 24. Railroads..... | 24-1 |
| 24.1. Highway Bridges Over Railroads (Overheads) | 24-1 |
| 25. Construction Support | 25-1 |
| 25.1. Responsibilities..... | 25-1 |
| 25.2. Shop and Working Drawings | 25-2 |
| 25.3. Construction Field and Shop Inspections..... | 25-4 |
| 25.4. Construction Change Orders | 25-5 |
| 25.5. Value Engineering Proposals..... | 25-6 |
| 25.6. Requests for Information | 25-6 |
| 25.7. Materials Certification List (MCL)..... | 25-6 |
| 26. Bridge Inspection Program | 26-1 |
| 26.1. Federal Bridge Inspection Program | 26-1 |

| | |
|--------------------------------------------------------|-------------|
| 26.2. Alaska Bridge Inspection Program | 26-5 |
| 26.3. Responsibilities/Qualifications | 26-6 |
| 26.4. Types of Inspections and Frequencies | 26-8 |
| 26.5. Special Bridge Inspection Activities | 26-12 |
| 26.6. Bridge Inspection and Inventory Procedures | 26-14 |
| 26.7. Quality Control/Quality Assurance..... | 26-18 |
| 27. Load Rating and Posting..... | 27-1 |
| 27.1. Load Rating..... | 27-1 |
| 27.2. Load Posting | 27-5 |
| 28. Bridge Management..... | 28-1 |
| 28.1. Responsibilities | 28-1 |
| 28.2. BrM Software | 28-2 |
| 28.3. Federal-Aid Program | 28-3 |