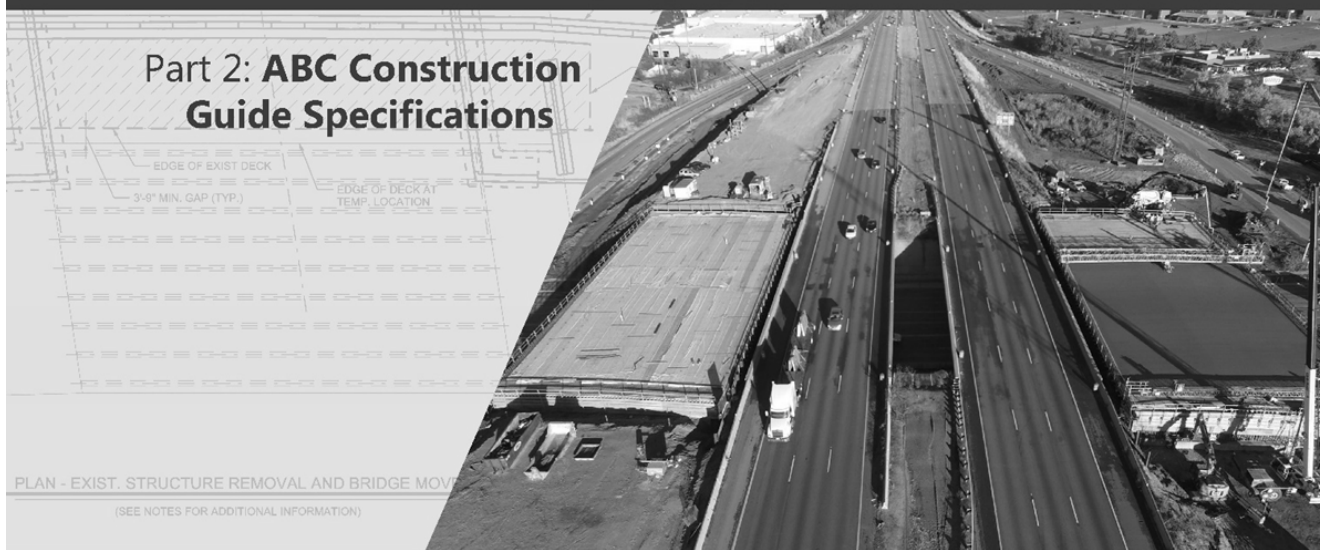




**Part 1: ABC Design
Guide Specifications**

LRFD Guide Specifications for Accelerated Bridge Construction

**Part 2: ABC Construction
Guide Specifications**



1st Edition • 2018

ABBREVIATED TABLE OF CONTENTS

The *AASHTO LRFD Guide Specifications for Accelerated Bridge Construction*, First Edition contains the following sections:

Part 1: ABC Design Guide Specifications

1. Design Introduction
2. General Design Provisions
3. Design of Prefabricated Elements
4. Detailing Requirements
5. Durability of ABC Technologies

Part 2: ABC Construction Guide Specifications

6. Construction Introduction
7. Temporary Works
8. Fabrication and Assembly Planning
9. Layout and Tolerances
10. Concrete Structures
11. Steel Structures
12. Geosynthetic Reinforced Soil–Integrated Bridge System (GRS-IBS)

FOREWORD

Accelerated Bridge Construction (ABC) technologies have evolved from the laboratory to trial installations into mainstream use. To date, the design and construction of ABC projects has been completed using engineering judgement and existing design and construction provisions that are contained in the *AASHTO LRFD Bridge Design Specifications* and the *AASHTO LRFD Bridge Construction Specifications*. These specifications fulfill the majority of the design and construction specification needs for an ABC project. This set of specifications is intended to fill the gaps for design and construction specification that are not specifically covered in the current AASHTO specifications.

The approach taken for the development of these guide specifications is to develop a document that supplements the current published design and construction specifications. The breakdown of sections within this document was based on a logical division of design and construction processes for ABC, as opposed to having provisions that would be integrated directly into the structure of provisions in the published documents.

This document was developed under NCHRP Project 12-102.

NCHRP Project 12-98 involved the development of several documents related to ABC. They are entitled *Guidelines for Prefabricated Bridge Elements and Systems Tolerances* and *Guidelines for Dynamic Effects for Bridge Systems*. These documents, which are not AASHTO publications, are referenced within this document and are available through NCHRP.

SECTION 1: DESIGN INTRODUCTION

TABLE OF CONTENTS

1.1—SCOPE.....	1-1
1.2—USE OF THESE SPECIFICATIONS	1-1
1.3—DEFINITIONS	1-2
1.3.1—GENERAL ABC DEFINITIONS.....	1-2
1.3.2—DECK ELEMENTS.....	1-2
1.3.3—BEAM ELEMENTS.....	1-3
1.3.4—PIER ELEMENTS.....	1-3
1.3.5—ABUTMENT AND WALL ELEMENTS	1-4
1.3.6—GEOSYNTHETIC REINFORCED SOIL INTEGRATED BRIDGE SYSTEM (GRS-IBS).....	1-5
1.3.7—MISCELLANEOUS ELEMENTS AND DEFINITIONS	1-5
1.3.8—SYSTEMS	1-7
1.4—DESIGN RESPONSIBILITIES FOR PREFABRICATED ELEMENTS.....	1-7
1.4.1—DESIGNER	1-8
1.4.1.1—Designer’s Role in Shipping and Handling of Elements	1-8
1.4.1.2—Establishment of Tolerances and Joints	1-8
1.4.1.3—Specification of Special Materials.....	1-9
1.4.2—CONTRACTOR	1-9
1.4.2.1—Temporary Works	1-9
1.4.2.2—Element Shipping and Handling Calculations including Lifting Hardware	1-9
1.5—DESIGN RESPONSIBILITIES FOR SPMT SYSTEMS.....	1-9
1.5.1—DESIGNER	1-10
1.5.1.1—Bridge Design.....	1-10
1.5.1.1.1—Superstructure Types.....	1-10
1.5.1.1.2—Analysis for Jacking Locations	1-10
1.5.1.1.3—Determine Allowable Deformations.....	1-11
1.5.1.2—Preliminary SPMT Investigation.....	1-11
1.5.1.2.1—Preliminary SPMT Layout	1-11
1.5.1.2.2—Vertical Geometry Management at Bridge Site	1-14
1.5.1.2.3—Staging Area and Travel Path Investigation	1-14
1.5.1.2.4—Support of the Bridge in the Staging Area	1-15
1.5.1.3—Information to be Included on the Plans.....	1-19

1.5.2—CONTRACTOR	1-19
1.5.2.1—Design of Temporary Supports in Staging Area	1-19
1.5.2.2—Final SPMT Design and Travel Path.....	1-19
1.5.2.3—Monitoring System.....	1-20
1.5.2.4—Bridge Analysis.....	1-20
1.6—DESIGN RESPONSIBILITIES FOR LATERAL SLIDE SYSTEMS.....	1-21
1.6.1—DESIGNER	1-21
1.6.1.1—Bridge Design.....	1-21
1.6.1.2—Preliminary Jacking Forces and Jacking Locations.....	1-21
1.6.1.3—Friction Forces	1-22
1.6.1.4—Resolution of Sliding Forces	1-22
1.6.1.5—Geotechnical Design for Sliding Systems	1-23
1.6.1.6—Substructure Design	1-23
1.6.1.7—Preliminary Falsework and Slide System Layout.....	1-23
1.6.1.8—Specification Requirements.....	1-24
1.6.2—CONTRACTOR	1-24
1.6.2.1—Design of Falsework and Sliding Systems	1-24
1.6.2.2—Final Design of Jacking Forces and Jacking Locations.....	1-24
1.6.2.3—Detailing of Slide System.....	1-24
1.7—REFERENCES	1-25

SECTION 1

DESIGN INTRODUCTION

1.1—SCOPE

The provisions in this section serve as an introductory section of the overall guide specifications. Included herein are definitions of common prefabricated elements and systems, recommended roles and responsibilities for Accelerated Bridge Construction (ABC) projects and design considerations for different types of ABC projects.

1.2—USE OF THESE SPECIFICATIONS

These specifications are a guide document for the design of ABC projects.

The provisions contained herein shall be used in conjunction with the *AASHTO LRFD Bridge Design Specifications*.

These guide specifications are intended for use on typical girder/stringer type bridges.

Collaboration between the Designer and the Contractor is a key element of most ABC projects. Portions of these specifications outline the roles and responsibilities of each in the design and construction phases of the project.

C1.2

This document should not be considered a full specification. Users of this document should exercise engineering judgement in conjunction with the provisions contained herein. This document makes use of the terms “shall,” “should,” “may,” and “recommended.” The following describes how these terms should be interpreted:

- The term “shall” denotes a requirement for compliance with these specifications.
- The term “should” indicates a strong preference for a given criterion.
- The term “may” indicates a criterion that is usable, but other local and suitably documented, verified, and approved criterion may also be used in a manner consistent with the LRFD approach to bridge design.
- The term “recommended” is used to give guidance based on past experiences.

This is not a stand-alone design specification. In many cases, provisions will refer to other AASHTO documents. This document is intended to supplement the *AASHTO LRFD Bridge Design Specifications*.

Many of these provisions are also applicable to other bridge types such as segmental bridges, trusses, and arches.

An example of collaboration is the need for the Designer to develop a preliminary Self-Propelled Modular Transporter (SPMT) and Lateral Slide Design to help define the constructability of the design, and then allowing the Contractor to finalize the construction methods working with the Designer for final approval.

SECTION 2: GENERAL DESIGN PROVISIONS

TABLE OF CONTENTS

2.1—SCOPE.....	2-1
2.2—DEFINITIONS	2-1
2.3—NOTATION.....	2-1
2.4—LOADS AND LOAD COMBINATIONS	2-1
2.4.1—PREFABRICATED ELEMENTS	2-1
2.4.1.1—Shipping and Handling.....	2-1
2.4.2—BRIDGE SYSTEMS—SPMT INSTALLATION	2-2
2.4.2.1—Service Load Combination for the Bridge.....	2-2
2.4.2.2—Strength Load Combination for the Bridge	2-3
2.4.2.3—Load Combinations for Falsework and SPMTs	2-3
2.4.3—BRIDGE SYSTEMS—LATERAL SLIDE INSTALLATION	2-4
2.4.4—OWNER SPECIFIED CRITERIA.....	2-4
2.5—REFERENCES	2-4

SECTION 3: DESIGN OF PREFABRICATED ELEMENTS

TABLE OF CONTENTS

3.1—SCOPE.....	3-1
3.2—DEFINITIONS	3-1
3.3—NOTATION.....	3-1
3.4—SEISMIC DESIGN FOR ACCELERATED BRIDGE CONSTRUCTION	3-3
3.4.1—SEISMIC ANALYSIS AND DESIGN METHODS.....	3-3
3.4.1.1—General	3-3
3.4.1.2—Force-Based Design.....	3-4
3.4.1.3—Displacement-Based Design	3-5
3.4.2—LOAD PATH.....	3-5
3.4.3—SEISMIC SYSTEMS, ELEMENTS, AND SUB-SYSTEMS	3-6
3.4.3.1—Earthquake-Resisting Systems (ERS).....	3-6
3.4.3.2—Earthquake-Resisting Elements (EREs).....	3-6
3.4.3.3—Earthquake-Resisting Sub-Systems (ERSS).....	3-8
3.4.4—ENERGY DISSIPATION (ED).....	3-8
3.4.5—CAPACITY PROTECTION (CP)	3-9
3.4.6—CONNECTION DESIGN REQUIREMENTS FOR SDC A (SEISMIC ZONE 1).....	3-9
3.5—PREFABRICATED ELEMENT DESIGN	3-9
3.5.1—CONCRETE ELEMENTS	3-9
3.5.1.1—Footings	3-10
3.5.1.2—Columns.....	3-11
3.5.1.3—Pier Caps.....	3-11
3.5.1.4—Retaining Wall Panels, Pier Wall Panels, and Abutment Stems	3-12
3.5.1.5—Integral Abutments	3-12
3.5.1.6—Full-Depth Precast Deck Panels.....	3-13
3.5.1.7—Adjacent Deck Beams.....	3-14
3.5.1.8—Approach Slabs.....	3-15
3.5.1.9—Precast Concrete Railings	3-15
3.5.2—STEEL ELEMENTS	3-16
3.5.2.1—Steel Decks	3-16
3.5.2.2—Modular Decked Beams.....	3-16
3.5.2.3—Steel Substructures.....	3-16
3.5.3—OTHER MATERIALS	3-17

3.6—CONNECTION DESIGN AND DETAILING	3-17
3.6.1—GENERAL PROVISIONS	3-17
3.6.1.1—General Seismic Connection Design.....	3-18
3.6.2—CAST-IN-PLACE CONCRETE CLOSURE JOINTS USING LAPPED BAR REINFORCEMENT	3-18
3.6.2.1—Reinforcing Bars in Closure Joints	3-19
3.6.2.2—Hooked Reinforcing Bars in Closure Joints	3-19
3.6.2.3—Headed and Mechanically Anchored Deformed Reinforcing Bars in Closure Joints.....	3-20
3.6.2.3.1—Development of Headed and Mechanically Anchored Deformed Reinforcing Bars in Tension	3-20
3.6.2.3.2—Development of Headed and Mechanically Anchored Deformed Reinforcing Bars in Compression	3-21
3.6.2.3.3—Splices of Headed and Mechanically Anchored Deformed Reinforcing Bars in Tension	3-21
3.6.2.4—Reinforced UHPC Connections in Closure Joints.....	3-22
3.6.2.4.1—Development of Deformed Reinforcing Bars in Tension in UHPC.....	3-22
3.6.2.4.2—Splices of Lapped Reinforcing Bars in Tension in UHPC.....	3-23
3.6.2.4.3—Minimum Spacing of Reinforcing Bars in UHPC	3-23
3.6.3—GROUTING OR CONCRETING UNDER PRECAST SPREAD FOOTINGS, PRECAST SLABS-ON- GRADE, AND APPROACH SLABS	3-23
3.6.4—MECHANICAL REINFORCING BAR CONNECTORS FOR ED AND CP APPLICATIONS.....	3-24
3.6.4.1—General	3-24
3.6.4.2—Type 1 Mechanical Connectors.....	3-24
3.6.4.3—Type 2 Mechanical Connectors.....	3-25
3.6.4.4—Type 2 Mechanical Connectors in Plastic Hinge (ED) Regions for SDCs C and D (Seismic Zones 3 and 4)	3-26
3.6.4.4.1—Force-Based Design of Column Connections with Mechanical Connectors for Seismic Zones 3 and 4.....	3-27
3.6.4.4.2—Displacement-Based Design of Column ED Connections with Mechanical Connectors for SDCs C and D	3-28
3.6.4.5—Debonding of Column Longitudinal Reinforcement for Mechanical Couplers in the Plastic Hinge (ED) Region ...	3-30
3.6.5—GROUTED DUCT CONNECTIONS	3-31
3.6.5.1—Minimum Development Length of Reinforcing Steel in Grouted-Duct Connections	3-32
3.6.5.2—Splicing of Longitudinal Reinforcement in Columns Subject to Ductility Demands (ED) for SDCs C and D (Seismic Zones 3 and 4) in Grouted Duct Connections.....	3-34
3.6.5.3—Debonding of Column Longitudinal Reinforcement in Grouted Duct Connections	3-34
3.6.5.4—Bedding Layer in Grouted Duct Connections	3-35
3.6.5.5—Development of Deformed Steel Bars in Corrugated Steel Ducts using UHPC	3-36
3.6.6—POCKET CONNECTIONS.....	3-36
3.6.6.1—Column-to-Pier Cap or Column-to-Footing Pocket Connections	3-36
3.6.6.2—Formed Pocket and Fill.....	3-37
3.6.6.3—Minimum Development Length of Reinforcing Steel in Pocket Connections	3-38
3.6.6.4—Corrugated Steel Pipe Thickness for Pocket Connections	3-39
3.6.6.5—Bedding Layer for Pocket Connections	3-41
3.6.6.6—Abutment-to-Pile Pocket Connections.....	3-41
3.6.7—SOCKET CONNECTIONS.....	3-42
3.6.7.1—General	3-42

3.6.7.2—Precast Concrete Column in Spread Footing or Pile Cap Socket Connection.....	3-43
3.6.7.2.1—Interface Shear Transfer in Socket Connections.....	3-44
3.6.7.3—Precast Concrete Column in Oversized Cast-in-Place Concrete Shaft Socket Connection.....	3-45
3.6.7.3.1—Development Length of Column Bars Extended into Oversized Drilled Shafts for Socket Connections.....	3-46
3.6.7.3.2—Lateral Confinement for Oversized Pile Shafts for Socket Connections	3-47
3.6.7.4—Precast Concrete Column in Precast Pier Cap Socket Connection.....	3-49
3.6.7.4.1—Minimum Socket Length.....	3-50
3.6.7.4.2—Precast Pier Cap Details	3-50
3.6.7.5—Concrete Filled Steel Tube (CFST) in Cast-in-Place Concrete Footing or Pier Cap.....	3-51
3.6.8—FULL-DEPTH PRECAST CONCRETE DECK PANEL CONNECTIONS	3-51
3.6.8.1—Primary Reinforcement.....	3-52
3.6.8.1.1—Cast-in-Place Concrete Closure Joints	3-52
3.6.8.1.2—Post-Tensioned Joint	3-52
3.6.8.2—Distribution Reinforcement	3-52
3.6.8.2.1—Cast-in-Place Concrete Closure Joints	3-53
3.6.8.2.2—Post-Tensioned Joint	3-53
3.6.8.2.3—Doweled Reinforced Joint.....	3-54
3.6.8.3—Connection of Deck Panels to Supporting Elements.....	3-54
3.6.9—LINK SLABS	3-55
3.6.9.1—Primary Reinforcement.....	3-56
3.6.9.2—Link Slab Reinforcement	3-56
3.6.10—STEEL CONNECTIONS	3-57
3.6.10.1—Bolted Connections.....	3-57
3.6.10.2—Welded Connections	3-57
3.6.10.3—Multi-Span Bridges.....	3-58
3.6.10.3.1—Simple Spans with Jointless Deck.....	3-58
3.6.10.3.2—Simple Span for Dead Load, Continuous for Live Load	3-58
3.6.11—INTEGRAL SUBSTRUCTURE-TO-SUPERSTRUCTURE CONNECTIONS	3-59
3.6.12—TWO-STAGE INTEGRAL PIER CAP	3-60
3.6.12.1—Joint Proportioning for Two-Stage Integral Pier Cap for SCDs C and D or Seismic Zones 3 and 4.....	3-61
3.6.12.2—Minimum Joint Shear Reinforcing for SDCs C and D or Seismic Zones 3 and 4.....	3-65
3.6.12.3—Superstructure Capacity Design for Two-Stage Integral Pier Caps for Longitudinal Direction for SDCs C and D	3-66
3.6.13—DECK BEAM CONNECTIONS	3-67
3.6.13.1—Welded Tab Deck Connection	3-67
3.6.13.2—Transverse Post-Tensioning.....	3-67
3.6.13.3—Closure Joints.....	3-68
3.7—GRS-IBS.....	3-68
3.7.1—DESIGN.....	3-69
3.7.1.1—Superstructure Design.....	3-69

3.7.1.2—GRS-IBS Design.....	3-69
3.7.1.3—Facing Block Design and Details.....	3-70
3.7.1.4—End Diaphragm Design.....	3-70
3.8—ACCELERATED BACKFILL	3-70
3.8.1—GRANULAR BACKFILL.....	3-70
3.8.2—FLOWABLE FILL	3-70
3.8.3—LIGHTWEIGHT MATERIALS	3-71
3.8.3.1—Expanded Polystyrene.....	3-71
3.9—REFERENCES	3-72

SECTION 4: DETAILING REQUIREMENTS

TABLE OF CONTENTS

4.1—SCOPE.....	4-1
4.2—DEFINITIONS	4-1
4.3—NOTATION.....	4-1
4.4—PREFABRICATED ELEMENTS	4-1
4.4.1—LAYOUT AND WORKING LINES.....	4-2
4.4.2—ELEMENT AND ERECTION TOLERANCES.....	4-2
4.4.3—JOINT WIDTHS.....	4-3
4.4.4—MATERIALS	4-3
4.5—SPMT SYSTEMS.....	4-4
4.6—LATERAL SLIDE SYSTEMS	4-5
4.7—GRS-IBS.....	4-6
4.7.1—LAYOUT GEOMETRY OF FACING BLOCK	4-7
4.7.1.1—Front Face of Abutment	4-7
4.7.1.2—Abutment Skew.....	4-8
4.7.1.3—Front Face Setback.....	4-8
4.7.1.4—Front Face Batter.....	4-8
4.7.1.5—Top Elevation of Facing Block	4-8
4.7.1.6—Corner and Wingwall Layout.....	4-9
4.7.1.7—Connections between Layers of Facing Block	4-9
4.7.2—LAYOUT OF REINFORCED SOIL FOUNDATION	4-9
4.7.3—LAYOUT OF GEOSYNTHETIC REINFORCEMENT	4-9
4.7.3.1—Minimum Bearing Width	4-10
4.7.3.2—Layer Thickness	4-10
4.8—ASSEMBLY PLANNING.....	4-10
4.9—REFERENCES	4-11

SECTION 5: DURABILITY OF ABC TECHNOLOGIES

TABLE OF CONTENTS

5.1—SCOPE.....	5-1
5.2—DEFINITIONS	5-1
5.3—NOTATION.....	5-1
5.4—SIMPLIFIED DETAILING FOR DURABILITY.....	5-1
5.4.1—INTEGRAL ABUTMENTS AND PIERS	5-1
5.4.2—SEMI-INTEGRAL ABUTMENTS.....	5-2
5.5—PREFABRICATED BRIDGE ELEMENTS.....	5-3
5.5.1—DURABILITY OF PRECAST CONCRETE ELEMENTS	5-3
5.5.2—ELEMENT CONNECTIONS	5-4
5.5.2.1—Concrete Cover with Mechanical Connectors	5-4
5.5.2.2—Concrete Cover with Headed Reinforcement.....	5-5
5.5.2.3—Location of Joints and Joint Protection	5-6
5.5.2.4—Complex Void Grouting.....	5-7
5.5.2.5—Materials for Closure Joints	5-7
5.5.3—PREFABRICATED DECK DETAILS	5-7
5.5.3.1—Deck Connections	5-7
5.5.3.2—Bare Decks	5-8
5.5.3.3—Overlays	5-8
5.5.4—CORROSION PROTECTION OF POST-TENSIONING TENDONS AND ANCHORAGES.....	5-8
5.5.5—CONTROL OF CRACKING OF PRECAST ELEMENTS DURING CONSTRUCTION.....	5-9
5.6—REFERENCES	5-9

SECTION 6: CONSTRUCTION INTRODUCTION

TABLE OF CONTENTS

6.1—SCOPE..... 6-1

6.2—DEFINITIONS 6-1

6.3—UNITS AND UNIT ABBREVIATIONS..... 6-1

6.4—REFERENCE 6-1

SECTION 7: TEMPORARY WORKS

TABLE OF CONTENTS

7.1—SCOPE.....	7-1
7.2—DEFINITIONS	7-1
7.3—ROLES AND RESPONSIBILITIES	7-1
7.3.1—DESIGNER	7-1
7.3.1.1—Bridge Systems.....	7-1
7.3.1.2—Geotechnical Investigations	7-2
7.3.2—CONTRACTOR	7-2
7.3.2.1—Bridge Systems.....	7-2
7.3.2.2—Geotechnical Investigations	7-2
7.4—DESIGN AND CONSTRUCTION OF TEMPORARY WORKS	7-3
7.4.1—TEMPORARY WORKS LOADS	7-3
7.4.2—DYNAMIC LOADS FOR HANDLING PREFABRICATED ELEMENTS	7-3
7.4.3—DYNAMIC LOADS FOR BRIDGE SYSTEM INSTALLATIONS.....	7-3
7.4.4—CONSTRUCTION OF TEMPORARY WORKS.....	7-3
7.4.5—REMOVAL OF TEMPORARY WORKS.....	7-3
7.5—MEASUREMENT AND PAYMENT.....	7-4
7.6—REFERENCES	7-4

SECTION 8: FABRICATION AND ASSEMBLY PLANNING

TABLE OF CONTENTS

8.1—SCOPE.....	8-1
8.2—SHOP DRAWINGS.....	8-1
8.2.1—STEEL ELEMENTS	8-1
8.2.2—PRECAST CONCRETE ELEMENTS	8-1
8.3—QUALITY CONTROL IN THE SHOP	8-2
8.3.1—STEEL ELEMENTS	8-2
8.3.2—PRECAST CONCRETE ELEMENTS	8-2
8.3.2.1—Temporary Precast Fabrication Facilities	8-2
8.3.2.2—Pre-Pour Inspection Checklists	8-3
8.3.2.3—Casting Inspection Checklist.....	8-3
8.3.2.4—Curing.....	8-4
8.3.2.5—Post-Pour Inspection Checklist	8-4
8.3.2.6—Dry Fit of Assemblies	8-5
8.3.2.7—Final Inspection prior to Shipping.....	8-5
8.3.2.8—Repairs	8-6
8.4—SHIPPING AND HANDLING CALCULATIONS	8-6
8.4.1—STEEL ELEMENTS	8-6
8.4.2—PRECAST CONCRETE ELEMENTS	8-6
8.4.3—MODULAR DECKED BEAMS	8-7
8.5—ASSEMBLY OF PREFABRICATED BRIDGE ELEMENTS	8-7
8.5.1—ASSEMBLY SEQUENCE AND CONSTRUCTION METHODS.....	8-8
8.5.2—LIFTING AND HANDLING PROCEDURES AND DETAILS	8-8
8.5.3—GEOMETRY CONTROL PLAN	8-9
8.5.4—INTERIM MATERIAL STRENGTH	8-9
8.5.5—POST-TENSIONING	8-10
8.5.6—ASSEMBLY SEQUENCE FOR POST-TENSIONED FULL-DEPTH DECK PANELS	8-10
8.5.7—ASSEMBLY SCHEDULE	8-12
8.6—ASSEMBLY OF BRIDGE SYSTEMS.....	8-12
8.6.1—ASSEMBLY SEQUENCE AND CONSTRUCTION METHODS.....	8-13
8.6.2—MEASUREMENT AND PAYMENT	8-15
8.7—REFERENCES	8-15

SECTION 9: LAYOUT AND TOLERANCES

TABLE OF CONTENTS

9.1—SCOPE	9-1
9.2—FABRICATION AND ERECTION	9-1
9.3—STRUCTURE LAYOUT	9-1
9.3.1—ESTABLISHMENT OF WORKING POINTS AND WORKING LINES	9-2
9.3.2—GEOMETRY CONTROL DURING CONSTRUCTION	9-2
9.4—MEASUREMENT AND PAYMENT	9-2
9.5—REFERENCE	9-2

SECTION 10: CONCRETE STRUCTURES

TABLE OF CONTENTS

10.1—SCOPE.....	10-1
10.2—RELATED WORK	10-1
10.3—SHOP DRAWINGS.....	10-1
10.4—MATERIALS	10-1
10.4.1—CLASSES OF CONCRETE	10-1
10.4.2—USE OF SUPPLEMENTARY MATERIALS.....	10-2
10.4.3—NON-SHRINK GROUTS.....	10-2
10.4.4—HIGH EARLY STRENGTH CONCRETE	10-3
10.4.4.1—Mix Design.....	10-4
10.4.4.2—Field Trial Placement	10-4
10.4.5—ULTRA HIGH PERFORMANCE CONCRETE FOR CLOSURE JOINTS.....	10-7
10.4.5.1—Material Performance Testing.....	10-7
10.4.5.2—Surface Preparation	10-8
10.4.5.3—Formwork for UHPC.....	10-9
10.4.5.4—Mixing UHPC	10-9
10.4.5.5—Placing UHPC	10-10
10.4.5.6—Finishing UHPC.....	10-11
10.4.5.7—Curing UHPC	10-11
10.5—PRECAST CONCRETE ELEMENTS	10-12
10.6—CONNECTIONS	10-12
10.6.1—SURFACE PREPARATION FOR CONCRETE CONNECTIONS	10-12
10.6.2—GROUTED JOINTS AND KEYS	10-12
10.6.3—GROUTED COUPLER CONNECTIONS	10-13
10.6.3.1—Materials.....	10-13
10.6.3.2—Installation of Grouted Couplers	10-14
10.6.4—POST-TENSIONED CONNECTIONS	10-15
10.6.5—CLOSURE JOINTS.....	10-16
10.6.5.1—Headed Reinforcing Bars	10-16
10.6.5.2—Precast Concrete Full Depth Deck Panel Shear Connector Blockouts on Precast Concrete Beams ..	10-16
10.6.5.3—Link Slabs	10-17
10.7—MEASUREMENT AND PAYMENT	10-17
10.7.1—PRECAST ELEMENTS.....	10-17

10.7.2—CLOSURE JOINTS..... 10-17

10.8—REFERENCES 10-18

SECTION 11: STEEL STRUCTURES

TABLE OF CONTENTS

11.1—SCOPE	11-1
11.2—RELATED WORK.....	11-1
11.3—SHOP DRAWINGS	11-1
11.4—ABC STEEL STRUCTURES.....	11-1
11.4.1—SIMPLE SPAN BRIDGES MADE CONTINUOUS FOR LIVE LOAD.....	11-1
11.4.2—MODULAR DECKED BEAMS	11-2
11.4.3—LINK SLAB REGIONS	11-2
11.5—MEASUREMENT AND PAYMENT	11-2
11.6—REFERENCES.....	11-2

SECTION 12: GEOSYNTHETIC REINFORCED SOIL—INTEGRATED BRIDGE SYSTEM

TABLE OF CONTENTS

12.1—SCOPE.....	12-1
12.2—INTRODUCTION	12-1
12.3—MATERIALS	12-1
12.3.1—FACING BLOCKS.....	12-1
12.3.1.1—Concrete Masonry Unit Facing Block.....	12-2
12.3.1.2—Precast Concrete Facing Units	12-2
12.3.2—BACKFILL MATERIALS	12-2
12.3.2.1—Abutment and Reinforced Soil Foundation Backfill	12-3
12.4—GEOSYNTHETIC SOIL REINFORCEMENT	12-3
12.5—MISCELLANEOUS MATERIALS.....	12-4
12.6—CONSTRUCTION REQUIREMENTS	12-4
12.6.1—REINFORCED SOIL FOUNDATION	12-4
12.6.2—PLACEMENT OF BACKFILL AND COMPACTION	12-5
12.6.3—PLACEMENT OF GEOSYNTHETIC REINFORCEMENT	12-5
12.6.4—WALL FACING.....	12-6
12.6.5—LEVELING COURSE.....	12-7
12.6.6—BEAM SEAT AND SUPERSTRUCTURE PLACEMENT	12-7
12.6.7—APPROACH INTEGRATION	12-7
12.6.8—SITE DRAINAGE	12-8
12.7—QUALITY CONTROL.....	12-8
12.8—MEASUREMENT AND PAYMENT	12-9
12.9—REFERENCES	12-9