CHAPTER 11 STRUCTURES

11.00	INTRODUCTION	11-1
11.01	REMOVAL OF BRIDGES	11-1
11.02	GUIDANCE FOR HEAVY EQUIPMENT & MATERIALS ON BRIDGES	11-1
11.03	TEMPORARY STRUCTURES FOR THE PROTECTION OF THE PUBLIC	11-3
11.04	RESERVED FOR FUTURE USE	11-3
11.05	PILE DRIVING CAP AND HAMMER INFORMATION	11-3
11.10	EARTHWORK FOR STRUCTURES	11-5
11.11	EXCAVATION	11-5
11.12	BACKFILLING STRUCTURES	11-5
	Culverts	11-5
	Bridge Abutments	11-5
	Measurement and Payment	11-6
11.20	FOUNDATIONS	11-7
11.21	STAKING AND CHECKING LOCATIONS OF STRUCTURES	11-7
	Check and Double Check	11-7
	Documentation	11-8
	Common Survey Errors to Avoid	11-8
	Encountering Old Substructures	11-8
	Setting Bench Marks (Post Construction)	11-8
11.22	PILING AND PILE DRIVING	11-9
	Pile Driving	11-9
	Vibratory Hammers	11-9
	Gravity Hammers	11-10
	Diesel Hammers	11-10
	Bearing and Penetration	11-11
	Retaps	11-11
	Dynamic Pile Analyzer	11-12
	Static Load Tests	11-13
11.23	SPLICING PILE	11-13
	Welding Steel Pile	11-13
	Concrete Pile	11-16
11.24	PILING ACCEPTANCE	11-17

<u>Constr</u>	uction Manual	01/13/12
	Steel Pile	11-17
	Wood Pile	11-17
	Steel Pile Cutoffs	11-17
11.25	WAVE EQUATION	11-18
	Hammer Data Form	11-18
	Driving Graphs	11-18
	Log of Piling Driven	11-20
11.26	PREBORED HOLES	11-21
	Typical Preboring	11-21
	Special Prebore Situations	11-22
	Bentonite	11-22
11.27	DRILLED SHAFTS	11-23
11.30	BRIDGES	11-24
11.31	FALSEWORK	11-24
	Temporary Fastenings	11-24
	Falsework Plans	11-24
	Falsework Inspection	11-25
	Falsework Foundations	11-25
	Materials	11-26
	Project Quality	11-28
	Miscellaneous Items	11-30
	Falsework Adjacent To Traffic	11-30
	Field Changes	11-30
	Inspection during Concrete Placement	11-30
	Removal of Falsework	11-31
11.32	BRIDGES - STEEL BEAM	11-31
	Prebolting Meeting	11-32
	Erecting Steel Beams	11-33
	High Strength Fasteners	11-34
	Painting	11-43
11.33	BRIDGES - CONCRETE BEAM	11-43
	Precast - Prestressed Deck Panels	11-43
	Pretensioned Prestressed Concrete Beam (PPC Beam) Erection	11-44
	Diaphragms (Steel or Concrete)	11-44

Consti	ruction Manual	01/13/12
11.40	REINFORCEMENT	11-46
	General Placement Guidelines for Bridge Reinforcing Steel	11-46
11.41	PLACEMENT AND CHECKING (BRIDGE FLOORS)	11-46
	Slab Thickness	11-46
	Clearance of Bottom Reinforcement	11-46
	Clearance of Top Mat Reinforcement	11-47
	Cover Over Top Mat of Reinforcement	11-47
	Slab Bridges	11-47
	Special Attention Areas	11-47
11.42	EPOXY COATED REINFORCEMENT	11-48
	Care and Handling	11-48
	Field Inspection	11-50
	Repair of Damaged Coating	11-50
11.43	CAGE STEEL (DRILLED SHAFTS)	11-51
11.44	SPLICING	11-51
	Splice Approval	11-51
11.45	PAYMENT FOR REINFORCING STEEL	11-52
11.50	CONCRETE (STRUCTURAL, CLASS X, AND FLOWABLE MORTAR)	11-53
11.51	PCC PLANT PAGE (FORMS 800240E AND 800240M)	11-53
11.52	USE OF READY MIXED STRUCTURAL CONCRETE	11-53
	Prepour Meeting	11-53
	Inspector's Checklist	11-53
11.53	ADMIXTURES	11-58
	Air Entraining Admixtures	11-58
	Water Reducing Admixtures – Regular	11-58
	Water Reducing Admixtures - Super Plasticizers	11-59
	Retarding Admixtures	11-59
	Accelerating Admixtures	11-60
	Corrosion Inhibiting Admixtures	11-60
	Finely Divided Mineral Admixtures	11-61
	Pozzolanic Materials	11-61
	Fly Ash (Class C & F)	11-61
	Silica Fume	11-61
	Cementitious Materials	11-61

<u>Constr</u>	ruction Manual	01/13/12
	Ground Granulated Blast Furnace Slag (GGBFS)	11-62
11.54	USE OF INSULATED FORMS FOR PROTECTION	11-62
	Checking Temperature of Concrete	11-63
11.55	DECK PLACEMENT AND HEAT OF HYDRATION	11-63
	Deck Placement	11-63
	Deck Concrete Temperature and Curing	11-64
	Placement Considerations	11-65
	Field Documentation	11-66
	Heat of Hydration	11-66
11.56	PLACEMENT METHODS (PUMPING, BELTING, AND CRANE BUCKET)	11-67
	Crane and Bucket	11-67
	Belt Placement	11-67
	Pump Placement	11-67
11.57	FORM REMOVAL	11-68
	Setting Beams	11-68
11.58	CLASS 3 CONCRETE SURFACE FINISH (RAIL AND BEAMS)	11-69
	Approval of Materials	11-69
	Application of Finish	11-69
	Concrete Railings	11-69
11.59	FLOWABLE MORTAR	11-69
	Backfilling Culverts - Typical Grading	11-70
	Plugging Culverts	11-71
	Backfilling Culverts - Under Bridges	11-71
	Filling Voids Between Culverts	11-72
11.60	DECKS AND OVERLAYS	11-74
11.61	DECK OVERLAY PREPARATION	11-74
	Class A Floor Repair	11-74
	Class A Surface Preparation	11-75
	Work on Adjacent Lanes	11-75
11.62	SEQUENCE OF POURING	11-76
	Use of Retarders	11-77
	Concrete Bridge Floors	11-80
	Placement Methods	11-87
11.63	INSTALLATION OF JOINTS	11-88

<u>Constr</u>	uction Manual	01/13/12
	Preformed Neoprene Joints	11-88
	Steel Extruded Expansion Joints (Strip Seals)	11-88
11.64	BRIDGE FLOORS	11-90
	Finishing and Equipment	11-90
	Profile Grades - Overlays	11-90
	Transverse Grooving	11-90
	Longitudinal Grooving In Hardened Concrete	11-91
	Missed Texturing	11-91
11.65	CONCRETE	11-92
	Concrete Mobile Mixers	11-92
	Frequency of Checks	11-92
	Density Testing	11-92
11.66	APPROACH SECTIONS	11-93
	Approach Pavements to Bridge Abutments	11-93
	"Movable" Abutments	11-94
	"Fixed" Abutments	11-95
	Bridge Approach Tapers	11-95
	Shoulder Maintenance	11-95
11.67	SMOOTHNESS OF BRIDGE DECKS	11-95
	Checklist	11-95
	Specification 2428	11-96
	Surface Checking	11-98
11.70	BARRIER RAILS	11-99
11.71	CONCRETE F-SHAPE, OPEN, AND RETROFIT RAIL	11-99
	Rail Concrete Placement and Bridge Deck Falsework	11-99
11.72	SLIP FORM BARRIER RAIL	11-100
	Longitudinal Cracks	11-100
	Reinforcement	11-100
	Reinforcement Bar Cover	11-100
	Misalignment and Nonuniform Top Elevation	11-100
	Shadowing	11-101
	Mix Design for Slip Form and Cast-in-Place	11-101
	Curing of Slip Form Barrier Rail	11-102
	Expansion Joint Construction in Barrier Rail	11-102

Consti	uction Manual	01/13/12
11.73	CAST-IN-PLACE (RETROFIT) BARRIER RAIL	11-103
	Preventing Dowel Installation Damage of Conduit	11-104
11.74	CAST-IN-PLACE OPEN BARRIER RAIL FORM REMOVAL	11-104
11.80	REINFORCED CONCRETE CULVERTS	11-105
11.81	DESIGN CHANGES ON CULVERTS	11-105
11.82	INSTALLING REINFORCING STEEL, PLACING CONCRETE, AND FORM	
	REMOVAL	11-105
	Installing Reinforcing Steel	11-105
	Placing Concrete	11-106
	Removal of Wall Forms	11-106
	Removal of Slab Forms	11-107
11.83	BOX CULVERT CURTAIN WALLS	11-107
	Sheet Pile Curtain Wall	11-107
	Reinforcement Placement	11-107
11.84	BOX CULVERT BELL JOINTS	11-108