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Bridge Design Guide : Appendices A-D, 2003

Maine Department of Transportation

APPENDICES

Casco Bay Bridge, Portland-South Portland

Artist Bridge, Newry

Appendix A Bridge Nomenclature

A.1 Terminology

A.1.1 Acronyms

Acronyms	
AADT	average annual daily traffic
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
ACM	Associated Constructors of Maine
ADA	Americans with Disabilities Act
ADT	Average daily traffic
AGC	Associated General Contractors of America
AGC	Association of General Contractors
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
AREA	American Railway Engineering Association
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASCE	American Society of Civil Engineers
ASD	Allowable Stress Design
ASTM	American Society for Testing and Materials
ATSSA	American Traffic Safety Services Association
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
BLCCA	bridge life cycle cost analysis
BMP	Best Management Practices for Erosion and Sediment Control
BPR	Bureau of Public Roads
BTIP	Biennial Transportation Improvement Program
CIP	cast-in-place
CL	centerline
CRF	critical rate factor
CRSI	Concrete Reinforcing Steel Institute
DHV	design hour volume
DTM	digital terrain model
EA	Environmental Assessment
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FEM	finite element method

Acronyms	
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FONSI	Finding Of No Significant Impact
FOS	Factor of Safety
fps	feet per second
FRP	fiber-reinforced polymer
GPR	ground-penetrating radar
GPS	Global Positioning System
GRS wall	geosynthetic-reinforced soil wall
HLMR bearing	high load multi-rotational bearing
HPC	high performance concrete
HUD	U.S. Department of Housing and Urban Development
ITE	Institute of Transportation Engineers
LCCA	life cycle cost analysis
LFD	Load Factor Design
LRFD	Load Resistance Factor Design
LURC	Land Use Regulation Commission - Maine
MaineDOT	Maine Department of Transportation - current
MDEP	Maine Department of Environmental Protection
MDOT	Maine Department of Transportation - outdated
MELT	Modified Eccentric Loader Terminal
MEMA	Maine Emergency Management Agency
MHHW	mean higher high water
MHW	mean high water
MHPC	Maine Historic Preservation Commission
MLLW	mean lower low water
MLW	mean low water
mph	miles per hour
MSE wall	mechanically stabilized earth wall
MSL	Multiple Service Level
MTL	mean tide level
MUTCD	Manual on Uniform Traffic Control Devices
NAVD	North American Vertical Datum
NC	normal crown
NCHRP	National Cooperative Highway Research Program
NEBT	New England Bulb Tee
NEPCOAT	Northeast Protective Coating Committee
NGVD	National Geodetic Vertical Datum
NHS	National Highway System
NOS	National Ocean Service
NRCS	Natural Resources Conservation Service
NSBA	National Steel Bridge Alliance
NTDE	National Tidal Datum Epoch

Acronyms	
PCE	pre-construction engineering
PCE-C	pre-construction engineering - conceptual
PCE-F	pre-construction engineering – feasibility study
pcf	pounds per cubic foot
PCI	Precast Concrete Institute
PCMG wall	prefabricated concrete modular gravity wall
PDR	Preliminary Design Report
PIN	Project Identification Number
PL	Performance Level
PQR	Procedure Qualification Record
PS&E	plans, specifications, and estimate
psf	pounds per square foot
psi	pounds per square inch
PTFE	polytetraflouroethylene - also known as Teflon
PVC	polyvinyl chloride
QA	Quality Assurance
QC	Quality Control
QCP	Quality Control Plan
QPL	Qualified Products List
RC	remove crown
RFI	Request for Information
ROW	right-of-way
R/W	right-of-way (alternate designation)
SCF	Site Coefficient Factor
SCS	Soil Conservation Service
SEWPCP	Soil Erosion and Water Pollution Control Plan
SI&A	Structure Inventory and Appraisal
SPC	Seismic Performance Category
SPCCP	Spill Prevention Control and Countermeasure Plan
STIP	Surface Transportation Improvement Program
TCP	Traffic Control Plan
TL	Test Level
TRB	Transportation Research Board
tsf	tons per square foot
U.S.G.S.	United States Geologic Survey
VECP	Value Engineering Change Proposal
WL	working line
WP	working point
WPS	Welding Procedure Specification

A.1.2 Approaches

Approaches	
approach	A general term referring to the roadway at either end of a bridge.
arterial	Routes that focus on high mobility of traffic with minimal or limited land access, often at relatively high speeds.
backslope	In an approach roadway, the upward sloping earth cut beyond the ditch line.
base course	One or more layers of specified material thickness placed on a subbase or a subgrade to support a surface course.
berm	The outside edge of the approach roadway shoulder and top of the sideslope.
cross-slope	The slope of the pavement surface perpendicular to the centerline.
ditch	A channel formed at the bottom of the sideslopes for open drainage.
embankment	The raised structure of earth supporting the approach roadway.
foreslope	An alternate designation for sideslope.
grade	The slope of a surface to the horizontal, often along a centerline.
guardrail	A vertical element near mid-height of the vehicles used to guide traffic.
gutterline	The intersection of the cross-slope and curb where drainage concentrates.
highway	A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.
highway curb	A low barrier constructed along the edge of a roadway, serving to guide the wheels of an errant vehicle and to control drainage.
lane	A strip of roadway intended to accommodate a single line of vehicles.
major collector	A route that serves a county seat that is not on an arterial route, a larger town not directly served by the higher systems, or other traffic generator of equivalent intracounty importance, such as a consolidated school, a shipping point, a county park, or an important mining or agricultural area.

Approaches	
minor collector	A route that is spaced at an interval consistent with population density to accumulate traffic from local roads and bring all developed areas to within a reasonable distance of collector roads, provides service to remaining small communities, or links a locally important traffic generator with its rural hinterland.
National Highway System	A system of interstate highways and major collectors specifically designated by FHWA. It includes the interstate system, other urban and rural principal arterials, highways that provide motor vehicle access between the NHS and major intermodal transportation facilities, the defense strategic highway network, and strategic highway network connectors.
normal crown	The typical cross section on a tangent section (i.e., no superelevation).
pavement structure	The combination of subbase, base course, and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed.
profile	An elevation view of the longitudinal centerline of construction.
profile grade	The trace of a vertical plane intersecting the top of the wearing surface, usually along the longitudinal centerline of the roadbed. Profile grade means either elevation or gradient of such trace according to the context.
remove crown	A superelevated cross section which is sloped across the entire traveled way in the same direction and at a rate equal to the typical cross slope on a tangent section (e.g., 2.0%).
riprap downspout	An open channel armored with riprap used to convey stormwater runoff from the top of a steep slope to the bottom of the slope in a controlled and stable manner.
road	A general term denoting a public way for purposes of vehicular travel, including the entire area within the right-of-way.
roadbed	The graded portion of a highway within top and side slopes, prepared as a foundation for the pavement structure and shoulders.
roadside	A general term denoting the area adjoining the outer edge of the roadway. Extensive areas between the roadways of a divided highway may also be considered roadside.

Approaches	
roadside development	Those items necessary to complete the highway that provide for the preservation of landscape materials and features; the rehabilitation and protection against erosion of all areas disturbed by construction through seeding, sodding, mulching, and the placing of other ground covers; and such suitable planting and other improvements as may increase the effectiveness and enhance the appearance of the highway.
roadway	The combined traveled way and shoulders of a public way intended for passage of vehicular traffic. A divided highway has two or more roadways.
rural	A term used to denote all areas that are not designated as urban.
shoulder	The portion of the road or roadway that is contiguous with the traveled way and that is provided for accommodation of stopped vehicles, emergency use, and lateral support of base and surface courses. Where guardrail is installed on the approach roadway, the shoulder area between the traveled way and the face of guardrail is the “design” or “usable” shoulder. The shoulder area between the face of guardrail and the berm is the “berm offset.”
sideslope	In an approach roadway, the downward sloping embankment beyond the outside edge of the shoulder. The top of the sideslope is the berm. The bottom of the sideslope is the “toe of slope”.
station	A distance of 100 feet used in the layout of centerlines, working lines, and other reference points on a project.
street	A general term denoting an urban public way for purposes of vehicular travel, including the entire area within the right-of-way.
subbase	Layers of specified material thickness placed on a subgrade to support a base course.
subgrade	The top surface of a roadbed upon which the pavement structure, shoulders, and curbs are constructed.
superelevation	Superelevation is the amount of cross slope or "bank" provided on a horizontal curve to help counterbalance the outward pull of a vehicle traversing the curve. The maximum rate of superelevation depends on several factors including climatic conditions, terrain conditions, and type of area (rural or urban).

Approaches	
superelevation axis of rotation	The superelevation axis of rotation is the line about which the pavement is revolved to superelevate the roadway. This line will maintain the normal highway profile throughout the curve, and it is known as the construction centerline or control edge.
superelevation rollover	Superelevation rollover is the algebraic difference between the travel lane cross slope and shoulder cross slope on the outside of a horizontal curve.
superelevation runoff	AASHTO defines superelevation runoff as the change in cross slope from the end of tangent runout (adverse crown removed) to a section that is fully superelevated.
superelevation transition length	The superelevation transition length is the distance required to transition the roadway from a normal crown section to the full superelevation needed. Superelevation transition length is the sum of the tangent runout and superelevation runoff.
surface course	The top layer(s) of a pavement structure designed to accommodate the traffic load, resist skidding, traffic abrasion, and the disintegrating effects of climate. This layer is sometimes called the "wearing course".
tangent runout	AASHTO defines tangent runout as the change from a normal crown section to a point where the adverse cross slope of the outside lane or lanes is removed (i.e., the outside lane(s) is level).
townway	A road that is locally owned and maintained.
urban	A term used to denote a place within boundaries set by the responsible State and local officials having a population of 5000 or more.

A.1.3 Contract

Contract	
addendum	See bid amendment.
award	The execution of the contract by MaineDOT, conditioned upon the successful bidder's performance of all pre-execution requirements of the bid documents.
best value procurement process	A process for procuring contractual services in which price is only one of several factors used in determining the successful proposer.
bid	The offer by a bidder on forms prescribed by MaineDOT to perform the work in conformity with all provisions of the bid documents for the price(s) set forth.
bid amendment	A change to the bid documents issued by MaineDOT after advertisement and before the bid opening.
bid documents	Documents issued by MaineDOT to solicit bids from Contractors. Bid documents generally include the Notice to Contractors, plans, Standard Specifications, Special Provisions, bidding instructions, and any bid amendments issued by MaineDOT. Documents attached to or referenced in the bid documents are part of the bid documents.
bid opening	The date and precise time by which the bidder must deliver its bid to be publicly opened and read as specified in the Notice to Contractors or any applicable bid amendment.
change order	See contract modification.
conform or conformity	The performance of an item of work in strict compliance with all applicable provisions of the contract.
contract	All documents affecting the respective rights and responsibilities of MaineDOT and the Contractor. These documents include, but are limited to, the contract agreement, the Notice to Contractors, plans, MaineDOT's Standard Specifications and Standard Details, Special Provisions, bid amendments, contract modifications, geotechnical information, permits, bid escrow documentation, the Contractor's bid prices, and all documents incorporated by reference.
contract modification	A general term describing a formal change to a contract. Types of contract modifications include; change orders, extra work orders, resident work orders, and supplemental agreements.

Contract	
critical path	The sequence of activities from the project start to its completion having the greatest cumulative elapsed time, thereby determining the minimum time duration of the entire project. The critical path is identified by the sequence of those activities with the least float.
Department	An alternate designation for MaineDOT.
design-build contract	A contract in which the Contractor is responsible for both design and construction requirements under the contract. In a design-build contract, the Contractor is procured through a best-value procurement process using a Request for Proposals and evaluation of submitted proposals using price as one of several evaluation factors.
extra work	Work that is outside the scope of the contract and that MaineDOT determines is necessary.
extra work order	See contract modification.
force account work	Prescribed work paid on the basis of actual costs and additives.
incentive or disincentive payment	An adjustment to the contract price of a predetermined amount for each day the work is completed ahead of or behind the contract time, contract completion date, or some specified intermediary milestone. A disincentive is not a penalty, but an estimate of user and other costs incurred by the people of the State of Maine.
incidentals	The terms "incidentals" and "incidental to the contract" mean items that are accessory to or incorporated into the work and that have no separate pay item. Unless otherwise provided in the contract, the cost of incidentals shall be included in the Contractor's prices for the pay items. There will be no separate payment.
liquidated damages	An amount due and payable to MaineDOT by the Contractor, normally realized through a reduction of amounts to be paid to the Contractor. Said amount is calculated by multiplying a daily amount set forth in the contract by the number of days the work remains incomplete after the contract completion time has expired.
major item	An individual pay item that constitutes 10% or more of the amount of the awarded contract, calculated using the Contractor's bid prices and the estimated quantities contained in the bid documents.
minor item	All pay items that are not major items.
order	A directive from MaineDOT requiring compliance by the Contractor.

Contract	
partnering	Partnering is a process of voluntary structured communication between MaineDOT, the Contractor, its principal Subcontractors and suppliers, and other project stakeholders for the purpose of improving efficiency and minimizing disputes.
pay item	An item of work set forth in the schedule of Items for which the Contractor must provide a price.
proposal	The response to a Request for Proposal. Proposals will normally be requested for anticipated best value procurements. See design-build contract, Request for Proposal and best value procurement. In another context, sometimes MaineDOT's solicitation for bids is called a bid proposal.
punch list	A written list of all items that must be completed or corrected before the physical work is complete. This list is prepared by MaineDOT and given to the Contractor.
quality assurance	All planned and systematic operations to ensure that the operation, material, and/or end product meets specifications. Quality assurance includes approval and oversight of the Contractor's Quality Control Plan; review of inspector, sampler, tester, and laboratory qualifications; inspection for conformity with contract requirements; Contractor quality control; acceptance testing; and independent assurance.
quality control	Planned and specified actions or operations necessary to produce an end product that conforms to the quality requirements of the contract. Unless otherwise specified, Quality control includes inspection and testing for process control to the extent determined necessary by the Contractor. Quality control is also referred to as process control.
Quality Control Plan	The program and documentation of that program, approved by MaineDOT, which specifies the actions, inspection, sampling, and testing necessary to keep production and placement operations within specifications, including provisions to quickly determine when an operations becomes out of control and those actions that the Contractor will take to restore compliance.
Request For Information	A written request for information or clarification submitted by the Contractor to the Construction Resident.
Request For Proposal	MaineDOT's solicitation for proposals in a best value procurement process, such as when soliciting for an anticipated design-build contract.

Contract	
resident work order	See contract modification.
schedule of items	A list of items of work provided in the bid documents for which the Contractor must provide prices.
Special Provision	Revisions to the Standard and/or Supplemental Specifications applicable to an individual project or contract.
Specifications	A written or electronic textual compilation of provisions and requirements for the performance of the work, including incorporations by reference.
Standard Details	Detailed drawings published and approved by MaineDOT for general application and repetitive use.
Standard Specifications	The Standard Specifications for Construction published and approved by MaineDOT for general application and repetitive use on projects.
supplemental liquidated damages	Liquidated damages for additional costs resulting from Contractor's failure to complete a specific work item, phase, or milestone within the time specified in the contract for that item. Supplemental liquidated damages are in addition to and separate and distinct from liquidated damages.
Supplemental Specifications	Approved additions or modifications to the Standard Specifications.
Supplemental Standard Details	Approved additions or modifications to the Standard Details.
Value Engineering Change Proposal	A proposal made by a Contractor after contract execution that is intended to produce cost savings without impairing essential characteristics of the project including function, serviceability, safety, durability, maintainability, and aesthetics, all as determined by MaineDOT.

A.1.4 Environmental

Environmental	
check dam	Small dams usually consisting of dumped stone constructed across a swale or drainage ditch to reduce the flow velocity of concentrated stormwater runoff.
dredge material or dredge spoils	"Dredge material" means sand, silt, mud, gravel, rock or other sediment or material that is removed from beneath any surface water. The term, "beneath any surface water" has been interpreted by the MDEP to mean that area that falls beneath the plane bounded by the normal high water line of any stream, river, brook, pond, lake, vernal pool, etc. Note that the entire area of dredge material removal could be dry at the time of excavation.
erosion	The detachment and movement of soil particles by the action of water, ice, gravity, and/or wind.
erosion control blanket	A sheet that is composed of biodegradable material such as jute matting, excelsior wood fiber, coconut fiber, straw or interwoven paper strips, and a netting made of a biodegradable polypropylene or extruded plastic.
floating boom-supported silt fence	A temporary silt fence barrier that is installed in the water and supported by a flotation boom along with weighting devices to hold the fence in an approximately vertical submerged position from the surface of the water to the design depth.
in-stream work	Any activities conducted in the water.
mulch	A material usually composed of hay, straw, wood waste compost/bark, crushed stone, or cellulose fiber that is placed on disturbed areas to prevent erosion.
riprap	A blanket of sizable angular stones placed along a slope or in a watercourse to hinder erosion. Types of riprap include plain, heavy, and hand laid.
runoff	Rainfall not absorbed by the soil.
sediment	The finely divided solid material that settles to the bottom of water or is suspended in the water.
sedimentation	The deposition of soil particles that are dislodged during the erosion process and transported by water or wind. It occurs when the velocity of the wind or water is insufficient to maintain suspension of the soil particles.
silt fence	A type of temporary sediment barrier constructed of geotextile fabric and posts that is installed parallel to the toe of a slope being disturbed.

Environmental	
slope stabilization	The use of vegetation and/or structural materials to stabilize and protect slopes of roadways, streams, brooks, rivers, lakes, tidal areas, or excavated channels against scour and erosion from flowing water.
stream diversion	A conduit or small diversion ditch used to divert the base flow of a perennial or intermittent stream around a construction area.
swale	A low tract of marshy land.
wetlands	Areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

A.1.5 General

General	
aggregate	Inert material such as sand, gravel, broken stone, crushed stone, or a combination of any of these materials.
alignment	The baseline for construction of a bridge and its approach roadway, described horizontally by a series of tangents and circular arcs, and vertically by a series of tangents and parabolic curves.
bearing centerline	The construction reference line that passes through the center of a line of bearings on an abutment or pier.
common borrow	Standard fill material used on approaches where a more free-draining material such as granular borrow is not required.
common excavation	Work consisting of the removal and disposal of all earth material encountered in excavating for permanent stream channel diversion, channel widening, when designated on the plans, outside the limits of structural excavation, or other classifications.
compact area	A urban area where the population exceeds 7500 inhabitants; or where the population is less than 7500, but more than 2499 inhabitants in which the ratio of people whose place of employment is in a given municipality to employed people residing in that same municipality is 1.0 or greater.
conduit	A pipe used for receiving and protecting wires or cable.
construction centerline	Typically, the alignment of the roadway from which all construction layouts are described. (See alignment.)
construction easement	A right acquired by MaineDOT to use or control property, outside of the established right-of-way.
construction limit line	A line, usually outside of the right-of-way, within which the Contractor may work and outside of which work may not be performed.
drainage	The system of pipes, drainage ways, ditches, and structures by which surface or subsurface waters are collected and conducted from the highway area.
drawings	See plans.
elevation	A scale drawing of the side, front, or rear view of a structure.
elevation	The vertical distance above a horizontal reference plane.
geometrics	The physical location (horizontally and vertically) and shape of the object under consideration.

General	
granular borrow	Fill material consisting of granular material, typically used next to or under structures.
gravel borrow	Fill material consisting of gravel.
hydraulics	The science concerned with the behavior and flow of liquids, especially in pipes and channels. Used to design the size of bridge openings.
hydrology	The science concerned with the occurrence, distribution, and circulation of water on the earth, including precipitation, runoff, and groundwater. Used to determine the design flow rates for sizing bridge openings.
Inspector	An authorized representative of the Resident assigned to make detailed inspections of the work to determine compliance with the contract.
longitudinal	The direction along the length of a bridge, following the centerline of construction.
material	Any substance specified for use in the construction of the project and related approaches.
normal	Any line placed perpendicular to a tangent or radial to a curve.
permits	Permits granted to MaineDOT for the project. Permits often required include a U.S. Coast Guard permit and environmental permits such as Natural Resources Protection Act (NRPA) permit from MDEP and Army Corps of Engineers permit.
plans	When the context so indicates, “plans” mean applicable construction drawings including plan, profile, typical cross sections, working drawings, Standard Details, Supplemental Standard Details, and supplemental drawings or exact reproductions thereof or electronically displayed equivalents, that show the location, character, dimensions, and details of the work. Where the context so indicates, “plan” may also mean a detailed process, program, or method worked out beforehand for the accomplishment of an objective. Examples include QCP, the SEWPCP, the TCP, Safety Plan, and project-specific emergency planning.
Program	The specific working unit within MaineDOT’s Bureau of Project Development within which a particular MaineDOT project is developed, designed, and administered. Such Programs include the Regional Program, the Urban and Arterial Highway Program, the Bridge Program, and the Multimodal Program.

General	
project	The bridge, highway, railroad, pier, airport, building, bike path, pedestrian path, or other infrastructure improvement being constructed, rehabilitated, or repaired, together with all appurtenances and Incidentals.
project limits	Areas within the right-of-way or construction limit lines shown on the plans or otherwise indicated in the contract. If no project limits are indicated in the contract, the project limits shall be the area actually occupied by the bridge, highway, or other infrastructure before construction extending to and including (A) the area outside the shoulders and ditch lines and within any landmarks or historic features such as fences, fence posts, tree rows, stone walls, corner stones, or other monuments indicating the boundary line, or (B) in the absence of any landmarks or historic features, sidewalks, shoulders, and ditch lines to the top of cuts or toe of fills.
Project Manager	MaineDOT's duly authorized representative for overall coordination of the project.
ProjEx	MaineDOT's Program and Project Management System developed for transportation program development, "cradle to grave" project planning and delivery, and enterprise wide access to project information.
Resident	MaineDOT's on-site representative.
right-of-way	A general term denoting land, property, or interest therein, usually in the form of a strip, acquired for or devoted to the Project or other purposes.
utility facilities	All structures, facilities, equipment, and all appurtenances thereto used by utility companies including, but not limited to, poles, wires, support poles, guys, anchors, water pipelines, sewer pipelines, gas pipelines, all other pipelines, fire alarms, service connections, meter boxes, valve boxes, light standards, cableways, conduits, signals, and manholes.
working drawings	Plans, sketches, or drawings provided by the Contractor or its Subcontractors, vendors, or fabricators for the purpose of supplementing the plans provided in the bid documents and being necessary to demonstrate that the work will comply with the contract and meet the intent of the contract. Working drawings shall be of sufficient detail to meet the purpose set forth in the preceding sentence. Examples include shop drawings, erection plans, falsework plans, cofferdam plans, and bending diagrams for reinforcing steel.

General	
working line	A horizontal tangent established on a curved alignment to facilitate the layout and construction of a bridge.
working point	The theoretical intersection of two lines, used as a layout reference point.

A.1.6 Geotechnical

Geotechnical	
bedrock	The solid mineral rock mass underlying and/or outcropping from soil or any other loose agglomerate surficial cover.
clay	A fine-grained, firm soil where particles are less than 0.002 mm in size and exhibit cohesive and plastic behavior when wet.
downdrag	A force that may be induced on a pile or buried structure where the soil deposit in which the pile or structure is installed is subject to settlement.
foundation	The part of a substructure which bears directly on either soil or bedrock. A foundation may be shallow, as with a spread footing, or deep, as with steel piles, drilled shafts, etc.
geophysics	Any nondestructive method used to determine the subsurface conditions/characteristics or unexposed limits of a buried structure/substructure. Examples include seismic refraction and ground penetrating radar.
geosynthetic	A flexible, synthetic, polymeric material used for separation, reinforcement, filtration, drainage, or containment. Examples include geotextiles, geogrids, and geomembranes.
geotechnical information	Boring logs, soil reports, geotechnical design reports, foundation design reports, hazardous waste assessments, and other records or reports of subsurface conditions.
geotextile	A polymeric material formed by the weaving or knitting (woven) or matting (nonwoven) of synthetic fibers into a flexible, continuous sheet. Geotextiles may be constructed from polyester (PET), polypropylene (PP), or high density polyethylene (HPDE).
gravel	Soil where the particles are less than 75 mm and greater than 4.75 mm in size and are cohesionless, nonplastic, and granular in nature.
ledge	A narrow, shelflike ridge or rock protrusion.
lightweight fill	Any construction material having a unit weight less than that of traditional soil backfills, such as lightweight foam concrete, geofoam, and tire shreds.
liquefaction	A soil condition caused by an intense load, of very short duration, resulting in a sudden increase in pore-water pressure and loss of shear strength. Liquefaction can result from cyclic loading associated with a seismic event.

Geotechnical	
prefabricated vertical drain	A geotextile consisting of a grooved plastic or paper core covered by a membrane placed vertically in the ground to produce a “wick” for faster movement of water in the soil structure. Also called wick drains, they accelerate settlement and the gain in strength of soft cohesive soils.
preload	Placement of materials to improve poor foundation soils in advance of construction of a bridge or other facility. Materials may consist of soil, rock, or other heavy materials.
rock excavation	Work consisting of the removal of hard igneous, metamorphic, and sedimentary rock that cannot be excavated without drilling and blasting or drilling and splitting. It also consists of excavating all boulders, solid mortared stone masonry, or concrete masonry, each with a volume of 2 CY or more.
sand	Soil where particles are less than 4.75 mm and greater than 0.075 mm in size and are cohesionless, nonplastic, and granular in nature. Sand is finer than gravel, but coarser than silt.
silt	Soil where particles are less than 0.075 mm and greater than 0.002 mm in size and are cohesionless and granular in nature with low plasticity. Silt is finer than sand, but coarser than clay.
soil	The relatively loose agglomeration of mineral, organic materials, and sediments found above bedrock.
soil envelope	The zone of controlled soil backfill around a culvert structure required to ensure anticipated performance based on soil-structure interaction considerations.
structural excavation	Work consisting of the removal, hauling and backfilling, and disposal of all material encountered for the installation and construction of drainage and minor structures and for major structures.
surcharge	A load used to model the weight of earth fill or other loads applied to the top of the retained material. Typically used behind new abutment or wall locations and usually removed prior to construction.
surficial	Of, relating to, or taking place on the earth’s surface.

A.1.7 Structures

Structures	
abutment	The supporting structure at either end of a traditional bridge, which also serves to retain the approach roadway embankment. Types include cantilevered, deep or full height, gravity or mass, integral, semi-integral, or stub.
ancillary product	A product not subject to calculated tensile stress from live load and not welded to main members in tension areas. Types include drainage components, expansion devices, curb plates, bearings, hand rails, cofferdams, and sheet piling.
approach slab	A concrete slab placed in the approach roadway and resting on the abutment backwall, distributing traffic loads and preventing settlement of the roadway behind the abutment.
appurtenance	A component such as curb, parapet, railing, barrier, divider, or sign and lighting post that is attached to the deck.
armored joint	Alternate name for expansion device.
backwall	The top portion of an abutment above the breastwall, serving primarily as a retaining wall but also supporting the approach slab and often the end of the bridge deck. When the top of backwall extends to finished grade, it supports one side of the expansion device at the end of the superstructure.
barrier parapet	The solid concrete vertical wall of a concrete barrier rail. Often includes a metal rail mounted on top.
batter	A slope, as of the outer side of a wall, that recedes from bottom to top.
batter pile	A pile driven at an angle inclined to the vertical to provide higher resistance to lateral loads.
beam	In a traditional bridge, a main load-carrying member spanning longitudinally between supports. (See girder.)
bearing	A device installed on the bridge seat to support a beam or girder, allowing for deflection and expansion of the superstructure, and the transmission of loads to the substructure. Types include elastomeric, HLMR, pedestal or rocker, and spherical.
bearing plate	Used to transmit loads from the superstructure to the substructure.
bituminous concrete	Asphalt concrete used on roadway and bridge riding surfaces.

Structures	
blocking	The rectangular section of concrete placed between the top of a beam and the bottom of the deck slab. Blocking dimensions are used to set bottom-of-slab elevations.
box beam	A precast, prestressed concrete hollow box-shaped beam. Box beams are typically 3 feet or 4 feet wide. They may be installed as butted beams post-tensioned together, or as spread beams with a CIP composite concrete slab.
box culvert	A buried structure, typically of aluminum plates or concrete, with a generally rectangular shaped opening.
box girder	A box-shaped girder of concrete or steel, usually multi-celled and with several interior webs.
brace	A structural member that provides stiffness to a frame.
breastwall	The lower wall portion of an abutment, providing the support for the superstructure.
bridge	A structure having a clear span of 20 feet or more measured horizontally at the elevation of the bridge seats along the centerline of the road or in case of multiple spans when the combined clear spans equal or exceed 20 feet.
bridge culvert	A buried structure with a span of 20 feet or more, generally of steel or aluminum, consisting of plates bolted into a round, elliptical or oblate shaped opening.
bridge curb	A low barrier constructed along the edge of a bridge deck, serving to guide the wheels of an errant vehicle and to control drainage.
bridge drain	A fabricated unit installed in a bridge deck to remove surface water.
bridge length	The length of a bridge structure is the overall length measured along the construction centerline back to back of backwalls of abutments, if present; otherwise end to end of the bridge floor; but in no case less than the total clear opening of the structure.
bridge rail	A railing system installed on the edges of a bridge deck or along a retaining wall to provide protection to the vehicles and pedestrians crossing the bridge.
bridge railing	The horizontal member elements.
bridge roadway width	The clear width measured at right angles to the longitudinal centerline of the bridge between the bottoms of curbs or between face of rails, whichever is less.
bridge seat	The top horizontal surface of an abutment breastwall or pier upon which the superstructure is supported.
brittle fracture	A sudden failure of an element prior to plastic deformation typically occurring at a sharp change of section properties. Also called low energy fracture.

Structures	
buckling	Deflection in an axially loaded member under compression.
bulb tee girder	A precast, prestressed concrete girder whose cross section somewhat resembles the letter “T” with a bulb shape on the bottom. MaineDOT uses NEBT standard shapes.
buried structure	Any culvert-type bridge structure deriving its strength from the condition of being surrounded by soil. (See traditional bridge and rigid frame.)
butt joint	The joint between two pieces of metal in the same plane that have been bolted or welded together.
butterfly wingwall	A wing that extends straight out from the abutment and has no footing of its own.
camber	The curving of a beam to compensate for deflections that occur when a load, such as a bridge deck, is placed on it.
cantilevered abutment	An abutment where the wall is designed as a cantilevered beam. See Figure A-4.
cap	The topmost portion of a pier, when supported by a shaft, columns or exposed piles. The top of the cap is the pier bridge seat.
catch basin	A precast concrete structure that is part of a closed drainage system with an inlet grate and culvert outlet.
cathodic protection	A system used to protect steel from the deteriorating effects of roadway salts or salt water. A passive system typically involves a sacrificial core such as zinc, and requires no external source of energy. An active system typically has an external energy source.
channel shape	An AISC rolled section in the shape of a “C”, “M”, or channel.
Charpy V-Notch Test	An impact test used to determine the notch toughness of a material. The test is performed at specified temperatures, to provide information about the toughness of the metal and the temperature at which it can be expected to fail in a brittle manner.
chord	Primary members located at either the top or bottom plane of a truss.
CIP concrete	Concrete placed in its final location in the structure while still in a plastic state.
class A concrete	Concrete typically used for standard CIP applications.
class LP concrete	Low permeability concrete usually containing silica fume, typically used in locations that are exposed to road salts or salt water.
class P concrete	Concrete typically used for precast concrete applications.
class S concrete	Concrete used in seals.

Structures	
clear span	The face-to-face distance between supporting components.
closed drainage system	A buried system composed of catch basins and culverts used to drain roadways.
closure pour	A placement of cast-in-place concrete used to connect two or more previously cast portions of a structure.
cofferdam	An enclosed cell constructed in the water, generally consisting of sheet piling, from which the water is removed so as to allow construction to take place inside. Also, a partially closed structure made of sandbags or the like, for diverting water away from a shoreline or a structure for the same reason.
column	A vertical support member typically several times taller than its width.
component	A constituent part of a structure.
composite beam	A beam connected to a deck so that they respond to force effects as a unit.
concrete	A mixture of portland cement and stone aggregates combined with water, causing the cement to bind the mass together. Concrete is high in compressive strength but weak in tension or bending. It may contain various admixtures to increase its strength or improve its workability. May be reinforced or unreinforced.
concrete cover	The distance between a concrete face and the nearest main reinforcement bar.
concrete joint	The divisions between individual placements of concrete in a structural unit. Common joint types are construction, contraction, and expansion.
concrete pedestal	A formed platform on a bridge seat used to support a bridge bearing.
connection plate	Secondary member connecting two elements (e.g., a connection plate joining a diaphragm to a girder.
construction joint	A temporary joint used to permit sequential construction.
contraction joint	A joint placed every 30 feet along a wall to control the location of cracks. Without these joints, the concrete would form cracks at unpredictable intervals. Reinforcing steel is normally not carried through the joint except in rigid frame structures, where moment must be transferred from wall to slab.
cover plate	A steel plate attached to the flange of a beam to increase the overall section properties of the member.
creep	Time-dependent deformation of concrete under permanent load.

Structures	
cross-frame	A typically X-shaped combination of members placed transversely to the main beams or girders to distribute stresses and improve strength and rigidity. (See diaphragm.)
culvert	Any structure not defined as a strut or bridge that provides a drainage opening under the roadway or approaches to the roadway.
curtain	A system used with finger joints that protects the girder ends from water coming through the joint. Neoprene curtains are placed at the end of each girder, allowing the water to be dumped diffusely on a protected bridge seat that is periodically cleaned by maintenance forces.
curved girder	A girder curved to accommodate horizontal alignment.
dead load	The permanent self weight of a structure and its components.
deck	The topmost roadway surface of a traditional bridge, supported by the beams or girders and carrying the vehicular and pedestrian traffic.
deck joint	A complete or partial interruption of the deck to accommodate relative movement between portions of a structure.
deck truss	A truss system in which the roadway is at or above the level of the top chord of the truss.
deck width	The fascia-to-fascia width normal to the centerline.
defect	A discontinuity or discontinuities that by nature or accumulated effect render a part or product unable to meet minimum applicable acceptance Standards or Specifications. The term implies rejectability.
delamination	The separation of a lamination under stress.
design span	For decks, the center-to-center distance between the adjacent supporting components, taken in the primary direction.
development length	The distance required to develop the specified strength of a rebar or prestressing strand.
diaphragm	A typically solid member placed transversely to the main beams or girders to distribute stresses and improve strength and rigidity. (See cross-frame.)
disc bearing	A bearing that accommodates rotation by deformation of a single elastomeric disc molded from a urethane compound. It may be movable, guided, unguided, or fixed. Movement is accommodated by sliding of polished stainless steel on PTFE.
distribution slab	A pier footing constructed on top of a cofferdam seal.
drain downspout	The outlet pipe of a bridge drain.

Structures	
drilled shaft	A deep foundation unit, wholly or partially embedded in the ground, constructed by placing fresh concrete in a drilled hole with or without steel reinforcement. Drilled shafts derive their capacity from the surrounding soil and/or from the soil or rock strata below its tip. Also commonly referred to as caissons, drilled caissons, bored piles, or drilled piers.
elastomer	Any of various polymers with elastic properties resembling those of natural rubber.
elastomeric bearing	A bearing made of elastomer, often reinforced with several layers steel plates.
embedment length	The length of rebar or anchor provided beyond a critical section over which transfer of force between concrete and reinforcement may occur.
expansion device	A fabricated unit installed at a deck joint in a bridge deck to allow for thermal movement between the superstructure and substructure. Some types of expansion devices include a joint seal to prevent drainage of water or debris from getting to the bridge seat. Types of expansion devices include compression seals, gland seals, finger joints, and modular joints.
expansion joint	A joint used to prevent compression forces from abutting concrete from crushing or displacing the adjacent structure. They are designed to isolate one structural element from another, and can occur where expansion forces in elements change direction. On a retaining wall, an expansion joint should be used every 90 feet. Reinforcing steel is not carried through the joint.
extraordinary bridge	A structure with a length of 250 feet or more which has an improvement cost of at least $5 million.
fascia	The outside face of a concrete deck.
fascia girder	The outside or exterior girder in a set of beams.
fatigue	The initiation and/or propagation of localized cracks due to a repeated variation of normal stress with a tensile component.
fill concrete	Unreinforced concrete used as fill material.
fixed bearing	A bearing that prevents differential longitudinal translation of abutting structural elements. It may or may not provide for differential lateral translation or rotation.
flange	The top and bottom horizontal component of an “I” girder or horizontal component in a “T” section.

Structures	
flatness	The degree of which a surface deviates from a plane. Used often with the term "flatness tolerance". Flatness tolerance shall be described by a unit number x the length or width of a plate. The resultant representing the maximum gap permitted beneath an edge placed parallel to the width or length of a plate.
floor beam	A secondary load-carrying member spanning transversely between trusses or other primary longitudinal members.
flowable fill	A loose, low-strength concrete material. Primarily used to fill gaps, such as that created by a sliplined culvert and the existing structure.
footing	The lowest portion of a substructure unit that distributes the structure loads either to the earth or to supporting piling.
fracture critical	A tension or stress reversal member whose failure would be expected to result in the failure of the structure.
french drain	A groundwater drainage system constructed of stone and place behind substructure walls.
friction pile	A pile whose support capacity is derived principally from soil resistance mobilized along the side of the embedded pile.
F-shape barrier	A solid, reinforced concrete barrier used as permanent bridge rail, typically on overpass structures.
gravity abutment	An abutment constructed of concrete with front and back batters that relies on its self weight to support its applied loads. A gravity abutment is either lightly reinforced for temperature and shrinkage or is unreinforced. Also called a mass abutment. See Figure A-3.
gusset plate	A steel plate used to connect steel members.
hanger	An assembly utilizing a pin connection to allow for expansion between a cantilevered and suspended span between supports.
haunched girder	A girder that has a deeper web over the pier that is transitioned over a short distance to a shallower constant depth web.
heel	The back protruding portion of a footing for a wall or abutment.
high performance concrete	Concrete that is typically used in precast, prestressed applications designed for a compressive strength equal to or greater than 5000 psi. There are other definitions of HPC, but this is the one commonly used at MaineDOT.
highway culvert	A buried structure with a span of less than 10 feet.

Structures	
hybrid girder	A girder made from plates of different steel types (e.g., high-strength steel used for flanges and lower strength for webs).
I-girder	A precast, prestressed concrete girder whose cross section somewhat resembles the letter "I". No longer used to refer to steel I-girders as they have been replaced with wide flange shapes.
inlet	Typically used to reference the upstream end of a culvert structure or the entrance grate to a catch basin or bridge drain.
integral abutment	An abutment consisting of a breastwall supported directly on driven piles or spread footings and constructed so as to act as a single unit with the superstructure. An integral abutment eliminates the need for an expansion device and therefore the associated potential maintenance problems.
jacking force	The force exerted by the device that introduces tension into tendons.
joint seal	A poured or preformed elastomeric device designed to prevent moisture and debris from penetrating joints.
lateral bracing	Bracing located near the top flange or bottom flange or chord of a beam, girder or truss to prevent lateral deformation induced by forces normal to the bridge centerline (e.g., wind).
live load	The transient loads supported by a structure, usually referring to the vehicle/truck loads and pedestrian loads.
masonry plate	The bottom steel plate of a bearing anchored to a concrete bridge seat.
membrane waterproofing	A hot-applied rubberized sheet applied to the top of a concrete deck prior to installation of the bituminous wearing surface. This system is intended to stop the ingress of salt into the substrate concrete of the deck, thereby preventing concrete delamination and corrosion of reinforcing steel.
metal rocker or roller bearing	A fabricated steel bearing formerly used to support steel beams. May also be called a pedestal bearing.
minor span	A structure having a clear span equal to or greater than 10 feet and less than 20 feet along the centerline of the road, or in case of multiple spans, when the combined clear spans equal or exceed 10 feet and is less than 20 feet.
multi-plate	An alternate designation for structural plate.

Structures	
neat line	A reference line from which dimensions are measured. Typically used on substructure details when the bottom of footing is founded on bedrock and the exact location of the bedrock is uneven or unknown.
non-voided slab	A solid precast, prestressed concrete slab with no circular voids. Non-voided slabs are typically 3 feet or 4 feet wide and are installed as butted beams post-tensioned together.
nose	The protruding portion of a pier shaft facing the oncoming flow of water.
ordinate	The coordinate dimension representing the distance from a specified point to the x-axis, measured parallel to the y-axis.
outlet	Typically used to reference the downstream end of a culvert structure.
pier	The intermediate supporting structures of a traditional bridge. Types of piers included column, hammerhead, cantilevered, mass, and bent. See Figure A-8.
pile	A vertical member driven into the soil to support the substructure units of a traditional bridge. Types of piles include steel H-piles, steel pipe piles, and precast, prestressed concrete piles.
pile bent	A pier consisting of a pier cap supported by exposed piles.
pile shoe	A metal piece fixed to the penetration end of a pile to protect it from damage during driving and to facilitate penetration through very dense material or boulders.
pipe arch	A commonly used bridge culvert with an oblate shaped opening.
plate	A flat rolled product whose thickness exceeds 1/4 inch.
plate girder	A girder with an “I” cross section fabricated from steel plates joined by welding, bolting, or riveting.
point-bearing pile	A pile whose support capacity is derived principally from the foundation material upon which the pile tip rests. Also known as an end-bearing pile.
post-tensioning	A method of prestressing in which the tendons are tensioned after the concrete has reached a predetermined strength.
precast concrete	Concrete components that are cast in a location other than their final position.
prestressed concrete	Concrete components in which stresses and deformations are introduced by the application of prestressing forces.
prestressing strand	High strength steel wires used for tension reinforcement in precast, prestressed beams.

Structures	
rebar	A shortened, alternative designation for reinforcing steel.
redundancy	The quality of a bridge that enables it to perform its design function in a damaged state.
redundant member	A member whose failure does not cause failure of the bridge.
reinforcing steel	A series of deformed steel bars placed in a concrete structure to increase its strength in tension and bending and to prevent cracking due to thermal changes.
residual stress	Stress locked into a member after it has been worked to its final shape.
retaining wall	A structure designed to retain and hold back a mass of earth. Types of retaining walls include cantilevered, gravity or mass, MSE, and PCMG.
return wingwall	A wing that extends back from the abutment and parallel to the roadway alignment.
rigid frame	A bridge structure consisting of a top slab with two integral walls forming an inverted “U” shaped opening. (See traditional bridge and buried structure.)
rolled beam	A steel beam formed by hot-rolling.
scabble	To remove the top portion of existing deck concrete with a machine that pounds the surface.
scarify	To remove the top portion of existing deck concrete with a machine that grinds the surface.
scupper	A drainage system used to drain storm water runoff from a bridge deck.
seal	The concrete placed underwater inside a sheet pile cofferdam to close the bottom and allow the water to be removed. See Figure A-1.
secondary member	Bracing between primary members designed to resist cross-sectional deformation of the superstructure frame and help distribute part of the vertical load between stringers
semi-integral abutment	An abutment that behaves in the conventional manner, while the backwall (end diaphragm) moves along a horizontal joint below ground.
shaft	The main portion of a solid pier, often supporting a separate cap.
shear key	A formed, rectangular notch used between successive placements of concrete.
sheet	A flat rolled product whose thickness is less than 1/4 inch.
sheet piling	A series of interlocking steel shapes driven vertically into the soil to form a wall or enclosed cell. (See cofferdam.)
sidewalk	A way constructed primarily for use by pedestrians.

Structures	
skew or skew angle	The acute angle formed by the intersection of the line normal to the centerline of the roadway or the working line of the superstructure with a line parallel to the face of the substructure or in the case of structural plate units and culverts, with the centerline of the structural plate units and culverts. The skew is always described as "ahead" or "back" on the left side of the centerline of construction.
slab	A component having a width of at least four times its effective depth.
sole plate	The top plate of a bearing attached to the bottom flange of a beam, girder, or box.
spandrel arch	An arch in which the roadway is supported on top of columns (open) or walls (closed) constructed on the arch ribs.
splice	The joining of two elements on the same plane through a connection device. Components such as rebar, piles, and beams are often spliced.
stiffener	A plate welded to a steel beam web to enhance section properties of the beam. Intermediate stiffeners are welded vertically and longitudinal stiffeners along the length of the beam. Bearing stiffeners are welded vertically at bearing locations.
stringer	A secondary load-carrying member spanning longitudinally between transverse floor beams.
structural concrete	Another term for reinforced concrete.
structural plate	A metal structural plate structure used as a minor span or bridge. Types include pipe, pipe arch, plate arch, or box frame.
structural steel	A generic term for steel used in structural applications.
structure	Bridge, culvert, catch basin, drop inlet, retaining wall, cribbing, manhole, endwall, building, sewer, services pipe, underdrain, foundation drain, or other manufactured feature.
strut	Any structure not defined as a culvert, minor span, or bridge that provides a drainage opening under the roadway or approaches to the roadway that is over 5 feet and less than 10 feet in span or nominal diameter.
strut	The transverse member in a lateral bracing system.
stub abutment	A short abutment usually founded on piles. Typically used with fill embankments. See Figure A-5.

Structures	
substructure	All of that part of the structure below the bearings of simple and continuous spans, skewbacks of arches, and tops of footings of rigid frames, plus the backwalls, parapets, and wingwalls of abutments. See Figure A-2.
superimposed dead load	The dead loads that are applied to the design of a composite beam section.
superstructure	The entire traffic-carrying portion of a traditional bridge structure above the bridge seats, including bearings, beams or girders, deck, curbs and bridge railing, but excluding backwalls, wingwalls, and wing protection railing. See Figure A-1.
surface finish	The relative smoothness of a surface usually defined in thousandths of an inch or microns allowing the maximum permissible deviation from a straight line; may be applied to flat or round surfaces.
sweep	Curving of the girder in the horizontal plane.
T girder	A girder whose cross section resembles the letter “T”.
temporary concrete barrier	A precast concrete barrier that is typically used to delineate temporary travel lanes for traffic control during construction.
tendon	A high-strength steel element used to prestress concrete.
through girder	A girder system where the roadway is below the top flange.
through truss	A truss system where the roadway is located near the bottom chord and a top chord lateral system is provided.
tied arch	An arch in which the horizontal thrust of the arch rib is resisted by a horizontal tie.
toe	The front protruding portion of a footing for a wall or abutment.
traditional bridge	A bridge structure consisting of separate substructure and superstructure units. (See buried structure and rigid frame.)
transverse	The direction perpendicular to the length of a bridge and the centerline of construction.
traveled way	The portion of the roadway that is intended for the movement of vehicles, exclusive of shoulders and auxiliary lanes.
trough	A system used with finger joints that collects and directs the water coming through the joint via a drain to a specific location.
true arch	An arch in which the horizontal thrust of the arch rib is resisted by an external force supplied by its foundation.

Structures	
truss	In a traditional bridge, a main load-carrying member spanning longitudinally between supports, consisting of individual components assembled into a rigid triangular framework.
turn-of-wing	The angle point between the abutment and the wingwall, where the wingwall changes plane and begins to slope downward. For a typical non-curbed approach roadway, the “turn–of-wing” is located at the shoulder berm.
viaduct	A structure of some length carrying a state highway over streets, railroads, or other various features.
voided slab	A precast, prestressed concrete slab with circular voids. Voided slabs are typically 3 feet or 4 feet wide and are installed as butted beams laterally post-tensioned together.
wearing surface	A layer of concrete, asphalt pavement or other material placed over a bridge deck to protect the concrete.
web	The vertical component of a girder or beam.
welded girder	In a traditional bridge, a main load-carrying member spanning longitudinally between supports and consisting of several individual pieces welded into one built-up section. (See beam.)
wing	A shortened alternative name for wingwall.
wingwall	The retaining wall extension of an abutment, serving to retain the sides of the approach roadway embankment.
wingwall parapet	The top surface of an abutment between the bridge curb and the wingwall. The parapet allows for the change in plane of the top of a sloping wingwall. A parapet is constructed so that its top surface is level.
yield point	The stress at which a material permanently deforms.

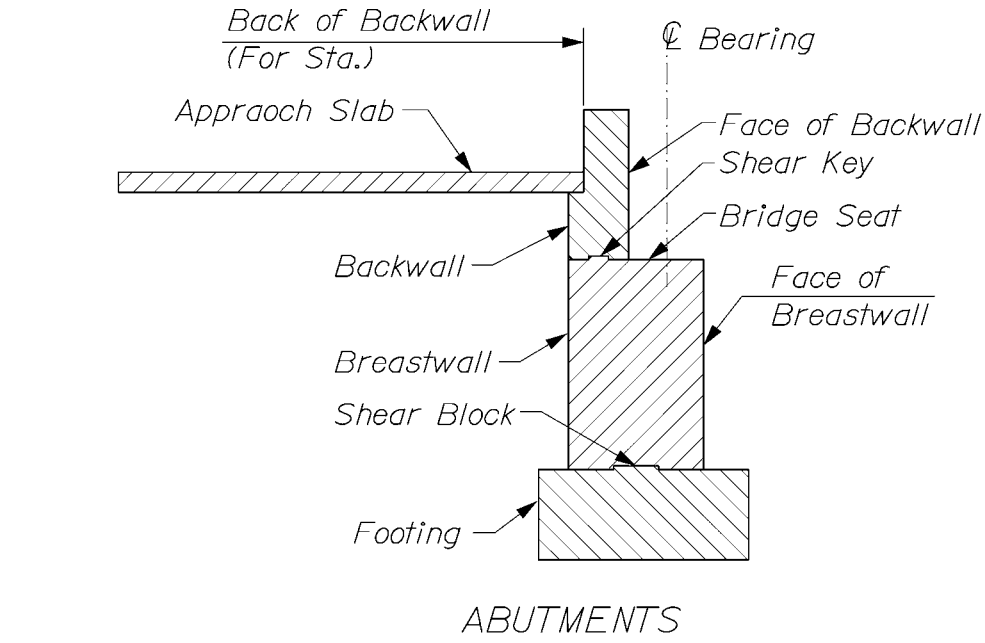
A.1.8 Welds

Welds	
ASTM A6	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling. Describes the dimensional tolerances, allowable imperfections, and methods of conditioning (repairing) the steel.
base metal	Material that is welded, heated, or cut.
complete joint penetration	Penetration of weld metal through the entire thickness of a joint with a groove weld (used only when needed to develop the full capacity of a member).
couplant	A substance used to ensure intimate contact of equipment with steel when performing UT (Ultrasound Testing).
coupon	A sample taken from a larger element used to determine the mechanical, physical, and/or chemical properties of that element. A test specimen.
discontinuity	Imperfections in welds or base metals. A discontinuity is not necessarily a defect. A discontinuity becomes a defect when it exceeds acceptable limits in accordance with the applicable Codes and Standards.
electrode	A component of the welding circuit through which current is conducted between the electrode holder and the arc. An electrode may or may not provide filler metal.
ESW weld process	Electro Slag Welding. A welding process that produces coalescence of metals with molten slag that melts the filler metal and the surfaces of the workpieces. The process is initiated by an arc that heats the slag. The arc is then extinguished by the conductive slag, which is kept molten by its resistance to electric current passing between the electrode and the workpieces.
FCAW weld process	Flux Core Arc Welding. A welding process that uses an arc between a continuous filler metal electrode and the weld pool.
FCAW-G weld process	Flux Cored Arc Welding (gas-shielded). A flux cored arc welding process variation in which shielding gas is supplied through the gas nozzle, in addition to that obtained from the flux within the electrode.
FCAW-S weld process	Flux Cored Arc Welding (self shielded). A flux cored arc welding process variation in which shielding gas is obtained exclusively from the flux within the electrode.

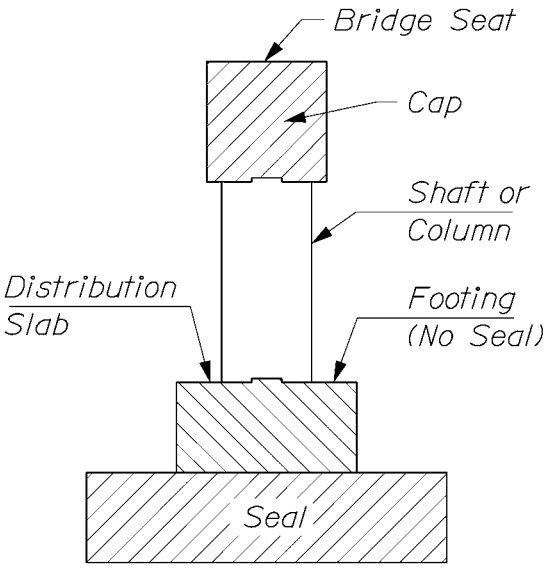
Welds	
globular weld process	The metal droplets are much larger in size, irregular in shape and short circuits occur at irregular intervals. Occurs when the current density is lower than that required for spray transfer or when CO_2, or mixtures of argon and CO_2 are used.
GMAW weld process	Gas Metal Arc Welding. An arc welding process that uses a continuous consumable electrode and a shielding gas.
GTAW weld process	Gas Tungsten Arc Welding. An arc welding process that uses an arc between a tungsten electrode (non-consumable) and the weld pool. This process is used with shielding gas and without the application of pressure.
heat input	The ratio of the arc power entering the workpiece to the weld travel speed. Excessive heat input often reduces weld metal and heat affected zone strength and toughness. Low heat input can increase the incidence of fusion defects and affect soundness and mechanical properties.
lamellar tearing	A fracture separation in heavy weldments, found within or just beneath the heat affected zone of thick weldments.
lamination	Flat, generally elongated, planar base metal discontinuities found near the center of rolled products. They generally run parallel to the surface of the rolled product and are most commonly found in structural shapes and plates.
partial joint penetration	Groove welds without steel backing, welded from one side, groove welds welded from both sides but without backgouging.
Procedure Qualification Record	A record of welding variables used to produce an acceptable test weldment and the results of tests conducted on the weldment to qualify a Welding Procedure Specification.
pulsed arc weld process	Spray transfer occurs in pulses at regularly spaced intervals rather than at random intervals. In the time between pulses, the welding current is reduced and no metal transfer occurs.
SAW weld process	Submerged Arc Welding. A welding process that uses an arc or arcs between a bare metal electrode or electrodes and the weld pool. The arc and molten metal are shielded by a blanket of granular flux on the workpieces.
seal weld	Any weld designed primarily to provide a specific degree of tightness against leakage.

Welds	
short circuit weld process	Occurs with low current density and low voltage. The arc short-circuits up to 200 times per second, and the metal is transferred during the short circuit. Used on thin sheets and is especially applicable to vertical and overhead welds when fit-up is poor.
SMAW weld process	Shielded metal arc welding (stick welding). A welding process with an arc between a covered, consumable electrode and the weld pool.
spray weld process	Very fine droplets of metal being transferred in the arc and a high current density on the electrode. The shielding gas is either argon or a mixture of argon and oxygen. No short circuits occur in the arc.
SW weld process	Stud Arc Welding. An arc welding process that uses an arc between a metal stud, or similar part, and the other workpiece. The process is used with or without shielding gas or flux, with or without partial shielding from a ceramic ferrule surrounding the stud, with the application of pressure after the faying surfaces are sufficiently heated, and without filler metal.
transfer mode weld process	The manner in which the molten metal travels from the end of a consumable electrode across the welding arc to the workpiece. Only spray and globular transfer modes are permitted on bridges.
ultrasonic gage	A device used to measure the thickness of steel or for locating discontinuities using a transducer and CRT (Cathode Ray Tube).
weld	The joining of two metal parts by applying heat, sometimes with pressure. Typical types of weld include fillet and groove, and they may have full or partial penetration.
weld soundness	The overall quality of a weld that establishes fusion to base metal and between weld passes.
Welding Procedure Specification	A document providing, in detail, the required variables for specific application to assure repeatability by properly trained welders and welding operators.

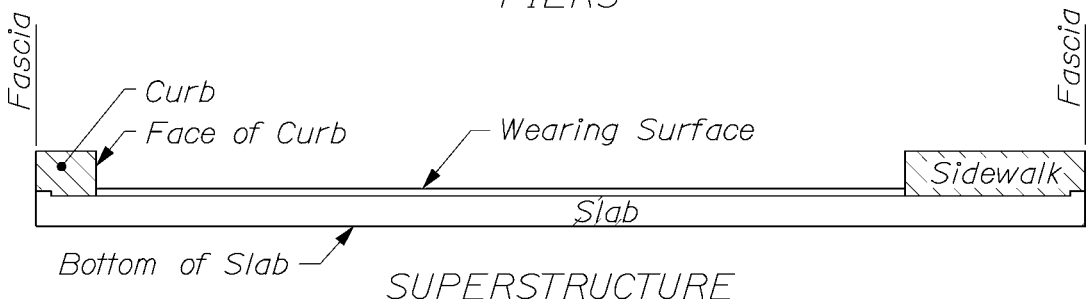
A.2 Drawings



ABUTMENTS

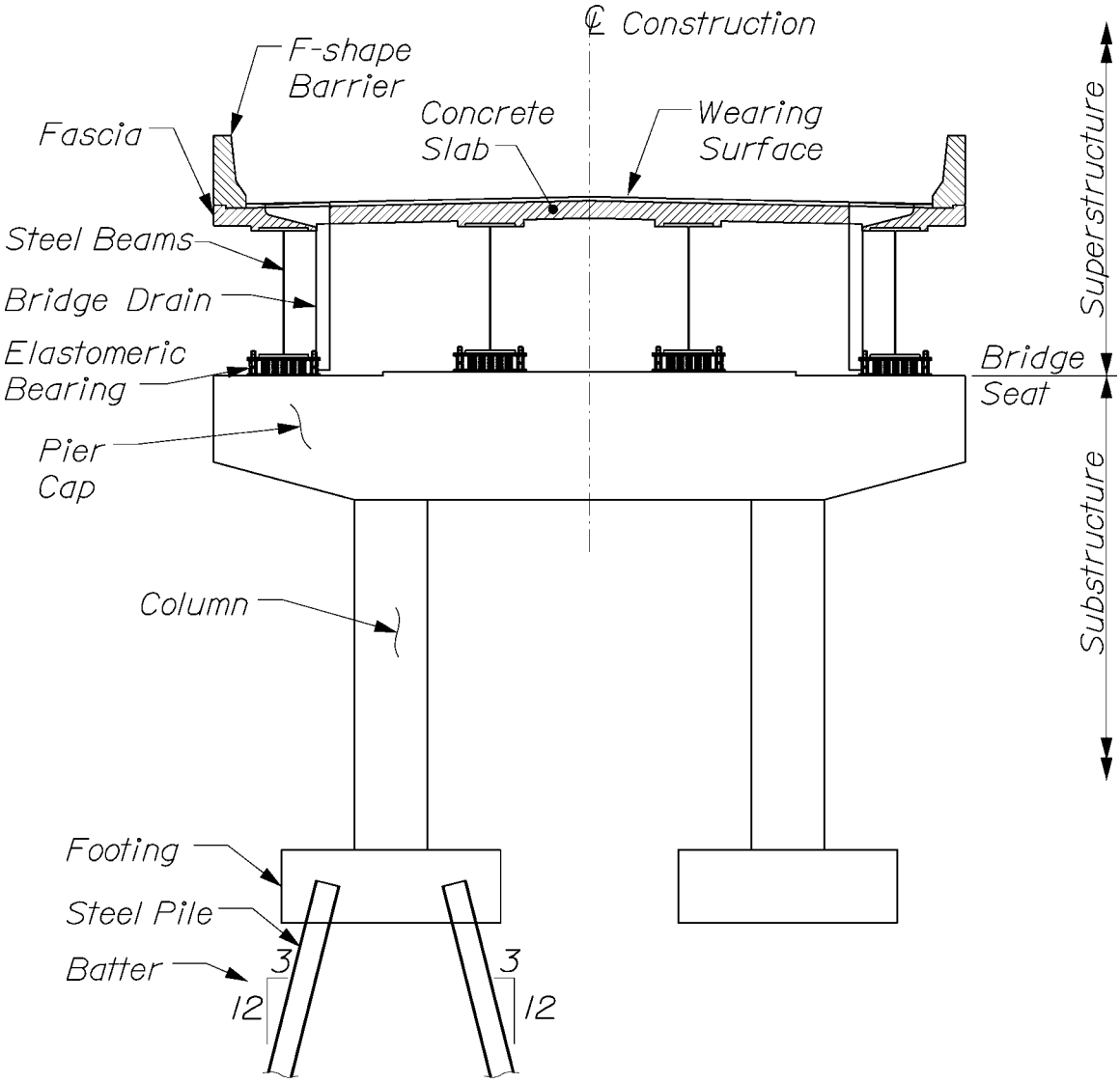


PIERS



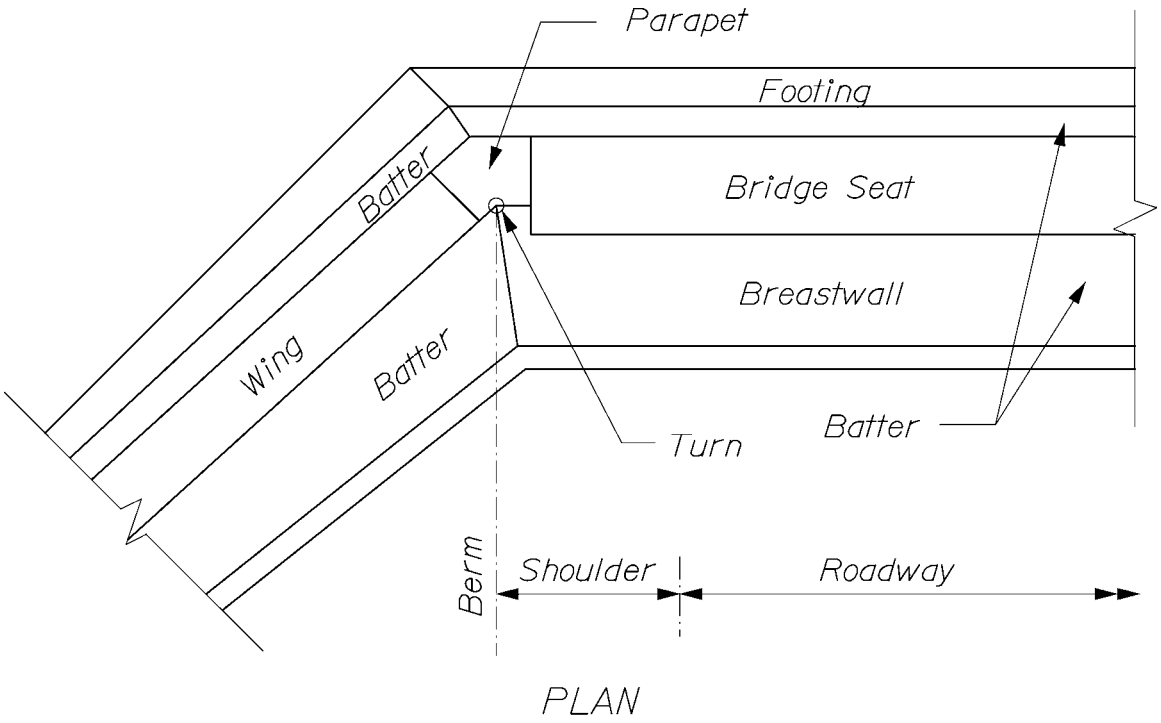
SUPERSTRUCTURE

Figure A-1 Abutment, Pier, Superstructure

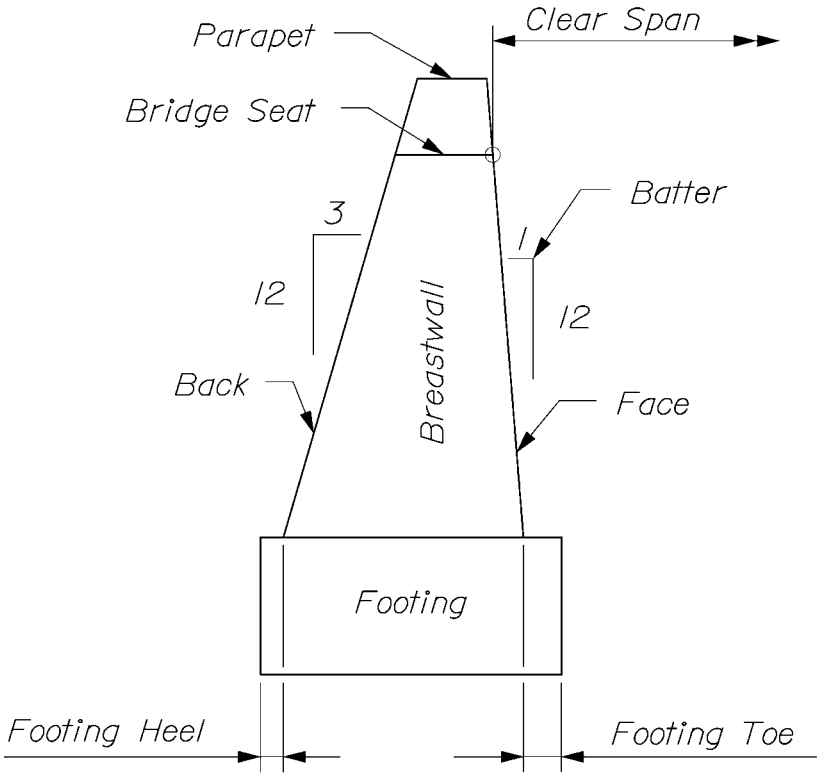


TRANSVERSE SECTION

Figure A-2 Superstructure and Substructure



PLAN



SECTION

Figure A-3 Gravity Abutment

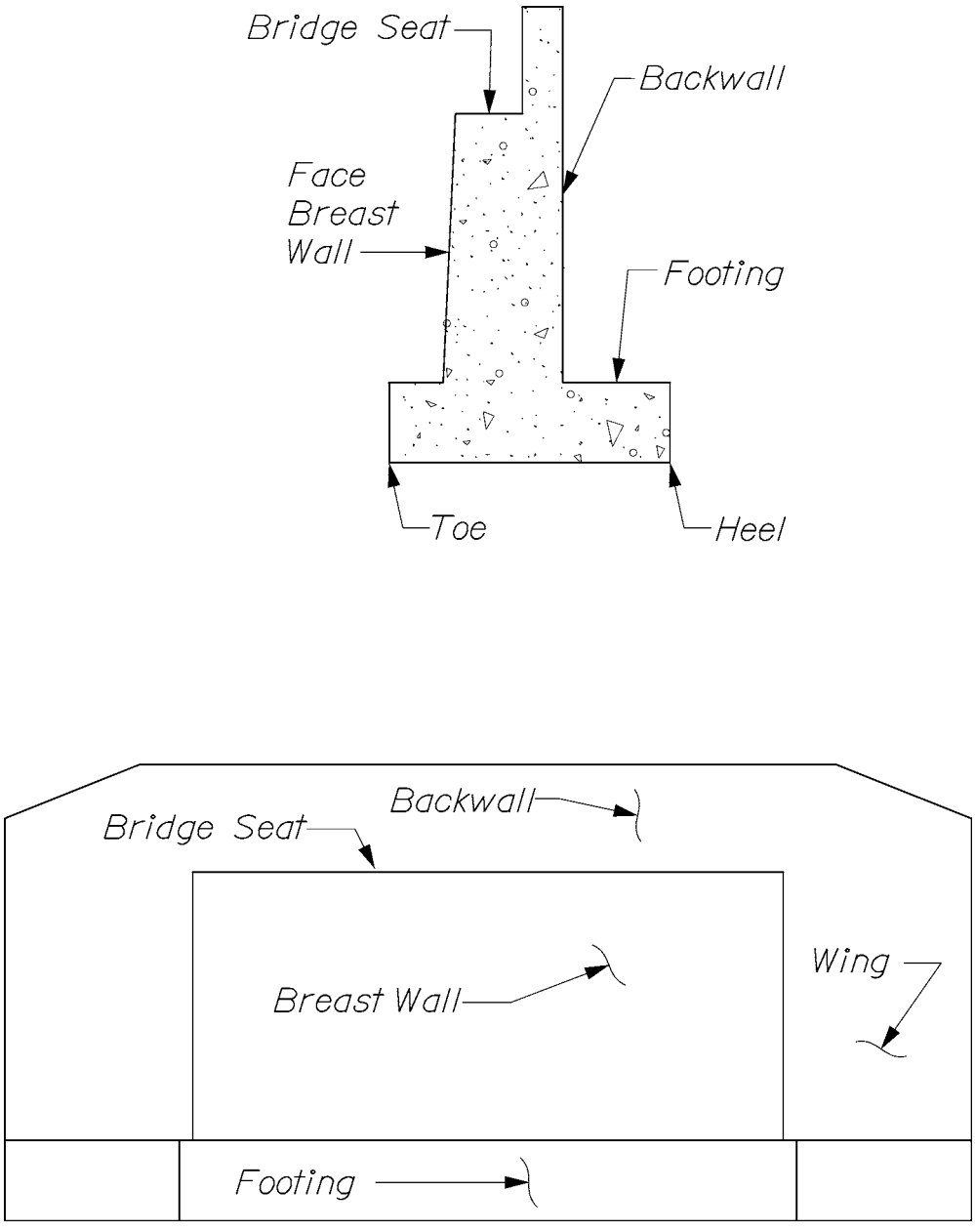
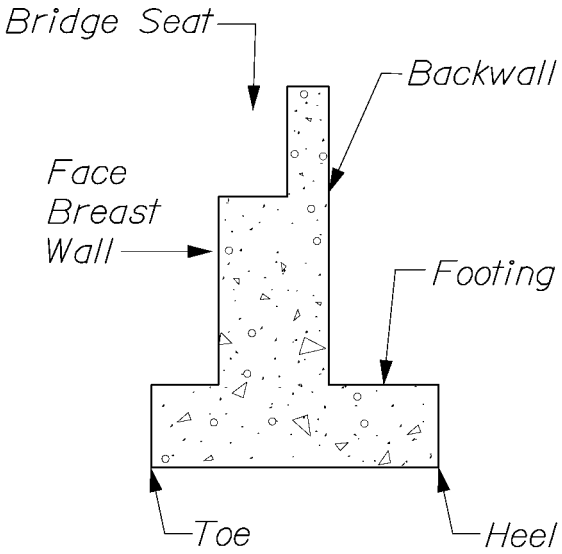


Figure A-4 Full Height Cantilever Abutment



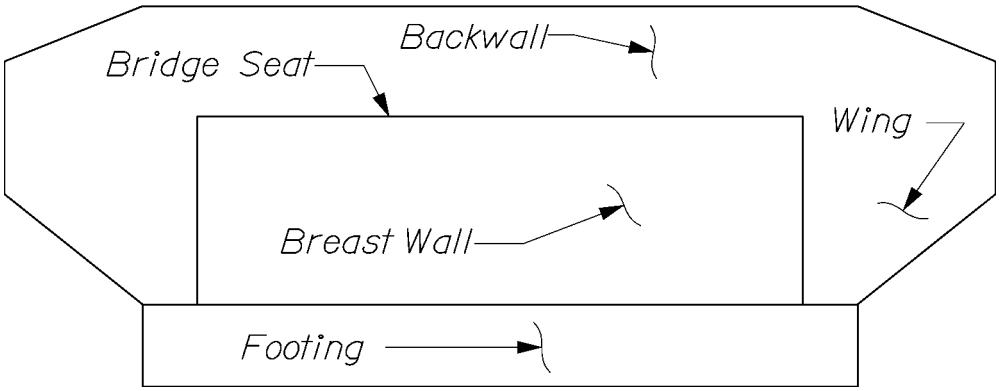


Figure A-5 Stub Abutment

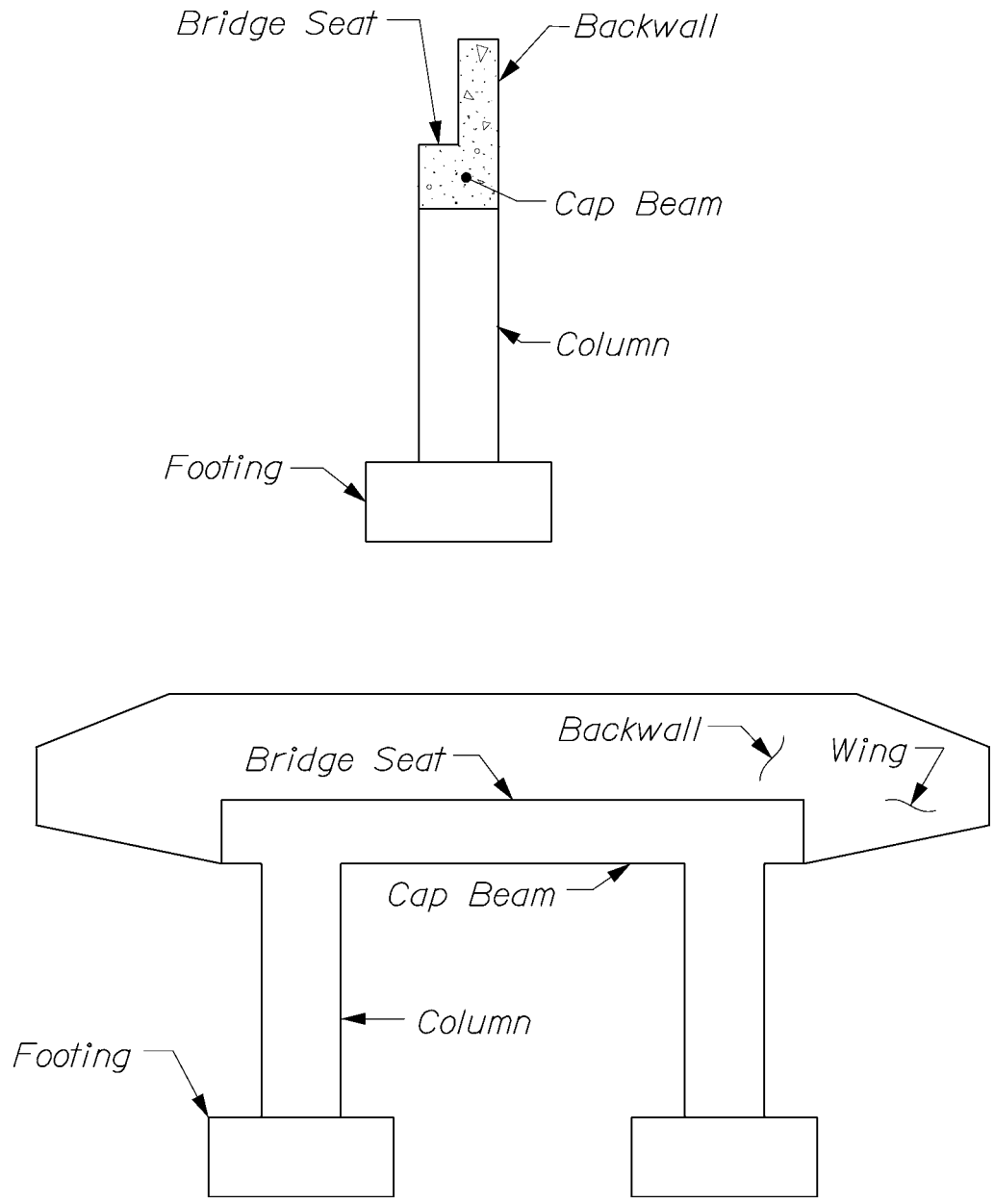


Figure A-6 Open Abutment

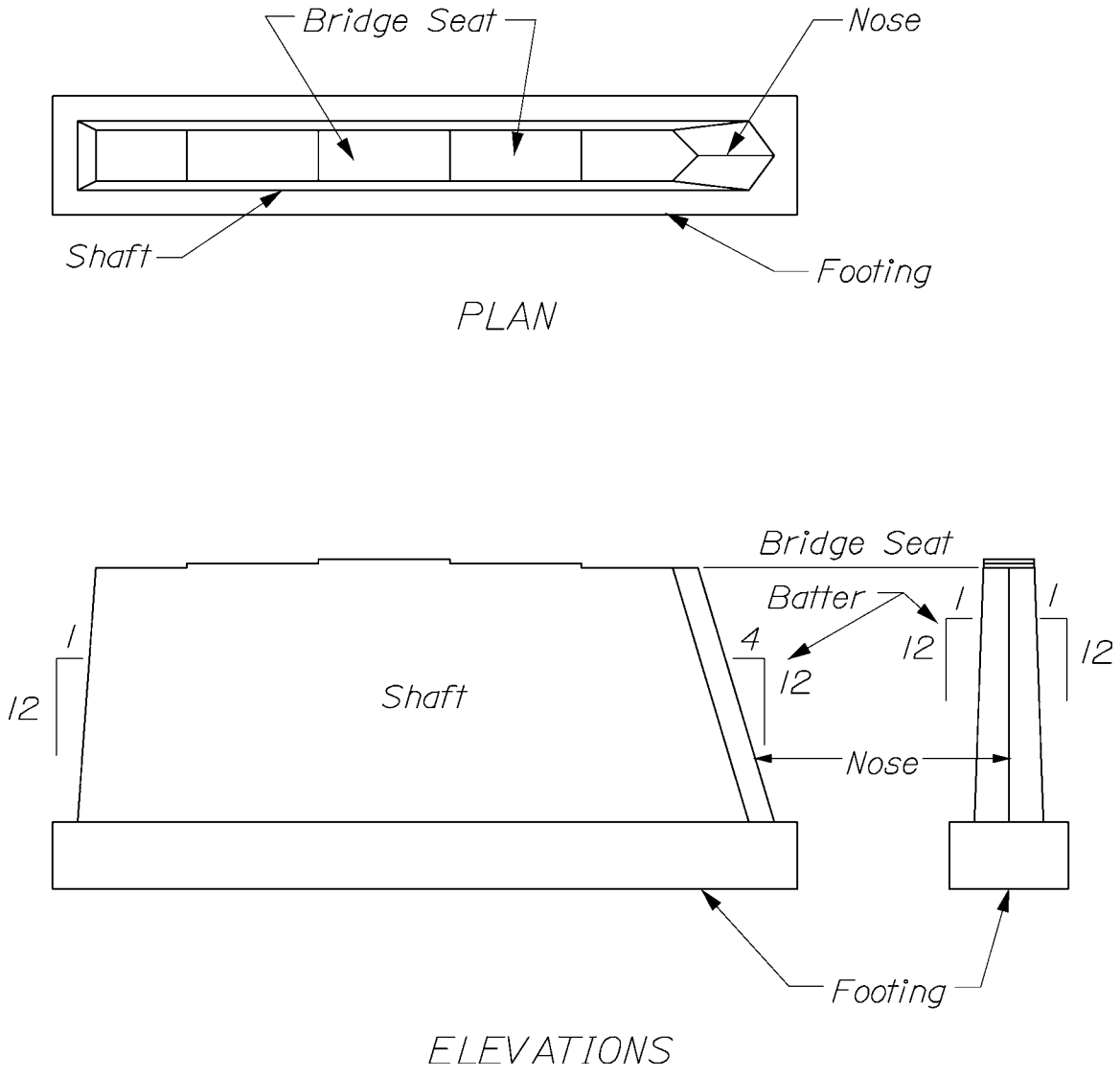


Figure A-7 Solid Pier

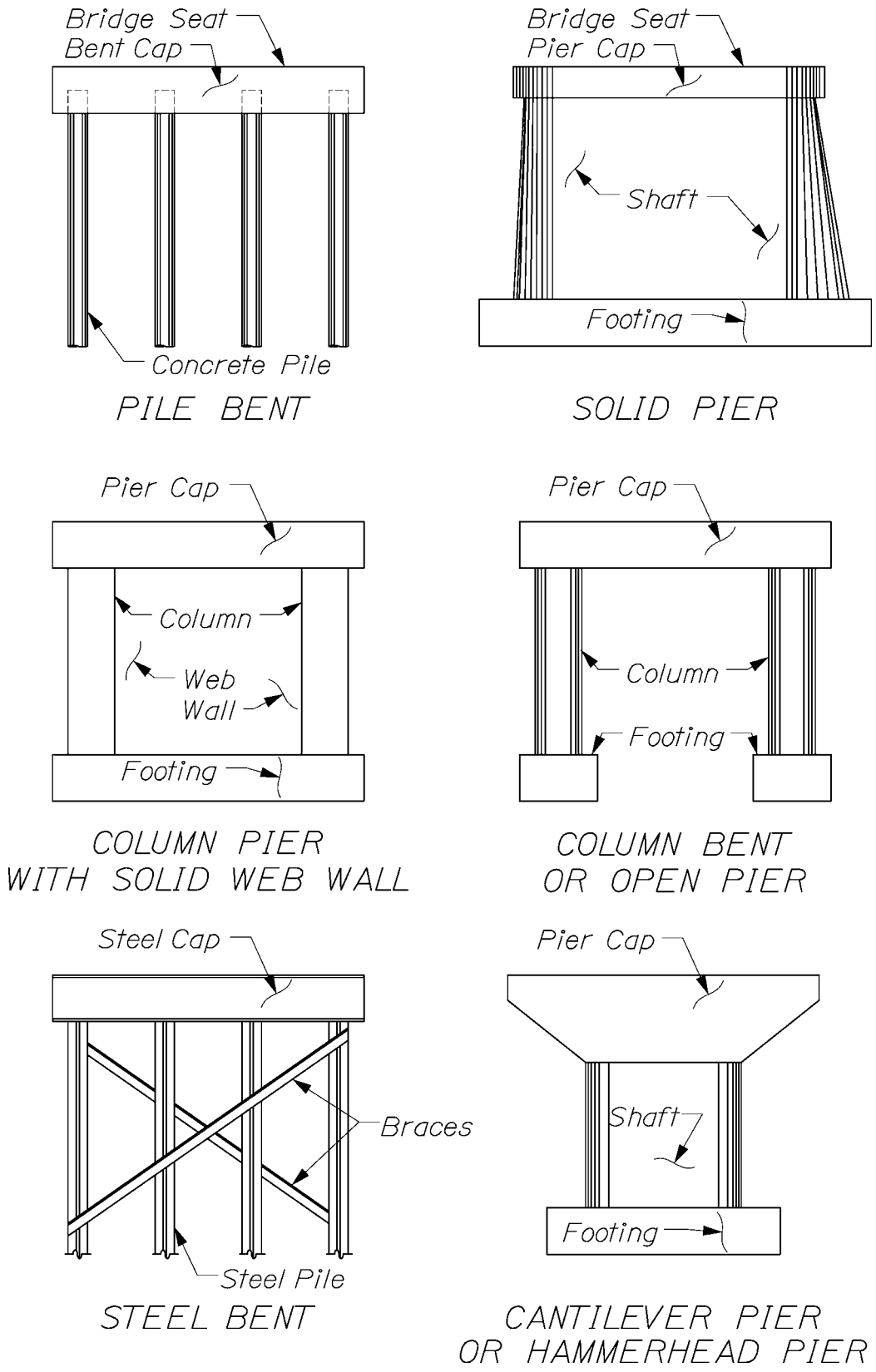


Figure A-8 Types of Piers

Appendix B

PDR FORMS

Wire Bridge, New Portland

Donald V. Carter Bridge, Waterville-Winslow

Appendix B PDR Forms

B.1 Background Information

TOWN - Anytown **PIN -** 10000.00 **BRIDGE NO. -** 1234

FUNDING - Federal/State **STATE ROUTE -** 9

TRANSPORTATION INVESTMENT PROGRAM:

YEAR	02/03	**ESTIMATE**	$100,000
YEAR	04/05	**ESTIMATE**	$1,000,000
		TOTAL	$1,100,000

PROGRAM SCOPE - Bridge Replacement

PROGRAM DESCRIPTION - Common Bridge (#1234) over Raging River, located 0.16 of a mile easterly of Route 9. This bridge is over 20' in length.

PROJECT BACKGROUND - This bridge was constructed in 1930 and was widened in 1960 along with a deck replacement. It is currently in poor condition and in need of complete replacement. Preconstruction engineering was funded in the 02/03 BTIP.

HIGHWAY SYSTEM - State Highway **FUNCTIONAL CLASSIFICATION -** Minor Collector

URBAN/RURAL - Rural **FHWA SUFFICIENCY RATING -** 35.9

LOAD POSTING - 15 tons **POSTED SPEED -** 45 mph

STRUCTURALLY DEFICIENT - Yes **FUNCTIONALLY OBSOLETE -** N/A

TRAFFIC - **2003** **AADT** 1000 **ACCIDENT DATA, CRF -** 1.0

2023 **AADT** 1200 **DHV** 200

B.2 Recommendation Water Crossing

TOWN - Anytown **BRIDGE -** Common Bridge **BRIDGE NO. -** 1234
DESIGNED BY - ABC **DATE -** 3/1/03 **PIN -** 10000.00
APPROVED BY - _____ **DATE -** _____

PROJECT - Bridge replacement with 800' of approaches, including transitions.

ALIGNMENT DESCRIPTION - Tangent on bridge with two 1000' horizontal curves located on each end of the project to match into existing curves. A 600' sag vertical curve with a finished grade about 1.5' higher than the existing bridge. New centerline located approximately 4.5' downstream of existing bridge centerline.

APPROACH SECTION - Two 11' lanes with 4' shoulders. 1:2 sideslopes with standard steel guardrail and 1:3 sideslopes without guardrail.

SPANS - 70'-70' **SKEW -** 30 º ahead on left

LOADING - HL-93 modified for Strength 1 **DESIGN SPEED -** 45 **mph**

SUPERSTRUCTURE - Precast, prestressed concrete butted box beams with a non-composite leveling slab and a 3" bituminous wearing surface on ¼" membrane waterproofing. 30' curb-to-curb with standard 2-bar steel bridge rail and a 2% normal crown. Beams made continuous for live load.

ABUTMENTS - Integral abutments with butterfly wings on H-piles driven to ledge. 1:1.75 riprapped slopes in front.

PIERS - Pile bent consisting of a concrete cap on pipe piles driven to ledge.

OPENING AND CLEARANCE -	**EXISTING**	**PROPOSED**
TOTAL OPENING -	3000 **SF**	3500 **SF**
TOTAL OPENING AT ELEVATION 103.5 **FT -**	2500 **SF**	2800 **SF**
CLEARANCE AT Q50 -	0.2 **FT**	2.1 **FT**

DISPOSITION OF EXISTING BRIDGE - Existing structure to be removed to below streambed, and to become property of the Contractor.

AVAILABLE SOILS INFORMATION - Existing plans and preliminary borings show ledge to be present at about 30'-50' below streambed. For more information, please refer to the Geotechnical Report.

TOWN - Anytown **BRIDGE -** Common Bridge

ADDITIONAL DESIGN FEATURES - Begin transition @ STA 100+00, begin project @ STA 100+50, end project @ STA 800+50, end transition @ STA 900+00. A 3' tall garden retaining wall will be constructed between STA 200+00 and 200+25 on the north side.

MAINTENANCE OF TRAFFIC - Maintain two-way traffic on a one-lane temporary bridge located on the upstream side.

CONSTRUCTION SCHEDULE - One construction season with landscaping the following spring.

ADVERTISING DATE - January 2004

PROGRAM FUNDING LEVEL -	**Program Amount**	**Total Approved**	**Recommendation**
Preliminary Engineering =	$120,000	$120,000	$120,000
Construction [STRUCTURE =	$850,000	$850,000	$700,000
APPROACHES =			$150,000
Construction Engineering =	$120,000	$120,000	$120,000
Right-of-Way =	$10,000	$10,000	$10,000
Total =	**$1,100,000**	**$1,100,000**	**$1,100,000**

PROJECT FISCALLY APPROVED DATE _____ ___

UTILITIES - Verizon, Anytown Sewer, Anytown Water, State Cable, CMP

ADDITIONAL SOILS INFO. REQUIRED? No
ADDITIONAL FIELD SURVEY REQUIRED? No

EXCEPTIONS TO STANDARDS - Bridge width is less than State Standards in order to match existing corridor width.

COMMENTS BY ENGINEER OF DESIGN -

B.3 Recommendation Overpass and Railroad Crossing

TOWN - Anytown **BRIDGE -** Common Bridge **BRIDGE NO. -** 1234
DESIGNED BY - ABC **DATE -** 3/1/03 **PIN -** 10000.00
APPROVED BY - _____ **DATE -** _____

PROJECT - Bridge replacement with 800' of approaches, including transitions.

ALIGNMENT DESCRIPTION - Tangent on bridge with two 1000' horizontal curves located on each end of the project to match into existing curves. A 600' crest vertical curve with a finished grade about 4.5' higher than the existing bridge. New centerline located approximately 4.5' south of existing bridge centerline.

APPROACH SECTION - Two 11' lanes with 4' shoulders. 1:2 sideslopes with standard steel guardrail and 1:3 sideslopes without guardrail.

SPANS - 35' **SKEW -** 30 º ahead on left

LOADING - HL-93 modified for Strength 1 **DESIGN SPEED -** 45 **mph**

SUPERSTRUCTURE - Precast, prestressed concrete voided slabs with a non-composite leveling slab and a 3" bituminous wearing surface on ¼" membrane waterproofing. 30' curb-to-curb with standard F-shape concrete barrier rail and a 2% normal crown.

ABUTMENTS - Cantilevered concrete abutments on H-piles driven to ledge.

PIERS - N/A

CLEARANCES -	**EXISTING**	**PROPOSED**
VERTICAL -	16.25 **FT**	22.5 **FT**
HORIZONTAL -	20 **FT**	30 **FT**

DISPOSITION OF EXISTING BRIDGE - Existing structure to be removed in its entirety, and to become property of the Contractor.

AVAILABLE SOILS INFORMATION - Existing plans and preliminary borings show ledge to be present at about 30'-50' below ground. For more information, please refer to the Geotechnical Report.

TOWN - Anytown **BRIDGE -** Common Bridge

ADDITIONAL DESIGN FEATURES - Begin transition @ STA 100+00, begin project @ STA 100+50, end project @ STA 800+50, end transition @ STA 900+00. A 3' tall garden retaining wall will be constructed between STA 200+00 and 200+25 on the north side.

MAINTENANCE OF TRAFFIC - Maintain two-way traffic on existing bridge with stage construction.

CONSTRUCTION SCHEDULE - One construction season with landscaping the following spring.

ADVERTISING DATE - January 2004

PROGRAM FUNDING LEVEL -	**Program Amount**	**Total Approved**	**Recommendation**
Preliminary Engineering =	$70,000	$70,000	$70,000
Construction [STRUCTURE =	$400,000	$400,000	$300,000
APPROACHES =			$100,000
Construction Engineering =	$70,000	$70,000	$70,000
Right-of-Way =	$10,000	$10,000	$10,000
Total =	**$550,000**	**$550,000**	**$550,000**

PROJECT FISCALLY APPROVED DATE _____ ___

UTILITIES - Verizon, Anytown Sewer, Anytown Water, State Cable, CMP

ADDITIONAL SOILS INFO. REQUIRED? No
ADDITIONAL FIELD SURVEY REQUIRED? No

EXCEPTIONS TO STANDARDS - Bridge width is less than State Standards in order to match existing corridor width.

COMMENTS BY ENGINEER OF DESIGN -

B.4 Recommendation Wearing Surface, Deck, Superstructure

TOWN - Anytown **BRIDGE -** Common Bridge **BRIDGE NO. -** 1234
DESIGNED BY - ABC **DATE -** 3/1/03 **PIN -** 10000.00
APPROVED BY - _____ **DATE -** _____

PROJECT - Bridge replacement wearing surface replacement with 50’ approach transitions.

ALIGNMENT DESCRIPTION - Horizontal and vertical - tangent, same as existing. Finish grade raised 1” on bridge.

APPROACH SECTION - Two 11’ lanes with 4’ shoulders. 1:2 sideslopes with standard steel guardrail and 1:3 sideslopes without guardrail.

SPANS - 80’-140’-80’ **SKEW -** 30 º ahead on left

LOADING - N/A **DESIGN SPEED -** 45 **mph**

SUPERSTRUCTURE - Place 3” bituminous wearing surface on ¼” membrane waterproofing, rehabilitating existing concrete deck as needed. Modify existing expansion joints to accommodate thicker wearing surface and replace seals. Replace two broken bridge rail posts.

ABUTMENTS - N/A

PIERS - Rehabilitate spalled concrete cap on Pier 1.

DISPOSITION OF EXISTING BRIDGE - Existing wearing surface and membrane waterproofing removed to become property of the Contractor.

AVAILABLE SOILS INFORMATION - N/A

TOWN - Anytown **BRIDGE -** Common Bridge

ADDITIONAL DESIGN FEATURES - Begin transition @ STA 100+00, begin project @ STA 100+25, end project @ STA 400+25, end transition @ STA 400+50.

MAINTENANCE OF TRAFFIC - Maintain two-way traffic with stage construction and temporary traffic signals.

CONSTRUCTION SCHEDULE - One construction season.

ADVERTISING DATE - January 2004

PROGRAM FUNDING LEVEL -	**Program Amount**	**Total Approved**	**Recommendation**
Preliminary Engineering =	$120,000	$120,000	$120,000
Construction [STRUCTURE =	$850,000	$850,000	$700,000
APPROACHES =			$150,000
Construction Engineering =	$120,000	$120,000	$120,000
Right-of-Way =	$10,000	$10,000	$10,000
Total =	**$1,100,000**	**$1,100,000**	**$1,100,000**

PROJECT FISCALLY APPROVED DATE _____ ___

UTILITIES - Verizon, Anytown Sewer, Anytown Water, State Cable, CMP

ADDITIONAL SOILS INFO. REQUIRED? No

ADDITIONAL FIELD SURVEY REQUIRED? No

EXCEPTIONS TO STANDARDS - N/A

COMMENTS BY ENGINEER OF DESIGN -

B.5 Recommendation Buried Structure

TOWN - Anytown **BRIDGE -** Common Bridge **BRIDGE NO. -** 1234
DESIGNED BY - ABC **DATE -** 3/1/03 **PIN -** 10000.00
APPROVED BY - _____ **DATE -** _____

PROJECT - Bridge replacement with 300' of approaches, including transitions.

ALIGNMENT DESCRIPTION - Horizontal - tangent, same as existing. Vertical - 300' sag curve with finished grade raised 1.5' at bridge.

APPROACH SECTION - Two 11' lanes with 4' shoulders. 1:2 sideslopes with standard steel guardrail and 1:3 sideslopes without guardrail.

SPANS - 25' **SKEW -** 30 º ahead on left

LOADING - HL-93 modified for Strength 1 **DESIGN SPEED -** 45 **mph**

STRUCTURE - Precast concrete arch on CIP concrete spread footings, with precast concrete headwalls and wings. 30' rail-to-rail width with bridge-mounted guardrail.

TOTAL OPENING - EXISTING - 156 **SF PROPOSED -** 286 **SF**

DISPOSITION OF EXISTING BRIDGE - Existing structure to be removed in its entirety, and to become property of the Contractor.

AVAILABLE SOILS INFORMATION - Existing plans and preliminary borings show ledge to be present at about 30'-50' below streambed. For more information, please refer to the Geotechnical Report.

TOWN - Anytown **BRIDGE -** Common Bridge

ADDITIONAL DESIGN FEATURES - Begin transition @ STA 100+00, begin project @ STA 100+50, end project @ STA 300+50, end transition @ STA 400+00.

MAINTENANCE OF TRAFFIC - Close bridge to traffic for 5 days and detour traffic onto This Road, That Street, and Route 1. Total length of detour is 7.5 miles.

CONSTRUCTION SCHEDULE - One construction season. Bridge must be reopened to traffic by Labor Day.

ADVERTISING DATE - January 2004

PROGRAM FUNDING LEVEL -	**Program Amount**	**Total Approved**	**Recommendation**
Preliminary Engineering =	$35,000	$35,000	$35,000
Construction [STRUCTURE =	$275,000	$275,000	$240,000
APPROACHES =			$35,000
Construction Engineering =	$35,000	$35,000	$35,000
Right-of-Way =	$5,000	$5,000	$5,000
Total =	**$350,000**	**$350,000**	**$350,000**

PROJECT FISCALLY APPROVED **DATE** _____ ___

UTILITIES - Verizon, Anytown Sewer, Anytown Water, State Cable, CMP

ADDITIONAL SOILS INFO. REQUIRED? No

ADDITIONAL FIELD SURVEY REQUIRED? No

EXCEPTIONS TO STANDARDS - Recommended bridge width is less than State Standards in order to match existing corridor width. Reduced berm offset is recommended to minimize wetland impacts.

COMMENTS BY ENGINEER OF DESIGN -

B.6 Recommendation Structural Plate Structure

TOWN - Anytown **BRIDGE -** Common Bridge **BRIDGE NO. -** 1234
DESIGNED BY - ABC **DATE -** 3/1/03 **PIN -** 10000.00
APPROVED BY - _____ **DATE -** _____

PROJECT - Bridge culvert replacement with 300' of approaches, including transitions.

ALIGNMENT DESCRIPTION - Horizontal - tangent, same as existing. Vertical - 300' sag curve with finished grade raised 1.5' at bridge.

APPROACH SECTION - Two 11' lanes with 4' shoulders. 1:2 sideslopes with standard steel guardrail and 1:3 sideslopes without guardrail.

LOADING - HL-93 modified for Strength 1 **SKEW -** 30 º ahead on left

DESIGN SPEED - 45 **mph**

STRUCTURE - Twin 16'-6" span by 11'-0" rise structural steel plate pipe arches with a 30' rail-to-rail width. Flow line of 1%±. Inlet and outlet invert elevations for easterly pipe arch are 53.2 and 52.5, respectively. Inlet and outlet invert elevations for westerly pipe arch are 53.7 and 53.0, respectively.

TOTAL OPENING - EXISTING - 156 **SF PROPOSED -** 286 **SF**

DISPOSITION OF EXISTING BRIDGE - Existing structure to be removed in its entirety, and to become property of the Contractor.

AVAILABLE SOILS INFORMATION - Existing plans and preliminary borings show ledge to be present at about 30'-50' below streambed. For more information, please refer to the Geotechnical Report.

TOWN - Anytown **BRIDGE -** Common Bridge

ADDITIONAL DESIGN FEATURES - Begin transition @ STA 100+00, begin project @ STA 100+50, end project @ STA 300+50, end transition @ STA 400+00.

MAINTENANCE OF TRAFFIC - Close bridge to traffic for 5 days and detour traffic onto This Road, That Street, and Route 1. Total length of detour is 7.5 miles.

CONSTRUCTION SCHEDULE - One construction season. Bridge must be reopened to traffic by Labor Day.

ADVERTISING DATE - January 2004

PROGRAM FUNDING LEVEL -	**Program Amount**	**Total Approved**	**Recommendation**
Preliminary Engineering =	$30,000	$30,000	$30,000
Construction [STRUCTURE =	$235,000	$235,000	$200,000
APPROACHES =			$35,000
Construction Engineering =	$30,000	$30,000	$30,000
Right-of-Way =	$5,000	$5,000	$5,000
Total =	**$300,000**	**$300,000**	**$300,000**

PROJECT FISCALLY APPROVED **DATE** _____ ___

UTILITIES - Verizon, Anytown Sewer, Anytown Water, State Cable, CMP

ADDITIONAL SOILS INFO. REQUIRED? No

ADDITIONAL FIELD SURVEY REQUIRED? No

EXCEPTIONS TO STANDARDS - Recommended bridge width is less than State Standards in order to match existing corridor width. Reduced berm offset is recommended to minimize wetland impacts.

COMMENTS BY ENGINEER OF DESIGN -

B.7 Summary of Impacts

RIGHT OF WAY - Number of: Property Owners = 4
Buildings To Be Taken = 1

Type of Acquisitions: ☒ Fee Simple ☒ Easement
☒ Grading ☐ Temporary Road

HISTORICAL/ARCHEOLOGICAL - Bridge eligible for National Historic Register. Bridge is not historic, but is located in a historic district. Archeological site located on downstream side of bridge is to be avoided.

COAST GUARD PERMIT? Exception Request Required **FAA PERMIT?** No

ENVIRONMENTAL - Instream Work Window? Yes From Jul 15 To Oct 30

Wetlands: Freshwater Area = 1025 SF Coastal Area = 0 SF

Mitigation Required? No Dredged Spoils Testing Required? No

Stream Diversion: Cofferdams required at each abutment and pier.

Expected Permit and NEPA Level:
DEP: DPBR ACOE: Category 1 LURC: N/A
NPDES? No NEPA: CE

Summary of Avoidance and Minimization: 1:2 sideslopes with guardrail and state standards for bridge widths are to be used to minimize wetland impacts, design speed in this area will be lowered from 80 km/h to 72 km/h so that the increase in finish grade can be dropped by 0.5 m to minimize wetland impacts. An aluminum arch culvert is recommended over the twin pipe option to reduce stream diversion costs and minimize streambed disturbance.

OTHER - Essential habitats (eagles nest, deer wintering area, rare plant site, etc.), public parks or recreation areas, hazardous materials (if known), special landscape needs.

B.8 Existing Bridge Synopsis

TOWN - Anytown **BRIDGE -** Common Bridge **YEAR BUILT -** 1936

SPAN LENGTHS - 60'-60' **CURB TO CURB WIDTH -** 24'

TYPE OF SUPERSTRUCTURE - Two-span continuous structure with painted steel beams, composite cast-in-place deck, bituminous wearing surface and membrane waterproofing, and concrete bridge rail.

GENERAL CONDITION - Steel beams are in fair condition with minor section loss along with rusting and extensive failing paint. Concrete deck is in fair condition with some spalling and leakage on the bottom. Wearing surface is in poor condition with extensive cracking and patching. Bridge rail is in very poor condition with much cracking and patching.

TYPE OF SUBSTRUCTURE - Mass concrete abutments on H-piles. Mass concrete pier on piles.

GENERAL CONDITION - The concrete for both abutments is cracked and spalled and in poor overall condition. The north wing on abutment #1 is tipped forward slightly. The pier concrete is in fair condition with some cracking and spalling.

BRIDGE RATINGS -	**OPERATING**	**INVENTORY**
H Truck	40 Tons	30 Tons
HS Truck	40 Tons	30 Tons

FHWA SUFFICIENCY RATING - 36.9 **POSTED LOAD/DATE -** N/A

MAINTENANCE PROBLEMS - Cracking of bituminous wearing surface. Cracking, spalling, and vehicular damage of concrete bridge rail.

MAINTENANCE WORK - Repeated patching of wearing surface and repair of bridge rail.

PREVIOUS STRUCTURE - A timber covered bridge on granite abutments.

OTHER COMMENTS - This is a non-historic bridge located in a historic district.

B.9 Summary of Existing Upstream and Downstream Bridges

Upstream -	1.3 miles	**Town -** Anytown **Name -** Common Bridge **Br. No. -** 1234 **Hydraulic Opening -** 100 ‘ Span x 30 ‘ Rise= 3000 SF **Known Ice, Flooding, Scour, and Debris Concerns:** Routinely floods every 2-3 years. No ice or debris.
Upstream -	13.1 miles	**Town -** Anytown **Name -** Common Bridge **Br. No. -** 1234 **Hydraulic Opening -** 100 ‘ Span x 30 ‘ Rise= 3000 SF **Known Ice, Flooding, Scour, and Debris Concerns:** None
Upstream -	23.6 miles	**Town -** Anytown **Name -** Common Bridge **Br. No. -** 1234 **Hydraulic Opening -** 100 ‘ Span x 30 ‘ Rise= 3000 SF **Known Ice, Flooding, Scour, and Debris Concerns -** None
Downstream -	2.4 miles	**Town -** Anytown **Name -** Common Bridge **Br. No. -** 1234 **Hydraulic Opening -** 100 ‘ Span x 30 ‘ Rise= 3000 SF **Known Ice, Flooding, Scour, and Debris Concerns -** Unknown
Downstream -	9.3 miles	**Town -** Anytown **Name -** Common Bridge **Br. No. -** 1234 **Hydraulic Opening -** 100 ‘ Span x 30 ‘ Rise= 3000 SF **Known Ice, Flooding, Scour, and Debris Concerns -** No ice or flooding. Debris collects around pile bent causing minor restriction in opening.
Downstream -	22.8 miles	**Town -** Anytown **Name -** Common Bridge **Br. No. -** 1234 **Hydraulic Opening -** 100 ‘ Span x 30 ‘ Rise= 3000 SF **Known Ice, Flooding, Scour, and Debris Concerns -** None

Appendix C

HYDROLOGY/HYDRAULICS

Scotty Richardson Bridge, Rumford

Covered Bridge, Norridgewock

Appendix C Hydrology/Hydraulics

C.1 Transposed Discharge Methods

The following three transposed discharge methods are used for ungaged sites on gaged, unregulated streams in rural drainage basins that are between 50% and 200% of the drainage area of the gaging station, except for sites that are plus or minus 3% of the drainage area. Ungaged sites within 3% of the gaging station drainage area, should use the values in " Estimating the Magnitude of Peak Flows for Streams in Maine for Selected Recurrence Intervals by Glen Hodgkins 1999, U.S. Geological Survey Water -Resources Investigations Report 99-4008 Table 1 pages 8 -17. Please note that Q_{50} is the same as the Q50 designation used elsewhere in this Guide – the same is true for other flow rates as well.

C.1.1 Transposed Discharge Method #1

This method is for calculating a final weighted peak flow at an ungaged site on a gaged stream by weighting the peak flow from the gaging station with the peak flow from the U.S.G.S. Hodgkins full regression equation.

$$Q_{uf} = Q_r(W_r) + Q_u(1 - W_r)$$

in which:

Q_{uf} - the final weighted peak flow for a given recurrence interval (for example, Q_{50}) for an ungaged site on a gaged stream.

Q_r - the regression estimate of the peak flow, at the ungaged site, for a given recurrence interval (for example, Q_{50}) using the U.S.G.S. Hodgkins full regression equation

W_r is a weighting factor:

For $A_u > A_g$, $W_r = (A_u/A_g) - 1$
For $A_u < A_g$, $W_r = (A_g/A_u) - 1$

in which:

A_u is the drainage-basin area of the ungaged site
A_g is the drainage-basin area of the gaging station

Q_u is the peak flow for the gaging station with a drainage area adjustment

$$Q_u = Q_w(A_u/A_g)^b$$

in which:

Q_w is the weight-average peak flow for a given recurrence interval (such as Q_{50}) for the gaging station from table 1 in "Estimating the Magnitude of Peak Flows for Streams in Maine for Selected Recurrence Intervals" by Glen Hodgkins, U.S. Geological Survey Water-Resources Investigation Report 99-4008.

b is the coefficient of the simplified (drainage area only) regression equation for the appropriate recurrence interval:

b = 0.825 for a recurrence interval of 2-years
b = 0.797 for a recurrence interval of 5-years
b = 0.783 for a recurrence interval of 10-years
b = 0.767 for a recurrence interval of 25-years
b = 0.757 for a recurrence interval of 50-years
b = 0.748 for a recurrence interval of 100-years
b = 0.729 for a recurrence interval of 500-years

C.1.2 Transposed Discharge Method #2

If the explanatory variable (drainage area and percentage of basin wetlands) are:

a. outside the 2-dimensional range of the variables used for the U.S.G.S.Hodgkins Full Regression Equation figure 1 or

b. if the ungaged site had Canadian Drainage, then

$$Q_{uf} = Q_w(A_u/A_g)^b$$

in which:

Q_{uf} is the final weighted peak flow for a given recurrence interval (for example, Q_{50}) for an ungaged site on a gaged stream

Qw is the weighted-average peak flow for a given recurrence interval (such as Q_{50}) for the gaging station from table 1 in "Estimating the Magnitude of Peak Flows for Streams in Maine for Selected Recurrence Intervals" by Glen Hodgkins, U.S. Geological Survey Water-Resources Investigation Report 99-4008 (or from future reports). If the weighted-average flow is not available, the gaging-station peak flow should be used.

C.1.3 Transposed Discharge Method #3

This method is for determining flows at an ungaged site located between two gaging stations.

$$Q_{uff} = (Q_{uf1}(A_{g2} - A_u) + Q_{uf2}(A_u - A_{g1}))/(A_{g1} - A_{g1})$$

in which:

Q_{uff} is the weighted flow for an ungaged site between gaging station 1 & 2

Q_{uf1} is from transposed method #1 or transposed method #2 (as appropriate) for the upstream gaging station

A_{g2} is the drainage-basin area of the downstream gaging station

A_u is the drainage-basin area of the ungaged site

Q_{uf2} is from transposed method #1 or transposed method #2 (as appropriate) for the downstream gaging station

A_{g1} is the drainage-basin area of the upstream gaging station

C.2 Discharge Adjustment Factors

The following table can be used to estimate flows, based upon a known Q_{50}. These factors should not be used to adjust flows provided by the MaineDOT Hydrology Section based on the U.S.G.S. equations.

Table C-1 Discharge Adjustment Factors

Recurrence Interval (years)	Factor to Apply to Q50
1.1	.32
2	.42
5	.56
10	.67
20	.80
25	.85
50	1.0
70	1.07
100	1.18

C.3 Forms

The following forms can be used to assist in gathering the needed data.

REPORT FROM BRIDGE MAINTENANCE SUPERVISOR

TOWN: _____

BRIDGE NO. & NAME:_____

CLEAR SPAN: _____

CLEARANCE TO WATER (upstream side): _____

AVERAGE DEPTH OF WATER (upstream side): _____

SPAN AND RISE DOWNSTREAM: _____
(if significantly different from above)

EVIDENCE OF SCOUR: none _____ slight _____ much _____

EVIDENCE OF LENGTH:
unlikely _____ likely _____ positive _____ uncertain _____

ADEQUACY OF OPENING:
undersized ____ appropriate ____ oversized ____ uncertain ____

HIGH WATER INFORMATION

Has water been over the road? _____ Date (if known) _____

Estimated Depth over the road: _____

Reliability of Estimate: poor _____ fair ____ good ____

Highest known water elevation relative to bottom of bridge: _____
Date (if known) _____

Was high water caused by a downstream constriction:

no ____ likely ____ positive ____ uncertain ____

Was high water caused by ice:
no ____ likely ____ positive ____ uncertain ____

GENERAL COMMENTS: **_____**

_____

COMMENTS PERTAINING TO UPSTREAM OR DOWNSTREAM BRIDGES:

_____

_____

DEGREE OF FAMILIARITY WITH SUBJECT BRIDGE:
negligible ____ some ____ considerable ____

Reported by: _____ Date: _____

INFORMATION FROM LOCAL RESIDENT

NAME: _____

ADDRESS: _____

PHONE: _____

YEARS OF RESIDENCE: _____

ADEQUACY OF OPENING: undersized ___ appropriate ___ oversized ___

HIGH WATER RELATIVE TO ROADWAY

Has water been over the road? _____

Estimated depth over the road (if applicable): _____

Flow over the road (velocity): _____

Other information: _____

_____

_____

HIGH WATER RELATIVE TO BRIDGE

Distance from bottom of bridge: _____ **above or below**

Date of high water: _____

Cause of flood: _____
(ice, spring runoff, hurricane, cloudburst, heavy rain, backwater, debris)

Frequency of flooding:
none ____ seldom _____ occasional _____ frequent _____

Other information:

_____

_____

_____

GENERAL COMMENTS:

_____

_____

_____

COMMENTS PERTAINING TO UPSTREAM OR DOWNSTREAM BRIDGES:

_____

_____

Reported by: _____ **Date:** _____

Appendix D

STANDARD NOTES

Mill Creek Bridge, Falmouth

Bingham, Mill Bridge

Appendix D Standard Notes

The notes on the following pages should be used on the plans where they apply.

D.1 Title Sheet

These notes should appear on the title sheet of the plans, or if a title sheet is omitted, on the general plan.

SPECIFICATIONS

DESIGN: Load and Resistance Factor Design per AASHTO LRFD Bridge Design Specifications 1998 and interim specifications through 200X.

DESIGN: Allowable Stress Design per AASHTO Standard Specifications for Highway Bridges 1996, and all supplementals thereto.

TRAFFIC DATA

Current (200X) AADT = XXXX
Future (20XX) AADT = XXXX
DHV - % of AADT = XX %
Design Hour Volume = XXX
Heavy Trucks (% of AADT) = XX %
Heavy Trucks (% of DHV) = XX %
Directional Distribution (% of DHV) = XX %
18 Kip Equivalent P 2.0 = XX
18 Kip Equivalent P 2.5 = XX
Design Speed = XX mph

DESIGN LOADING

LIVE LOAD: HL-93 Modified

MATERIALS

CONCRETE:	Structural Wearing Surface	Class LP
	Barriers, Curbs, Sidewalks, End Posts	Class LP
	Seals	Class S
	Precast	Class P
	Fill	Fill
	All Other	Class A

REINFORCING STEEL: ASTM A615/A615M Grade 60

PRESTRESSING STRANDS: AASHTO 203 (ASTM A416), Grade 270, Low Relaxation

STRUCTURAL STEEL:

All Material (unless otherwise noted)	ASTM A709, Grade 50W (unpainted)
High Strength Bolts	ASTM A325M, Type 3

BASIC DESIGN STRESSES

CONCRETE: f'_c = 4,350 psi

PRECAST CONCRETE: f'_c = XX psi
f'_{ci} = XX psi

REINFORCING STEEL: f_y = 60,000 psi

PRESTRESSING STRANDS: f_y = 270,000 psi

STRUCTURAL STEEL:	ASTM A709, Grade 345W	F_y = 50,000 psi
	ASTM A709, Grade 250	F_y = 36,000 psi
	ASTM A325	F_u = 120,000 psi

HYDROLOGIC DATA

Drainage Area = _____sq mi
Design Discharge (Q50) = _____cfs
Check Discharge (Q100) = _____cfs
Headwater Elev. (Q50) = _____ft
Headwater Elev. (Q100) = _____ft
Discharge Velocity (Q50) = _____fps
Discharge Velocity (Q100) = _____fps
Headwater Elev. (Q1.1) = _____ft
Discharge Velocity (Q1.1) = _____fps
Mean Lower Low Water (MLLW) = -X.XX ft
Mean Low Water (MLW) = -X.XX ft
Mean Tide Level (MTL) = X.XX ft
Mean High Water (MHW) = X.XX ft
Mean Higher High Water (MHHW) = X.XX ft
20__ Predicted High Tide = X.XX ft

(The following note is used only when a Coast Guard Permit is required, and should be the only note to be put on the plans in reference to permits.)

COAST GUARD PERMIT REQUIRED

D.2 General Construction Notes

1. All utility facilities shall be adjusted by the respective utilities unless otherwise noted.

2. For easements, construction limits, and right-of-way lines, refer to Right-of-Way Map.

3. During construction, the road will be closed to traffic for a time period specified in the Special Provisions.

4. Place a 2 foot wide strip of temporary erosion control blanket on the side slopes along the top of the riprap and behind the wingwalls.

5. All embankment material, except as otherwise shown, placed below Elevation XX, shall be granular borrow meeting the requirements of Subsection 703.19, Material for Underwater Backfill.

(The following note is used when the quantity of clearing is 20,000 ft^2 or less and is to be incidental to contract items.)

6. The clearing limits as shown on the plans are approximate. The exact limits shall be established in the field by the Resident. Payment for clearing will be incidental to related Contract items.

(The following note is used when the clearing quantity is more than 20,000 ft^2.)

7. The clearing limits as shown on the plans are approximate. The actual clearing limits for payment will be established in the field by the Resident.

8. Place loam 2 inches deep on slopes between Station XX and Station XX.

9. Do not excavate for Aggregate Subbase Course where existing material is suitable as determined by the Resident.

10. In areas where the Resident directs the Contractor not to excavate to the subgrade line shown on the plans, payment for removing existing pavement, grubbing, shaping, ditching, and compacting the existing subbase and layers of new subbase 6 inches or less thick will be made under appropriate equipment rental items.

(The following note is used when unscreened gravel such as aggregate subbase gravel is designated as surface material in the shoulders.)

11. Stones which cannot be rolled or compacted into the surface of the shoulder shall be removed by hand raking. Payment for hand raking will be considered incidental to Item 304.10 Aggregate Subbase Course - Gravel.

12. Two guardrail delineator posts shall be installed at each leading guardrail end and one at each trailing guardrail end.

13. Modified eccentric loader terminals shall be installed concurrently with the placement of each section of beam guardrail.

(The following note is used when Cable Guardrail is to be removed and retained by MaineDOT as part of the contract. The Designer should check with Bridge Maintenance to determine the need for retention.)

14. All hardware used on Cable Guardrail which is to be removed shall be carefully salvaged by the Contractor and will remain the property of the Department. Associated guardrail cable and posts shall become the property of the Contractor.

15. Extended-use erosion control blanket, seeded gutters, riprap downspouts, and other gutters lined with stone ditch protection shall be constructed after paving and shoulder work is completed, where it is apparent that runoff will cause continual erosion. Payment will be made under appropriate Contract items.

(The following note is used for Reduced Berm Offsets)

16. Guardrail post length and embedment as shown in the Standard Details shall be modified from the indicated 6 foot length to 7 feet, with 4'-6" of embedment.

17. Protective coating for concrete surfaces shall be applied to the following areas:

    All exposed surfaces of concrete curbs and sidewalks,
    Fascia down to drip notch,
    All exposed surfaces of concrete transition barriers,
    Concrete wearing surfaces,
    Concrete barrier railing,
    Top of abutment backwalls and to one foot below the top of backwalls on the back side.

18. Bark Mulch may be substituted in those areas normally receiving loam and seed as directed by the Resident. Placement shall be in accordance with Section 619 Mulch. Payment will be made under Item 619.1301 Bark Mulch.

[The following two notes are used in conjunction with Standard Detail 610(2-4).]

19. Place riprap on sideslopes up to elevation XX.

20. Construct the riprap shelf at each abutment at elevation XX.

(The following three notes are used as needed.)

21. Plans of the existing bridge are available for the Contractor's reference at the Bridge Program office in Augusta. The plans are reproductions of the original drawings as prepared for the construction of the bridge. It is very unlikely that the plans will show any construction field changes or any alterations, which may have been made to the bridge during its life span.

22. A hydrologic report of the bridge site is available for the Contractor's reference at the Bridge Program office in Augusta. The hydrologic report is based on the Department's interpretation of information obtained for the subject site. No assurance is given that the information or the conclusions of the report will be representative of actual conditions at the time of construction.

23. A bridge deck evaluation report of the existing bridge is available for the Contractor's reference at the Bridge Program office in Augusta. The report contains visual inspection information and deck core data of the bridge. There is no assurance that the information or data is a true representation of the conditions of the entire deck.

D.3 Standard Notes Abutments

1. Reinforcing steel shall have 2 inches cover in the walls and 3 inches cover in the footings unless otherwise noted.

2. Cover joints in accordance with Standard Detail 502 (01) where waterstops are not required.

3. Place 4 inch diameter drains in breastwall and wings at XX feet maximum spacing. Exact location to be determined by the Resident in the field.

4. Construct french drains behind the abutments and wings in accordance with Standard Specification Section 512, French Drains.

5. Structural Earth Excavation, Abutments and Retaining Walls, required below Elevation XX will be paid for at one and a half times the contract unit price for Item 206.081, Structural Earth Excavation.

6. Abutments, wings, and their footings shall be backfilled with granular borrow. Pay limits will be the structural excavation limits in cut areas and a vertical plane located 10 feet behind the walls and 1 foot behind the footings in fill areas.

7. Maximum calculated footing pressure is XX tsf.

(The following note is used with pile-supported integral abutments.)

8. Excavate a 2 foot diameter by one foot deep hole around the centroid of each pile. The depth is measured from the bottom of abutment elevation. Fill the hole with abutment concrete. Payment will be incidental to related Contract items.

D.4 Standard Notes Piles

1. Piles marked thus H→, shall be battered XX% in the direction of the arrow.

2. Maximum calculated pile loads: XX kips (including XX kips allowed for negative skin friction).

3. Estimate of piles required:

Abutment Number 1:	XX-HP XX x XX @ XX ft
Abutment Number 2:	XX-HP XX x XX @ XX ft
Pier Number 1:	XX-HP XX x XX @ XX ft
Pier Number 2:	XX-HP XX x XX @ XX ft

4. HP 13 x XX bearing piles may be substituted for HP 14 x XX (HP 12 x XX) bearings piles at the option of the Contractor.

(The following note is used for integral abutments with steel stringers.)

5. Piles shall not be out of position shown by more than 2 inches in any direction.

(The following two notes are used for pile-supported foundations. The Geotechnical Designer will make a recommendation for their use or exclusion. The Structural Designer should determine the appropriate pay item and the Geotechnical Designer determine the number of dynamic tests.)

6. The Contractor shall perform and submit a wave equation analysis for review and acceptance by the Resident. The Contractor shall determine a stopping criteria based on the wave equation analysis. The stopping criteria shall include the blows per inch and the number of 1 inch intervals at which pile installation may be terminated. The cost of performing the wave equation analysis will be considered incidental to pay Item 501.92, Pile Driving Equipment Mobilization.

7. The ultimate capacity shall be the maximum calculated design load times 2.25 per LFD Specifications. The Contractor shall perform XX dynamic load test(s) to confirm the ultimate capacity of the piles. The dynamic test shall be performed on the first production pile driven.

8. All piles shall be equipped with a pile tip in accordance with Standard Specification Section 501.10, Prefabricated Pile Tips.

9. H-pile material shall be ASTM A572M Grade 50.

10. Pile pile material shall be ASTM A252 Grade 2 or 3.

D.5 Standard Notes Piers

1. Reinforcing steel shall have 3 inches minimum cover unless otherwise noted.

2. Maximum calculated footing pressure is XX tsf.

Design Criteria

1. Critical AASHTO Loading - Group XX.

2. Buoyancy - Water level assumed at Elevation XX.

3. Stream flow - Velocity of XX fps skewed at XX^{o} to longitudinal centerline of pier.

4. Wind - XX mph or XX psi.

5. Ice - Thickness X feet, pressure 100 psi at Elevation XX, 30% of nose force applied transverse to pier.

D.6 Standard Notes Seal Cofferdams

1. The seal concrete placement dimensions represent the minimum seal necessary for design and are not based on any particular sheet pile section.

2. The horizontal pay limit for seal concrete shall be to the dimensions shown on the plans. No additional payment will be made for concrete placed outside of these limits.

3. When sheet piling is used for seal cofferdams:

   a. Appropriate rolled corners shall be used.

   b. The inside face of the sheet piling shall be at or outside of the seal concrete dimensions shown.

4. The depth of the seal is set for a water elevation of XX. If the water elevation at the time of construction is higher, the depth of the seal shall be adjusted.

5. The Resident shall approve the method of placing dowels in the seal concrete.

D.7 Standard Notes Structural Steel

1. Camber ordinates as shown are computed to compensate for all dead load deflections and for the curvature of the finished grade profile.

2. No transverse butt-weld splices will be allowed in the flange plates or web plates within 10 feet or 10% of the span length (whichever is greater) from the points of maximum negative moment or maximum positive moment. Butt-weld splices in flanges shall be not less than 3 feet from transverse butt-welds in the web plates and no transverse web or flange butt-welds shall be located within 3 feet of other transverse welds (e.g. connection plates to web welds) on either flange or web. No transverse butt-weld splices will be allowed in areas of stress reversal.

3. Sections of flange plates or web plates between transverse shop splices or between a transverse shop splice and a field splice shall be not less than XX feet in length unless otherwise shown on the plans.

4. One longitudinal butt weld splice will be allowed in the web of the haunched sections of the girders. Feather edges between the longitudinal welds and the bottom flanges will not be allowed.

5. Bearing stiffeners shall be plumb after erection and dead loading of the structure. Intermediate web stiffeners may be either plumb or normal to the top flange.

6. Cross-frame or diaphragm connection plates may be either plumb or normal to the top flange.

(The following note is used only with designs using A709, Grade 50 or painted Grade 50W.)

7. Filler plates may be steel conforming to the requirements of A709, Grade 36.

8. The dimensions and elevations omitted from the Bottom of Slab Elevations table, the Camber Diagram, and the Stress Diagram will be provided to the Contractor for the structural steel option that has been selected.

9. At locations marked with an asterisk (*), the designated diaphragms shall be changed to a Type A (C) (D) diaphragm as required to accommodate the Contractor's deck placement sequence. No extra compensation will be allowed for any diaphragms so substituted, and any additional costs will be considered incidental to the Contract items.

10. Theoretical blocking is XX inch(es) at the centerline of bearing. Refer to Standard Details 502 (02) for blocking details.

(The following note is used when web depth is 6 feet or greater.)

11. Handhold bars shall be installed in accordance with the Plans and Standard Detail 504 (21-24).

(The following note is used when a single span rolled beam with 3" or more camber is used.)

12. The Contractor may substitute welded plate girders in place of the rolled beams shown on the plans, as approved by the Resident. The fabricator shall determine the plate thicknesses based upon the depth and moment of inertia of the rolled section.

D.8 Standard Notes Precast Concrete Superstructures

1. The Initial Force is XX kips per prestressing strand.

2. The top surface of the upper flange of the prestressed beams shall be raked to a surface roughness of plus or minus 1/4", except at locations corresponding to the blocking points. At these locations a flattened area of sufficient size shall be left to facilitate taking elevations for setting bottom of slab elevations.

3. The drilling of holes in the prestressed beams and the use of power-actuated tools on the beams will not be permitted.

4. Neoprene pads shall be either polychloroprene or natural polyisoprene of 50±5 Shore A durometer hardness, and shall conform to the requirements of Division 2, Section 18.2 of AASHTO Standard Specifications for Highway Bridges. Neoprene pads will not be paid for directly, but will be considered incidental to related Contract items.

5. Install a 1 inch diameter nonmetallic void drain in the bottom of each void at both ends.

6. Reinforcing steel shall have 2 inches minimum cover unless otherwise noted.

7. Post-tensioning strands shall be covered by a seamless polypropylene sheath, with corrosion inhibiting grease between the strands and sheath, for the full length of the strand except at the anchorage location.

8. The Contractor shall calibrate the jacking equipment as necessary to provide an anchorage of 38 to 41 kips after setting losses in each 0.6" diameter post-tensioning strand.

(The following note is used for all voided slab and butted box beam structures.)

9. Screed rails shall be installed to the elevation shown on the profile, adjusted for wearing course thickness and cross slope.

D.9 Standard Notes Superstructures

1. Form a 1 inch V-groove on the fascias at the horizontal joint between the curb and slab.

2. Reinforcing steel shall have a minimum cover of 2 inches unless otherwise noted.

3. Adjust reinforcing steel to fit around the bridge drains in a manner approved by the Resident. Do not cut transverse reinforcing bars.

(The following note is used for simple span structures.)

4. The superstructure slab concrete for each span shall be placed continuously and shall be kept plastic until the entire span has been placed.

(The following note is used for multiple span continuous structures with less than 250 yd^3 of deck concrete.)

5. The superstructure slab concrete shall be placed in one continuous operation and the concrete shall be kept plastic one complete span behind the span being placed.

(The following note is used for multiple span continuous structures with more than 250 yd^3 of deck concrete.)

6. Unless the superstructure slab concrete is placed in one continuous operation, the initial placement shall start at a simply supported end of the deck slab and shall terminate at the completion of a positive moment section. Successive placements shall proceed from the end of the previous placement, terminate at the completion of a positive moment section, and include two or more spans. The Resident shall approve the placement sequence of the superstructure slab concrete.

7. Concrete in a placement shall be kept plastic one complete span behind the span being placed. A minimum of 5 days shall elapse between successive partial placements.

(The following note is used with staged construction of CIP structural slabs.)

8. The formwork and its supports, over the full width of the structural slab, shall remain in place until a minimum of 48 hours has elapsed after placement of the final section of the slab. Removal of formwork for sections may then proceed and shall meet the requirements for form removal in Standard Specifications Section 502, Structural Concrete.

9. Mortar for bedding and for joints in the granite curb shall contain an approved non-shrink additive.

(The following two notes are used for seals where applicable. Seal types required should be noted on the plans. When compression seals are used, a Compression Seal Adjustment Chart should be shown on the plans)

10. The seals to be furnished shall have a minimum Movement Rating of:

    Abutment Number 1 = XX

    Abutment Number 2 = XX

11. The Resident shall approve the seals prior to fabrication of the joint armor.

(The following two notes are used when Precast Deck Panels are allowed.)

12. At the Contractor's option, Precast Deck Panels may be used in place of the full depth cast-in-place slab in accordance with Special Provision 502, Structural Concrete - Precast Deck Panels, and in accordance with the Standard Details.

13. Payment for the reinforcing steel fabricated, delivered, and placed in the cast -in-place portion of the structural concrete slab will be considered incidental to the appropriate 502 item.

14. The theoretical blocking used for design of the structure is XX inch(es) at the centerline of bearings of the abutments and piers. See Standard Detail 502 (2) for blocking details.

D.10 Standard Notes Elastomeric Bearings

1. The shear modulus shall be between 100 and 130 psi.

2. Vulcanizing elastomer to steel plates shall be done during the primary mold process.

(The following two notes are used when anchor rods are required.)

3. Upset the threads on the anchor rods after assembly.

4. Anchor rods shall meet the requirements or ASTM F1554, Grade XX, and swedged on the embedded portion of the rod

5. Bearings shall be covered during transit.

6. The masonry plate, sole plate, anchor bolts, and shear pin shall meet the requirements of ASTM A709, Grade 50W.

7. The bearings are designed so that the superstructure may be erected when the ambient air temperature is within the range of 65^{o}F and 90^{o}F.

8. The masonry plate shall be hot dip galvanized or metallized.

9. All bearings shall be marked prior to shipping. The marks shall include the bearing location on the bridge, and a direction arrow that points up-station. All marks shall be permanent and shall be visible after the bearing is installed.

10. All precautions necessary shall be taken to protect bearing components from field weld flash and spatter. Welding procedures shall be established by the Contractor to restrict the maximum temperature of steel adjacent to the elastomer to 200^{o}F through use of temperature indicating crayons or other suitable means.

D.11 Standard Notes HLMR Bearings

1. Refer to the Special Provisions for design, materials, fabrication, and general construction requirements.

2. The actual dimension “H” shall be the responsibility of the Contractor. Dimensions and sizes of plates not shown are dependent on design loads, bearing type, capacity, and the manufacturer of the bearings. The shop drawings, prepared by the manufacturer, shall provide all pertinent bearing information. The final bridge seat elevations shall be determined by the Contractor and submitted with the shop drawings for approval prior to construction of the substructure units.

3. Masonry plates shall be placed on 1/4” thick preformed pads in accordance with the specifications.

4. All steel, except anchor rods, shall be AASHTO M270, Grade 70W.

5. Anchor rods shall meet the requirements or ASTM F1554, Grade XX, and swedged on the embedded portion of the rod.

6. Anchor bolt spacing shall be coordinated with the bearing manufacturer.

7. Bearing installation shall be in strict conformance with the Special Provisions and the manufacturer’s recommendations.

8. The abbreviation “PTFE” indicates polytetraflouroethylene.

9. The design temperature range shall be 150°F (-30°F to 120°F)

10. At abutment bearings only, all steel located below the PTFE sliding surface shall be coated in accordance with Special Provision, Section 506, Protective Coating-Steel (Thermal Spray Coating). All remaining steel at abutment bearings shall be coated in accordance with Special Provision, Section 506, Protective Coating-Steel (Zinc Rich System).

11. All bearings shall be marked prior to shipping. The marks shall include the bearing location on the bridge, and a direction arrow that points up-station. All marks shall be permanent and shall be visible after the bearing is installed.

(The following note is used if applicable.)

12. Bearings need not be designed with hold-downs.

D.12 Standard Notes Structural Plate Structures

1. One XX inch diameter Structural Plate Pipe is required. Top plates shall be XX inches thick; bottom (three) plates(s) shall be XX inches thick. The pipe shall be elongated 5% vertically.

2. One XX'-XX" span by XX'-XX" rise Structural Plate Pipe Arch required. Top plates shall be XX inches thick; bottom and corner plates shall be XX inches thick.

3. Ends shall be cut on a 1:1.75 bevel normal to the end skew shown on the details.

4. Riprap adjacent to the pipe shall be carefully placed so as not to damage the pipe (pipe arch) and so that the finished slope will match the ends of the pipe. Any extra labor, material, or equipment used will be considered incidental to Item 610.08, Plain Riprap.

5. Place a 2 foot wide temporary erosion control blanket along the top of the riprap and over the pipe (pipe-arch). Typical at both ends of pipe (pipe-arch).

(The following two notes are used for aluminum pipe or pipe arch.)

6. End reinforcement devices shall be of aluminum and shall be of sufficient strength to provide a minimum section modulus, about an axis perpendicular to the center of the pipe of 1.10 in^3/ft of pipe circumference. Maximum spacing of the devices shall be 5'-5". Attachment to the pipe shall be with 3/4" galvanized steel bolts. Section properties and details of the device and the method of attachment shall be submitted to the Resident for approval.

7. Payment for end reinforcement devices will be considered incidental to Item 509.XX, Aluminum Alloy Structural Plate (Pipe) Arch.

D.13 Standard Notes Drilled & Anchored Bolts and Reinforcing Steel

1. The anchoring material shall be one of the products listed on the Maine Department of Transportation List of Prequalified Type XX Anchoring Materials. Installation shall be in accordance with the Manufacturer's recommendations.

(The following note is used for Type 1 anchors when bolts are size 7/8" or greater.)

2. For drilling and anchoring bolts size 7/8" or greater, the anchor material chosen from the prequalified list shall be submitted to the Resident for approval.

(The following note is used for Type 3 anchors when reinforcing bars are size #9 or greater.)

3. For drilling and anchoring reinforcing bars size #9 or greater, the anchor material chosen from the prequalified list shall be submitted to the Resident for approval.

D.14 Standard Notes Precast Concrete Arches or Boxes

(The following note is used if applicable.)

1. The precast units shall be designed to carry construction loadings with a minimum fill cover of 1’-6” on top of the units.

2. The construction, handling, and assembly of the precast units shall be in accordance with Special Provision Section 534 Precast Structural Concrete, and with the Manufacturer’s Specifications as applicable.

3. Install membrane waterproofing over the top and to 1 foot down the exterior sides of the precast units.

D.15 Standard Notes Prefabricated Concrete Modular Gravity Wall

1. The Contractor shall provide a Prefabricated Concrete Modular Gravity (PCMG) wall in accordance with Special Provision 635. The PCMG shall be designed and stamped by a Registered Professional Engineer and the design shall be submitted to the Resident for review. Plan Details are shown for estimating purposes only.

2. The precast units shall be manufactured by the following, or equal: "T-Wall" as manufactured by Superior Concrete Co., Inc. of Auburn, Maine, or DoubleWal as manufactured by a licensed manufacturer of DoubleWal Corp., Plainville, Connecticut.

3. The applied bearing pressure for the PCMG wall shall not exceed XX tsf.

(The following note is used when the bridge passes over salt water.)

4. The PCMG wall shall consist of LP concrete and epoxy-coated rebar.

(The following note is used when cofferdams are required.)

5. Cofferdam for the PCMG wall installation shall be included with Pay Item 511.07 – Cofferdam.