NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
6/24/2018	Section 2.1 Replace all pages.	Section 2.1.2, page 2.1-1	**Revised 1st paragraph:** **To:** *AASHTO, Subcommittee on Transportation Communications has published a website that provides resources:* *https://bridges.transportation.org/* *Bridge terms can be found at the following websites:* *http://sdrc.lib.uiowa.edu/eng/bridges/WaddellGlossary/GlossA.htm .* *https://bridgemastersinc.com/breaking-down-essential-parts-of-a-bridges-structure/* **From:** ~~AASHTO, Subcommittee on Transportation Communications has published a website that provides bridge terms definitions, frequently asked questions, bridge statistics, facts, and other resources. The website can be found at: http://www.iowadot.gov/subcommittee/bridgeterms.aspx.~~	Link had changed.
6/24/2018	Section 2.4 Replace all pages.	Section 2.4.1, page 2.4-1, 3	**General** **Revised C. Bridge Geometry Guidelines Note 4)** **Added:** *If the shoulder is 10-ft. (3-m) or greater, two breaks can be shown on the deck section to match approach cross-slopes.* **Revised C. Bridge Geometry Guidelines Note 18)** **To:** *18) Bridge sidewalks shall have a minimum width of 6'-0" (1.8-m) measured from the face of the curb to the face of the rail, unless approved otherwise by the Design Chief. The sidewalk cross-slope shall have a minimum of 1-in. (25-mm) wash for widths up to 6-ft. (1.8-m) and 1.5-in (38-mm) wash for widths 7-ft. to 12-ft. (2-m to 3.7-m) [1% min., 2% max. per ADA requirements].* **From:** ~~18) Bridge sidewalks shall have a minimum width of 6'-0" (1.8-m) measured from the face of the curb to the face of rail. The sidewalk cross-slope shall have minimum of 1% and a maximum of 2% in accordance with ADA requirements.~~	Clarified bridge deck superelevation shoulder breaks. The Bureau of Construction stated that the concrete deck screed machine can now handle 2 breaks in the shoulder when the widths are 10' and greater. Clarifed sidewalk cross-slope.

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
		Section 2.4.3, page 2.4-7	**E. Vertical Clearances** **Added:** *• NH Title XXXIV – Public Utilities RSA 373:39 (railroad under all roads) 22'-0" (6.7-m)*	
		Section 2.4.4, page 2.4-8	**Water Crossing** **Revised C. Vertical Clearances, 3rd paragraph** **To:** *Floodway vertical clearance shall be in accordance with Section 2.7, Bridge Hydraulic Study. The roadway profile and the bridge superstruce depth must accommodate this. The acutal minimum vertical clearance to the design flood and approximate location shall be shown ((to the nearest 0.1-ft. [0.03-m]) on the elevation and plan view.* **From:** ~~Floodway vertical clearance shall be based upon design flood requirements plus 1-ft. (0.3-m) of freeboard, unless otherwise approved, and in accordance with Section 2.7, Bridge Hydraulic Study. The roadway profile and the bridge superstructure depth must accommodate this. The actual minimum vertical clearance to the design flood and approximate location shall be shown (to the nearest 0.1-ft. [0.03-m]) on the elevation and plan view.~~	The vertical clearance is specified in Section 2.7.
		Section 2.4.7, page 2.4-11	**Inspection and Maintenance Access** **Added 3rd paragraph** *As noted in Appendix 2.4-A3, the inspection bucket truck (Snooper) can only lift the bucket 8-ft. (2.4-m) above the reference surface. If a security fence is placed on the bridge, the Snooper can place the bucket outside the bridge prior to driving onto the bridge and continue across the bridge to perform the inspection. However, if the bridge has light poles, the Snooper cannot continue across the bridge because the boom will hit the light pole. If the only way the bridge can be inspected is by the Snooper Bucket truck, then the designer needs to design/layout the bridge so truck can access the underside of the bridge.*	Designers are to be aware of limits of the Snooper truck when laying out the bridge elements.

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
6/24/2018	Section 2.6 Replace all pages.	Section 2.6.4, page 2.6-2	**Abutment, Pier and Wall Surfaces** **Revised B. Concrete Form Liners 2nd paragraph** **To:** *SC Ashlar No. 1515 cut ashlar stone in radom pattern form liner manufactured by Spec Formliners, Inc.* **From:** ~~Ashlar Cut Stone No. 460 form liner manufactured by Greenstreak or an approved equal that matches the MSE wall form liner (Ashlar Stone No. 15006 manufactured by Fast Formliner).~~	Updated form liner name because MSE wall manufacturer Reinforced Earth (manufacturer of most MSE walls for projects) changed the form liner they use for NHDOT projects.
6/24/2018	Section 2.7 Replace all pages.	Section 2.7.1, p. 2.7-1	Revised 4th paragraph **Added sentence:** *The degree of analysis and report documentation shall correspond with the complexity of the project, see Section 2.7.2 for guidance.*	Clarified the degree and method of analysis for hydrologic design depending the complexity of a project.
		Section 2.7.2, p. 2.7-2, 3	**Added** the following paragraphs: *Required Documentation Levels:* *The degree of analysis required for the hydrologic and hydraulic design will be determined by the Design Chief on a project-by-project basis and noted in the scope of work for Consultant projects. The following is a guide as to the level of documentation that will be expected:* *Level 1:* *Projects that do not impact the substructure, lower the low chord elevation, or place material within the channel (temporarily or permanently), and have no history of flooding do not require any further hydrologic or hydraulic analysis. A brief summary to this effect along with existing hydraulic data shall be included in the Project File.* *Level 2:* *For projects with bridge spans less than 20-ft. that involve enlarging the waterway opening and are located on streams without FEMA base flood elevations, a single-section analysis as noted in Section 2.7.6D is sufficient unless there are other complicating factors (such as suspected backwater, complex geometry, or impoundments within the reach). A hydraulic design report documenting the change to the crossing shall be completed as noted in Appendix 2.7-A9 and A10.*	Clarified the degree and method of analysis for hydrologic design depending the complexity of a project.

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
			Level 3: *For projects with bridge spans greater than 20-ft. that involve enlarging the waterway opening, crossings with a history of flooding, known or suspected backwater conditions, fill placed within the channel or the FEMA floodway, or when there is a change in the type of conveyance and are located on streams with FEMA base flood elevations, a full step-backwater hydraulic analysis (1-D model) such as HEC-RAS shall be performed single section analysis as noted in Section 2.7.6DE is sufficient provided the FEMA Floodplain Compliance is met. Output obtained from the FEMA modeling may also be used for scour calculations. A hydraulic design report documenting the change to the crossing shall be completed as noted in Appendix 2.7-A9 and A10.* *Level 4:* *For projects that involve complex geometry (e.g., skews greater than 30 degrees, mulitple embankment openings, multiple channels, multiple bridge openings), wide floodplains, large tidal waterways, significant roadway overtopping, or upstream controls, crossings with a history of flooding, known or suspected backwater conditions, fill being placed within the channel or the FEMA floodway, or when there is a change in the type of conveyance (e.g., over a roadway to within the channel), a full step-backwater hydraulic analysis (2-D model) shall be performed per Section 2.7.6E. A hydraulic design report documenting the change to the crossing shall be completed as noted in Appendix 2.7-A9 and A10.*	

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
		Section 2.7.5, p. 2.7-7	**Hydrologic Analysis A. Design Frequency: Added 5th paragraph** *The purpose of the 500-year check flood (1% exceedance probability) for bridge structures is to ensure the safety of the structure and any downstream development by identifying any risk to life or property in the event of capacity exceedance. The intent is to investigate where the overflow travels, not to require the 500-year flood to pass through the structure. The investigation shall also include the assessment of tailwater. The effects of the 500-year check flood shall be documented in the Hydraulic Report. The report shall document all the effects and if the effects shall be remediated or why they cannot be remediated. Bridge importance as noted in Chapter 4, Section 4.2.2 Load Modifiers, shall also be considered if the 500-year check flood has impacts to the bridge and substructure. Discuss with the Bridge Design Chief if the 500-year flood impacts the structure with an importance modifier of 1.05.*	Clarified the purpose of 500-year check flood.
		Section 2.7.6, p. 2.7-14	**Revised 3rd paragraph** **To:** *Bridge hydraulic studies shall be completed as early as possible during the alternatives analysis of a project. The scour analysis shall be performed once boring and preliminary design information is available. The degree of analysis and report documentation shall correspond with the complexity of the associated design, see Section 2.7.2 for guidance.* **From:** ~~Bridge hydraulic studies shall be completed as early as possible during the design phase of a project. The degree of analysis and report documentation shall be commensurate with the complexity of the associated design. Prior to the hydraulic analysis, the Design Chief will direct the designer the degree of analysis is required for the hydraulic design, on a project by project basis and noted in the scope of work for Consultant projects.~~	

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
		Section 2.7.6, p. 2.7-14, 15	**Revised 1) Freeboard: 1st paragraph** **To:** *Freeboard is defined as the vertical distance between the low chord elevation of the bridge superstructure and the design flood elevation.* **From:** ~~Freeboard is defined as the vertical distance between the low chord elevation of the bridge superstructure and the design flood elevation. A freeboard of 1.0-ft. (0.3-m) is the minimum for all types of superstructures. Closely evaluate the type and amount of debris and ice that would pass through the structure possibly requiring additional freeboard.~~ **Revised 1) Freeboard: 2nd paragraph** **To:** *The design flood elevation shall be the greater of the following, projected onto the upstream face of the bridge (BU, Figure 2.7.6-1):* *• Water surface elevation measured at cross section 3. Normally located at the toe of the upstream road embankment. This cross section should not be placed immediately upstream of the bridge deck. See Figure 2.7.6-1 and HEC-RAS Reference Manual for additional information.* *• Water surface elevation measured at cross section 4. Normally an upstream cross section where the flow lines are approximately parallel and the cross section is fully effective. The cross section shall be located a distance upstream of Section 3 equal to approximately one (1) [contraction ratio] times the length of the average embankment constriction. See Figure 2.7.6-1 and HEC-RAS Reference Manual for additional information.* **From:** ~~The minimum vertical opening (freeboard) at the upstream face of the bridge (BU, Figure 2.7.6-1) shall be the greater of the following flow depths applied at the upstream face of bridge; not the elevations projected onto the bridge:~~ ~~• Flow depth measured at cross section 3 plus 1-ft. (0.3-m). Normally located at the toe of the upstream road embankment. This cross section should not be placed immediately upstream of the bridge deck. See Figure 2.7.6-1 and HEC-RAS Reference Manual~~	Clarified freeboard definition and location for measurement. Changed the location to measure freeboard from the water surface elevation taken at cross section 3 or 4, which ever is greater. This is more conservative than measuring at the bridge using hydraulic depth. It was decided that it was difficult to determine the hydraulic depth at the bridge for the design flood since the WSE can be taken from HEC-RAS and most states measure using WSE. Therefore, since the freeboard elevation will be conservative, the 1-ft. freeboard can be lowered if there is no history of debris and/or ice or the freeboard can be measured using the hydraulic depth at the bridge instead of the WSE.

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
			~~for additional information.~~ ~~• Flow depth measured at cross section 4 plus 1-ft. (0.3-m). Normally an upstream cross section where the flow lines are approximately parallel and the cross section is fully effective. The cross section shall be located a distance upstream of Section 3 equal to approximately one (1) [contraction ratio] times the length of the average embankment constriction. See Figure 2.7.6-1 and HEC-RAS Reference Manual for additional information.~~ **Added 3rd paragraph 1) Freeboard:** *The vertical distance between the low chord elevation and the governing water surface elevation (freeboard) shall be a minimm of 1-ft. (0.3-m), unless determined otherwise by the Design Chief, depending if the bridge has a history of debris and/or ice. If 1-ft. (0.3-m) freeboard cannot be met and there is no history of debris and/or ice, the Design Chief may revise the method of measuring the freeboard (e.g., hydraulic depth instead of water surface elevation) or decrease the freeboard measurement.*	

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
		Section 2.7.7, p. 2.7-24, 25, 26	**C. Channel Protection:** **Revised 1st paragraph** **To:** *Riprap protection against scour damage shall be provided in the design of all bridge piers and abutments within the flood plain unless directed otherwise by the Design Chief. Embankment slopes adjacent to structures subject to erosion shall also be adequately protected.* **From:** ~~Riprap portection against scour damage should be provided in the design of all bridge piers and abutments. Embankment slopes adjacent to structures subject to erosion should also be adequately protected.~~ **Revised 2nd paragraph:** **To:** *Channel protection shall be designed in accordance with Hydraulic Engineering Circular HEC-23, Vol. 1 & 2, Bridge Scour and Stream Instability Countermeasures (http://www.fhwa.dot.gov/engineering/hydraulics/scourtech/counter.cfm), and NCHRP Report 568 Riprap Design Criteria (http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_568.pdf).* **From:** ~~Channel protection shall be designed in accordance with Hydraulic Engineering Circular HEC-23, Bridge Scour and Stream Instability Countermeasures (http://www.fhwa.dot.gov/engineering/hydraulics/scourtech/counter.cfm), and NCHRP Report 568 Riprap Design Criteria (http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_568.pdf).~~ **Revised 3rd paragraph, 1st sentence:** To: *Riprap consists of a layer or rock, placed in the channel and structure boundaries in a manner which produces a well-graded mass that will limit the effects of erosion.* **From:** ~~Riprap consists of a layer or facing of rock, dumped or hand-placed on channel and structure boundaries to limit the effects of erosion.~~ **Revised 4th paragraph, 1st sentence:** **To:** The designer shall determine the required d50 and depth of riprap in accordance to FHWA HEC-23, Vol. 1 & 2 publication.	Clarified rirap layout.

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
			From: ~~The designer shall determine the required d50 and depth of riprap in accordance to FHWA HEC-23 publication.~~ **Revised 6th paragraph, 1st sentence:** **To:** *For new or replacement bridges, the pier shall be designed with the foundations and piling designed for expected scour depths.* **From:** ~~For new or replacement bridges, the pier shall be designed with the foundations and piling extending below expected scour depths.~~ **Revised 10th paragraph** **To:** *Bank protection for abutments shall be provided up to the elevation of the design flow condition. Provide a 2-ft. minimum (0.6-m) wide top shelf on the slopes in front of the abutments. If directed by the Design Chief and feasible, a 5-ft. (1.5-m) wide shelf at the top of the slopes shall be provided in front of the abutments for future inspection access.* **From:** ~~Bank protection for abutments shall be provided up to the elevation of the design flow condition with 1-ft. (0.3-m) of freeboard. If feasible, provisions for future inspection access shall be provided on the slopes in front of the abutments by providing a 5-ft. (1.5-m) wide shelf at the top of the slopes, as directed by the Design Chief.~~	
		Section 2.7.8, p. 2.7-26	**Final Hydraulic Report & Contract Drawings** **Added to 1st paragraph:** *stamped by a P.E.*	

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
6/24/2018	Section 2.10 Replace all pages.	Section 2.10.1, p. 2.10-1	**Revised 1st paragraph:** **To:** *After an approved alternative, a boring request shall be prepared and submitted to both the Bureau of Materials and Research and the Design Services Section in the Bureau of Highway Design.* **From:** ~~After approval of the bridge TS&L by the Bridge Design Administrator, Commissioner's Office, and Hearing (if applicable), a boring request shall be prepared and submitted to both the Bureau of Materials and Research and the Design Services Section in the Bureau of Highway Design.~~	
6/24/2018	Section 2.11 Replace all pages.	Section 2.11.1, p. 2.11-1	**Revised 3rd paragraph:** **To:** *The topographical datum changed in 1988. The survey supervisor shall be contacted to determine whether the survey will use the 1929 or 1988 datum. If existing bridge plans dated prior to 1988 are used, then a request shall be made to obtain common benchmark elevations to confirm the differences in the change of datums. Also, there may be plans <u>after</u> 1988 that may still use the 1929 datum. Therefore, a request shall be made to obtain common bench mark elevations. The datum shall be noted on the plans.* **From:** ~~The topographical datum changed in 1988. The survey supervisor shall be contacted to determine whether the survey will use the 1929 or 1988 datum. If existing bridge plans dated prior to 1988 are used, then a request shall be made to obtain common benchmark elevations to confirm the differences in the change of datums.~~	
6/24/2018	Appendix 2.4-A2 Replace all pages.	Railroad Clearance Guidelines	**Revised clearance** from 23'-0" to 22'-6"	Match what is noted in the Bridge Manual
6/24/2018	Appendix 2.5-A1 Replace all pages.	Bridge Selection Guide	**Revised:** "Timber Deck" to " Longitudial Laminated Deck"	
6/24/2018	Appendix 2.6-A2 Replace all pages.	NHDOT Aesthetic Bridge Details - Bridge Railing	**Added:** Traffic Bridge Rail T4 Steel Rail	
6/24/2018	Appendix 2.9-A2 Replace all pages.	Slope-Intercept Bridge Costs per Square Foot	**Updated Tables**	Updated tables to current costs.

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
4/1/2016	Section 2.7 Replace all pages.	Section 2.7.5, page 2.7-10	**2) Checking Hydrologic Data:** **Revised a) Flood Insurance and Flood plain Studies:** **To:** *• Federal Emergency Management Agency (FEMA) Flood Insurance Studies (FIS and maps).* *o NH GRANIT Flood Insurance Study. This site is considered NH's "official" DFIRM repository and allows users to view the original FEMA flood maps in pdf as well as access other flood information specific to NH. This site also contains the flood insurance studies themselves as well as other backup information. The flood insurance studies are available at: http://www.granit.unh.edu/dfirms/index.html* *o New Hampshire GRANITView II web mapping application is available at : http://www.granit.unh.edu/data/onlinemapservices/mapservicesoverview.html* *This is a web based GIS application which allows you to view FEMA's flood insurance rate maps and overlay other GIS data layers such as water resources, roads, conservation lands, aerial photography, topography, etc. all on the same map* *o FIS reports and maps for NH can be found on the FEMA web site at: https://msc.fema.gov/portal. Hit on "Search All Products" to download the FIS reports.* *• USGS Flood Reports* *o Open file reports by the USGS have been developed, and in some cases, are available for download at: http://water.usgs.gov/floods/reports/index.html* **From:** ~~• Federal Emergency Management Agency (FEMA) Flood Insurance Studies (FIS).~~ ~~o FIS reports for NH can be found at: http://www.granit.sr.unh.edu/ or the FEMA web site (see references for link).~~ ~~• USGS Flood Reports~~ ~~o Open file reports by the USGS have been developed, and in some cases, are available for download at: http://water.usgs.gov/floods/reports/index.html~~	The link to the FEMA reports changed. Also added additional resource information: NH GRANITView web mapping.
4/1/2016	Chapter 2 References, Replace all pages.	page 2R-1, 2	Updated links for FEMA and NH GRANIT, NH Staatewide GIS Clearinghouse.	

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
3/11/2016	Section 2.4 Replace all pages.	Section 2.4.6, Page 2.4-11	**Added to last sentence of B. Live Load** *... in accordance to Section 501 of NHDOT Standard Specifications for Road and Bridge Construction and as noted on the plans.* **Added *C. Dead Load Deflection*** *For longer spans, the Designer should be aware that the magnitude of the dead load deflection and pin-hole sag of modular prefabricated panel bridge systems (i.e., Acrow, Mabey) may become undesirable from a rideability stand point. For high speed and high volume roadways (Tier 1 and 2), the Designer shall decide whether the use of "camber panels" or "compression panels", which compensate for the expected pin-hole sag and dead load deflection, shall be required. If panels are required, a note shall be placed on the Contract Plans*	Designer shall be aware of possible sag and deflection for modular prefabricated panel bridge systems.
2/8/2016	Section 2.4 Replace all pages.	Section 2.4.2, page 2.4-5	Added link to "Tiers Viewer"	
2/8/2016	Section 2.6 Replace all pages.	Section 2.6.4, page 2.6-2, 3	**Added 2nd paragrah in B. Concrete Form Liners** **Added** Figure 2.6.4-1	Clarification on form liner typically used.
2/8/2016	Section 2.7 Replace all pages.	Section 2.7.5, page 2.7-6	**Added:** "*(less than 10-ft. [3-m])* " to the last paragraph.	Clarification.

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
		Section 2.7.7, page 2.7-23,24	**Revised C. Channel Protection:** **Added paragraph:** "*The designer shall determine the required d50 and depth of riprap in accordance to FHWA HEC-23 publication. The specific gravity (weighted average) of processed aggregates from quarries across the state is 2.69, which results in a density of 168 lb/cf (2.69 tonnes/m3)* ." **Revised stone Items:** **To:** • *Item 583, Riprap* *o Riprap shall be quarry stone of approved quality, hard, durable, subangular to angular in shape, resistant to weathering and free from structural defects such as weak seams and cracks.* *o Riprap is required for erosion protection of bridge structures in waterways, for active waterway channel slopes and bottoms, and for intermittent waterway channels where the Engineer determines riprap protection is required to resist expected high water flow velocities or volumes.* *o The designer shall specify a minimum d50 (median stone diameter) for the rock comprising the riprap to correspond with standard classes as noted in the Table 1 of the Specification 583 and FHWA HEC-23 publication.* *Item 583.1 Riprap, Class I* *Item 583.3 Riprap, Class III* *Item 583.5 Riprap, Class V* *Item 583.5 Riprap, Class VII* *Item 583.9 Riprap, Class IX* *Item 585.X, Stone Fill, Class X shall only be used for highway work such as roadway slope protection and at drainage outlets. This item is no longer used for channel protection.* **From:** ~~• Item 583, Riprap~~ ~~o This item consists of field stone, quarry stone or rock fragments with 75% of the~~ ~~stone having a minimum volume range of 2 ft3 to 18 ft3.~~ ~~o This type of stone can be used if the channel protection design requires large~~ ~~stones.~~ ~~• Item 585.X, Stone Fill, Class X~~ ~~o This item consists of quarry stone or broken rock of hard, sound and durable~~ ~~quality. The stone and spalls are graded as to produce a dense fill with minimum~~ ~~voids.~~	Clarification. The existing stone specification items were not correctly being chosen for channel protection required nor installed correctly. Typically designers were using Item 585.21 Stone Fill, Class B (Bridge) without consideration of the river velocity or scour countermeasures. At times Keyed Stone Fill was called for in the contract but just dropped along the river banks without keying in the stone. It was decided to revise the stone specifications to the following: 1) Replace existing Section 583, Riprap with the new Specification 583. (This is the only item that will be used for bridge channel protection.) 2) Keep Section 585, Stone Fill. (This item will be used for highway work such a slope protection and at drainage outlets.) 3) Remove Section 586, Placing Excavated Rock. (No one uses this item.) 4) Remove Section 587, Keyed Stone Fill. (Parts of this specification was combined with Item 583 to create one new item for channel protection.) For channel protection, the designer now determines the required stone diameter and depth of stone protection for the river/stream.

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
			~~o Class A consist of irregular shape with 50% of mass having a minimum volume of 12 ft3.~~ ~~o Class B consists of irregular shape with 50% of mass having a minimum volume of 3 ft3.~~ ~~o Class C consists of clean durable fragments of uniform quality ledge rock graded as noted in the Standard Specifications.~~ ~~• Item 587.1, Keyed Stone Fill~~ ~~o This item consists of stone that is hard, durable, and angular in shape, having a gradation as noted in the Standard Specifications.~~ ~~o Keyed stone fill is difficult to place and shall only be used if design requires this type of stone size and placement.~~ **Revised Figure 2.7.7-1:** Revised stone item number to Item 583.X	
2/8/2016	Section 2.9 Replace all pages.	Section 2.9.1, page 2.9-1	Revised Slope Intercept Method Formula: **To:** Overpasses: L = SPAN + [(2 x slope) x (finished grade overpass to finished grade underpass)]/ cosine(skew) Stream Crossings: L = SPAN + [(2 x slope) x (finished grade overpass to top of stone elev. at face of abut.)]/ cosine(skew) Slope value examples = 1.5 for 1.5:1 slope, 2 for 2:1 slope skew angle = angle formed between a line perpendicular to the centerline of the roadway and the centerline of abutment. **From:** ~~o (Span) + [4 x (finished grade to finished grade) x (secant of skew angle)] for overpasses~~ ~~o (Span) + [3 x (streambed to finished grade) x (secant of skew angle)] for stream crossings~~ ~~The skew angle is the angle formed between a line perpendicular to the centerline of roadway and the face of abutment or edge of stream.~~	Clarificaiton.

NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

BUREAU OF BRIDGE DESIGN

BDM CHAPTER 2 - REVISION HISTORY

Date of Revision	Action	Location of Change	Revision Description	Background
2/8/2016	Appendix 2.2-A2 Replace all pages.	page 2.2-A2-1	**Added:** "*Drive Detour* " check box. **Revised:** "Signals" to "*Existing Signals* "	Clarification.
2/8/2016	Appendix 2.9-A1 Replace all pages.	page 2.9-A1-1, 2	**Revised** Slope-Intercept Method equation to the same revision as noted in Chapter 2, Section 2.9.1. **Revised** diagram.	Clarification.