



Illinois Department of Transportation

Memorandum

To: ALL BRIDGE DESIGNERS
From: D. Carl Puzey
Subject: Revised Scour Design Policy
Date: November 7, 2014

14.2

A handwritten signature in blue ink, reading "D. Carl Puzey".

Changes to HEC-18, "Evaluating Scour at Bridges", released by FHWA in April 2012, have prompted revisions to the Department's scour design policy. In addition, the Bureau of Bridges and Structures is now responsible for approving the Scour Critical Evaluation Rating, Illinois Structure Information System (ISIS) Item 113. This memorandum describes these changes and provides guidance to planners and designers regarding this new policy which applies to all state and local agency maintained structures over waterways with the exception of box culverts.

Changes to Extreme Event II Check Flood - When designing for the Extreme Event II limit state, the check flood scour depth for routine bridges in Illinois shall be determined using the Q200 flood, rather than the Q500 flood referred to in the AASHTO LRFD Bridge Design Specifications. The scour depths shall continue to be adjusted for soil or rock type per the Bridge Manual and the Strength and Service limit state design scour depths shall continue to be determined using the Q100 flood.

While the Q100 and Q200 floods are generally expected to produce the maximum scour depths needed for design, the presence of roadway overtopping may result in lesser floods producing deeper scour depths. When maximum design scour depths are caused by floods less than Q100 and/or Q200, the maximum scour depths shall be used in lieu of the Q100 and/or Q200 scour depths.

District Hydraulic Engineers have been informed of the scour policy change and were directed to provide Q200 flood data in Hydraulic Reports initiated after April 30, 2013. Due to the lead time between preparation and approval of the hydraulic report and the initiation of the TS&L, planners and designers may continue to use Q500 flood data to determine the check flood scour elevation if Q200 flood data is not available.

Determination of the ISIS Item 113 Rating - The scour critical evaluation ISIS Item 113 rating is based on the relationship between the Q100 scour elevation and the foundation. The bridge planner shall determine the ISIS Item 113 rating for the proposed structure. The bridge designer shall verify the Item 113 rating after the design is complete. Any required changes to the approved rating shall be reported to the Bureau of Bridges and Structures Bridge Planning Unit or Local Bridge Unit for verification.

Attachments A, B and C have been included to provide guidance on determining the appropriate design and check scour elevations, as well as the appropriate Item 113 rating for new or total replacement structures, rehabilitation of existing structures designed using ASD and LFD, and rehabilitation of existing structures designed using LRFD.

While foundation elevations should be located in accordance with the Bridge Manual, consideration may be given to lowering a foundation elevation if scour, economics, constructability or environmental concerns exist. Unless otherwise noted, ISIS Item 113B – Scour Critical Evaluation Method shall be A – Analytical method.

For new or total replacement structures, only ratings of 5, 8 or 9 are allowed. For projects reusing existing substructures, typically only ratings of 5, 7, 8 or 9 are allowed. Consult the Bureau of Bridges and Structures in circumstances where this cannot be met.

A completed copy of the Scour Critical Evaluation Coding Report, Form BBS SCE, shall be included in the TS&L or Preliminary Bridge Design and Hydraulic Report submittal package. Determination of Item 113 shall follow the guidance provided in the attachments.

For all piers where significant debris collection is expected, engineered scour countermeasures should be considered as part of the project, regardless of the Item 113 rating. For all structures where the Design Flood provides less than one foot of vertical clearance or where the Q100 flood inundates the low beam, engineered scour countermeasures should be considered as part of the project.

If ice forces are considered in the design of piers per Section 3.9.3.5 of the Bridge Manual, the structure shall also satisfy the Extreme Event II limit state with IC - Ice Load. The scour depth for this condition shall be equal to the lower of the design scour elevation or the midpoint between the finished ground line and the check scour elevation.

New Scour Design Table - The revised Design Scour Table shown below has been developed and shall be used in place of Table 2.3.6.3.2-1 and Table 2.3.6.3.2-2 currently shown in the Bridge Manual. The Design Scour Elevation Table will no longer be required for closed bottom box culverts.

Event/Limit State	Design Scour Elevations (ft.)				Item 113
	W. Abut.	Pier 1	Pier 2	E. Abut.	
Q100					
Q200					
Design					
Check					

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The new table documents the soil adjusted calculated scour, the design and check scour as well as the ISIS Item 113 rating. It shall be placed near the Waterway Information Table on the TS&L plan and on the general plan and elevation sheet of the final design plans.

This policy is effective immediately and should be incorporated in all prefinal plans and Preliminary Bridge Design and Hydraulic Reports that have not yet been approved.

For questions or concerns, please contact Patrik Claussen at (217) 782-2125 or Jack Elston at (217) 782-5928.

PDC/kktABD14.2RevisedScour-20141107

Attachment A

Design and Check Scour Elevations for New Structures

All new structures over waterways shall be planned such that the Item 113 rating is 5, 8 or 9. For single span bridges with closed abutments and for multiple span bridges, the lowest Item 113 rating of the individual substructure units shall be used for the structure rating. Unless otherwise noted, ISIS Item 113B – Scour Critical Evaluation Method shall be A – Analytical method.

When maximum design scour depths are caused by floods less than Q100 and/or Q200 due to overtopping, the maximum scour depths shall be used in place of the Q100 and/or Q200 scour depths.

Spill Through Abutments

Spill through abutments shall be protected by riprap or slopewall in accordance with the Bridge Manual. The design and check scour elevations shall be the bottom of the cap. The Item 113 rating shall be 8. The Item 113B rating shall be B (rational analysis).

Spread Footings

Spread footings shall have the design and check scour elevations located at the bottom of footing elevation. The Item 113 rating shall be 8 if the calculated Q100 scour elevation is above the top of the footing or 5 if the calculated Q100 scour elevation is below the top of the footing.

The use of spread footings in non-scour resistant material is not recommended and requires prior approval from the Bureau of Bridges and Structures. If allowed, the bottom of footing shall be located at least 1 foot below the calculated Q200 scour elevation.

Pile Supported Footings

For pile supported footings, the design scour elevation shall be the lower of the bottom of the footing and the calculated Q100 scour elevation. The Item 113 rating shall be 8 if the calculated Q100 scour elevation is above the top of the footing or 5 if the calculated Q100 scour elevation is below the top of the footing.

The check scour elevation shall be the lower of the bottom of the footing and the calculated Q200 scour elevation.

Engineered scour countermeasures designed for the Q200 flood are required if the calculated Q100 scour elevation is below the bottom of the footing unless approved otherwise by the Bureau of Bridges and Structures.

Drilled Shaft Supported Footings

For drilled shaft supported footings, the design scour elevation shall be the lower of the bottom of the footing and the calculated Q100 scour elevation. The Item 113 rating shall be 8 if the calculated Q100 scour elevation is above the top of the footing or 5 if the calculated Q100 scour elevation is below the top of the footing.

The check scour elevation shall be the lower of the bottom of the footing and the calculated Q200 scour elevation.

Pile Bent Piers and Solid Wall Encased Drilled Shaft Bent Piers

For pile bent piers, the design scour elevation shall be the lower of the bottom of the pile encasement and the calculated Q100 scour elevation. If the calculated Q100 scour elevation is within 6 feet of the finished ground line, the Item 113 rating shall be 8. If the calculated Q100 scour elevation is 6 feet or greater below the finished ground line, the Item 113 rating shall be 5.

The check scour elevation shall be the lower of the bottom of the pile encasement and the calculated Q200 scour elevation.

Engineered scour countermeasures designed for the Q200 flood should be considered if the calculated Q100 scour elevation is below the bottom of pile encasement or 6 feet or greater below finished ground line.

Individual Drilled Shaft Bent Piers

For drilled shaft bent piers, the design scour elevation shall be the calculated Q100 scour elevation. If the calculated Q100 scour elevation is less than 6 feet below the finished ground line, the Item 113 rating shall be 8. If the calculated Q100 scour elevation is 6 feet or greater below the finished ground line, the Item 113 rating shall be 5.

For drilled shaft bent piers, the check scour elevation shall be the calculated Q200 scour elevation.

Footings and pile encasements should not be lowered solely for the purpose of achieving an Item 113 rating of 8. Engineering judgment and economics should be used to determine if a foundation elevation lower than current Bridge Manual policy is warranted.

If the required riprap size to mitigate the Q200 flood is larger than A5, the designer shall contact the Bureau of Bridges and Structures for further guidance.

Table A - Design and Check Scour Elevations for New or Total Replacement Structures

Foundation Type	Calculated Q100 Scour Elev.	Design Scour Elev.	Check Scour Elev.	Item 113	Notes
Spread Footing in scour resistant material (rock)	Above top of footing	Bottom of footing	Bottom of footing	8	
	Within footing thickness			5	
Spread Footing in non-scour resistant material	Above top of footing	Bottom of footing	Bottom of footing	8	A
	Within footing thickness			5	
Pile supported footing	Above top of footing	Bottom of footing	Lower of calculated Q200 scour elevation and bottom of footing	8	B
	Below top of footing	Lower of the calculated Q100 scour elevation and bottom of footing		5	
Drilled shaft supported footing	Above top of footing	Bottom of footing	Lower of calculated Q200 scour elevation and bottom of footing	8	
	Below top of footing	Lower of the calculated Q100 scour elevation and bottom of footing		5	
Pile bent piers	Less than 6 feet below the finished ground line	Lower of the calculated Q100 scour elevation and bottom of encasement	Lower of the Q200 scour elevation and bottom of encasement	8	C
	6 feet or greater below the finished ground line			5	
	Less than 6 feet below the finished ground line			8	
Drilled shaft bent piers	6 feet or greater below the finished ground line	Calculated Q100 scour elevation	Calculated Q200 scour elevation	8	
	Less than 6 feet below the finished ground line			5	
Spill thru abutments	Not calculated	Bottom of cap	Bottom of cap	8	D, E

Table A Notes:

- A) Spread footings in non-scour resistant material shall be located such that the bottom of the footing is at least 1 foot below the calculated Q200 scour. Engineered scour countermeasures are required and shall be designed for the Q200 flood. The use of spread footings in non-scour resistant material requires prior approval from the Bureau of Bridges and Structures.
- B) Engineered scour countermeasures are required and shall be designed for the Q200 flood unless otherwise approved by the Bureau of Bridges and Structures.
- C) Engineered scour countermeasures designed for the Q200 flood should be considered if the Q100 scour is below the bottom of pile encasement or greater than 6 feet below finished ground line.
- D) Bridge abutments with embankment cones shall be protected by slopedwall or engineered countermeasures.
- E) ISIS Item 113B Scour Evaluation Rating Method shall be B – Rational Analysis

Attachment B

Design Scour Elevations for Existing Structures Designed Using ASD or LFD

All structure projects over a waterway incorporating existing substructures designed using ASD or LFD and requiring a Type, Size and Location plan or a Preliminary Bridge Design Hydraulic Report shall be evaluated for scour due to the Q100 flood using current hydraulic methods. The check flood is not used for ASD or LFD design and the requirement to satisfy the extreme event does not apply. The projects shall be planned such that the Item 113 rating is 5, 7, 8 or 9 in the final condition. Under special circumstances and with concurrence of the Bureau of Bridges and Structures, scour critical substructure units may be allowed to remain scour critical subject to the requirements herein.

Previous hydraulic analyses may not reflect current hydraulic data or modeling methods, and the current practice of using soil type adjustment factors in the scour depth calculation may not have been used in older ratings. Consequently, existing structures may have Item 113 ratings inconsistent with current practice. Bridge planners should not assume the current recorded ISIS Item 113 rating is accurate.

The initial evaluation of the structure shall ignore existing scour countermeasures, if present. If the initial evaluation indicates the structure is not adequate for the Q100 flood, the design / construction of existing scour countermeasures, if present, shall be evaluated. If the countermeasures are satisfactory for the Q100 flood, the Item 113 rating shall be 7 and no remediation is required. Countermeasures that are not satisfactory for the Q100 flood shall be retrofitted to mitigate the Q200 flood unless otherwise approved by the Bureau of Bridges and Structures. If retrofitted, the Item 113 rating shall be 7. If not retrofitted, the Item 113 rating shall be 3 and documentation of acceptable past performance, a scour plan of action, and monitoring within the Department's BridgeWatch system is required.

Unless otherwise noted, ISIS Item 113B – Scour Critical Evaluation Method shall be A – Analytical method.

When maximum design scour depths are caused by floods less than Q100 and/or Q200 due to overtopping, the maximum scour depths shall be used in place of the Q100 and/or Q200 scour depths.

If the required riprap size to mitigate the Q200 flood is larger than A5, the designer shall contact the Bureau of Bridges and Structures for further guidance.

Spill Through Abutments

If a spill through abutment is protected by satisfactorily performing riprap or sloped wall, the design scour elevation shall be the bottom of the cap. The Item 113 rating shall be 8. The Item 113B Scour Critical Evaluation Method shall be B (rational analysis).

Spread Footings

Spread footings on scour resistant material (rock) shall have the design scour elevation at the bottom of footing. The Item 113 rating shall be 8 if the calculated Q100 scour elevation is above the top of the footing or 5 if the calculated Q100 scour elevation is below the top of the footing.

Spread footings on non-scour resistant material having a calculated Q100 scour elevation above the bottom of the footing shall have the design scour elevation at the bottom of footing. Engineered scour countermeasures designed for the Q200 flood are

required. The Item 113 rating shall be 8 if the calculated Q100 scour elevation is above the top of the footing or 5 if the calculated Q100 scour elevation is below the top of the footing.

Spread footings on non-scour resistant material having a calculated Q100 scour elevation below the bottom of footing shall have a design scour elevation at the bottom of footing. Engineered scour countermeasures designed for the Q200 flood are required. The Item 113 rating shall be 7.

Pile and Drilled Shaft Supported Footings

If the calculated Q100 scour elevation is above the top of the footing, the design scour elevation shall be the bottom of the footing. The Item 113 rating shall be 8.

If the calculated Q100 scour elevation is within the limits of the footing, the design scour elevation shall be the bottom of the footing. The Item 113 rating shall be 5.

If the calculated Q100 scour elevation is below the bottom of the footing and the Group I load combination is satisfied with all soil above the calculated Q100 scour elevation removed, the design scour elevation shall be the calculated Q100 scour elevation. Engineered scour countermeasures designed to satisfy the Q200 flood are required unless otherwise approved by the Bureau of Bridges and Structures. Documentation of acceptable past performance may be used to justify not providing countermeasures. The Item 113 rating shall be 5.

If the calculated Q100 scour elevation is below the bottom of the footing and the Group I load combination is not satisfied with all soil above the calculated Q100 scour elevation removed, the design scour elevation shall be the bottom of footing. Existing countermeasures, if present, shall be evaluated for the Q100 flood. If the countermeasures satisfy the Q100 flood, no remediation is required. Countermeasures that do not satisfy the Q100 flood shall be retrofitted to satisfy the Q200 flood. The Item 113 rating shall be 7.

All new countermeasures and extensions of existing countermeasures required for widened substructures shall be designed to mitigate the Q200 flood.

Bent Piers with Individually Encased Piles or Solid Wall Encased Piles or Drilled Shafts

If the calculated Q100 scour depth is less than 6 feet below the finished ground line and the Group I Load Combination is satisfied with all soil above the calculated Q100 scour elevation removed, the design scour elevation shall be the lower of the calculated Q100 scour elevation and the bottom of encasement. The Item 113 rating shall be 8.

If the calculated Q100 scour depth is 6 feet or greater below the finished ground line and the Group I Load Combination is satisfied with all soil above the calculated Q100 scour elevation removed, the design scour elevation shall be the lower of the calculated Q100 scour elevation and the bottom of encasement. Engineered scour countermeasures designed for the Q200 flood are required unless otherwise approved by the Bureau of Bridges and Structures. Documentation of acceptable past performance may be used to justify not providing countermeasures. The Item 113 rating shall be 5.

If the calculated Q100 scour depth is 6 feet or greater below the finished ground line and the Group I load combination is not satisfied with all soil above the calculated Q100 scour elevation removed, the design scour shall be set at the lower of the finished ground line and the bottom of encasement. Existing countermeasures, if present, shall be evaluated for the Q100 flood. If the countermeasures satisfy the Q100 flood, no

remediation is required. Countermeasures that do not satisfy the Q100 flood shall be retrofitted to satisfy the Q200 flood. The Item 113 rating shall be 7.

All new countermeasures and extensions of existing countermeasures required for widened substructures shall be designed to mitigate the Q200 flood.

Bent Piers with Individual Drilled Shafts or Exposed Piles

If the calculated Q100 scour depth is less than 6 feet and the Group I load combination is satisfied with all soil above the calculated Q100 scour elevation removed, the design scour elevation shall be the calculated Q100 scour elevation. The Item 113 rating shall be 8.

If the calculated Q100 scour depth is 6 feet or greater and the Group I Load Combination is satisfied with all soil above the calculated Q100 scour elevation removed, the design scour elevation shall be the calculated Q100 scour elevation. Engineered scour countermeasures designed for the Q200 flood are required unless otherwise approved by the Bureau of Bridges and Structures. Documentation of acceptable past performance may be used to justify not providing countermeasures. The Item 113 rating shall be 5.

If the Group I Load Combination is not satisfied with all soil above the calculated Q100 scour elevation removed, the design scour elevation shall be the finished ground line. Engineered scour countermeasures designed to satisfy the Q200 flood are required. Existing countermeasures, if present, shall be evaluated for the Q100 flood. If the countermeasures satisfy the Q100 flood, no remediation is required. Countermeasures that do not satisfy the Q100 flood shall be retrofitted to satisfy the Q200 flood. The Item 113 rating shall be 7.

All new countermeasures and extensions of existing countermeasures required for widened substructures shall be designed to mitigate the Q200 flood.

Table B - Design Scour Elevations for Existing Structures Designed Using ASD or LFD				
Foundation Type	Calculated Q100 Scour Elevation	Design Scour Elevation	Item 113	Notes
Spread Footing in scour resistant material (rock)	Above top of footing	Bottom of footing	8	
	Within footing thickness		5	
Spread Footing in non-scour resistant material	Above top of footing	Bottom of footing	8	A
	Within footing thickness		5	
	Below bottom of footing		7	A
Pile and drilled shaft supported footings	Above top of footing	Bottom of footing	8	
	Within footing thickness		5	
	Below bottom of footing (Group I load combination satisfied)		5	B
Bent piers with individually encased piles or solid wall encased piles or drilled shafts	Below bottom of footing (Group I load combination not satisfied)	Bottom of footing	7	C
	Less than 6 feet below the finished ground line (Group I load combination satisfied)		8	
	6 feet or greater below the finished ground line (Group I load combination satisfied)		5	B
Bent piers with individual drilled shafts or exposed piles	Below bottom of encasement (Group I load combination not satisfied)	Bottom of encasement	7	C
	Less than 6 feet below the finished ground line (Group I load combination satisfied)		8	
	6 feet or greater below the finished ground line (Group I load combination satisfied)		5	B
Spill thru abutments	Any depth (Group I load combination not satisfied)	Finished ground line Bottom of cap	7	C
	Not calculated		8	D,E

Table B Notes:

- A) Engineered scour countermeasures designed for the Q200 flood are required.
- B) Engineered scour countermeasures designed for the Q200 flood are required unless otherwise approved by the Bureau of Bridges and Structures.
- C) Engineered scour countermeasures required to mitigate the Q200 flood are required if countermeasures are not present. If countermeasures are present and mitigate the Q100 flood, no additional countermeasures are required. If countermeasures are present and do not mitigate the Q100 flood, the countermeasures shall be retrofitted to mitigate the Q200 flood.
- D) Bridge abutments with embankment cones shall be protected by satisfactorily performing countermeasures.
- E) ISIS Item 113B Scour Evaluation Rating Method shall be B – Rational Analysis

Attachment C

Design and Check Scour Elevations for Existing Structures Designed Using LRFD

All structure projects over a waterway incorporating existing substructures designed using LRFD and requiring a Type, Size and Location plan or Preliminary Bridge Design Hydraulic Report shall be evaluated for scour due to the design flood and check floods using current hydraulic methods. The design flood shall be the Q100 flood and the check flood shall be the Q200 flood. The projects shall be planned such that the Item 113 rating is 5, 7, 8 or 9 in the final condition. Under special circumstances and with concurrence of the Bureau of Bridges and Structures, scour critical substructure units may be allowed to remain scour critical subject to the requirements herein.

Previous hydraulic analyses may not reflect current hydraulic data or modeling methods, and the current practice of using soil type adjustment factors in the scour depth calculation may not have been used in older ratings. Consequently, existing structures may have Item 113 ratings inconsistent with current practice. Bridge planners should not assume the current recorded ISIS Item 113 rating is accurate.

The initial evaluation of the structure shall ignore existing scour countermeasures, if present. If the initial evaluation indicates the structure is not adequate for the Q100 flood, the design / construction of existing scour countermeasures, if present, shall be evaluated. If the countermeasures are satisfactory for the Q100 flood, the Item 113 rating shall be 7 and no remediation is required. Countermeasures that are not satisfactory for the Q100 flood shall be retrofitted to mitigate the Q200 flood unless otherwise approved by the Bureau of Bridges and Structures. If retrofitted, the Item 113 rating shall be 7. If not retrofitted, the Item 113 rating shall be 3 and documentation of acceptable past performance, a scour plan of action, and monitoring within the Department's BridgeWatch system is required.

If the required riprap size to mitigate the Q200 flood is larger than A5, the designer shall contact the Bureau of Bridges and Structures for further guidance.

Unless otherwise noted, ISIS Item 113B – Scour Critical Evaluation Method shall be A – Analytical method.

When maximum design scour depths are caused by floods less than Q100 and/or Q200 due to overtopping, the maximum scour depths shall be used in place of the Q100 and/or Q200 scour depths.

Spill Through Abutments

If a spill through abutment is protected by satisfactorily performing riprap or sloped wall, the design and check scour elevations shall be the bottom of the cap. The Item 113 rating shall be 8. The Item 113B Scour Critical Evaluation Method shall be B (rational analysis).

Spread Footings

Spread footings in scour resistant material (rock) shall have the design and check scour elevations located at the bottom of footing elevation. The Item 113 rating shall be 8 if the calculated Q100 scour elevation is above the top of the footing or 5 if the calculated Q100 scour elevation is below the top of the footing.

Spread footings in non-scour resistant material having a calculated Q100 scour elevation above the top of the footing and the calculated Q200 scour elevation above the bottom of the footing shall have the design scour and check scour elevations located at the bottom of footing. Engineered scour countermeasures designed for the Q200 flood are required. The Item 113 rating shall be 8 if the calculated Q100 scour elevation is above the top of the footing or 5 if the calculated Q100 scour elevation is below the top of the footing.

Spread footings in non-scour resistant material having either a calculated Q100 or Q200 scour elevation below the bottom of the footing shall have the design scour and check scour elevations located at the bottom of footing. Engineered scour countermeasures designed for the Q200 flood are required. The Item 113 rating shall be 7.

Pile and Drilled Shaft Supported Footings

If the calculated Q100 scour elevation is above the top of the footing and the appropriate limit states are satisfied for both the design and check events with all soil above the calculated Q100/200 scour elevation removed, the design scour elevation shall be located at the bottom of the footing. The check scour elevation shall be the lower of the calculated Q200 scour elevation and the bottom of footing. The Item 113 rating shall be 8.

If the calculated Q100 scour elevation is within the limits of the footing and the appropriate limit states are satisfied for both the design and check events with all soil above the calculated Q100/200 scour elevation removed, the design scour elevation shall be located at the bottom of the footing. The check scour elevation shall be the lower of the calculated Q200 scour elevation and the bottom of footing. The Item 113 rating shall be 5.

If the calculated Q100 scour elevation is below the bottom of the footing and the appropriate limit states are satisfied for both the design and check events with all soil above the calculated Q100/200 scour elevation removed, the design scour elevation shall be located at the calculated Q100 scour elevation. The check scour elevation shall be located at the calculated Q200 scour elevation. Engineered scour countermeasures designed to satisfy the Q200 flood are required unless otherwise approved by the Bureau of Bridges and Structures. Documentation of acceptable past performance may be used to justify not providing countermeasures. The Item 113 rating shall be 5.

If the calculated Q100 scour elevation is below the bottom of the footing and the appropriate limit states are not satisfied with all soil above the calculated Q100/200 scour elevation removed, the design scour and check scour elevations shall be located at the bottom of footing. Existing countermeasures, if present, shall be evaluated for the Q100 flood. If the countermeasures satisfy the Q100 flood, no remediation is required. Countermeasures that do not satisfy the Q100 flood shall be retrofitted to satisfy the Q200 flood. The Item 113 rating shall be 7.

All new countermeasures and extensions of existing countermeasures required for widened substructures shall be designed to mitigate the Q200 flood.

Bent Piers with Individually Encased Piles or Solid Wall Encased Piles or Drilled Shafts

If the calculated Q100 scour depth is less than 6 feet below the finished ground line and the appropriate limit states are satisfied for both the design and check events with all soil above the calculated Q100/200 scour elevation removed, the design scour elevation shall be the lower of the calculated Q100 scour elevation and the bottom of encasement.

The check scour elevation shall be the lower of the calculated Q200 scour elevation and the bottom of the encasement. The Item 113 rating shall be 8.

If the calculated Q100 scour depth is 6 feet or greater below the finished ground line and the appropriate limit states are satisfied with all soil above the calculated Q100/200 scour elevation removed, the design scour elevation shall be the lower of the calculated Q100 scour elevation and the bottom of encasement. The check scour elevation shall be the lower of the calculated Q200 scour elevation and the bottom of encasement. Engineered scour countermeasures designed for the Q200 flood are required unless otherwise approved by the Bureau of Bridges and Structures. Documentation of acceptable past performance may be used to justify not providing countermeasures. The Item 113 rating shall be 5.

If the calculated Q100 scour depth is 6 feet or greater below the finished ground line and the appropriate limit states are not satisfied with all soil above the calculated Q100/200 scour elevation removed, the design and check scour shall be set at the lower of the finished ground line and the bottom of encasement. Existing countermeasures, if present, shall be evaluated for the Q100 flood. If the countermeasures satisfy the Q100 flood, no remediation is required. Countermeasures that do not satisfy the Q100 flood shall be retrofitted to satisfy the Q200 flood. The Item 113 rating shall be 7.

All new countermeasures and extensions of existing countermeasures required for widened substructures shall be designed to mitigate the Q200 flood.

Bent Piers with Individual Drilled Shafts or Exposed Piles

If the calculated Q100 scour depth is less than 6 feet below the finished ground line and the appropriate limit states are satisfied for both the design and check events with all soil above the calculated Q100/200 scour elevation removed, the design scour elevation shall be located at the calculated Q100 scour elevation. The check scour elevation shall be located at the calculated Q200 scour elevation. The Item 113 rating shall be 8.

If the calculated Q100 scour depth is 6 feet or greater below the finished ground line and the appropriate limit states are satisfied for both the design and check events with all soil above the calculated Q100/200 scour elevation removed, the design scour elevation shall be the calculated Q100 scour elevation. The check scour elevation shall be the calculated Q200 scour elevation. Engineered scour countermeasures designed for the Q200 flood are required unless otherwise approved by the Bureau of Bridges and Structures. Documentation of acceptable past performance may be used to justify not providing countermeasures. The Item 113 rating shall be 5.

If the appropriate limit states are not satisfied with all soil above the calculated Q100/200 scour elevation removed, the design and check scour elevations shall be located at the finished ground line. Existing countermeasures, if present, shall be evaluated for the Q100 flood. If the countermeasures satisfy the Q100 flood, no remediation is required. Countermeasures that do not satisfy the Q100 flood shall be retrofitted to satisfy the Q200 flood. The Item 113 rating shall be 7.

All new countermeasures and extensions of existing countermeasures required for widened substructures shall be designed to mitigate the Q200 flood.

Table C - Design and Check Scour Elevations for Existing Structures Designed Using LRFD

Foundation Type	Calculated Q100 Scour Elev.	Calculated Q200 Scour Elev.	Design Scour Elev.	Check Scour Elev.	Item 113	Notes
Spread Footing in scour resistant material (rock)	Above top of footing	Above bottom of footing	Bottom of footing	Bottom of footing	8	
	Below top of footing				5	
Spread Footing in non-scour resistant material	Above top of footing	Above bottom of footing	Bottom of footing	Bottom of footing	8	A
	Within footing thickness				5	
	Below bottom of footing	Below bottom of footing			7	A
	OR					
Pile and drilled shaft supported footings	Above top of footing (Strength I and Service I load combination satisfied)	Any depth (Extreme Event II load combination satisfied)	Lower of bottom of footing or Q100 scour elevation	Lower of bottom of footing or Q200 scour elevation	8	
	Within footing limits (Strength I and Service I load combination satisfied)				5	
	Below bottom of footing (Strength I and Service I load combination satisfied)				5	B
	OR					
Bent piers with individually encased piles or solid wall encase piles or drilled shafts	Below bottom of footing (Strength I and Service I load combination not satisfied)	Below bottom of footing (Extreme Event II load combination not satisfied)	Bottom of footing	Bottom of footing	7	C
	OR					
	Less than 6 feet below the finished ground line (Strength I and Service I load combination satisfied)	Any depth (Extreme Event II load combination satisfied)			8	Lower of bottom of encasement or Q200 scour elevation
	6 feet or greater below the finished ground line (Strength I and Service I load combination satisfied)				5	
	Below bottom of encasement (Strength I and Service I load combination not satisfied)	Below bottom of encasement (Extreme Event II load combination not satisfied)	Bottom of encasement	Bottom of encasement	7	C

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Table C (continued)- Design and Check Scour Elevations for Existing Structures Designed Using LRFD						
Foundation Type	Calculated Q100 Scour Elev.	Calculated Q200 Scour Elev.	Design Scour Elev.	Check Scour Elev.	Item 113	Notes
Bent piers with individual drilled shafts or exposed piles	Less than 6 feet below the finished ground line (Strength I and Service I load combination satisfied)	Any depth (Extreme Event II load combination satisfied)	Q100 scour elevation	Q200 scour elevation	8	
	6 feet or greater below the finished ground line (Strength I and Service I load combination satisfied)					
Spill thru abutments	Any depth (Strength I and Service I load combination not satisfied)	Any depth (Extreme Event II load combination not satisfied)	Finished ground line	Finished ground line	7	C
	OR Not calculated					

Table C Notes:

- A) Engineered scour countermeasures designed for the Q200 flood are required.
- B) Engineered scour countermeasures designed for the Q200 flood are required unless otherwise approved by the Bureau of Bridges and Structures.
- C) Engineered scour countermeasures required to mitigate the Q200 flood are required if countermeasures are not present. If countermeasures are present and mitigate the Q100 flood, no additional countermeasures are required. If countermeasures are present and do not mitigate the Q100 event, the countermeasures shall be retrofitted to mitigate the Q200 flood.
- D) Bridge abutments with embankment cones shall be protected by satisfactorily performing countermeasures.
- E) ISIS Item 113B Scour Evaluation Rating Method shall be B – Rational Analysis