

TO: All Design Section Staff
FROM: Bijan Khaleghi
DATE: May 6, 2014
SUBJECT: Bridge Anchor Types

This design memorandum revises the WSDOT requirements for bridge anchor types. This memorandum supersedes the memorandum issued on April 29, 2014. Cast-in-place concrete anchors remain the preferred option for bridge applications.

Conventional drilled anchor systems (resin bonded anchors and undercut anchors) may be used for permanent attachments in many aspects of bridge design, including the permanent cyclical or sustained tension applications listed below:

- Sign structures mounted to the sides of bridges with a maximum cantilever length or total span of 10 ft.
- Light standards with a maximum cantilever length of 16 ft.
- Sign structures with a supporting, round or rectangular, post or beam with a maximum dimension of 8 in.
- Retrofitted corbels for bridge approach slabs; and
- Supporting utilities under bridges, including water pipes, electrical conduit and other utility piping systems.

For resin bonded anchors used in permanent sustained tension applications, the stress versus time-to-failure test method is required to determine a resin bonded anchor's ability to resist sustained tensile loads. The resin bonding materials in all resin bonded anchor systems shall have successfully completed testing for long term sustained load performance in accordance with AASHTO TP 84. Depending on the specific application of the permanent attachment, additional quality assurance performance measures such as field proof testing of production anchors in accordance with ACI 355.2 should be included in the design. Resin bonded anchors shall not be used in monotube sign structure, sign structure truss, and mast arm type signal standard applications.

Fast set epoxy resin bonding materials shall not be used for resin bonded anchors.

For carbon steel undercut anchors, the system components shall be compatible with hot-dip galvanizing. Electroplated zinc galvanizing methods are not acceptable. Otherwise, undercut anchors shall be stainless steel. As specified above for resin bonded anchor systems and depending on the specific application of the permanent attachment, additional quality assurance performance measures such as field proof testing of production anchors in accordance with ACI 355.2 should be included in the design. The design procedure for undercut anchors shall be in accordance with ACI 318 Appendix D, and system qualification testing requirement in accordance with ACI 355.2.

Expansion anchors and mechanical anchors are not allowed for any permanent applications, except for specific connection details previously approved by the Bridge and Structures Office for precast concrete panel faced structural earth walls as low risk applications.

Background:

Conventional drilled anchor systems (resin bonded anchors and undercut anchors) may be used for permanent attachments in cyclical or sustained tension applications, provided certain safeguards are observed. The resin bonding agent of the resin bonded anchor system shall have successfully completed testing for long term sustained load performance in accordance with AASHTO TP 84. Depending on the specific application of the permanent attachment, additional quality assurance performance measures such as field proof testing of production anchors in accordance with ACI 355.2 should be included in the design.

The system components of undercut anchors shall be compatible with hot-dip galvanizing. Electroplated zinc galvanizing methods are not acceptable. Otherwise, undercut anchors shall be stainless steel. As specified above for resin bonded anchor systems and depending on the specific application of the permanent attachment, additional quality assurance performance measures such as field proof testing of production anchors in accordance with ACI 355.2 should be included in the design. The design procedure and system qualification testing requirement for undercut anchors are added for better performance.

If you have any questions regarding these issues, please contact DeWayne Wilson at (360) 705-7214 (WilsonD@WSDOT.WA.GOV), Mike Bauer at (360) 705-7190 (BauerM@WSDOT.WA.GOV), or Bijan Khaleghi at (360) 705-7181 (Bijan.Khaleghi@WSDOT.WA.GOV)

cc: Mark Gaines, Bridge Construction - 47354
Craig Boone, Bridge and Structures – 47340

BDM Revisions: (Black is current BDM, Red is added revisions)

10.10 Drilled Anchors For Permanent Attachments

WSDOT allows **conventional drilled anchors systems** (resin bonded anchors and undercut anchors) for permanent attachments in many aspects of bridge design, including the permanent cyclical or sustained tension applications listed below.

- Sign structures mounted to the sides of bridges with a maximum cantilever length or total span of 10 ft.
- Light standards with a maximum cantilever length of 16 ft.
- Sign structures with a supporting, round or rectangular, post or beam with a maximum dimension of 8 in.
- Retrofitted corbels for bridge approach slabs.
- Supporting utilities under bridges, including water pipes, electrical conduit and other utility piping systems.

For resin bonded anchors used in permanent sustained tension applications, the stress versus time-to-failure test method is required to determine a resin bonded anchor's ability to resist sustained tensile loads. The resin bonding material in all resin bonded anchor systems shall have successfully completed testing for long term sustained load performance in accordance with AASHTO TP 84. Depending on the specific application of the permanent attachment, additional quality assurance performance measures such as field proof testing of production anchors in accordance with ACI 355.2 should be included in the design. Resin bonded anchors shall not be used in monotube sign structure, sign structure truss, and mast arm type signal standard applications.

Fast set resin bonding materials shall not be used for resin bonded anchors.

For carbon steel undercut anchors, the system components shall be compatible with hot-dip galvanizing – electroplated zinc galvanizing methods are not acceptable. Otherwise, undercut anchors shall be stainless steel. As specified above for resin bonded anchor systems and depending on the specific application of the permanent attachment, additional quality assurance performance measures such as field proof testing of production anchors in accordance with ACI 355.2 should be included in the design. The design procedure for undercut anchors shall be in accordance with ACI 318 Appendix D, and system qualification testing requirement in accordance with ACI 355.2.

Expansion anchors and mechanical anchors are not allowed for any permanent applications, except for specific connection details previously approved by the Bridge and Structures Office for precast concrete panel faced structural earth walls as low risk applications.

Cast-in-place concrete anchors remain the preferred option for bridge applications.