



TABLE OF CONTENTS

Table of Contents 1

General Crane Information 2

Service Duty Classes 2

Top Running Bridge Crane Bracket Details 4

 AH0010 – Runway Beam to Bracket Connection 4

 AH0030 – Runway Beam to Column Bracing (Unbraced Bay) 5

 AH0070 – Runway Beam to Column Bracing (braced Bay) 6

 AH0090 – Runway Beam to Bracket Connection (Double Bracket) 7

 AH0110 – Runway Beam to Column Bracing (Double Bracket) (Unbraced Bay) 8

 AH0120 – Runway Beam to Column Bracing (Double Bracket) (braced Bay) 9

Top Running Bridge Crane Auxiliary Column Details 10

 AH0150 – Runway Beam to auxiliary column Connection 10

 AH0170 – Auxiliary Column to Frame Column Connection 11

Top Running Bridge Crane Stepped Column Details 12

 AH0180 – Runway Beam to Stepped Column Connection 12

 AH0200 – Runway Beam to Double Stepped Column Connection 13

Crane Stop Detail 14

 AH0220 – Crane Stop Detail 14

 AH0225 – Alternate Crane Stop Detail 15

Hook Bolt And Floating Rail Clamp Details 16

 AH0230 – Rail to Runway Hook Bolt Connection 16

 AH0240 – Rail to Runway Beam Floating Clamp Connection 17

Monorail/Underhung Cranes 18

 AH0250 – Standard Connection (Crane Steel Not By Nucor) 19

 AH0260 – Optional Connection (Crane Steel Not By Nucor) 20

 AH0255 – Standard Transverse Connection (Crane Steel Not By Nucor) 21

 AH0265 – Optional Transverse Connection (Crane Steel Not By Nucor) 22



GENERAL CRANE INFORMATION

Following is an explanation of Nucor Building System's (NBS) interpretation of basic crane serviceability criteria for use by the builder in properly defining the crane system. This information is based on the MBMA Low-Rise Building Systems Manual, 1996 and CMAA Specification #74, 1994 Revised.

SERVICE DUTY CLASSES

The CMAA (Ref. 74.2) has established six categories of crane service classification as a guide for determining the usage or serviceability requirements of a specific crane application. These criteria are related to number of lifts per hour, average percent of capacity per lift, speed requirements when moving the load, and height of lift. Since it is NBS standard approach to use the design procedures outlined in the MBMA Low-Rise Building Systems Manual, 1996 for crane design, Classes E and F are considered extreme special cases and are not discussed herein. **Please contact NBS Estimating Department directly with questions or requests concerning Class E or F cranes.**

The classes are as follows:

<u>Class</u>	<u>Description</u>
A <i>Stand-By or Infrequent</i>	This service class covers cranes which may be used in installations such as powerhouses, public utilities, turbine rooms, motor rooms and transformer stations where precise handling of equipment at slow speeds with long, idle periods between lifts are required. Capacity loads may be handled for initial installation of equipment and for infrequent maintenance.
B <i>Light</i>	This service class covers cranes which may be used in repair shops, light assembly operations, service buildings, light warehousing, etc., where service requirements are light and the speed is slow. Loads may vary from no load to occasional full rated loads with two to five lifts per hour, averaging ten feet per lift.
C <i>Moderate</i>	This service class covers cranes which may be used in machine shops or papermill machine rooms, etc., where service requirements are moderate. In this type of service, the crane will handle loads which average 50 percent of the rated capacity with 5 to 10 lifts per hour, averaging 15 feet, not over 50 percent of the lifts at rated capacity.
D <i>Heavy</i>	This service class covers cranes which may be used in heavy machine shops, foundries, fabricating plants, steel warehouses, container yards, lumber mills, etc., and the standard duty bucket and magnet operations where heavy duty production is required. In this type of service, loads approaching 50 percent of the rated capacity will be handled constantly during the working period. High speeds are desirable for this type of service with 10 to 20 lifts per hour averaging 15 feet, not over 65 percent of the lifts at rated capacity.

In design of the crane beam and brackets, it is also important to consider the effects of fatigue on the welds and bolted joints. This is taken into consideration by NBS as explained in the MBMA Low-Rise Building Systems Manual, 1996. AISC has defined four loading conditions in the AISC-ASD Manual of Steel Construction, 9th Ed. as follows:

Loading Condition	Total No. of Loading Cycles *		Equiv. No. Cycles Per Day Over Life Span.
	From	To	
1	20,000	100,000	2 to 10
2	100,000	500,000	10 to 50
3	500,000	2,000,000	50 to 200
4	2,000,000	and over	200 and up

* over entire life span, assuming 25 year life span.

These loading conditions define the allowable stresses on the joints of the beam and bracket. MBMA has correlated these loading conditions to the service duty classes defined by CMAA so that if a certain class is chosen, the appropriate loading condition can then be chosen from the following table:

Service Class	AISC Loading Condition	
	R ≤ 0.5	R > 0.5
B	--	1
C	1	2
D	2	3

where,

$$R = \frac{TW}{(TW + RC)}, \text{ for underhung monorail cranes,}$$

$$R = \frac{TW}{(TW + 2RC)}, \text{ for bridge cranes.}$$

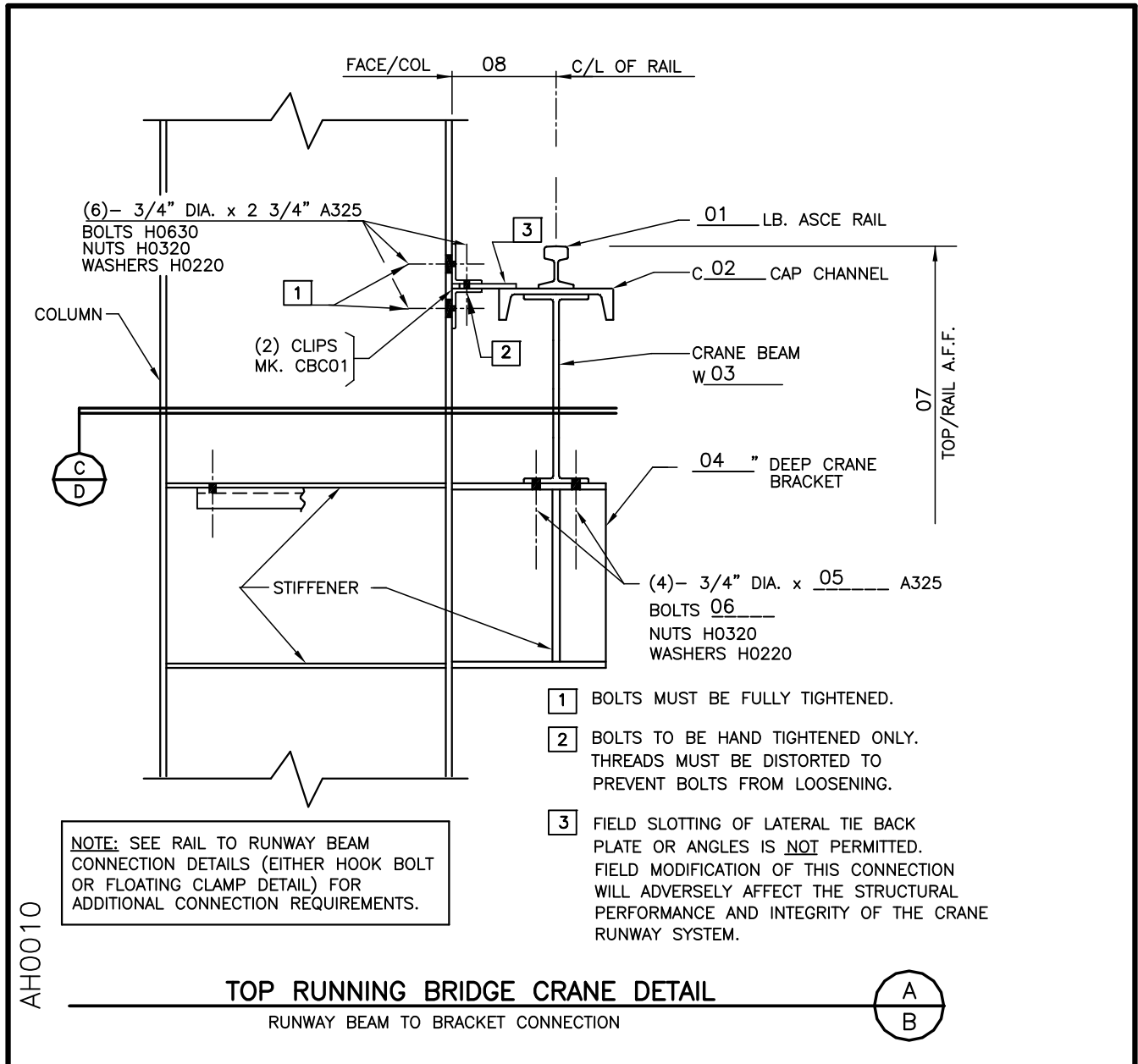
TW = Total weight of the crane including bridge with end trucks, hoist with trolley, and cab with walkway for cab-operated cranes.

RC = Rated Capacity of the crane.

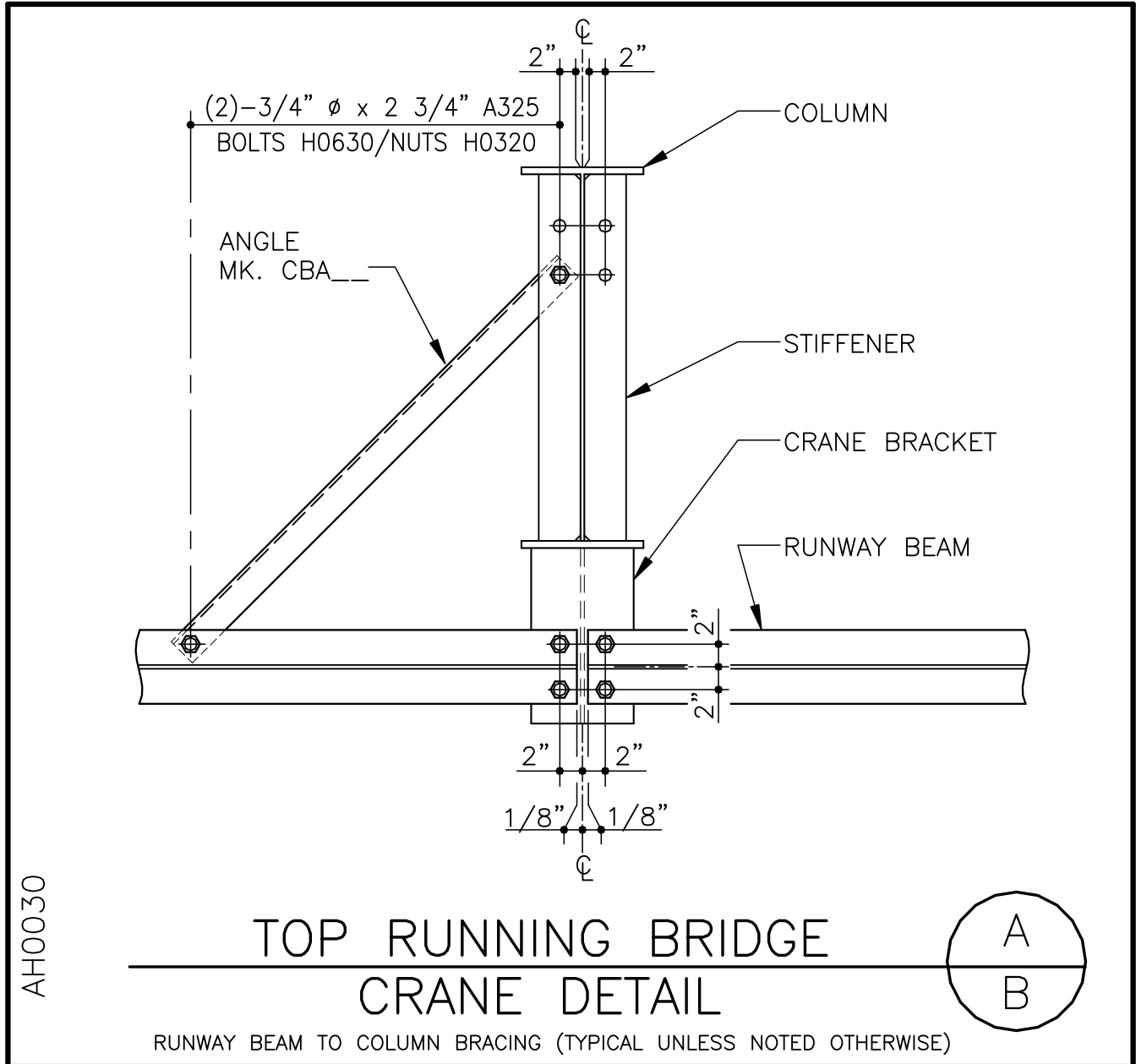
Service Class A is not represented in the above table nor is there a value for Class B if $R \leq 0.5$. This is because fatigue does not need to be considered in these cases. NBS requires only that the customer supply the Service Duty Class as defined previously for the given crane system. The customer must determine and supply this value as NBS cannot define usage in relation to the crane system. The loading condition per AISC is then determined by NBS.

TOP RUNNING BRIDGE CRANE BRACKET DETAILS

AH0010 – RUNWAY BEAM TO BRACKET CONNECTION



AH0030 – RUNWAY BEAM TO COLUMN BRACING (UNBRACED BAY)

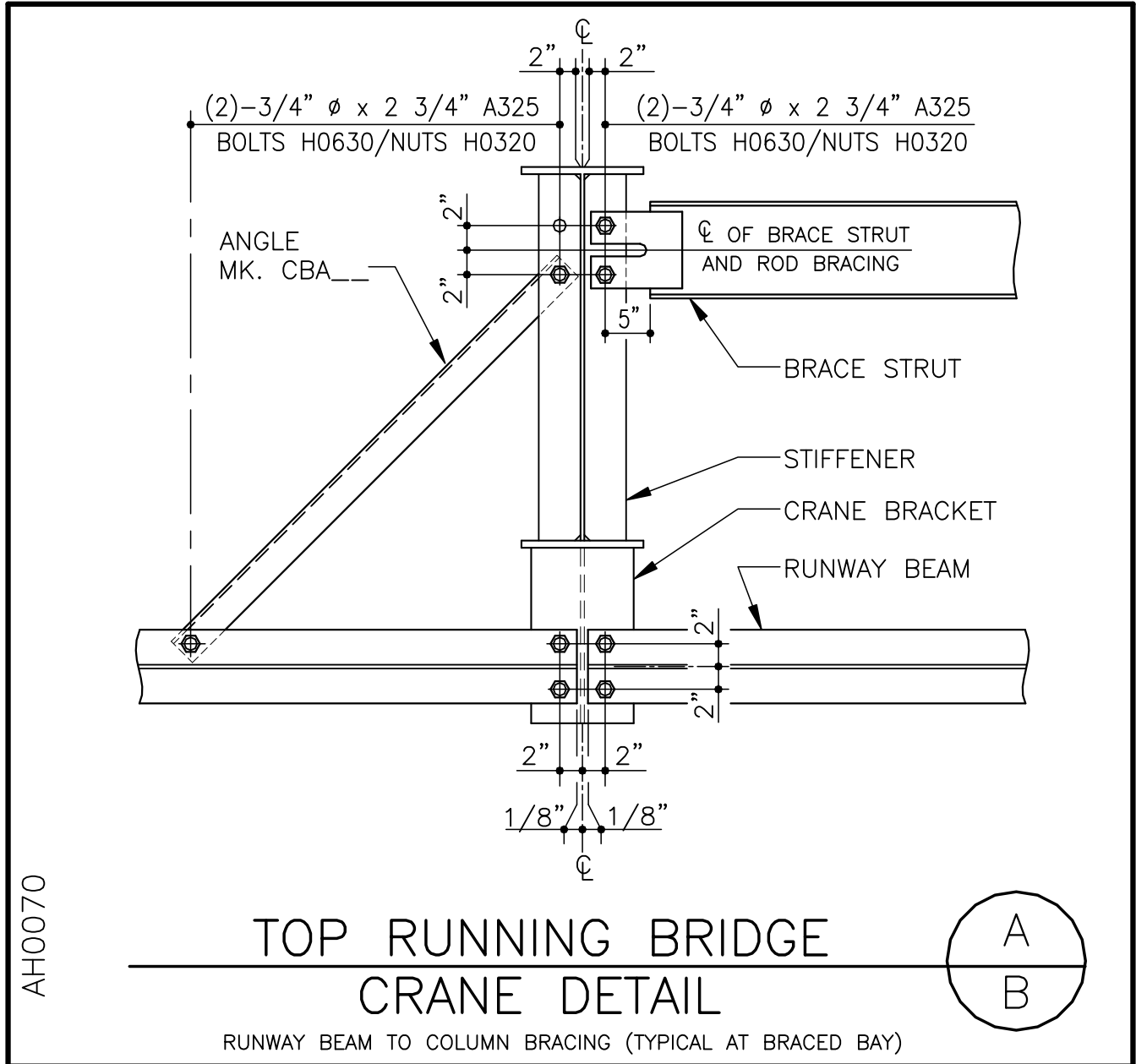


LAST REVISION DATE: <u>03/03/05</u> BY: <u>KMC</u> CHK: <u>EGB</u>
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<u>DETAIL NAME IF APPLICABLE</u> AH0030.DWG

4.6.5

AH0070 – RUNWAY BEAM TO COLUMN BRACING (BRACED BAY)



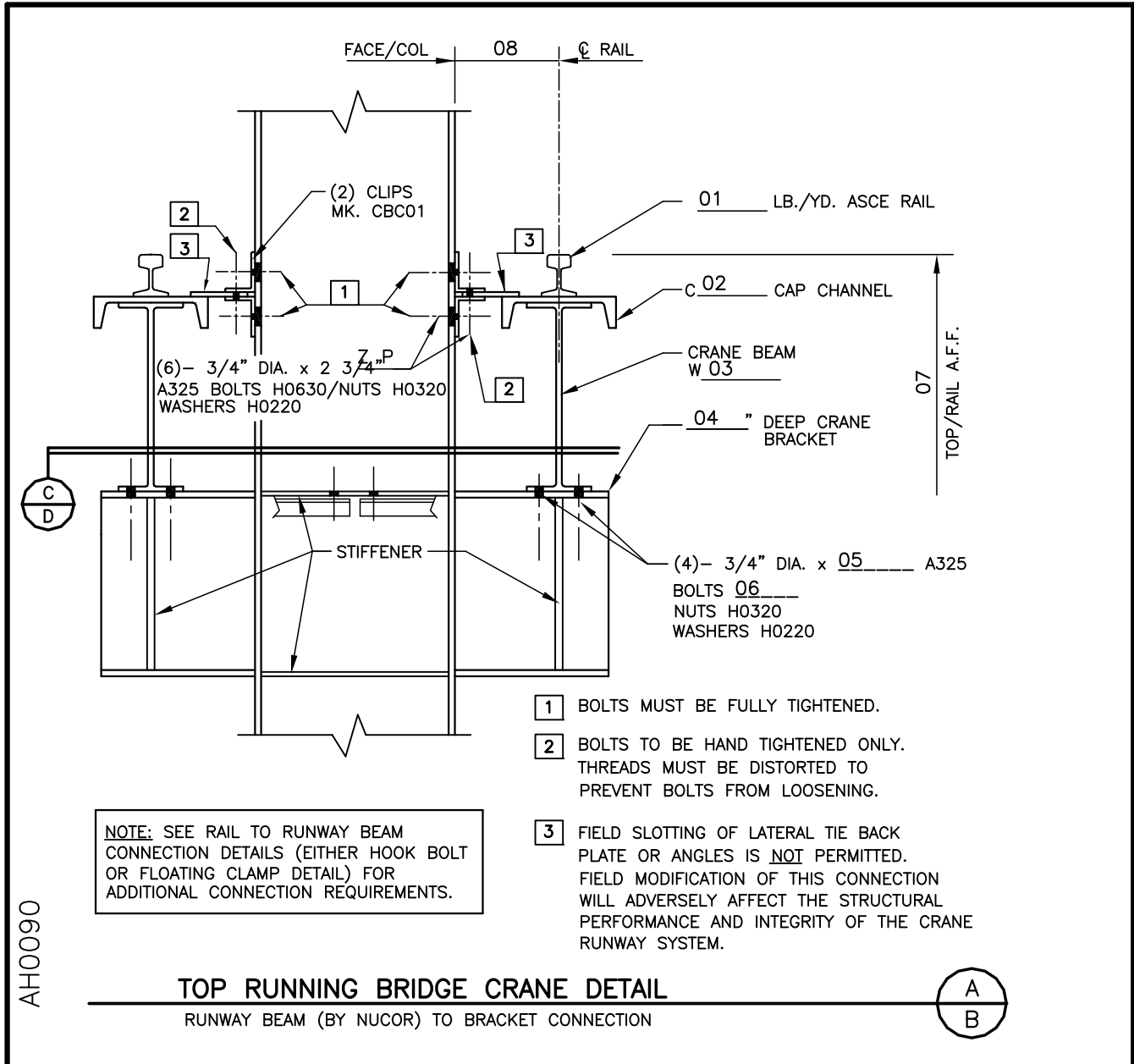
AH0070

LAST REVISION DATE: 03/03/05 BY: KMC CHK: EGB

DETAIL NAME IF APPLICABLE AH0070.DWG
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4.6.6

AH0090 – RUNWAY BEAM TO BRACKET CONNECTION (DOUBLE BRACKET)

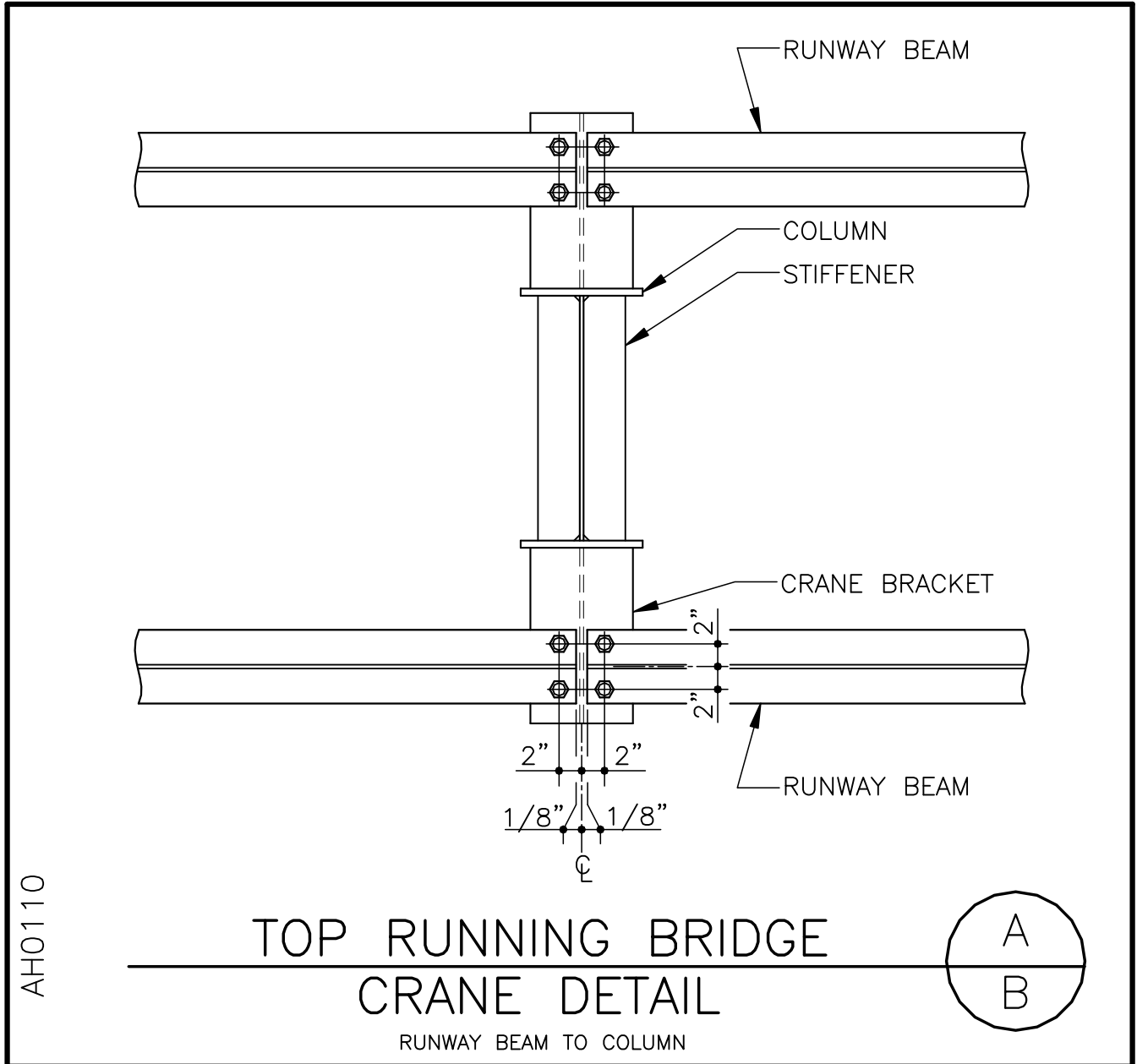


LAST REVISION
DATE: 07/11/06
BY: RJF CHK: KMC

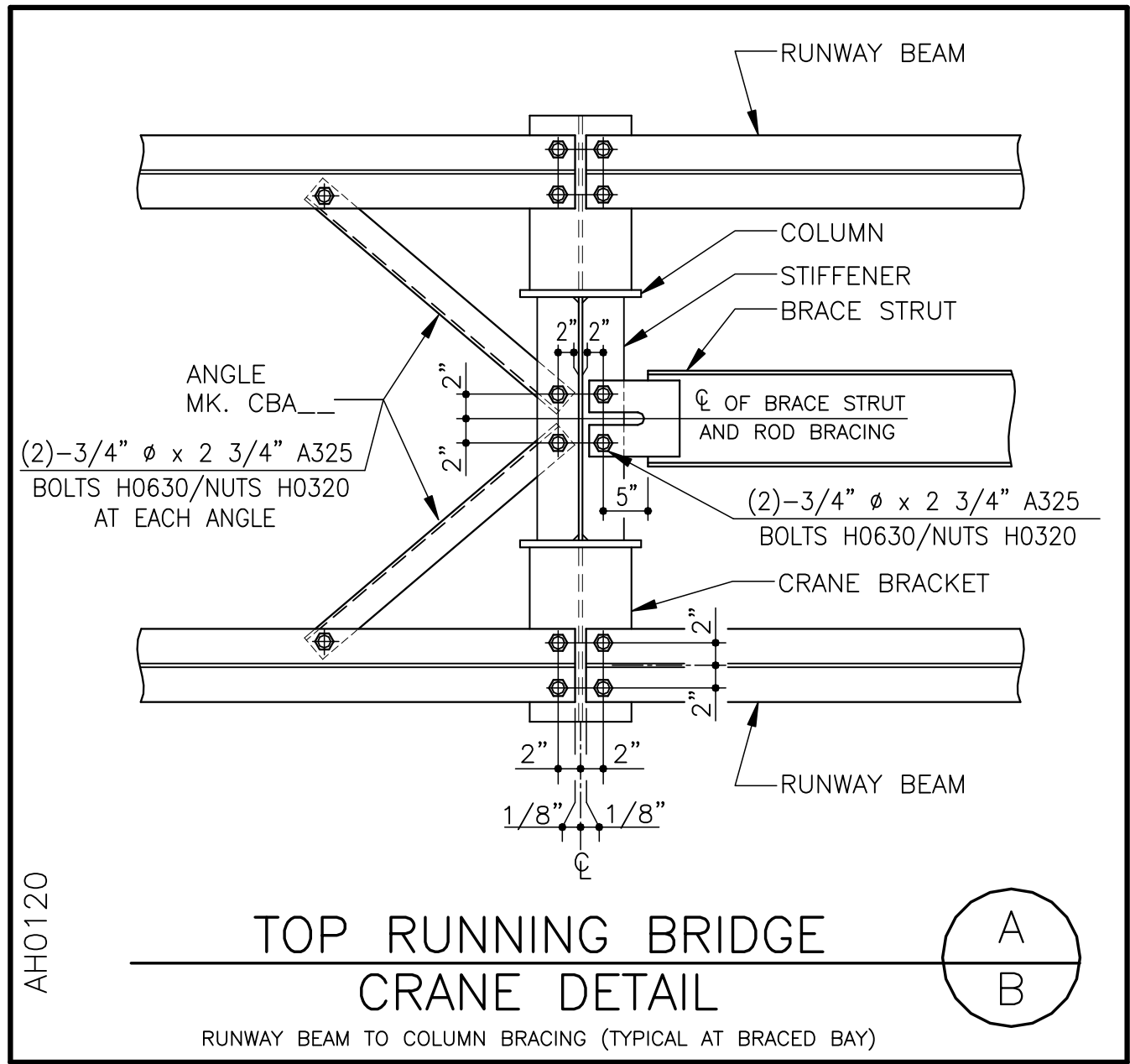
DETAIL NAME IF APPLICABLE
AH0090.DWG

4.6.7

AH0110 – RUNWAY BEAM TO COLUMN BRACING (DOUBLE BRACKET) (UNBRACED BAY)

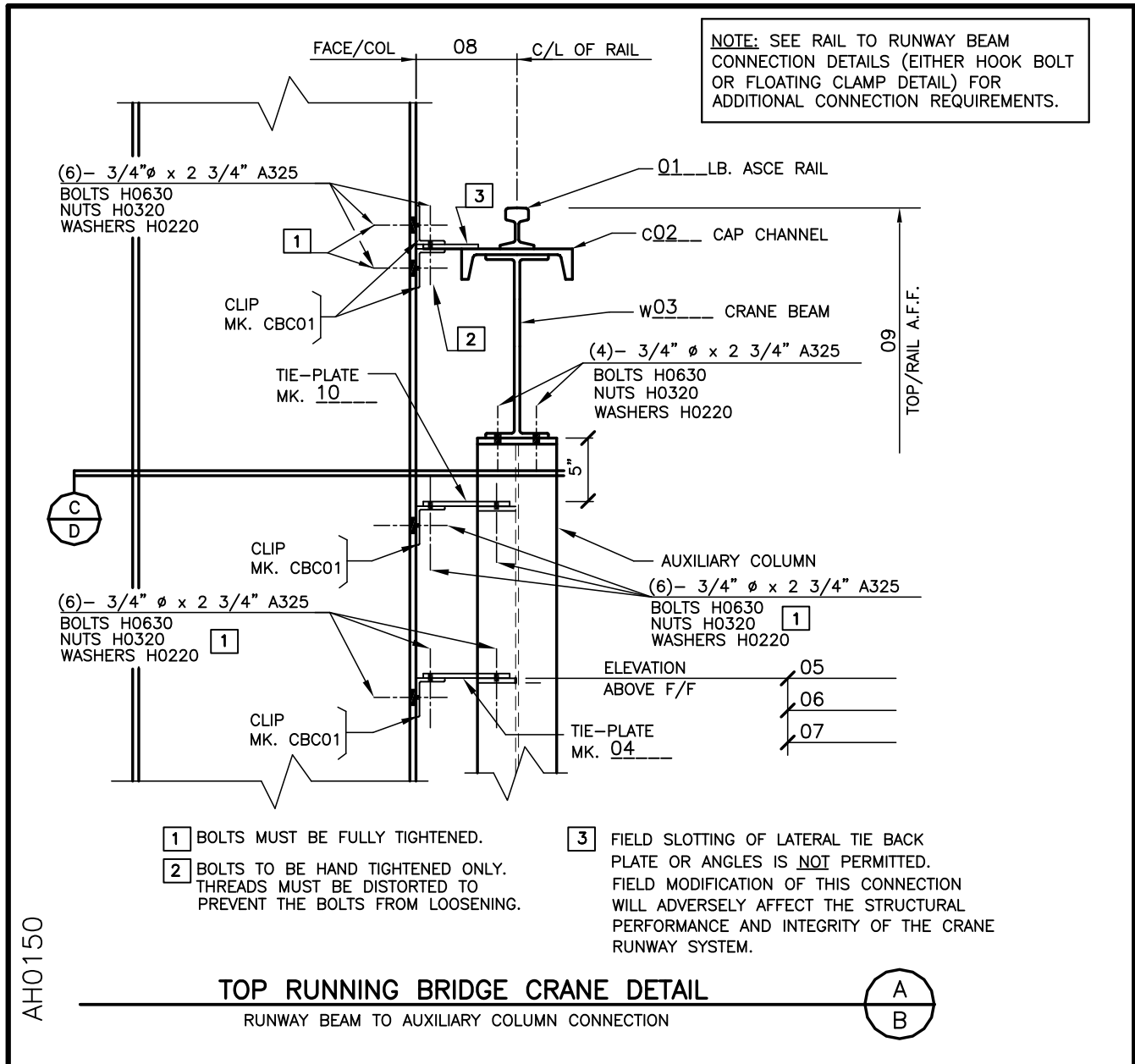


AH0120 – RUNWAY BEAM TO COLUMN BRACING (DOUBLE BRACKET) (BRACED BAY)

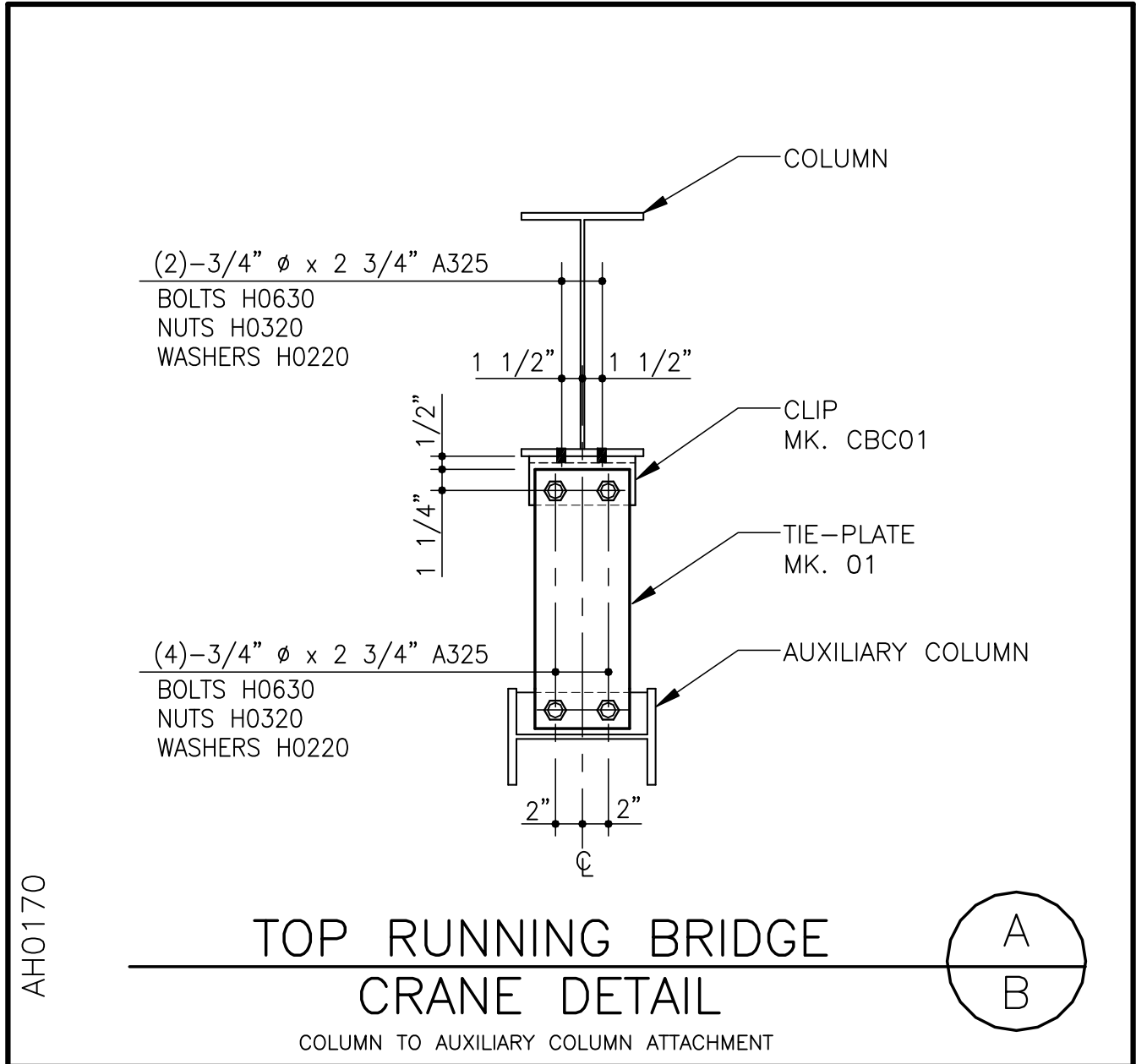


TOP RUNNING BRIDGE CRANE AUXILIARY COLUMN DETAILS

AH0150 – RUNWAY BEAM TO AUXILIARY COLUMN CONNECTION



AH0170 – AUXILIARY COLUMN TO FRAME COLUMN CONNECTION



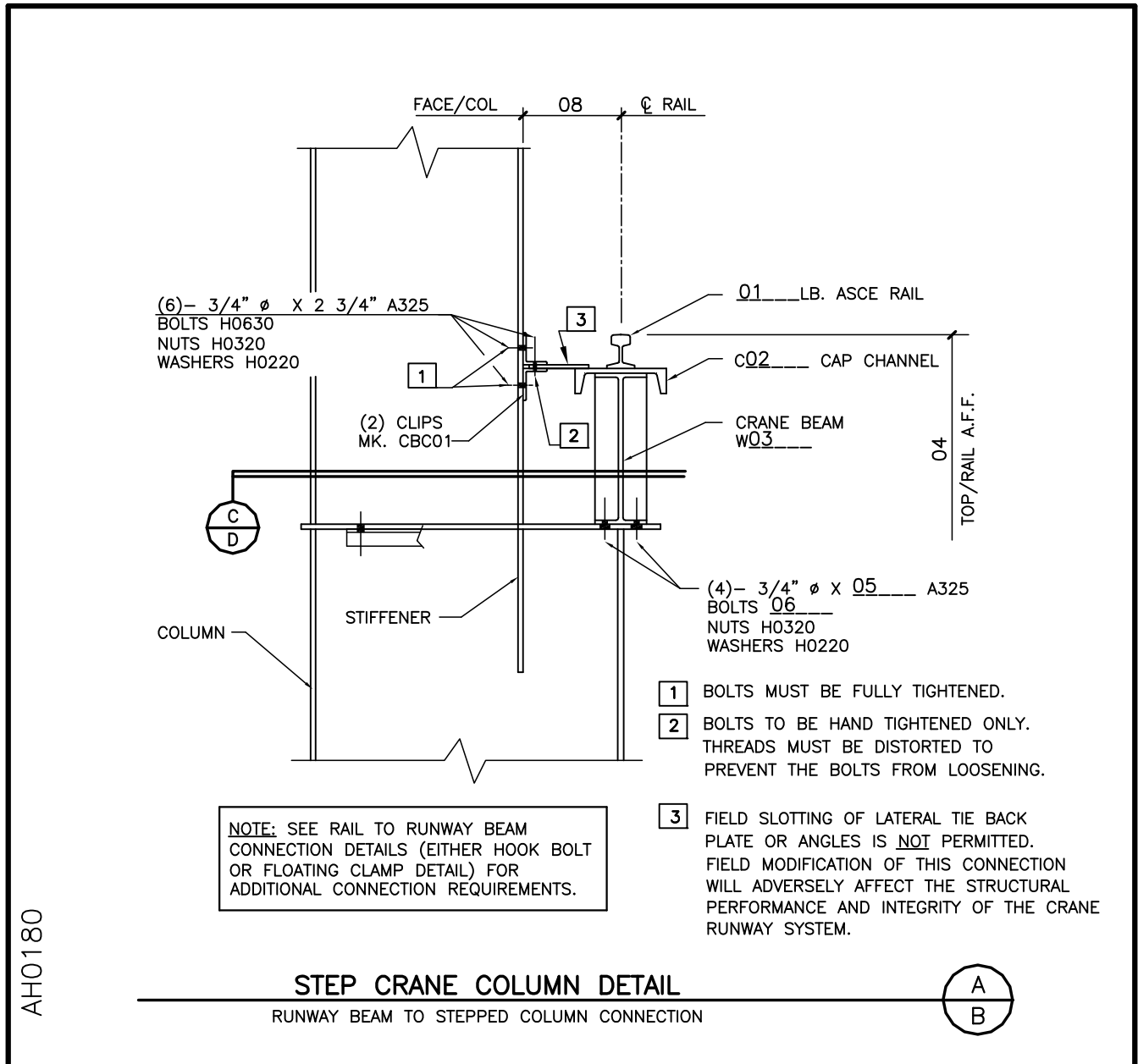
LAST REVISION DATE: <u>03/03/05</u> BY: <u>KMC</u> CHK: <u>EGB</u>
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<u>DETAIL NAME IF APPLICABLE</u> AH0170.DWG

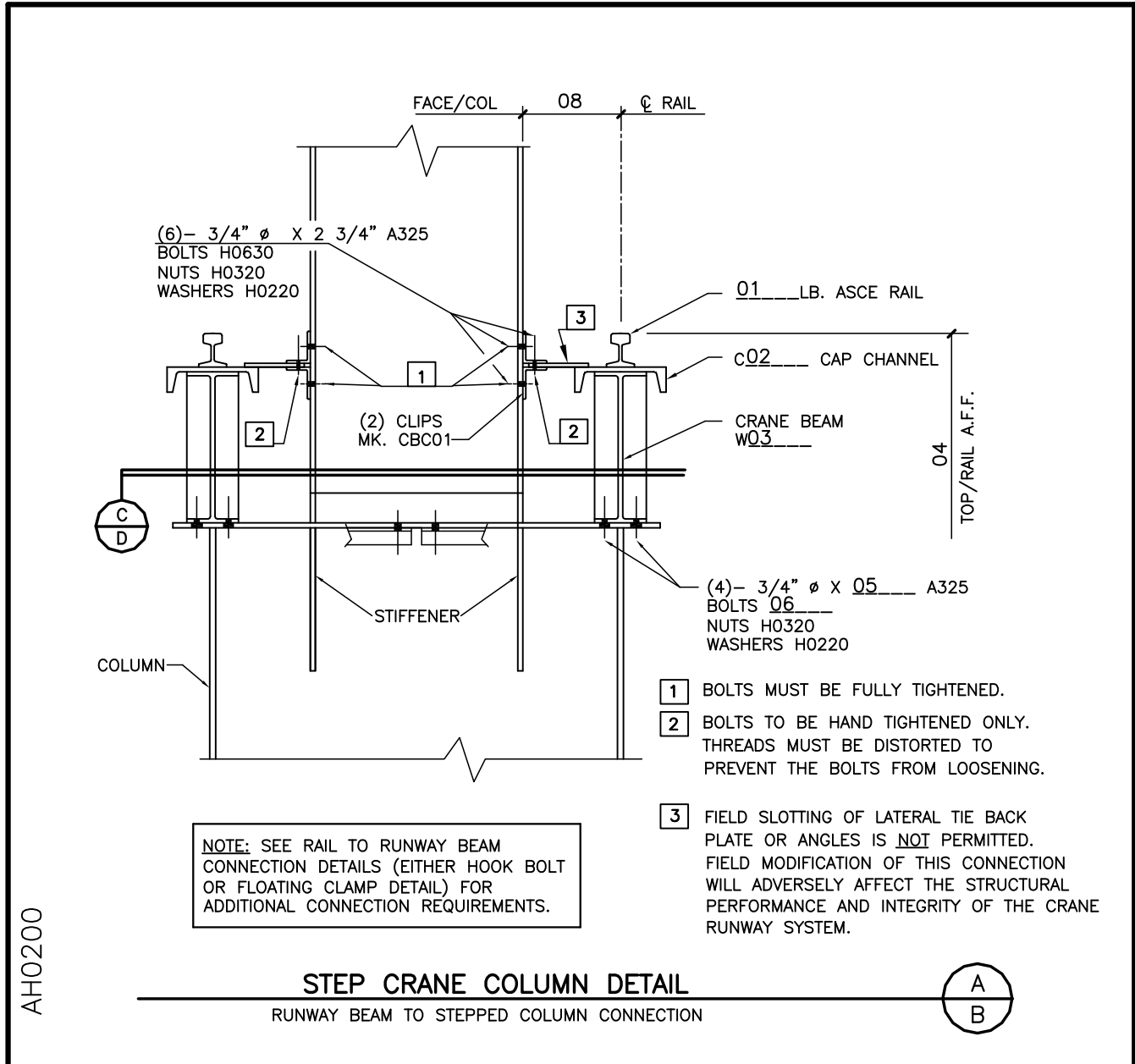
4.6.11

TOP RUNNING BRIDGE CRANE STEPPED COLUMN DETAILS

AH0180 – RUNWAY BEAM TO STEPPED COLUMN CONNECTION

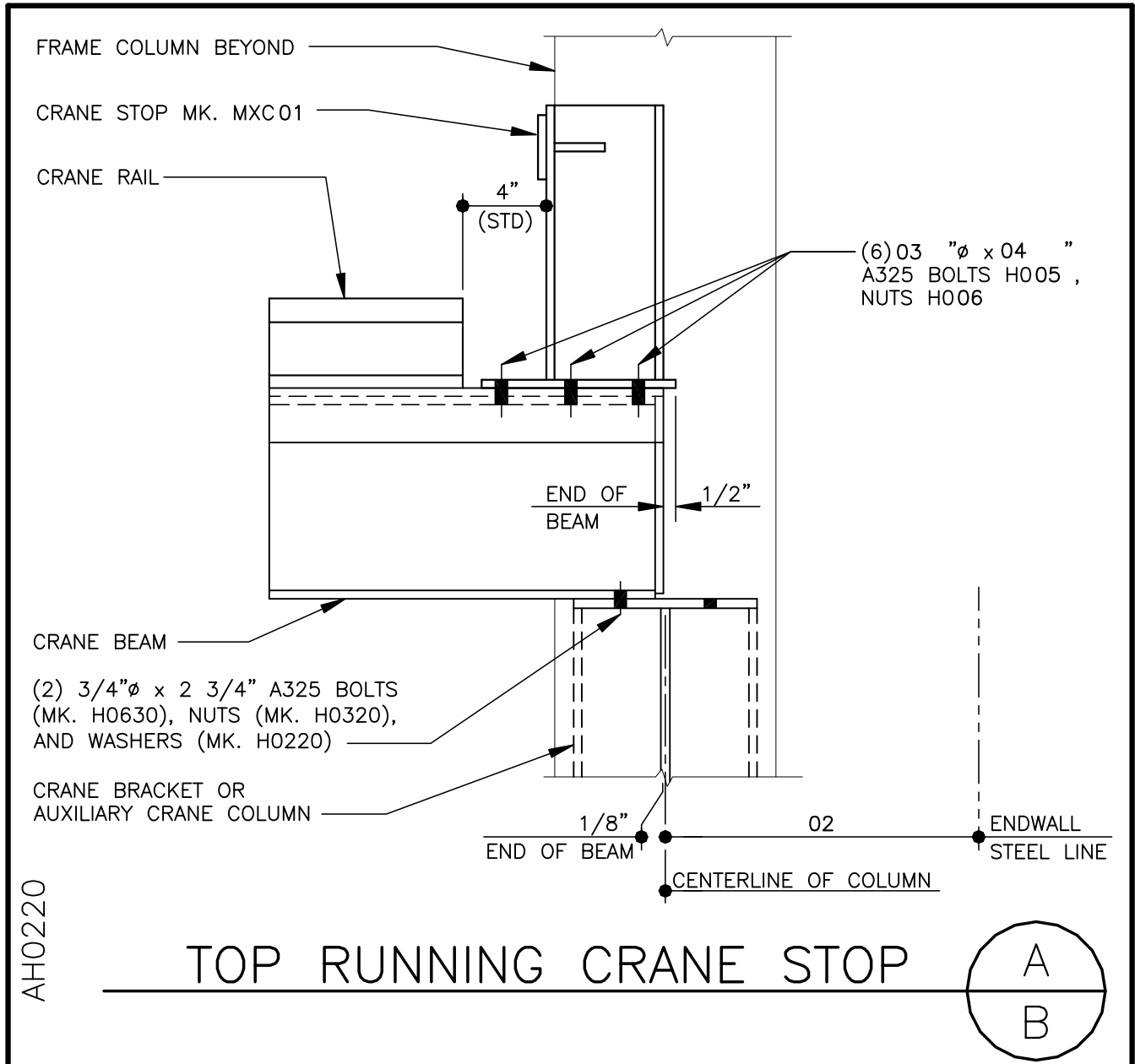


AH0200 – RUNWAY BEAM TO DOUBLE STEPPED COLUMN CONNECTION



CRANE STOP DETAIL

AH0220 – CRANE STOP DETAIL

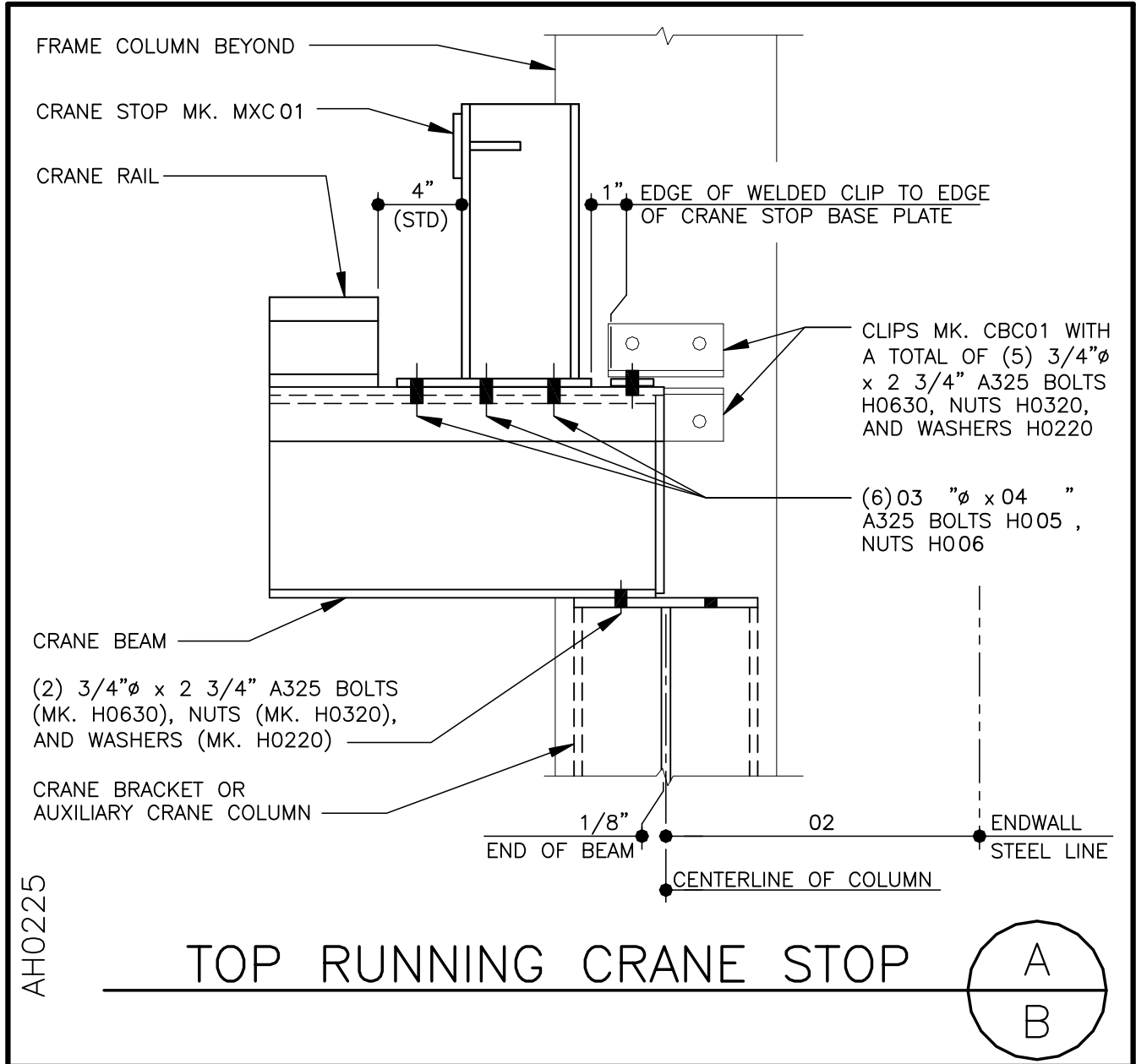


LAST REVISION
 DATE: 08/11/04
 BY: KMC CHK: RJF

DETAIL NAME IF APPLICABLE
AH0220.DWG

4.6.14

AH0225 – ALTERNATE CRANE STOP DETAIL



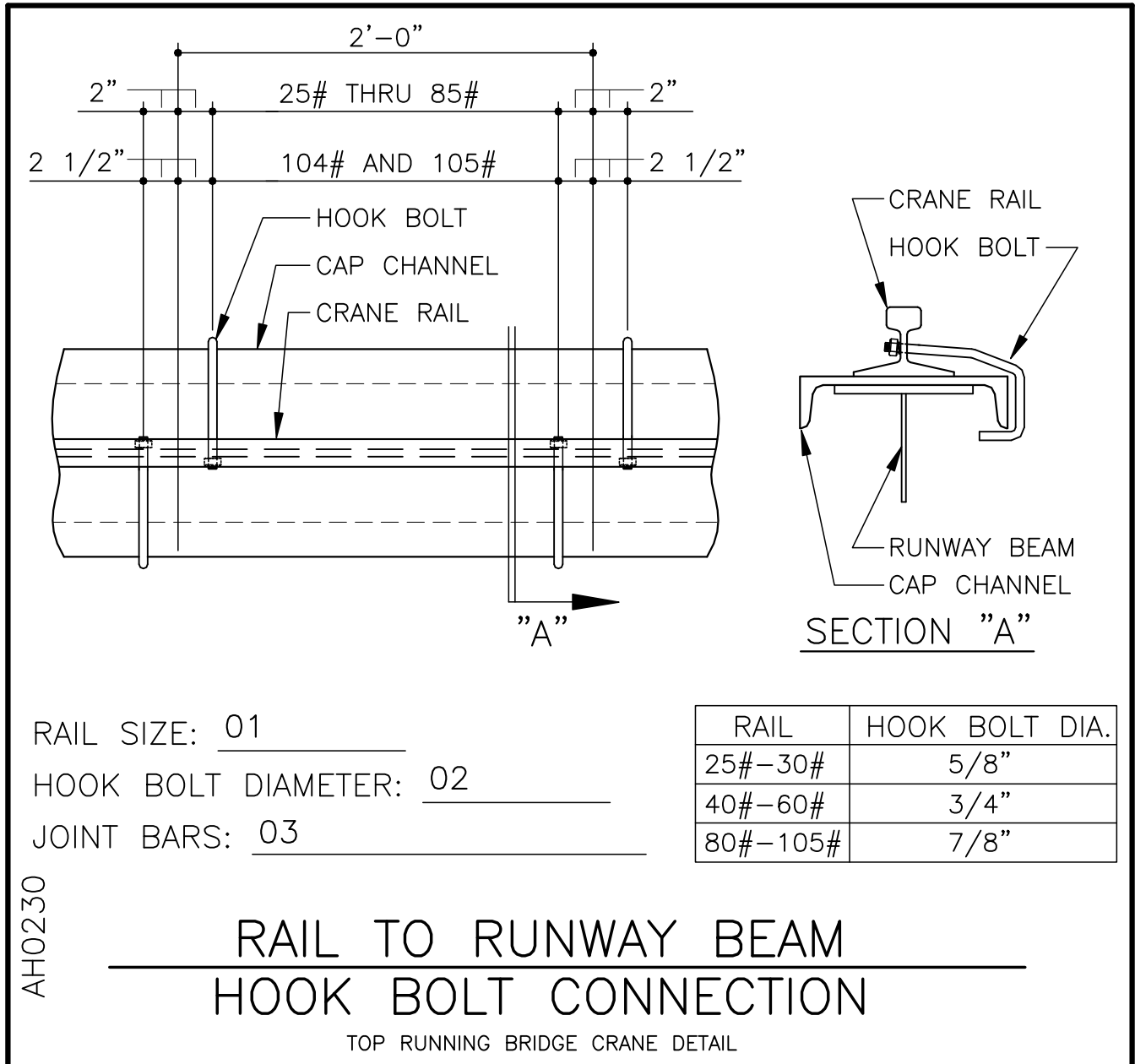
LAST REVISION DATE: <u>08/11/04</u> BY: <u>KMC</u> CHK: <u>RJF</u>
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<u>DETAIL NAME IF APPLICABLE</u> AH0225.DWG

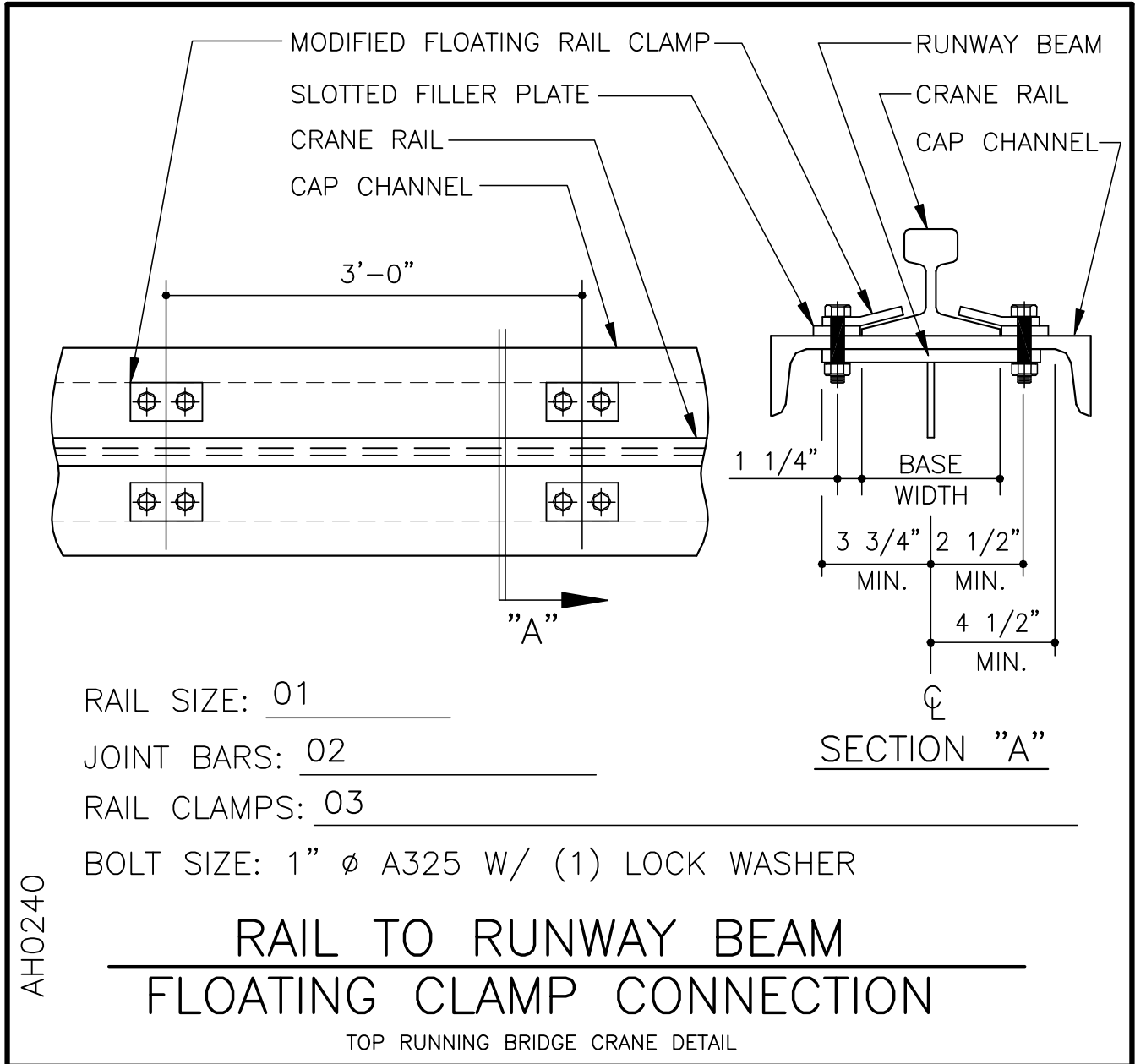
4.6.15

HOOK BOLT AND FLOATING RAIL CLAMP DETAILS

AH0230 – RAIL TO RUNWAY HOOK BOLT CONNECTION



AH0240 – RAIL TO RUNWAY BEAM FLOATING CLAMP CONNECTION



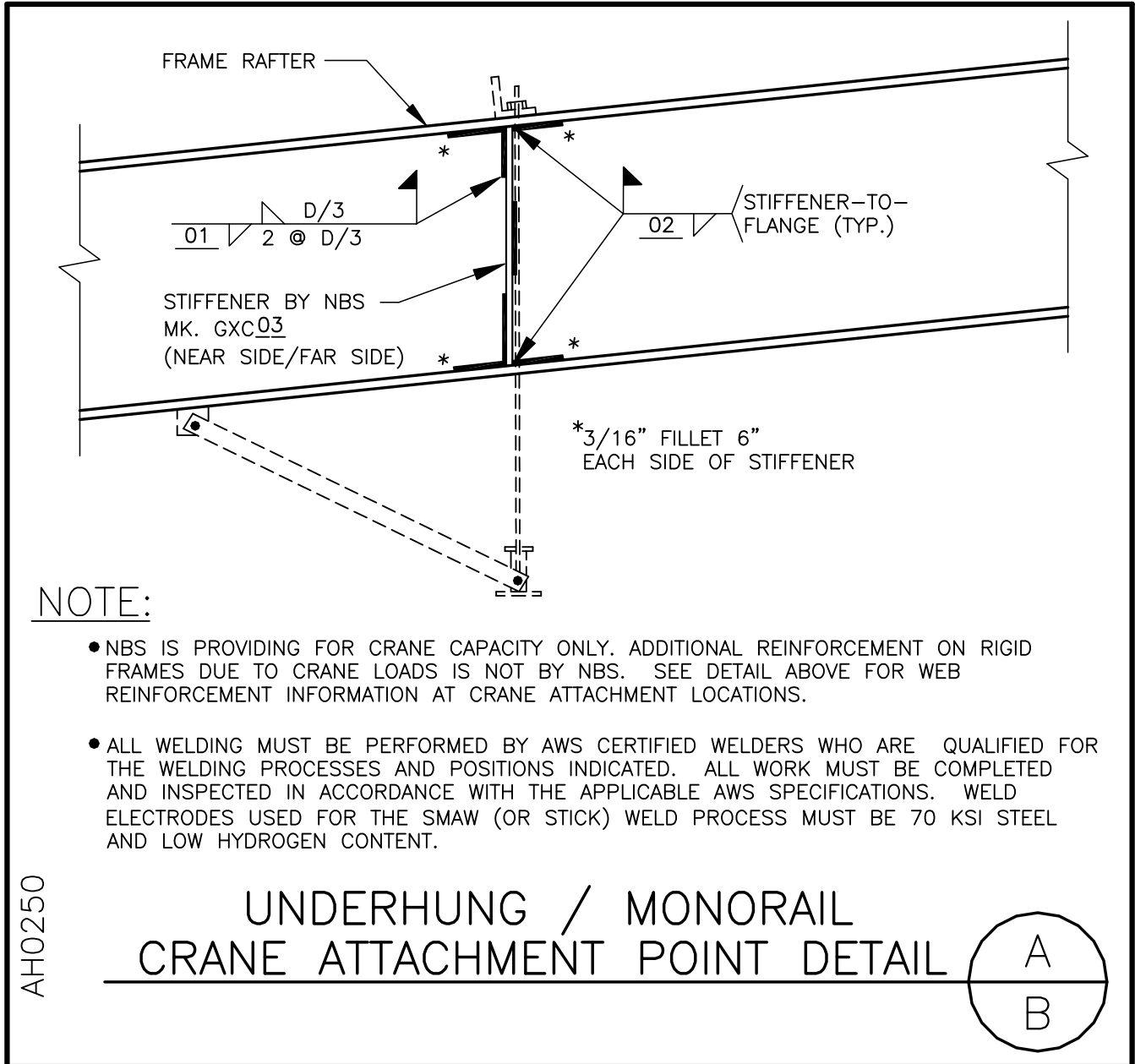
AH0240



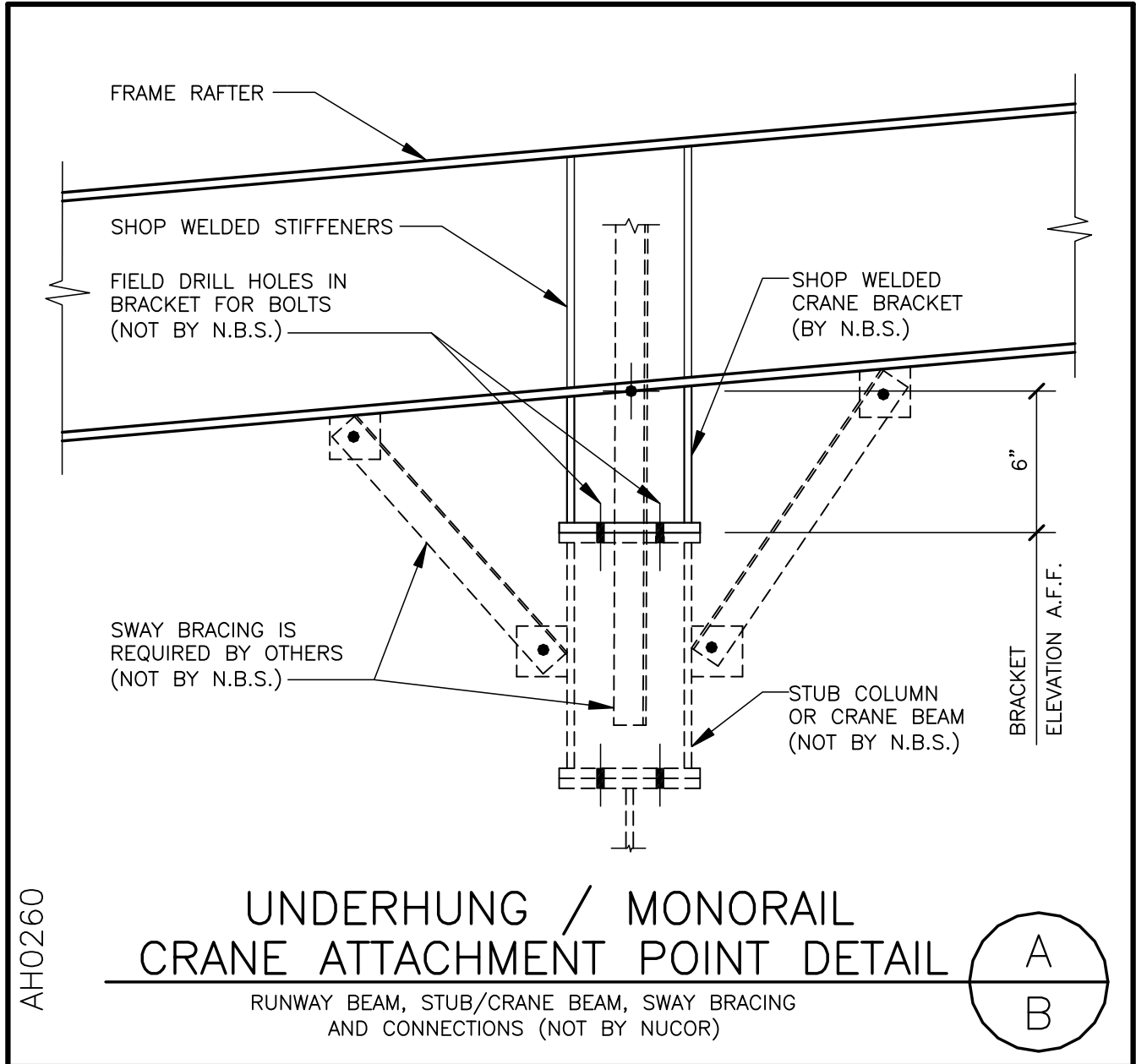
MONORAIL/UNDERHUNG CRANES

- Underhung crane beams have rigid specifications with regard to tolerances. Many suppliers of underhung systems require hardened flanges where crane wheels come in contact with the crane beam. NBS standard approach to underhung and monorail cranes is to design for the effects on the primary structural system only. Nucor will qualify back a maximum vertical frame deflection due to crane load combination; project engineer of record needs to review this information with crane supplier. As a standard, all beams, rails, connections to main frames, etc. are by others. NBS will design the frame of the building for the vertical and lateral loads and the building longitudinal bracing for the longitudinal loads.
- There are capacity limits for the monorail and underhung cranes. For both crane types, we will not design to a CMAA service class above C. The monorail crane capacity limit is 5 tons and the underhung capacity limit is 10 tons.
- It is important to specify clearly on the sketch of the building(s) included with the order proposal the start and stop point, direction, orientation, and capacity of each monorail or underhung crane in the structure. Please also note that NBS standard connection type designed for is the “truss” type. NBS will provide a web stiffener plate to be welded in place directly over the centerline of the crane connection in the rafter by an AWS certified welder in the field. We ship this stiffener plate loose for the customer to place and weld because of the uncertainty of the exact end location of the crane attachment. This allows the customer more flexibility during erection to allow for unknowns.

AH0250 – STANDARD CONNECTION (CRANE STEEL NOT BY NUCOR)



AH0260 – OPTIONAL CONNECTION (CRANE STEEL NOT BY NUCOR)

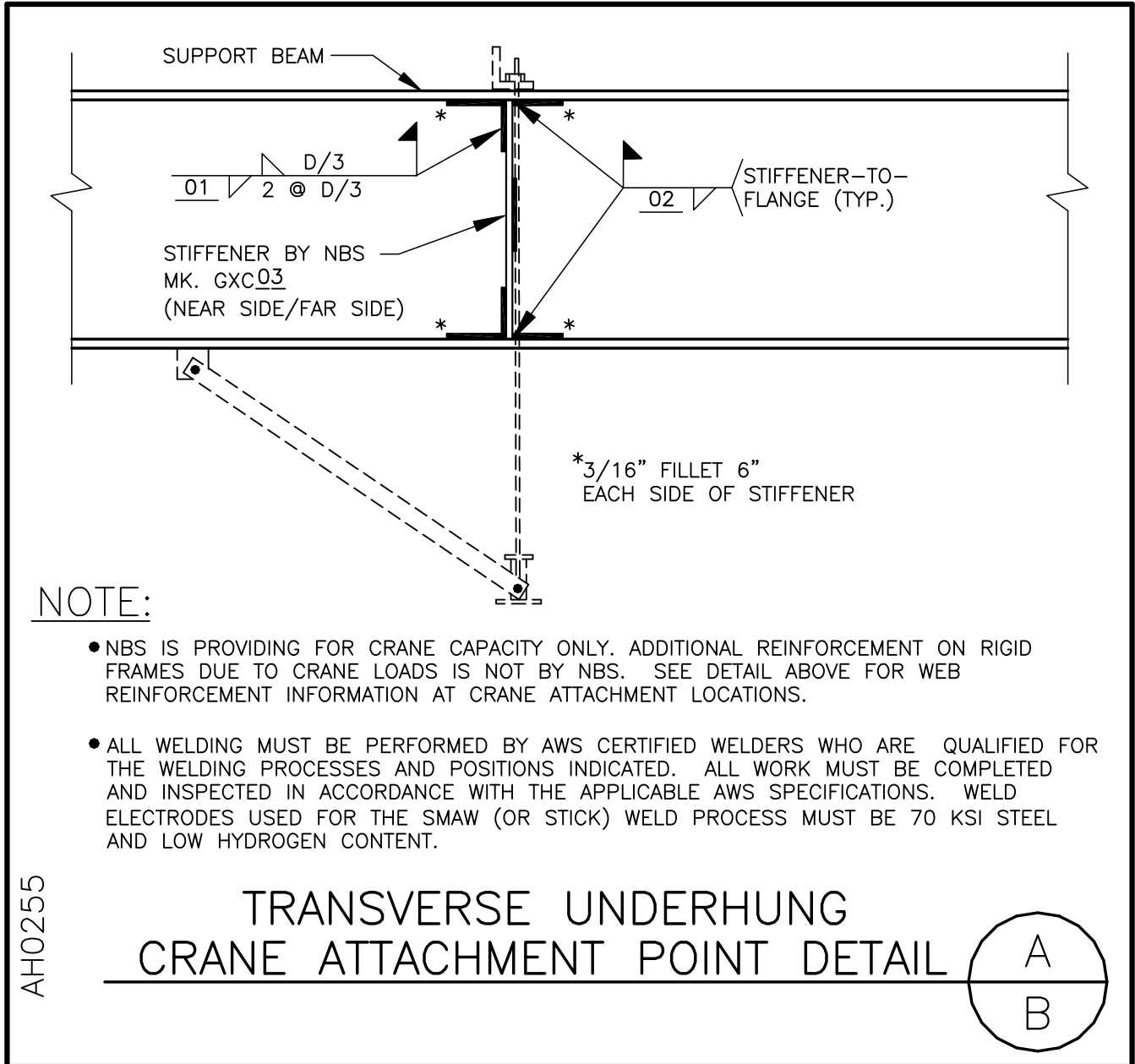


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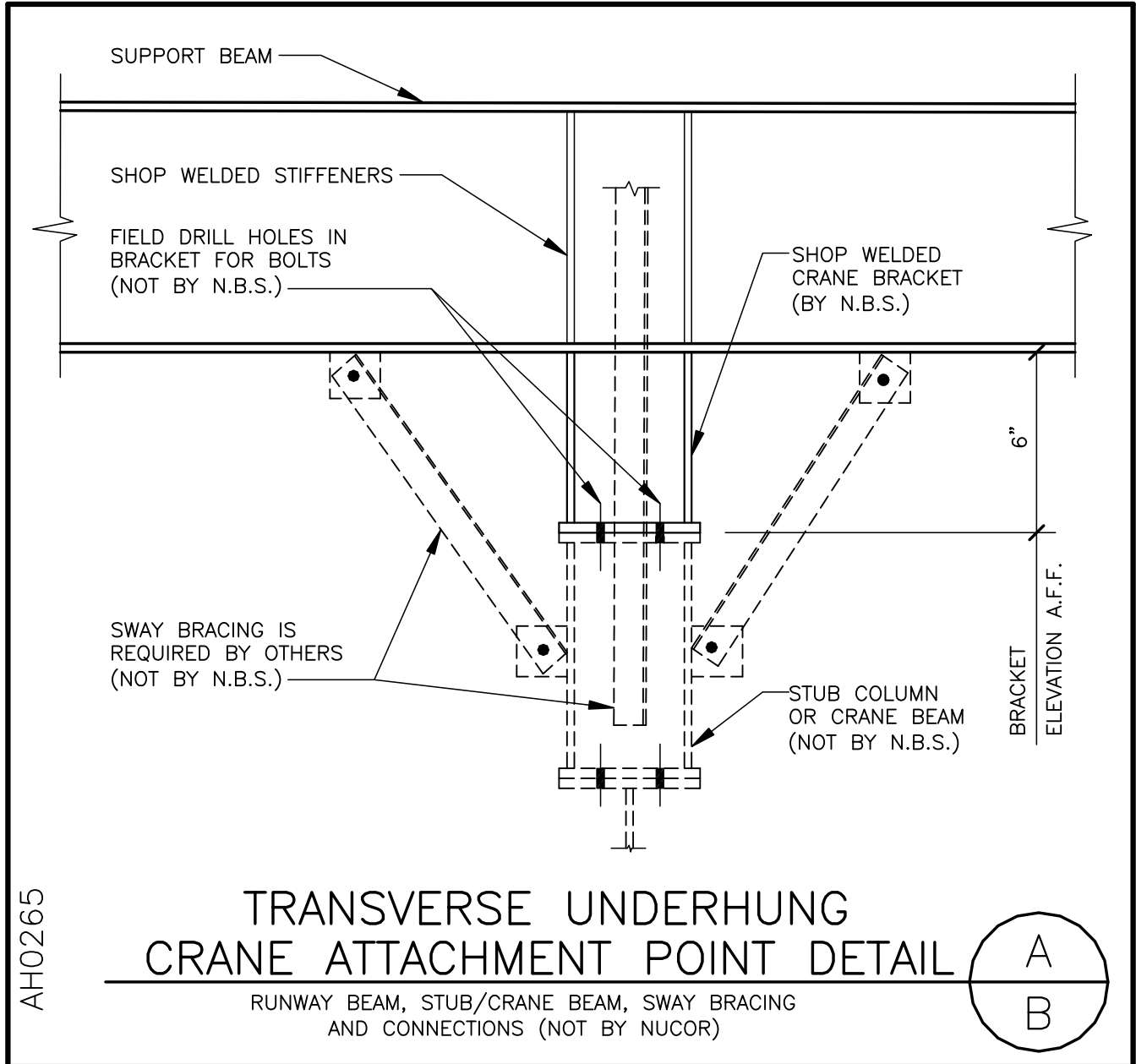
<p><u>DETAIL NAME IF APPLICABLE</u> AH0260.DWG</p>

<p>4.6.20</p>

AH0255 – STANDARD TRANSVERSE CONNECTION (CRANE STEEL NOT BY NUCOR)



AH0265 – OPTIONAL TRANSVERSE CONNECTION (CRANE STEEL NOT BY NUCOR)



<p>LAST REVISION DATE: <u>08/11/04</u> BY: <u>KMC</u> CHK: <u>RJF</u></p>

<p><u>DETAIL NAME IF APPLICABLE</u> AH0265.DWG</p>

<p>4.6.22</p>
