Supplementary Information

The following information is associated with Network Rail Standard:
NR CIV/SD/816 Rev A

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CAD Drawing

- CIV/SD/816

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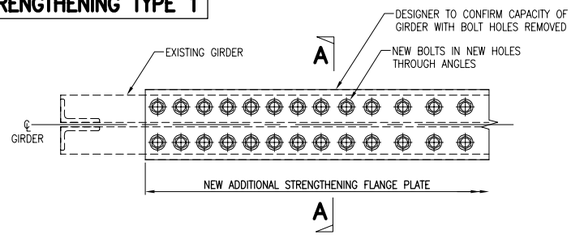
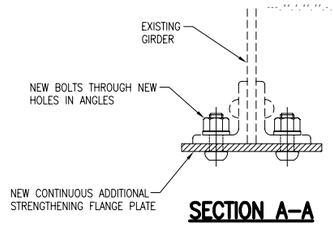
STRENGTHENING TYPE 1



VIEW ON UNDERSIDE OF BOTTOM FLANGE

SCALE 1:10



SECTION A–A

SCALE 1:5

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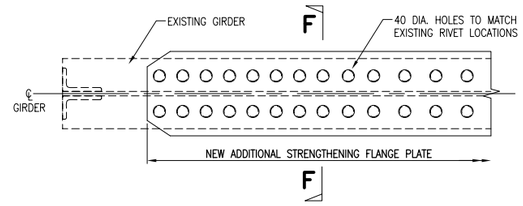
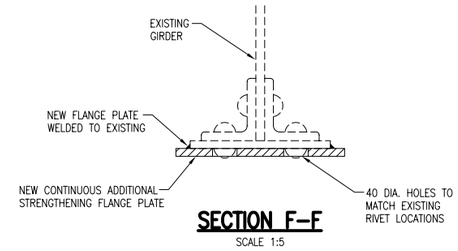


VIEW ON UNDERSIDE OF BOTTOM FLANGE

SCALE 1:10



SECTION F–F

SCALE 1:5

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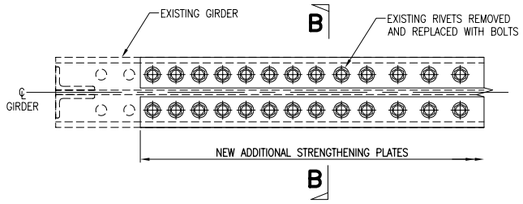

VIEW ON UNDERSIDE OF BOTTOM FLANGE

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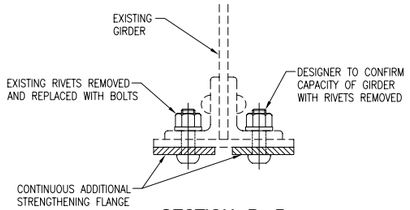

SECTION B–B

SCALE 1:5

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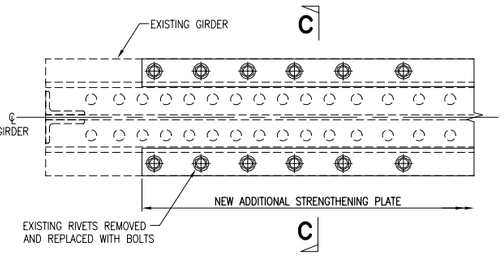

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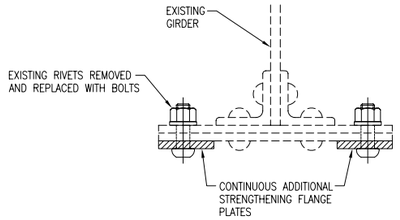
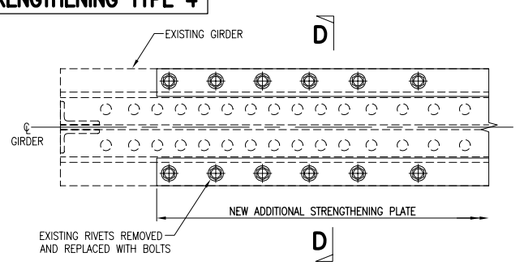


SECTION C–C

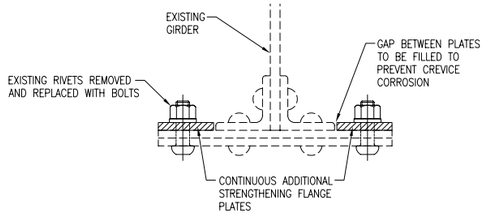
SCALE 1:5

STRENGTHENING TYPE 4



TOP VIEW ON BOTTOM FLANGE

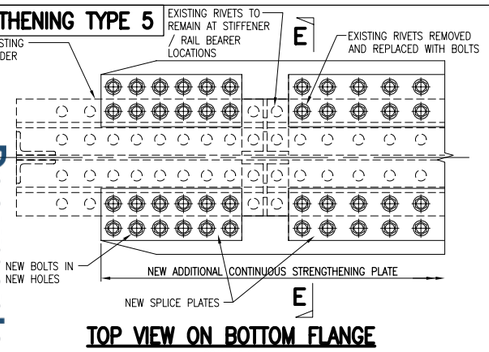
SCALE 1:10



SECTION D–D

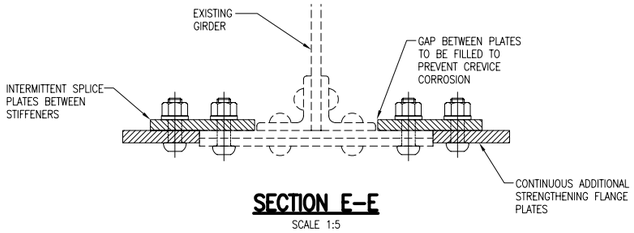
SCALE 1:5

STRENGTHENING TYPE 5



TOP VIEW ON BOTTOM FLANGE

SCALE 1:10



SECTION E–E

SCALE 1:5

TYPICAL BOTTOM FLANGE STRENGTHENING

1. THE FOLLOWING INSTALLATION SEQUENCE HAS BEEN DEVELOPED ON THE BASIS THAT:
   - THE PREPARATORY WORKS ARE TO BE CARRIED OUT (IN THE MAIN) DURING NORMAL WORKING HOURS, DURING WHICH TRAINS WILL BE OPERATING OVER THE STRUCTURE. THE CONTRACTOR IS TO BE AWARE THAT THE STRUCTURE WILL BE LIVE AND ALL NECESSARY PROTECTION TO TRAINS / WORKFORCE SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF THE WORKS.
   - ALL PREPARATORY WORKS CAN BE UNDERTAKEN OUTSIDE OF POSSESSIONS.
   - CONNECTIONS ARE TO BE CARRIED OUT DURING IN BETWEEN TRAIN PERIODS / POSSESSIONS WITH NO TRAIN MOVEMENT.
   - REAMING OF HOLES IS TO BE CARRIED OUT DURING IN BETWEEN TRAIN PERIODS.
   - STEELWORK INSTALLATION IS TO BE CARRIED OUT DURING POSSESSIONS WITH NO TRAIN MOVEMENTS.
   - THE ERECTION SEQUENCE OF EACH INDIVIDUAL PART AND THE CONNECTIONS TO THE EXISTING STEELWORK IS SUCH TO MAINTAIN THE EXISTING STRUCTURES INTEGRITY AND TO PREVENT THE BUILD UP OF LOCKED IN STRESSES.

SAFETY

STRENGTHENING TYPE 1
PROPOSED SEQUENCE OF WORKS (INDICATIVE)

1. DRILL NEW HOLES IN EXISTING ANGLES OUTSIDE OF POSSESSIONS
2. REMOVE EXISTING PROTECTIVE PAINT FROM FLANGE TO RECEIVE NEW PLATES TO MEET REQUIRED FAYING SURFACE.
3. INSTALL NEW STRENGTHENING PLATES AND FASTEN TO EXISTING ANGLES WITH PERMANENT BOLTS DURING A POSSESSION.

SAFETY

THE DESIGNER IS TO CONFIRM THE INSTALLATION SEQUENCE AND CHECK IF UNDER PERMANENT AND LIVE LOAD CONDITIONS THAT HOLES CAN BE DRILLED THROUGH THE FLANGE ANGLES EITHER ONE ANGLE AT A TIME OR SIMULTANEOUSLY. IF SIMULTANEOUS HOLES CAN NOT BE DRILLED THE DETAIL MAY BE MODIFIED TO TWO HALVES AS SHOWN IN TYPE 2.

STRENGTHENING TYPE 2
PROPOSED SEQUENCE OF WORKS (INDICATIVE)

1. EXISTING RIVETS TO BE REMOVED ONE AT A TIME AND REPLACED WITH TEMPORARY BOLTS OUTSIDE OF POSSESSION.
2. REMOVE EXISTING PROTECTIVE PAINT FROM FLANGE TO RECEIVE NEW PLATES TO MEET REQUIRED FAYING SURFACE.
3. INSTALL NEW STRENGTHENING PLATES AND FASTEN TO EXISTING FLANGE WITH PERMANENT BOLTS ONE SIDE AT A TIME DURING POSSESSION.

SAFETY

THE DESIGNER IS TO CONFIRM THE INSTALLATION SEQUENCE AND CHECK IF UNDER PERMANENT LOAD CONDITIONS ALL CONNECTIONS TO ONE SIDE CAN BE REMOVED AT THE SAME TIME. IN THE EVENT THIS CAN NOT BE INSTALLED TO THIS REQUIREMENT THE DESIGNER IS TO CONFIRM THE NUMBER AND ARRANGEMENT OF RIVETS THAT ARE TO REMAIN IN PLACE AND PROVIDE CHEESE HOLES IN THE PLATE AS NECESSARY.

STRENGTHENING TYPE 3
PROPOSED SEQUENCE OF WORKS (INDICATIVE)

1. EXISTING OUTER RIVETS TO BE REMOVED ONE AT A TIME AND LEFT BLANK WITH TEMPORARY BOLTS INSTALLED IN EVERY SIXTH HOLE TO MAINTAIN CLAMPING OF PLATES DURING THE TEMPORARY CONDITION.
2. REMOVE EXISTING PROTECTIVE PAINT FROM FLANGE TO RECEIVE NEW PLATES TO MEET REQUIRED FAYING SURFACE.
3. INSTALL NEW STRENGTHENING PLATES TO EXISTING FLANGE WITH PERMANENT BOLTS AND HAND TIGHT CONNECTIONS.
4. DURING A POSSESSION FULLY TORQUE BOLTS.

SAFETY

THE DESIGNER IS TO CONFIRM THE INSTALLATION SEQUENCE AND CHECK IF UNDER PERMANENT AND LIVE LOAD CONDITIONS THAT HOLES CAN BE DRILLED THROUGH THE FLANGE PLATES EITHER ONE SIDE AT A TIME OR SIMULTANEOUSLY.

STRENGTHENING TYPE 4
PROPOSED SEQUENCE OF WORKS (INDICATIVE)

1. EXISTING OUTER RIVETS TO BE REMOVED ONE AT A TIME AND LEFT BLANK WITH TEMPORARY BOLTS INSTALLED IN EVERY SIXTH HOLE TO MAINTAIN CLAMPING OF PLATES DURING THE TEMPORARY CONDITION.
2. REMOVE EXISTING PROTECTIVE PAINT FROM FLANGE TO RECEIVE NEW PLATES TO MEET REQUIRED FAYING SURFACE.
3. INSTALL NEW STRENGTHENING PLATES TO EXISTING FLANGE WITH PERMANENT BOLTS AND HAND TIGHT CONNECTIONS.
4. DURING A POSSESSION FULLY TORQUE BOLTS.

SAFETY

THE DESIGNER IS TO CONFIRM THE INSTALLATION SEQUENCE AND CHECK IF UNDER PERMANENT AND LIVE LOAD CONDITIONS THAT HOLES CAN BE DRILLED THROUGH THE FLANGE PLATES EITHER ONE SIDE AT A TIME OR SIMULTANEOUSLY.

THIS STRENGTHENING ARRANGEMENT IS OFTEN NOT SUITED TO CROSS GIRDERS OR MAIN GIRDERS AS INTER CONNECTING CROSS GIRDERS, STIFFENERS, RAIL BEARERS AND THE LIKE PREVENT THE PLATE BEING CONTINUOUS. REFER TO STRENGTHENING TYPE 5 FOR ALTERNATIVE ARRANGEMENT.

STRENGTHENING TYPE 5
PROPOSED SEQUENCE OF WORKS (INDICATIVE)

1. EXISTING OUTER RIVETS TO BE REMOVED ONE AT A TIME AND LEFT BLANK WITH TEMPORARY BOLTS INSTALLED IN EVERY SIXTH HOLE TO MAINTAIN CLAMPING OF PLATES DURING THE TEMPORARY CONDITION.
2. REMOVE EXISTING PROTECTIVE PAINT FROM FLANGE TO RECEIVE NEW PLATES TO MEET REQUIRED FAYING SURFACE.
3. INSTALL NEW SPLICE PLATES AND STRENGTHENING PLATES TO EXISTING FLANGE WITH PERMANENT BOLTS AND HAND TIGHT CONNECTIONS.
4. DURING A POSSESSION FULLY TORQUE BOLTS.

SAFETY

THE DESIGNER IS TO CONFIRM THE INSTALLATION SEQUENCE AND CHECK IF UNDER PERMANENT AND LIVE LOAD CONDITIONS THAT HOLES CAN BE DRILLED THROUGH THE FLANGE PLATES EITHER ONE SIDE AT A TIME OR SIMULTANEOUSLY.

THIS STRENGTHENING ARRANGEMENT IS OFTEN NOT SUITED TO CROSS GIRDERS OR MAIN GIRDERS AS INTER CONNECTING CROSS GIRDERS, STIFFENERS, RAIL BEARERS AND THE LIKE PREVENT THE PLATE BEING CONTINUOUS. REFER TO STRENGTHENING TYPE 5 FOR ALTERNATIVE ARRANGEMENT.

REPAIR TYPE 6
PROPOSED SEQUENCE OF WORKS (INDICATIVE)

1. REMOVE EXISTING PAINT FROM FLANGE TO RECEIVE NEW PLATES
2. INSTALL NEW PLATE AND WELD TO EXISTING.

DRAWING No. NR/CIV/SD/816

NOTES

GENERAL NOTES

1. THIS DRAWING SHOWS A TYPICAL EXAMPLE OF BOTTOM FLANGE STRENGTHENING USED TO GENERATE ADDITIONAL CAPACITY TO EXISTING METALLIC GIRDERS.
2. THE SIZES AND DIMENSIONS SHOWN ON THIS DRAWING RELATE TO EITHER A TYPICAL LONGITUDINAL OR CROSS GIRDER. THE CONFIGURATION OF STRENGTHENING PLATE IS THE RESPONSIBILITY OF THE DESIGNER.
3. ALL EXISTING PLATES, STIFFENERS AND CONFIGURATION OF THE GIRDER ARE TO BE CONFIRMED ON SITE BY THE DESIGNER.
4. THIS DRAWING TO BE READ IN CONJUNCTION WITH NR/CIV/SD/817.

SPECIFICATION

1. FOR SPECIFICATION REFER TO DRG. NR/CIV/SD/801.

DESIGN ASSUMPTIONS

1. THE DESIGNER SHALL BE RESPONSIBLE FOR THE DESIGN OF THE FLANGE STRENGTHENING SYSTEM WHICH SHALL ADDRESS AS A MINIMUM THE FOLLOWING.
   - A) CLEARANCES FOR ACCESS TO THE WORKS
   - B) 'LOCKED IN' PERMANENT LOAD STRESSES
   - C) CONDITION OF EXISTING FLANGES
   - D) CLEARANCES BETWEEN BOLTS
   - E) EXTENT AND SEQUENCE OF RIVET REPLACEMENT IF REQUIRED
   - F) INTEGRITY OF FLOOR CONNECTIONS
2. THE DESIGNER SHALL CHECK THE VARIOUS STAGES IN THE CONSTRUCTION SEQUENCE TO ENSURE THE INTEGRITY OF THE GIRDER AND OTHER CONNECTING PARTS ARE MAINTAINED THROUGHOUT THE WORKS. (SAFETY)
3. THE DESIGNER SHALL SPECIFY THE SLIP FACTOR (μ) REQUIRED FOR FAYING SURFACES TO SATISFY THE DESIGN.
4. THE DESIGNER SHALL CHECK THE NUMBER OF RIVETS OR BOLTS THAT CAN BE REMOVED AT ANY ONE TIME UNDER THE LOADING REGIME FOR THE GIVEN WORK ITEM. (SAFETY)
5. THE DESIGNER IS TO CONSIDER THE REQUIREMENT FOR TAPERED WASHERS ON SLOPING ANGLE LEGS.

NOTE

- DENOTES NEW BOLT IN EXISTING HOLE REAMED TO SUIT.
- DENOTES NEW BOLT IN PRE DRILLED HOLE.
- DENOTES EXISTING RIVET TO BE LEFT IN PLACE.

Rev	Date	Description of revision	Design'd	C'kd
A	22.06.12	FIRST ISSUE	MK	AGW
P3	01.07.11	DRAFT PUBLICATION ISSUE	MK	AGW
P2	14.04.11	ISSUED FOR FORM B	MK	AGW
P2	24.02.11	ISSUED FOR COMMENT	MK	AGW
P1	24.01.11	DRAFT ISSUE	MK	AGW

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Approved	Name	Position	Signature	Date
	Paul Clark	Head of Engineering Infrastructure Projects Central Region	P.C.	June 12

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METALLIC STRUCTURE REPAIRS STANDARD DRAWINGS

BOTTOM FLANGE STRENGTHENING DETAILS

Scale	AS SHOWN	
Drawing Number	NR/CIV/SD/816	A

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