SECTION VIII: DRAWINGS

Name of Work:
Construction of Jamkhardrang Steel Composite Bridge on Chazam-Duskum SNH

BID. No.: DoR/RO-Tg/Works(03)
## LIST OF DRAWINGS

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## LIST OF DRAWINGS

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<td>JKD-ABT-26</td>
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## SHEET CONTENTS:

- **ROYAL GOVERNMENT OF BHUTAN**
- Ministry of Works & Human settlement
- Department of Roads, Bridge Division
- Thimphu, Bhutan

<table>
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<th>DRAWING LIST</th>
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34 M SPAN STEEL COMPOSITE BRIDGE (7.0 m carriageway width)
GENERAL NOTES
1. ALL THE DIMENSIONS ARE IN MILLIMETER AND LEVELS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2. DO NOT SCALE THE DRAWINGS USE GIVEN DIMENSIONS ONLY DURING THE CONSTRUCTION.
3. DURING THE CONSTRUCTION, THE CONTRACTOR MUST CHECK THE DIMENSIONS, LEVELS AND MEASUREMENTS. DISCREPANCY IF ANY TO BE REPORTED TO THE ENGINEER BEFORE EXECUTION.
4. THE STRUCTURE IS DESIGNED TO CATER THE MAXIMUM OF:
   A) CLASS A LOADING - ONE, TWO
   B) CLASS 70R WHEELED
5. ALL CONSTRUCTION SHALL CONFIRM TO CONTRACT SPECIFICATIONS.
7. EXPANSION JOINT - STRIP SEAL.
8. BEARING TYPE - STEEL REINFORCED ELASTOMERIC BEARING.
9. PRE-CAMBER OF 20 MM TO BE PROVIDED DURING FABRICATION AND ERECTION OF LONGITUDINAL GIRDER.

CONCRETE
CONCRETE SHALL BE OF DESIGN MIX AND SHALL HAVE MINIMUM 28 DAYS CHARACTERISTIC CUBE STRENGTH AS FOLLOWS:
1. M35 - FOR RCC DECK SLAB
2. M35 - FOR KERBS AND RAILING POSTS
3. M35 - FOR PEDESTALS AND SEISMIC ARRESTORS
4. M35 - FOR SUBSTRUCTURE
5. M25 - FOR APPROACH SLAB
6. M15 - FOR PCC LEVELING CONCRETE

REINFORCEMENT
1. ALL REINFORCEMENT SHALL BE OF HIGH YIELD STRENGTH DEFORMED BARS (MIN Y 500 MPa).
3. SPLICES SHALL BE STAGGERED AT LEAST 600 MM AND ALL SPLICES SHALL BE CLASS B SPLICES.
4. MINIMUM LAP LENGTH OF REINFORCEMENT SHALL BE CONFORM TO AASHTO2007 AS SHOWN BELOW FOR CLASS B SPLICES:

<table>
<thead>
<tr>
<th>BAR DIA, mm</th>
<th>LAP SPICE, mm</th>
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<tbody>
<tr>
<td>10</td>
<td>500</td>
</tr>
<tr>
<td>12</td>
<td>412</td>
</tr>
<tr>
<td>16</td>
<td>328</td>
</tr>
<tr>
<td>20</td>
<td>284</td>
</tr>
<tr>
<td>25</td>
<td>238</td>
</tr>
<tr>
<td>32</td>
<td>197</td>
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</table>

5. CLEAR CONCRETE COVER TO REINFORCEMENT SHALL BE:
   - 50 MM FOR ABUTMENT WALLS &
   - 30 MM FOR DECK AND APPROACH SLABS.
   UNLESS OTHERWISE SPECIFIED BY ENGINEER, THIS SHALL BE FOLLOWED THROUGHOUT THE CONSTRUCTION.
6. SPECIFICALLY MADE COVER BLOCKS OF SAME STRENGTH AS THAT OF CONCRETE AND DIMENSION AS PROVIDED IN DRAWINGS SHALL BE ONLY USED TO OBTAIN THE UNIFORMITY OF CLEAR COVER THROUGH OUT THE CONSTRUCTION.

STEEL
1. STEEL PLATE GIRDER: MILD STRENGTH STEEL GIRDER (GRADE E 250 CONFORMING TO IS:2062).
2. STEEL PLATE GIRDER: MILD STEEL CONFORMING TO IS: 2062.
3. STUD SHEAR CONNECTORS: SHALL CONFORM TO IRC:22-2008; FY 385 MPA, MIN.
4. ELONGATION 18% AND CHARACTERISTIC TENSILE STRENGTH OF 495 MPA.

BOLTS
1. WEB AND FLANGE SPICE: 270 HSFG BOLTS (GRADE 10.9 IN CLEARANCE HOLE).
2. DIAPHRAGM GIRDER: 220 HSFG BOLTS (GRADE 10.9 IN CLEARANCE HOLE).
3. STIFFENER AND BRACING: 160 HSFG BOLTS (GRADE 10.9 IN CLEARANCE HOLE).
4. HSFG BOLTS - ACTING IN FRICITION SHALL CONFORM TO IS:4000 - 1992
   - SLIP FACTORS (=0.3) FOR PAYING SURFACES CONFORMING TO IS:4000 - 1992

WELDS
1. THE WELDING CONSUMABLES SHALL CONFORM TO IS:814 - 1991 AND OF STRENGTH REQUIREMENT APPROPRIATE FOR PREHEATED HT STEEL OR UNHEATED MILD STEEL.
2. ALL FILLET WELDS ARE TO BE EXAMINED BY DYE PENETRATION TEST OR ANY EQUALLY EFFECTIVE NON-DESTRUCTIVE TEST METHOD.
3. ALL WELDINGS TO BE CARRIED OUT BY CERTIFIED EXPERIENCED WELDERS AS PER APPROVED WELDING PROCEDURES.
4. MEMBERS SHALL BE RIGIDLY SECURED IN JIGS AND FIXTURES WITH TEMPORARY BOLTS DURING WELDING TO AVOID DISTORTION.
5. DURING WELDING, POSITION OF MEMBERS AND ASSEMBLY SHOULD BE SUCH THAT OVERHEAD WELDING SHALL BE AVOIDED/ MINIMISED.

FABRICATION AND ERECTION
1. FABRICATION WORKS TO BE CARRIED OUT AS PER APPROVED FABRICATION DRAWINGS AND AS PER IRC:24, IS: 816 AND IS:1024.
2. ALL THE MEMBERS MEETING AT A JOINT SHALL BE CONNECTED AS PER DETAILS.
3. ALL BRACING GUSSETS SHALL BE 12 MM THICK UNLESS SPECIFIED OTHERWISE.
4. PAINTING OF STEEL STRUCTURE SHALL BE CARRIED OUT IN ACCORDANCE WITH MORTH SPECIFICATIONS FOR ROAD AND BRIDGES, REVISION IV.
5. CROSS BRACING SHOULD BE PROVIDED SQUARE TO LONGITUDINAL GIRDER.
6. ALL STUD SHEAR CONNECTORS: SHALL CONFORM TO IRC:22-2008; FY 385 MPA, MIN.
7. ELONGATION 18% AND CHARACTERISTIC TENSILE STRENGTH OF 495 MPA.

CONSTRUCTION SEQUENCE
1. STEEL PLATE GIRDER TO BE FABRICATED ON GROUND.
2. ALL LONGITUDINAL GIRDER TO ERECTED AT SITE.
3. DIAPHRAGM GIRDER AND CROSS BRACINGS TO BE FIXED.
4. THE DECK SLAB TO BE CASTED ONLY AFTER ALL BRACING AND CONNECTION WORKS ARE COMPLETED.

WATER
WATER TO BE USED IN THE CONCRETING AND CURING SHALL BE PORTABLE WATER.

SUPERVISION
CONSTRUCTION WORK MUST BE SUPERVISED BY A COMPETENT SUPERVISION ENGINEER.
**REBAR HOOK SPECIFICATION**

### 45° Hook

- **Detailed Length**
- **Hook Length**
- **Unbend Hook Length**
- **Offset Length**
- **Diameter**
- **Extension**

### 90° Hook

- **Detailed Length**
- **Bend 0 + Bar 0**
- **Unbend Hook Length**
- **Offset Length**
- **Diameter**
- **Extension**

### 135° Hook

- **Detailed Length**
- **Bend 0 + Bar 0**
- **Unbend Hook Length**
- **Offset Length**
- **Diameter**
- **Extension**

### 180° Hook

- **Detailed Length**
- **Bend 0 + Bar 0**
- **Unbend Hook Length**
- **Offset Length**
- **Diameter**
- **Extension**

---

**STANDARD RE-BAR PROPERTIES**

(UNIT WT. 0.00785 kg / mm²/m)

<table>
<thead>
<tr>
<th>Rebar Designation</th>
<th>Dia, mm</th>
<th>Area, mm²</th>
<th>Unit WT., kg/m</th>
<th>Rebar Type</th>
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<tr>
<td>T10</td>
<td>10</td>
<td>79</td>
<td>0.617</td>
<td>IS : 1786 GRADE Fe 500</td>
</tr>
<tr>
<td>T12</td>
<td>12</td>
<td>113</td>
<td>0.888</td>
<td>IS : 1786 GRADE Fe 500</td>
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<tr>
<td>T16</td>
<td>16</td>
<td>201</td>
<td>1.578</td>
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<tr>
<td>T20</td>
<td>20</td>
<td>314</td>
<td>2.466</td>
<td>IS : 1786 GRADE Fe 500</td>
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<tr>
<td>T25</td>
<td>25</td>
<td>491</td>
<td>3.853</td>
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<tr>
<td>T28</td>
<td>28</td>
<td>616</td>
<td>4.834</td>
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<tr>
<td>T32</td>
<td>32</td>
<td>804</td>
<td>6.313</td>
<td>IS : 1786 GRADE Fe 500</td>
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**STANDARD HOOK AND BEND REQUIREMENT**

(ART. 5.10 AASHTO LRFD 2007)

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<th>Bending Diameter</th>
<th>Standard Hook Extension, mm</th>
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<tr>
<td>TIE/STIRRUPS</td>
<td>OTHER 90° 135° 180°</td>
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</tr>
<tr>
<td>T10</td>
<td>40</td>
<td>60 75 120 65</td>
</tr>
<tr>
<td>T12</td>
<td>48</td>
<td>72 75 144 65</td>
</tr>
<tr>
<td>T16</td>
<td>64</td>
<td>96 96 192 65</td>
</tr>
<tr>
<td>T20</td>
<td>-</td>
<td>120 240 120 80</td>
</tr>
<tr>
<td>T25</td>
<td>-</td>
<td>150 300 150 100</td>
</tr>
<tr>
<td>T28</td>
<td>-</td>
<td>168 336 168 112</td>
</tr>
<tr>
<td>T32</td>
<td>-</td>
<td>256 192 384 128</td>
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1 ALL REINFORCEMENT SHALL BE COLD BEND

---

**SHAPE CODE AS PER ISO 4066 : 2000**

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<th>Legend</th>
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</tr>
<tr>
<td>00</td>
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<tr>
<td>51</td>
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</table>

**LEGEND:**

- r = BENDING RADIUS AS PER TABLE 4
- d = DIAMETER OF BAR
- ab/cd = AS SHOWN

---

**SHEET CONTENTS:**

- **REBAR CODES & SHAPE DETAILS**
- **REVISION**
- **DATE**
- **NAME & SIGNATURE**
- **DRAWING NO.**

**ROYAL GOVERNMENT OF BHUTAN**

Ministry of Works & Human settlement

Department of Roads, Bridge Division

Thimphu, Bhutan

**JAMKHARDRANG ZAM**

On Tashigang - Tashi Yangtse Road

34 M SPAN STEEL COMPOSITE BRIDGE

(7.0 m carriageway width)
SECTION "E-E"

VERTICAL STIFFENER
(Plate 130 x 10 thick)

ISA 100x100x8

SECTION "F-F"

BEARING STIFFENER
(Plate 160 x 12 thick)

2x2 ISA 100x100x10

SECTION "G-G"

DIAPHRAGM GIRDER

2 ISA 200x200x16
SHEET CONTENTS:

ROYAL GOVERNMENT OF BHUTAN
Ministry of Works & Human settlement
Department of Roads, Bridge Division
Thimphu, Bhutan

CROSS BRACING CONNECTION DETAILS

34 M SPAN STEEL COMPOSITE BRIDGE
(7.0 m carriageway width)

JAMKHANDRANG ZAM
On Tashigang - Tashi Yangtse Road

KARMA WANGDI (EE)
JANGCHUK YESHI (CE)
TSHEWANG DORJI (CE, BD)

April 2016

FIRST ISSUE
April 2016

REVISION
DATE
NAME & SIGNATURE
DRAWING NO.

DESIGN
KARMA WANGDI (EE)

CHECKED
JANGCHUK YESHI (CE)

APPROVED
TSHEWANG DORJI (CE, BD)

JKD-BC-11

(44 Sheet A3 size)

SHEET CONTENTS:

ROYAL GOVERNMENT OF BHUTAN
Ministry of Works & Human settlement
Department of Roads, Bridge Division
Thimphu, Bhutan

CROSS BRACING CONNECTION DETAILS

34 M SPAN STEEL COMPOSITE BRIDGE
(7.0 m carriageway width)

JAMKHANDRANG ZAM
On Tashigang - Tashi Yangtse Road

KARMA WANGDI (EE)
JANGCHUK YESHI (CE)
TSHEWANG DORJI (CE, BD)

April 2016

FIRST ISSUE
April 2016

REVISION
DATE
NAME & SIGNATURE
DRAWING NO.

DESIGN
KARMA WANGDI (EE)

CHECKED
JANGCHUK YESHI (CE)

APPROVED
TSHEWANG DORJI (CE, BD)

JKD-BC-11

(44 Sheet A3 size)
34 M SPAN STEEL COMPOSITE BRIDGE
(7.0 m carriageway width)

SHEET CONTENTS:
- WEB SPlice DETAILS

DRAWING NO.  JKD-WS-12

SCALE: 1:10

(As Sheet A3 size)
TOP FLANGE SPLICE
(VIEW "J-J")

BOTTOM FLANGE SPLICE
(VIEW "K-K")

14 mm thick plate (980x450)

2x24 Nos. 27 dia. bolts

2x34 Nos. 27 dia. bolts

2 Nos. 14 mm thick plates (980x205)

2 Nos. 20 mm thick plates (980x230)

20 mm thick plate (980x500)

2x24 Nos. 27 dia. bolts

10 mm GAP

TOP PLATE

BOTTOM PLATE

TOP PLATES

BOTTOM PLATES

34 M SPAN STEEL COMPOSITE BRIDGE (7.0 m carriageway width)

SHEET CONTENTS:

ROYAL GOVERNMENT OF BHUTAN
Ministry of Works & Human settlement
Department of Roads, Bridge Division
Thimphu, Bhutan

JAMKHARDRANG
ZAM
On Tashigang - Tashi Yangtse Road

KARMA WANGDI (EE)
JANGCHUK YESHI (CE)
TSHEWANG DORJI (CE, BD)

FIRST ISSUE April 2016
DESIGN KARMA WANGDI (EE)
DRAWN KARMA WANGDI (EE)
CHECKED JAMKHARDRANG
APPROVED TSHEWANG DORJI (CE, BD)

DRAWING NO. JKD-FS-13
SCALE 1:10 (as Sheet A3 size)
**DETAIL "7"**

- **260 mm thick deck slab**
- **50 mm average thickness black top**
- **Drainage spout** (refer Dwg. No. DZL-DS-15)
- **Construction joint**

**SIDE ELEVATION VIEW "L-L"**

- **RCC Head**
- **RCC Post (200x200)**
- **750 GI Pipes**

**PLAN VIEW "M-M"**

- **RCC Post (200x200)**
- **Drainage spout**
- **750 GI Pipes**

**DECK SLAB**

- **260 mm thick deck slab**
- **50 mm average thickness black top**

---

**SHEET CONTENTS:**

- **ROYAL GOVERNMENT OF BHUTAN**
- **Ministry of Works & Human settlement**
- **Department of Roads, Bridge Division**
- **Thimphu, Bhutan**

**RAILING DETAILS**

- **JAMKHARDRANG ZAM**
  - On Tashigang - Tashi Yangtse Road

**34 M SPAN STEEL COMPOSITE BRIDGE**

- **(7.0 m carriageway width)**

---

**REVISION DATE NAME & SIGNATURE**

- **FIRST ISSUE April 2016**
  - **DESIGN KARMA WANGDI (EE)**
  - **DRAWN KARMA WANGDI (EE)**
  - **CHECKED JANGCHUK YESHI (GE)**
  - **APPROVED TSHERING DORJI (GE, BD)**

**DRAWING NO.**

- **JKD-RD-14**

**SCALE**

- **1:25**

**(as Sheet A3 size)**
TYPICAL DETAIL OF EXPANSION JOINT
(Scale 1:3)

ROYAL GOVERNMENT OF BHUTAN
Ministry of Works & Human settlement
Department of Roads, Bridge Division
Thimphu, Bhutan

KARMA WANGDI (EE)
JANGCHUK YESHI (CE)
TSHEWANG DORJI (CE, BD)

April 2016

JAMKHARDRANG
ZAM
On Tashigang - Tashi Yangtse Road

34 M SPAN STEEL COMPOSITE BRIDGE
(7.0 m carriageway width)

EXPANSION JOINT DETAILS

REVISION DATE NAME & SIGNATURE DRAWING NO.
FIRST ISSUE April 2016 KARMA WANGDI (EE) JKD-EJ-15
DESIGN
DRAWN
CHECKED
APPROVED

(As Sheet A3 size)
NOTE:

i) All connections are welded connections

ii) All welds as fillet welds a=4mm

iii) All steel parts should be hot dip galvanised

TOTAL NUMBER OF DRAINAGE SPOUTS REQUIRED = 16 NOS.
## Rebar Schedule of Deck Slab (Table - 2)

<table>
<thead>
<tr>
<th>Member</th>
<th>Bar Mark</th>
<th>Type &amp; Size</th>
<th>Length of each bar (mm)</th>
<th>Number of members</th>
<th>Number of bar in each member</th>
<th>Total number</th>
<th>Total length (mm)</th>
<th>Shape code</th>
<th>Bending Dimension</th>
<th>Additional Information</th>
<th>Hook</th>
<th>Total Weight (Kgs)</th>
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**Total** | **8054.72**

---

**Design & Brief Information**

** Sheet : ** DECK SLAB REINFORCEMENT SCHEDULE

**Sheets : ** Sheet A3 size

**Drawing No. : ** JKD-SL-18

**First Issue : ** April 2016

**Drawn by : ** JANGCHUK YESHI (CE)

**Checked by : ** JANGCHUK YESHI (CE), RINCHEN KHANDU (Dy. EE), TSHEWANG DORJI (CE, BD)

**Approved by : ** JAMIKHARDRANG ZAM (ZAM)

**Project : ** 34 M SPAN STEEL COMPOSITE BRIDGE (7.0 m carriageway width)
### Rebar Schedule of Approach Slab

#### Table - 3

<table>
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<tr>
<th>Member</th>
<th>Bar Mark</th>
<th>Type &amp; Size</th>
<th>Length of each bar</th>
<th>Number of each bar</th>
<th>Total Length</th>
<th>Shape Code</th>
<th>Bending Dimension</th>
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**Additional Information**
- **Hook**: START and END
- **Total Weight**: Kgs
- **Location/Remarks**
  - Bottom bar in transverse direction
  - Bottom bar in longitudinal direction
  - Top bar in transverse direction
  - Top bar in longitudinal direction
  - Chairs
  - Stirrups for Kerbs
  - Top bar in longitudinal direction
  - Bottom bar in longitudinal direction
  - Side bar in longitudinal direction
  - Vertical reinfor.
  - Vertical reinfor.
  - Ties for railing post
  - Top post reinfor. Bar

---

**This Schedule has been prepared in accordance with ISO 4066:2000**

**Total**: 1544.03 Kgs
ROCK ANCHORAGE PLAN

Hole diameter of at least 32mm

11x5=55-01-T20-600/800 (Rock Anchorage)

FOOTING REINFORCEMENT PLAN

Legend:
- Top bar
- Bottom bar

55-02-T16-150-bott
55-07-T12-150-top
18-03-T12-150-bott
18-08-T12-150-top

SHEET CONTENTS:
ROYAL GOVERNMENT OF BHUTAN
Ministry of Works & Human settlement
Department of Roads, Bridge Division
Thimphu, Bhutan

34 M SPAN STEEL COMPOSITE BRIDGE
(7.0 m carriageway width)

ABUTMENT REINFORCEMENT DETAILS (2 OF 2)

REVISION DATE
NAME & SIGNATURE
DRAWN
CHECKED
APPROVED
SCALE

JAMKHARDRANG
ZAM
On Tashigang - Tashi Yangtze Road

JAMKHARDRANG
ZAM

KARMA WANGDI (EE)
BUNCHUK WANGDI (Dy. EE)
JANGCHUK YESHI (CE)
TSHEWANG DORJI (CE, BD)

JAMKHARDRANG
ZAM

April 2016

JKD-ABT-23

1:45

(As Sheet A3 size)
NOTE:
THE SIZE OF BEARING PEDESTAL/BEARING SEAT
WOULD CHANGE AS PER MANUFACTURER'S DESIGN
REQUIREMENTS.
## ABUTMENT REINFORCEMENT SCHEDULE

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<th>Total length</th>
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<td>320</td>
<td>Std - 90 deg.</td>
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**TOTAL:** 4448.52

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**Notes:**
- This schedule has been prepared in accordance with ISO 4066:2000.