BRIDGE STRENGTHENING WORKS AT NIKACHHU ZAM, WANGDUE - TRONGSA HIGHWAY
# DRAWING LIST

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<th>DESCRIPTION</th>
<th>DRAWING NUMBER</th>
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<td>DETAILS 'A' &amp; 'B'</td>
<td>BSW-NKZ-09</td>
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<td>FOOTING PLAN &amp; REINFORCEMENT DETAILS</td>
<td>BSW-NKZ-12</td>
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<td>14</td>
<td>MESH DETAILS, SECTION &quot;C-C&quot; &amp; SECTION &quot;D-D&quot; OF TRESTLE FOOTING</td>
<td>BSW-NKZ-13</td>
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<td>STEEL PLACEMENT PLAN AND SECTION DETAILS</td>
<td>BSW-NKZ-14</td>
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<td>16</td>
<td>GABION WALL LAYOUT</td>
<td>BSW-NKZ-15</td>
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<td>17</td>
<td>REBAR SCHEDULE OF TRESTLE FOUNDATION</td>
<td>BSW-NKZ-16</td>
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</table>
GENERAL NOTES FOR ABUTMENT CONSTRUCTION

A. GENERAL

1. THE NOTES IN THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL
   RELEVANT DRAWING PERTAINING TO THE BRIDGE.

2. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS IN MILLIMETER (mm) AND
   ALL LEVELS ARE IN METER (m). DIMENSIONS ARE NOT TO BE SCALED AND ONLY
   WRITTEN DIMENSION ARE TO BE FOLLOWED.

3. THE CONTRACTOR SHALL VERIFY ALL CHAINAGES, REDUCED LEVELS,
   COORDINATES AND DIMENSIONS BEFORE START OF THE WORK. INCASE
   OF ANY DISCREPANCY, THE MATTER SHALL BE BROUGHT TO NOTICE OF
   THE ENGINEER.

4. ABUTMENTS OF THE BRIDGE IS DESIGNED AS PER IRC - 21 & IS 456 USING MIDAS CIVIL.

5. LOADING: CLASS 24R AS PER IRC.

B. CONCRETE

UNLESS OTHERWISE SPECIFICALLY MENTIONED IN THE DRAWINGS OR DIRECTED
BY THE ENGINEER, CONCRETE GRADE SHALL BE AS PER THE RELATED SECTION
OF CONTRACT DOCUMENT PARTLY REPRODUCED AS BELOW:

<table>
<thead>
<tr>
<th>APPLICATION LOCATION</th>
<th>SPECIFIED COMPRRESSIVE STRENGTH IN CUBE (28 DAYS) IN MPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>REINFORCED CONCRETE (RCC) FOOTING SLAB AND ABUTMENT</td>
<td>M25</td>
</tr>
<tr>
<td>PLAIN CEMENT CONCRETE (PCC) FOR LEVELING</td>
<td>M10</td>
</tr>
</tbody>
</table>

C. REINFORCEMENT

1. ALL REINFORCEMENT SHALL BE OF HIGH YIELD STRENGTH
   DEFORMED BARS (MIN fy 500 MPa).


3. MINIMUM LAP LENGTH OF REINFORCEMENT SHALL BE CONFORM TO
   AASHTO/2007. IF 50% OF REINFORCEMENT IS TO BE SPLICED PROVIDE
   CLASS B AND FOR 100% SPLICING PROVIDE CLASS C AS SHOWN BELOW:

<table>
<thead>
<tr>
<th>BAR DIA mm</th>
<th>DEV. LENGTH, mm</th>
<th>SPLICE LENGTH, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>220</td>
<td>300</td>
</tr>
<tr>
<td>12</td>
<td>317</td>
<td>317</td>
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<td>18</td>
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<td>880</td>
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<td>22</td>
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<td>1374</td>
<td>1797</td>
</tr>
<tr>
<td>28</td>
<td>1724</td>
<td>2247</td>
</tr>
<tr>
<td>32</td>
<td>2252</td>
<td>2931</td>
</tr>
</tbody>
</table>

4. CLEAR CONCRETE COVER TO REINFORCEMENT IS AS FOLLOW.
   UNLESS OTHERWISE SPECIFIED BY ENGINEER,
   THIS SHALL BE FOLLOWED THROUGHOUT THE CONSTRUCTION.

   | ABUTMENT (ALL SIDES) (UP TO OUTER FACE OF MAIN REINFORCEMENT) = 50 MM |
   | RETURN WALL (ALL SIDES) (UP TO OUTER FACE OF MAIN REINFORCEMENT) = 50 MM |

5. 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.

D. WATER

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

E. SUPERVISION

CONSTRUCTION WORK MUST BE SUPERVISED BY A COMPETENT
SUPERVISION ENGINEER.
### TABLE 3: 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>
</tr>
</thead>
<tbody>
<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>
</tr>
<tr>
<td>T16</td>
<td>16</td>
<td>201</td>
<td>1.578</td>
<td>IS : 1786  GRADE Fe 500</td>
</tr>
<tr>
<td>T20</td>
<td>20</td>
<td>314</td>
<td>2.466</td>
<td>IS : 1786  GRADE Fe 500</td>
</tr>
<tr>
<td>T25</td>
<td>25</td>
<td>491</td>
<td>3.853</td>
<td>IS : 1786  GRADE Fe 500</td>
</tr>
<tr>
<td>T28</td>
<td>28</td>
<td>616</td>
<td>4.834</td>
<td>IS : 1786  GRADE Fe 500</td>
</tr>
<tr>
<td>T32</td>
<td>32</td>
<td>804</td>
<td>6.313</td>
<td>IS : 1786  GRADE Fe 500</td>
</tr>
</tbody>
</table>

### TABLE 4: STANDARD HOOK AND BEND REQUIREMENT

(ART. 5.10 AASHTO LRFD 2007)

<table>
<thead>
<tr>
<th>Rebar Designation</th>
<th>Bending Diameter</th>
<th>Standard Hook Extension, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tie/Stirrups</td>
<td>Other 90°</td>
</tr>
<tr>
<td>T10</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>T12</td>
<td>48</td>
<td>72</td>
</tr>
<tr>
<td>T16</td>
<td>64</td>
<td>96</td>
</tr>
<tr>
<td>T20</td>
<td>-</td>
<td>120</td>
</tr>
<tr>
<td>T25</td>
<td>-</td>
<td>150</td>
</tr>
<tr>
<td>T28</td>
<td>-</td>
<td>168</td>
</tr>
<tr>
<td>T32</td>
<td>-</td>
<td>256</td>
</tr>
</tbody>
</table>

† ALL REINFORCEMENT SHALL BE COLD BEND

### SHAPE CODE AS PER ISO 4066 : 2000

<table>
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<th>21</th>
<th>31</th>
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<tbody>
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</tr>
<tr>
<td>Total Length</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**
- r = Bending Radius as per Table 4
- d = Diameter of Bar above r = As Shown

**Materials:**
1. Concrete 28 Days Strength in Cube, fck = 25 MPa.
2. Yield Strength of Steel, fy = 500 MPa (GRADE Fe 500, IS 1786).
3. Details of Steel is mentioned in the drawing and its quantity in the bar bending schedule.

**Notes:**
1. All the dimensions are in Millimeter unless otherwise mentioned.
2. Do not scale this dimension or use given dimensions only.
3. During the construction, the Contractor must check the dimensions, levels and measurements. Discrepancy if any to be reported to the Engineer before execution.

**Design:**
- SHAPE AND LAYOUT (Fe 500, IS 1786)
- REBAR BENDING SCHEDULE

**Scale:**
- NTs.

**Drawing No.:**
- BSW-NKZ-03

**Revision: First Issue:**
- JUNE 2015
SIDE ELEVATION

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

BRIDGE STRENGTHENING WORKS AT NIKKA CHU ZAM ON WANGDUE - TRONGSA HIGHWAY FOR MHPA
SH: STEEL STAGING WORKS

DRAWING NO. BSW-NKZ-04

KARMA TENZIN (Chief Engineer)

(As Sheet A3 size)
RIGHT TRESTLE

DETAIL "AA"

RCC Girder

STIFFENER @2000MM PITCH

ISHB 300x0.6x7.6
ISHB 350x1.6x8.3

STIFFENER @2000MM PITCH

220 HD BOLT
BASE PLATE

FOOTING SLAB FOR STEEL TRESTLE

LEVELING CONCRETE (C0Y THI CO)

GABION WALL

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

BRIDGE STRENGTHENING WORKS AT NIKKA CHU
ZAM ON WANGDUE - TRONGSA HIGHWAY FOR
MHPA

SH: STEEL STAGING WORKS

DRAWING NO. BSW-NKZ-05

SHEET CONTENTS: RIGHT TRESTLE

REVISION DATE NAME & SIGNATURE DRAWING NO.
FIRST ISSUE JUNE 2015 MASUMI ANDO (Sr. Volunteer, JICA)
DESIGN SUEHIKO KIMURA (ENGINEER)
DRAWN KARMA TSONG (Chief Engineer)
CHECKED MASUMI ANDO (Sr. Volunteer, JICA)
APPROVED

SCALE: 1:60
(in Sheet A3 size)
LEFT TRESTLE

STIFFENER @200MM PITCH

SHB 300x10.6x7.6

SHB 350x11.6x8.3

STIFFENER @200MM PITCH

220 HD BOLT BASE PLATE

220 HD BOLT BASE PLATE

FOOTING SLAB FOR STEEL TRESTLE

LEVELING CONCRETE 00mm THICK

GABION WALL

300

4300

300

LEFT TRESTLE

7000
NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETER & LEVELS ARE IN METER UNLESS OTHERWISE NOTED.
2. ALL STRUCTURAL STEEL SHALL CONFORM TO IS: 2062.
3. ALL WELD SHALL CONFORM TO IS: 9595.
4. LENGTH OF ALL INCLINED MEMBERS AND THE SHAPE AND SIZE OF THE GUSSET PLATES SHALL BE MADE FROM FULL SCALE LAYOUT BEFORE FABRICATION.
5. ALL WELDS TO BE 6 mm. THK. FILLET UNLESS OTHERWISE NOTED.
6. ALL HOLES ARE 25.00 FOR 220 BOLTS OF PROPERTY CLASS 8.8 CONFORMING TO IS: 1363.
7. ALL GUSSET ARE 10 mm THK. PLATE UNLESS OTHERWISE NOTED.
DETAIL "A"

9MM THICK STIFFENER AT 2000MM PITCH FOR EACH TESTLE

DETAIL "B"

22MM Ø BOLTS CONNECTING TWO STEEL SECTIONS

STEEL PLATE 270x270x12MM

ISA 132x132x12

ISHB 350x11.6x8.3
DETAIL "AA"

10MM ELASTOMER RUBBER COATING TO BE USED AT THE TWO SIDES OF GIRDER (ON BOTH BANKS)

DETAIL "BB"

12MM STEEL PLATES TO BE USED AT THE TWO SIDES OF GIRDER (ON BOTH BANKS)

10MM ELASTOMER RUBBER COATING TO BE USED AT THE BOTTOM OF GIRDER (ON BOTH BANKS)

12MM STEEL PLATES TO BE USED AT THE BOTTOM OF GIRDER (ON BOTH BANKS)
LEFT WEDGE DETAILS

STEEL PLATE AT THE TOP

STEEL PLATE AT THE BOTTOM

STEEL PLATE AT THE TOP

STEEL PLATE AT THE BOTTOM

STEEL PLATE AT THE TOP

STEEL PLATE AT THE SIDES

STEEL PLATE AT THE SIDES

RIGHT WEDGE DETAILS

ROYAL GOVERNMENT OF BHUTAN
Ministry of Works & Human Settlement
Department of Roads, Design Division
Thimphu, Bhutan

REVISION
DATE
NAME & SIGNATURE
DRAWING NO.

FIRST ISSUE
JUNE 2015
KARMA TENZIN (Chief Engineer)
BSW-NKZ-11

SCALE: 1:40
(as Sheet A3 size)
PLAN SHOWING LAYOUT OF OPEN FOUNDATION

R.C DETAIL OF OPEN FOUNDATION IN PLAN

VIEW A-A

VIEW B-B

BRIDGE STRENGTHENING WORKS AT NIKKA CHU ZAM ON WANGDUE - TrONGSA HIGHWAY FOR MHPA
SH: STEEL STAGING WORKS

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

REVISION DATE NAME & SIGNATURE DRAWING NO.
FIRST ISSUE JUNE 2015 KARMA TSENCHI (Chief Engineer) BSW-NKZ-12

FOOTING PLAN &
REINFORCEMENT DETAILS

SHEET CONTENTS:

SCALE: 1:70
(as Sheet A3 size)
NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETERS
2. THE BOTTOM LEVEL OF RCC FOOTING SHALL BE ABOVE BOULDER MASONRY
3. THE NET SAFE HEARING CAPACITY OF SOIL HAS BEEN CONSIDERED AS 10 T/M²
4. GRADE OF CONCRETE FOR RCC FOOTING SHALL BE M20
5. REINFORCEMENT BAR IN RCC FOOTING SHALL BE HIGH STRENGTH DEFORMED BAR (Fe-450) CONFIRMING TO IS:17865
6. CLEAR COVER TO THE REINFORCEMENT SHALL BE 50MM
7. LAP LENGTH OF REINFORCEMENT BARS SHALL BE 50 X DIAMETER OF BAR

LEGEND
1. TOP REINFORCEMENT SHOWN THIS
2. BOTTOM REINFORCEMENT SHOWN THIS

MESH DETAILS OF FOOTING
SECTION C-C
SECTION D-D

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

BRIDGE STRENGTHENING WORKS AT NIKKA CHU ZAM ON WANGDUE - TRONGSA HIGHWAY FOR MHPA
SH: STEEL STAGING WORKS

MESH DETAILS, SECTION C-C & SECTION D-D OF FOOTING

REVISION DATE NAME & SIGNATURE DRAWING NO.
FIRST ISSUE JUNE 2015 KARMA TENDUP (Chief Engineer) BSW-NKZ-13
DESIGN MASAUM ANDO (JICA Engineer) SCALE: 1:50
DRAWN
CHECKED MASAUM ANDO (JICA Engineer)
APPROVED
STEEL PLACING PLAN

SECTION DETAILS:
1. DEPTH OF SECTION (h) = 300MM
2. WIDTH OF FLANGE (b) = 250MM
3. THICKNESS OF FLANGE (t₁) = 10.6MM
4. THICKNESS OF WEB (t₆) = 7.6MM
5. SECTIONAL AREA = 80.25cm²

SECTION DETAILS:
1. DEPTH OF SECTION (h) = 350MM
2. WIDTH OF FLANGE (b) = 250MM
3. THICKNESS OF FLANGE (t₁) = 11.6MM
4. THICKNESS OF WEB (t₆) = 8.3MM
5. SECTIONAL AREA = 85.9cm²
6. WEIGHT PER METER = 67.40Kg
Notes:
1. All dimensions are in millimeters.
2. On right bank of wall, the existing Ga 7M x 1.4M to be demolished and new Ga 7M x 4M x 2M to be provided so as to a steel trestle of 4M.
3. On left bank of wall, the existing Ga 7M x 4.188M to be demolished and new of 7M x 4.5M x 2M to be provided so as accommodate steel trestle of 4M.
REBAR SCHEDULE OF TRESTLE FOUNDATION (Table - 01)

<table>
<thead>
<tr>
<th>Member</th>
<th>Bar</th>
<th>Type &amp; Dia (in mm)</th>
<th>Length of each bar (in mm)</th>
<th>Number of bars in each member</th>
<th>Total number of bars</th>
<th>Total length (in mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>T16</td>
<td>10</td>
<td>41032</td>
<td>2</td>
<td>90</td>
<td>362880</td>
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<td>02</td>
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<td>362880</td>
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<td>03</td>
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<td>16</td>
<td>6174</td>
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**SHAPE DETAILS**

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<th>SHAPE</th>
<th>d</th>
<th>c</th>
<th>b</th>
<th>a</th>
<th>START</th>
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<tbody>
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<td>b</td>
<td>c</td>
<td>d</td>
<td>e</td>
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<tr>
<td>21</td>
<td>a</td>
<td>b</td>
<td>c</td>
<td>d</td>
<td>e</td>
<td>256</td>
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<td>b</td>
<td>c</td>
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<td>e</td>
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<td>00</td>
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<td>b</td>
<td>c</td>
<td>d</td>
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<td>57800</td>
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**ADDITIONAL INFORMATION**

<table>
<thead>
<tr>
<th>UNIT WEIGHT OF REINFORCEMENT BAR</th>
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<tbody>
<tr>
<td>DIAMETER (IN MM)</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>16</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>25</td>
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</tbody>
</table>

**NOTES**

1. ALL THE DIMENSIONS ARE IN MILIMETER UNLESS OTHERWISE SPECIFIED.
2. DO NOT SCALE THE DRAWINGS. USE THE GIVEN DIMENSIONS ONLY.
3. DURING THE CONSTRUCTION, THE CONTRACTOR MUST CHECK THE DIMENSIONS, LEVELS AND MEASUREMENTS. DISCREPANCY IF ANY TO BE REPORTED TO THE ENGINEER BEFORE EXECUTION.

**CONCRETE**

1. CUMULATIVE 28 DAYS STRENGTH IN CUBE FOR ABUTMENT AND RETURN WALL, \( f_{ck} = 25 \) MPa.
2. YIELD STRENGTH OF STEEL, \( f_y = 500 \) MPa (GRADE Fe 500, IS 1786).
3. DETAILS OF STEEL IS MENTIONED IN THE DRAWINGS AND ITS QUANTITY IN THE BAR BENDING SCHEDULE.

**BAR CUT POINT**

- T: HIGH YIELD DEFORMED BAR
- Y: DEFORMED MS BAR
- R: ROUND MS BAR

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

**TOTAL**: 1982.57