



Government of Nepal
Ministry of Federal Affairs and General Administration
Department of Local Infrastructure (DoLI)
Local Roads Bridge Programme (LRBP)

PRE-STRESSED CONCRETE BRIDGE

Intermediate Traffic Simply Supported Span, 3-Web ,Cast-in-Situ

Standard Drawings for Typical 45m Span Super Structure



Local Roads Bridge Support Unit (LRBSU)

Prepared by

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STANDARD DRAWINGS

GENERAL NOTES

1. All dimensions are in millimeters unless and otherwise stated.
2. Any doubtful dimensions/descriptions and confusions shall be brought to the attention of the Engineer-in-charge for any corrections (if any) before the execution of work.
3. No dimension shall be scaled from the drawings. Only written dimension shall be followed.
4. Maintain the profile of cable as shown in the drawings and so in the emerging angle also.

Acceptable deviation
Horizontal ± 4.0 cm
Vertical ± 4.0 cm

5. Appropriate "prestressing force measurement device" shall be part of the multistrand jack and shall be duly checked and calibrated for correctness and removal of zero error, regularly in consultation with the concerned manufacturer.

All prestressing cable shall be laid to smooth profiles using the specified profile ordinates given in the attached prestressing drawing. Short 12mm diameter cross-bars shall be spot welded to the stirrups legs at approximately 2m centre to centre along the length of cable to give necessary cable profile.

6. Number of reinforcement bars shall not be counted from the drawings. Only given spacing and/or specified numbers of bars, shall be provided.
7. All materials and workmanship shall be in accordance with these **NOTES** and those in the stated drawings and shall be generally in accord with the applicable specifications and relevant Standards/Codes of Practice specified therein and Sound Engineering Practice.
8. The contractor shall be responsible for the construction and maintaining all parts of the structure in stable, acceptable and serviceable condition, ensuring no part under construction is unduly stressed and unsafe.
9. The superstructure in a span can be lifted upwards at each of its ends (work only at one end at a time) by operating the appropriate-capacity **LIFTING JACKS** applied under the end-cross girder at that end as indicated in the attached relevant Drawing.
10. **CAUTION:** The shown Profiles of prestressing cables shall be strictly followed without any compromise, whatsoever. Where absolutely necessary, the Untensioned Reinforcement Bars/ Meshes may be suitably slightly repositioned to suit.
11. Vertical Ordinates 'Y' and Horizontal Distances 'Z' of Cables -Profiles given in this dwg. are to Centerlines of the cables from soffit of web and from Vertical Center -lines of web, respectively. Account should be taken of the **RADIUS** of the cable - duct in welding the 12 mm dia. Cross bars to the stirrups-legs for profiling the cables.
12. The strip seal expansion joint may vary as per manufacturers standard / specification than one shown here.
13. Expansion joint assembly/system must be approved by engineer.

14. Parapet posts shall be cast in situ after all cables have been stressed.

CURING

All structural concrete shall be cured for a period of time required to obtain the specified strength, but not less than fourteen consecutive days (and nights) beginning immediately after initial setting of concrete (which is when it loses its surface sheen). Membrane curing or water curing or chemical curing are allowed.

2. CONSTRUCTION SEQUENCE

Entire deck (i.e the superstructure comprising the cast in situ Prestressed three webbed slab shall preferably be concreted in one operation in one day for one span. If this is not possible, then the three webs following by side girders shall be cast one after the other (each web up to about 150 mm below the top throat) on one day (if possible) otherwise on two successive days, one after the other, along with the Cross Girders, and then the slab cast on the next day. This entire Deck must be cast in situ on staging in span in no more than three successive days.

ADDITIVES

1. To suitably improve workability and increase initial setting time of concrete and cement grout, Admixtures conforming to IS 9103 and ASTM C-494 Type F water reducing, high range admixtures, shall be permitted in appropriate dosages, subject to their satisfactory proven use.

REINFORCEMENT

1. All reinforcing steel bars shall be High Yield Strength Deformed type and Thermo Mechanically Treated (TMT), having specified minimum 0.2 per cent proof stress of 500 MPa conforming to IS 1786.
2. Minimum lap length of reinforcement bars shall be 48d (subject to change) where d is the diameter of the smaller diameter bar to be lapped (unless otherwise specified).
3. Not more than 50 per cent of reinforcement crossing a section shall be lapped at that location.
4. All laps in reinforcement bars shall be properly staggered and minimum distance between the laps shall be 1.33 times the lap length.

CONSTRUCTION JOINTS

1. On resuming concreting work, the surface of the concrete previously placed shall first be thoroughly cleaned of dirt, scum, laitance, loosely projecting aggregates and any other soft material, using stiff wire brushes, and- if deemed necessary by the Engineer- by sand blasting.
2. As far as possible the location of construction joints shall be as shown in the drawings, but if not shown on the drawings but found absolutely necessary, they shall be planned in advance and the placing of concrete carried out continuously from joint to joint.
3. A construction joint should not be located near the centroid level of the section as here transverse SHEAR stress is highest. The joint should be nearly perpendicular to the principal lines of tensile stress and in general be located at points of minimum shear and minimum moment as far as possible.
4. Where dowels, reinforcing bars, or other adequate ties are not shown at construction joints, "Keys" should be formed at reasonable spacing by embedding water soaked beveled timbers while the concrete is still soft.

5. These keys should be sized as may be shown in the details, or as directed by the Engineer, and these key forming timber should be removed when the concrete has initially set.

6. The concrete surface shall then be thoroughly soaked with clean water (just before further concreting) and the free water, etc. air blown away, and the cleaned concrete surface painted with a thin layer of cement slurry, and only then further concrete poured.

COLD JOINTS

1. When a planned 'continuous' placement of concrete in any structural member is interrupted and delayed, for any reason, for a period long enough for the previously partially placed concrete to take its initial set, the Engineer may declare such a joint as a cold joint and the contractor shall immediately remove the previously partially placed concrete from the forms.
2. However, where feasible, the previously partially placed concrete may instead be suitably and carefully hacked and its hacked end brought into 'low shear low moment' zone as far as possible, and given shear key depression after bringing it nearly perpendicular to the principal lines of tensile stress (for example: brought to vertical or nearly vertical in a beam with principal bending reinforcement horizontal) and thereafter same treatment shall be given to it as to a construction joint and only then the concreting resume (making sure all reinforcements are as per the approved Drawings and shuttering has been brought to line and plumb tightly).

PRESTRESS

1. At the time of installation of Cable-Sheathing (HDPE Ducts), the sheathing materials shall be examined for any possible punctures/cuts etc. and the same shall be sealed with waterproof tape. The number of joints should be kept to the minimum, and each joint adequately sealed against the possibility of any ingress of any material and mortar. Joints in adjacent ducts should be staggered by at least 300 mm. Adequate concrete shield should exist between the adjacent ducts to prevent any accidental flow of grout from one duct to the other and the ducts shall be strictly maintained in their correct alignment and profile during the placing of concrete.
2. Before commencement of prestressing, it should be ensured that all the Cables/Ducts are free of any clogs and that the structure-members are free to accommodate the horizontal and vertical movements due to application of prestress, and that there is enough space for the movement of the jack piston.
3. Each cable shall be stressed from both its ends simultaneously, equally and gradually, and the extensions recorded at each suitable increment of Jacking force.
4. For tensioning a cable, the initial slack in it shall first be removed (taken up) by applying a relatively small initial tension from each end as required to remove this slack shall be taken as the starting point for measuring the cable elongations and the correction shall be applied as per clause 12.2.13 of IS: 1343(1980).



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STANDARD SUPERSTRUCTURE

Bridge Type: Pre-Stress Concrete
Road Carriageway Width: 6.00m plus 2 Footpaths each 1.20 m wide
Overall Deck Width: 8.4 m
Effective Simply Supported Span (Center to Centre of Bearings): 45m

DRAWING TITLE

GENERAL NOTES-1



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Designed by:		Sign:		Date:	Date: July, 2021
Drawn by:					Dwg No. SD-1
Checked by:					Rev:
Approved by:					

5. The Cable Elongations at their Jacking-Points, mentioned in the attached relevant Prestressing Drawing, are based on the assumption that the Modulus of Elasticity of Cable-steel, $E_s = 1.95 \times 10^5$ MPa. However, if E_s of the actually supplied Cable-steel at site is slightly different, then the required Elongations at each end shall be re-worked out at site by multiplying the specified values by the ratio of (assumed E_s /actual E_s), and these shall then be the correct specified extensions.
6. Cable-Elongation at each end of each cable, given in the attached Prestressing Drawing, has already taken in to account the actual cable-length along its profile between end to end of girder. Gripping length of jack is not accounted.
7. After concreting of the Deck is over REMOVE these Plain HDPE Ducts AND quickly blow oil-free compressed air through the emptied Corrugated HDPE Ducts in order to flush them clean. Stand-by flushing equipment, capable of developing a pumping pressure of 2 MPa and a sufficient capacity to flush out any blockages due to any accidental partial grout leaks in ducts, shall be kept available at site.
8. At the time of installation of cable -Sheathing (HDPE Ducts), the sheathing materials shall be examined for any possible punctures and the same shall be sealed with waterproof tape. The number of joints should be kept to the minimum, and each joint adequately sealed against the possibility of any ingress of any material and mortar. Joints in adjacent ducts should be staggered by at least 300 mm. Adequate to prevent any accidental flow of grout from one duct to the other and the duct shall be strictly maintained in their correct alignment and profile during the placing of concrete.
9. Prior to concreting the Deck, INSERT Plain HDPE ducts into the Corrugated HDPE Ducts (which have already been placed to the required cable profiles), protruding them suitably beyond the cable -anchorages.

TENSIONING OF PRESTRESSING CABLES

1. Normally, the specified required extensions shall be achieved at the specified Jacking Forces at stressing ends.
2. In case, Jacking pressure is reached and elongation is not reached stressing can be continued upto maximum extra 5% of calculated jack pressure or specified elongation whichever reached earlier.
3. In case, elongation is reached and jacking pressure is not reached, stressing shall be continued upto 5% in excess of prescribed sum of elongation or specified pressure whichever reached earlier.
4. Cables satisfying these provisions shall be locked (i.e. anchored).
5. However, if the Jack Forces are still lower than their specified values despite the 5% increase in the "sum of the 'specified' extensions", then the particulars of such cases shall be reported to the Designer for further instructions ('locking' but not 'grouting' these cables yet until receipt of instructions, just in case).
6. Extensions should also be checked 24 hours after anchoring the cables to guard against the possibility of 'slow slipping', if any. If the average observed 'slow slip' at anchorages of a cable exceeds 3mm, the matter should be reported to the Designer for any further instructions.
7. All cables which satisfy the above provisions shall be grouted, taking care that cables not yet stressed do not get accidentally blocked due any internal grout leak.

8. Prestressing tendons shall never be heated or exposed to flame or to welding. Protruding ends of tensioned strands of Grouted Cables, protruding beyond anchorages, shall only be saw cut, not flame-cut. Recesses at anchorages (in the girder ends) shall be filled and sealed with non-shrink cement mortar after the protruding strand -ends of tensioned, anchored and grouted cables are cut to suit.
9. Prestressing cables shall be protected against any unacceptable rusting, damage due to 'pitting', and any greasing. The strands must be thoroughly cleaned with petrol at locations where stressing jacks and wedges have to grip them.
10. An appropriate experienced Technical representative of the supplier of pre-stressing system shall carry out and supervise all prestressing and grouting operations at site and ensure, monitor and certify their correctness.

SEQUENCE OF STRESSING AND STAGES OF PRESTRESSING

1. The back walls of the two Abutments shall be constructed after successfully Prestressing and Grouting the cables of the Decks supported by abutments.
2. After completion of stressing and anchoring a cable, the Jack Force shall be released in such a way so as to avoid shock to the anchorage and the cable.
3. Complete record of all Prestressing and Grouting shall be carefully maintained at site.

GROUTING THE DUCTS OF SUCCESSFULLY TENSIONED CABLES

1. Prestressing steel shall be bonded by the grout to the concrete by filling the void space between the duct and the tendon with cement grout.
2. For this purpose each cable shall normally be Grouted within 5 days of completion of its successful tensioning unless specific requirements require delaying it till certain other cables are first successfully stressed.
3. The Grout shall consist of Ordinary Portland Cement, Water, and an Expansive admixture approved by the Engineer. All grout shall pass through a screen with 2 mm maximum clear openings prior to being introduced into the grout-pump. No admixtures containing chlorides and nitrates shall be used. Grouting tests shall be performed as instructed by the Engineer.
4. The grout shall be mixed in mechanical mixing equipment of a type that will produce uniform and thoroughly mixed colloidal grout. The water content shall not be more than 24 litres per 50 kg sack of cement. Retempering of grout shall not be permitted grout shall be continuously kept agitated until it is pumped in.
5. If some delays in Grouting are unavoidable (e.g. due to sequence of construction planned), temporary protection against corrosion shall be provided by ventilating the ducts with dry/hot air, since any humid conditions contribute considerably to acceleration of corrosion of cable -steel.

FORMWORK AND FALSEWORK

Contractor shall plan, design, get approval, supply and erect the appropriate formwork to get first class finished surface.

Notes:-

1. Any shortfall in stressing may be adjusted by stressing the dummy cable 'D' if there is no shortfall, dummy cable shall be taken out and grouted afterwards.
2. **Prestressing Schedule:**
 - 2.a. Stressing of cable 1-1,2-2,3-3,4-4,6-6 (Total 15 nos.) Should be done in one stage after 28 days of casting of deck slab.
 - 2.b. The cable D shall act as dummy and shall be stressed in case of any short fall in stressing. If there is no short fall all strands in cable D shall be taken out and grouted.

Stressing Procedure:

3. Stressing is to be done from both end. Extension shown are total extension including effect of slip at each end hence no extra allowance should be made for slip.
4. Normally extension should be obtained at specified gauge pressure in case extension is not obtained at specified gauge pressure, the stressing should be continued till required extension are obtained subject to gauge pressure not exceeding 5% of reqd. Gauge pressure.
5. In case the required extension is obtained at lower gauge pressure then stressing should be continued in order to obtain the specified gauge pressure however the extension should not exceed by more than 5% of required extension.
6. All cables satisfying the above condition should be grouted.
7. If in case of any cable required extension at one end is not obtained even reaching gauge pressure of 5% but not exceeding 2731 KN more than the specified gauge pressure, otherwise refer to the designer. The balance extension should be obtained by stressing the other end.
8. Additional extension at each end to account for extension in grip length of cable should be added to the respective extension shown in the chart
9. All cables are to be stressed from both ends simultaneously.
10. Prestressing steel and accessories:-
 - Cable consisting of 19 nos. of 12.7 mm dia. 7-ply class 2 low relaxation strand as per IS:14268-1983 shall be used for prestressing.
 - Sheathing:- Sheathing shall be of "corrugated" HDPE type of 90 mm ID. As per cl. 3.6.2 of IRC:18



1. Design Specifications

a. IRC 112 (Design)

b. IRC 6 (Load and Stresses)

c. Class A & 70 R (Loading)

d. Freyssinet manual (PSC)
2. Material Tests

All material test shall comply with the requirement of section 600 of "standard specification for road and Bridge work with amendment 2075".
3. Formwork & Falsework

a. Detailed working drawing and design calculations for false work shall be furnished by the contractor to the Engineer.

b. Falsework and formwork shall comply with " Standard specification for road and Bridge work with amendment 2075" section 1800.

c. Formwork : Class F3 Finish.

d. Tie rod shall be used in shuttering .After removal of formwork tie rods shall be cut and patched with rich mortar.

4. REINFORCEMENT

a. Reinforcement shall comply with following standards:

NS:191/IS:1786 for high strength deformed steel bars and wires.

IS: 1566 for steel mesh fabric.

NS:84/IS :432 mild steel and medium tensile steel bars.

b. For 50% of lap in a section , following table shall be used

Concrete Grade	For M25	For M45
Bar Dia.	Ls provided	Ls provided
32	2150	1450
25	1650	1200
20	1350	900
16	1100	750
12	800	550
10	700	500

5. Design of proposed mixes

a. Concrete mixes shall comply with section 600.

b. Cube test and curing shall comply with " SP 2073 with 2075" section & 2000.
6. CONSTRUCTION JOINTS

a. The location of construction joints shall be as shown in the drawings only if required.If it is found absolutely necessary to be placed in other locations, construction joints shall be planned in advance with prior approval Engineers.

b. Refer " Standard specification for road and Bridge work with amendment 2075" section 2000 for further details.
7. COVER BLOCK

a. Proper concrete cover blocks confirming to section 2000, Clause 2014-4 shall be used.

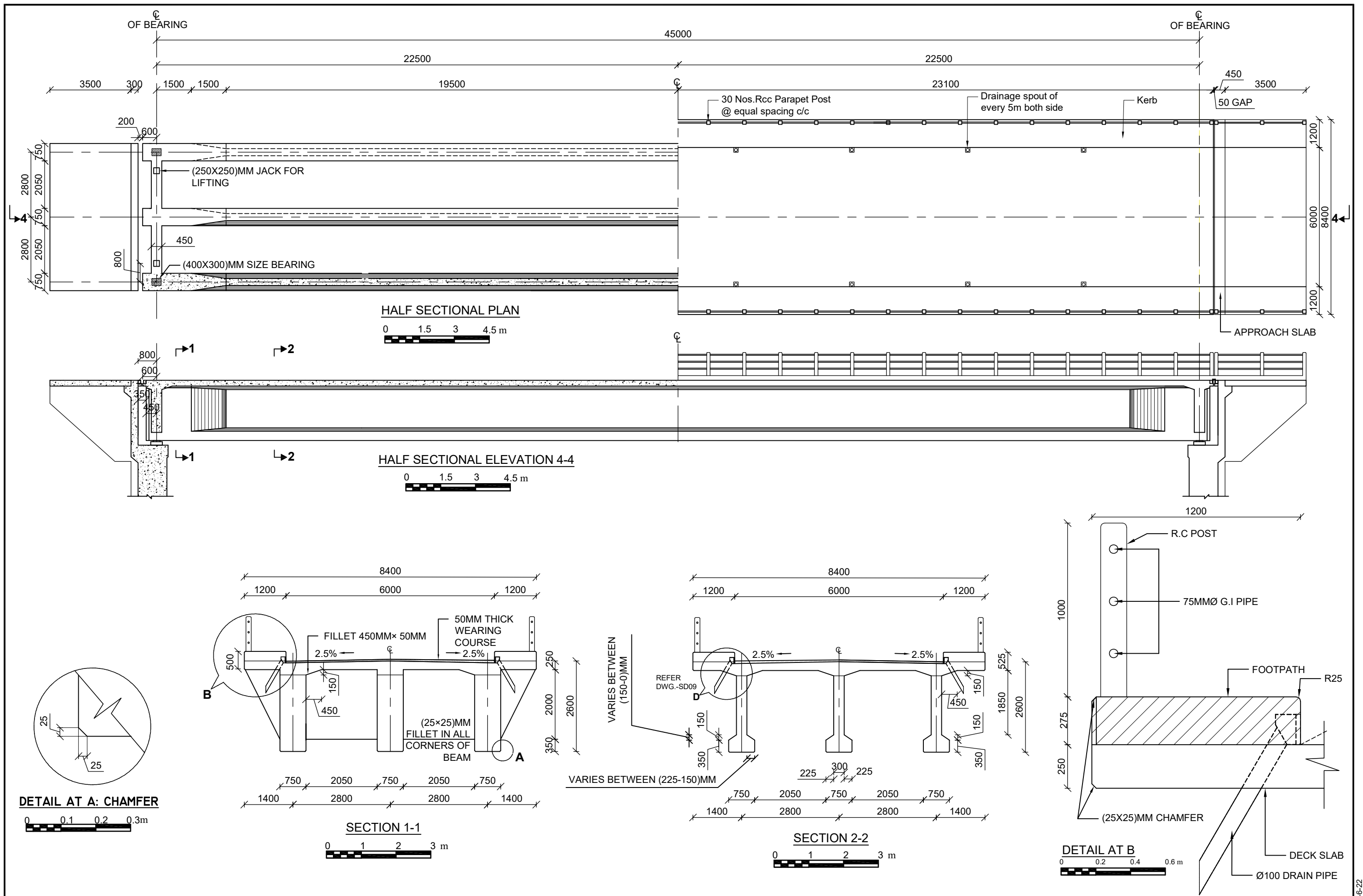
b. For other types of concrete cover blocks, engineers prior approval is required.

MATERIAL SPECIFICATIONS	
CONCRETE GRADE FOR PARAPET POSTS AND KERBS	M25
CONCRETE GRADE FOR WEARING COURSE AND APPROACH SLAB	M25
CONCRETE GRADE FOR SUPERSTRUCTURE	M45
REINFORCEMENT GRADE	Fe 500
CABLE GRADE	1860 N/mm²
CABLE TYPE	19K13
NUMBER OF PRESTRESSING CABLES	Refer DWG.NO. SD - 5
NUMBER OF DUMMY CABLES	Refer DWG.NO. SD - 5
INTERNAL DIAMETER(ID) OF SHEATHING DUCT	90 mm
FRICTION COEFFICIENT BETWEEN DUCT AND CABLE	0.18 per radian
COVER AND OTHER REQUIREMENTS	
COVER FOR SUPERSTRUCTURE	40 mm
MINIMUM LAP IN REINFORCEMENT	Clause 15.2.5.1 (2) IRC :112
MAXIMUM ALLOWABLE SLIP IN CABLE	10 mm
ULTIMATE PRESTRESSING FORCE	3488 KN
MAXIMUM ALLOWABLE JACKING FORCE	Refer DWG.NO. SD - 5
JACK CAPACITY TO LIFT WEB TO CHANGE BEARING	685 KN

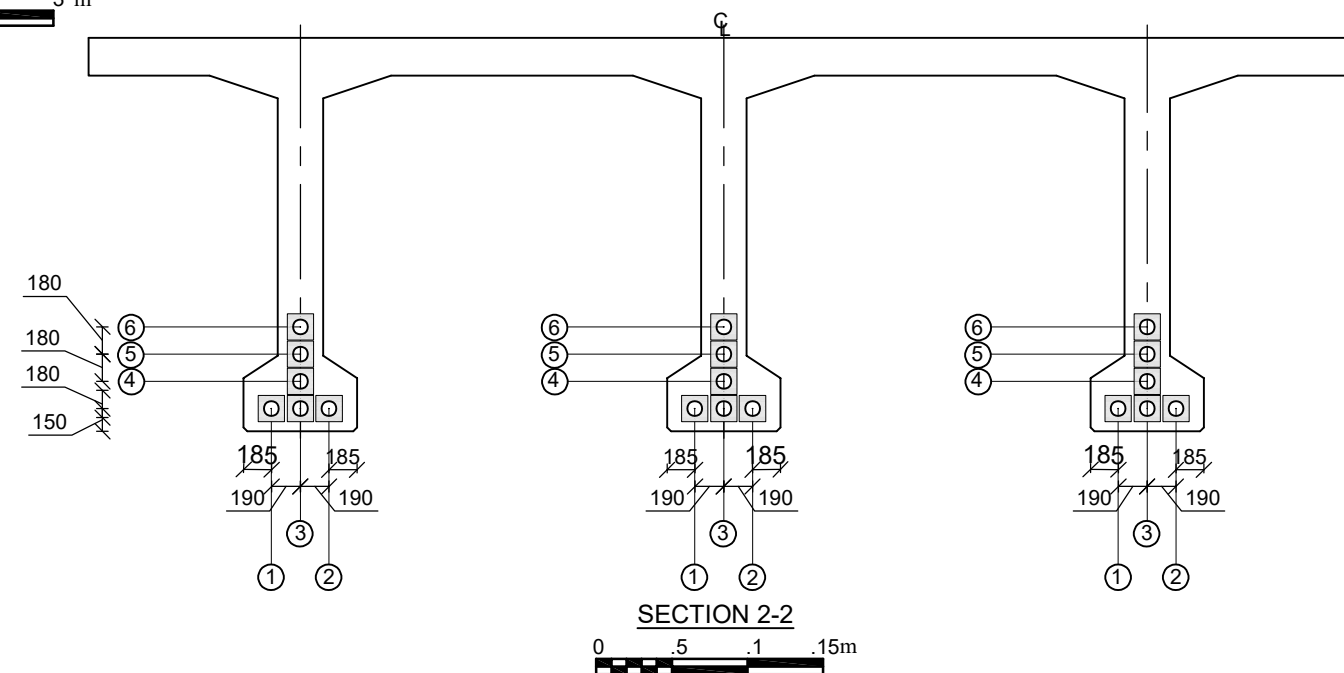
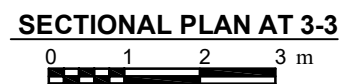
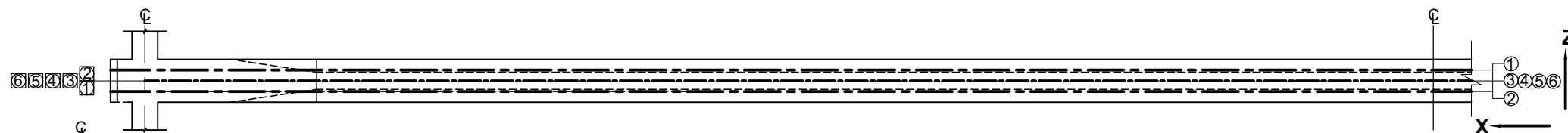
SUB-STRUCTURE DESIGN DATA (UNFACTORED)			
Dead Load (KN)		Live Load (KN)	
Superstructure Load	Surface Load	Vehicle Load	Pedestrian Load
3653.86	253.13	1040.11	161.20

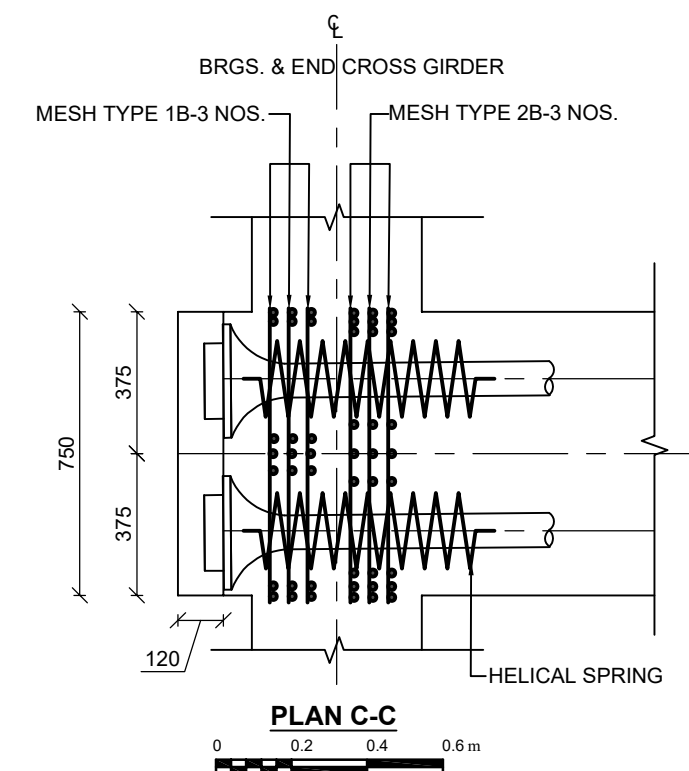
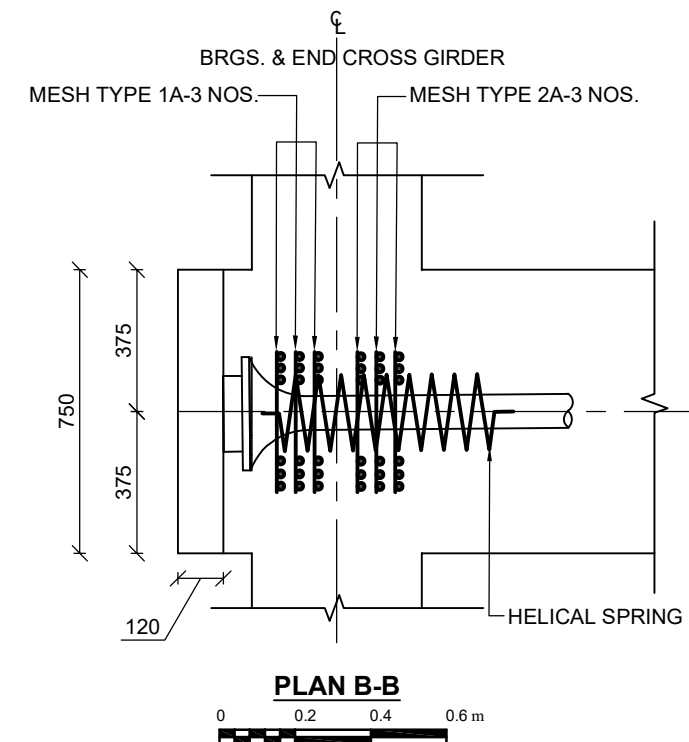
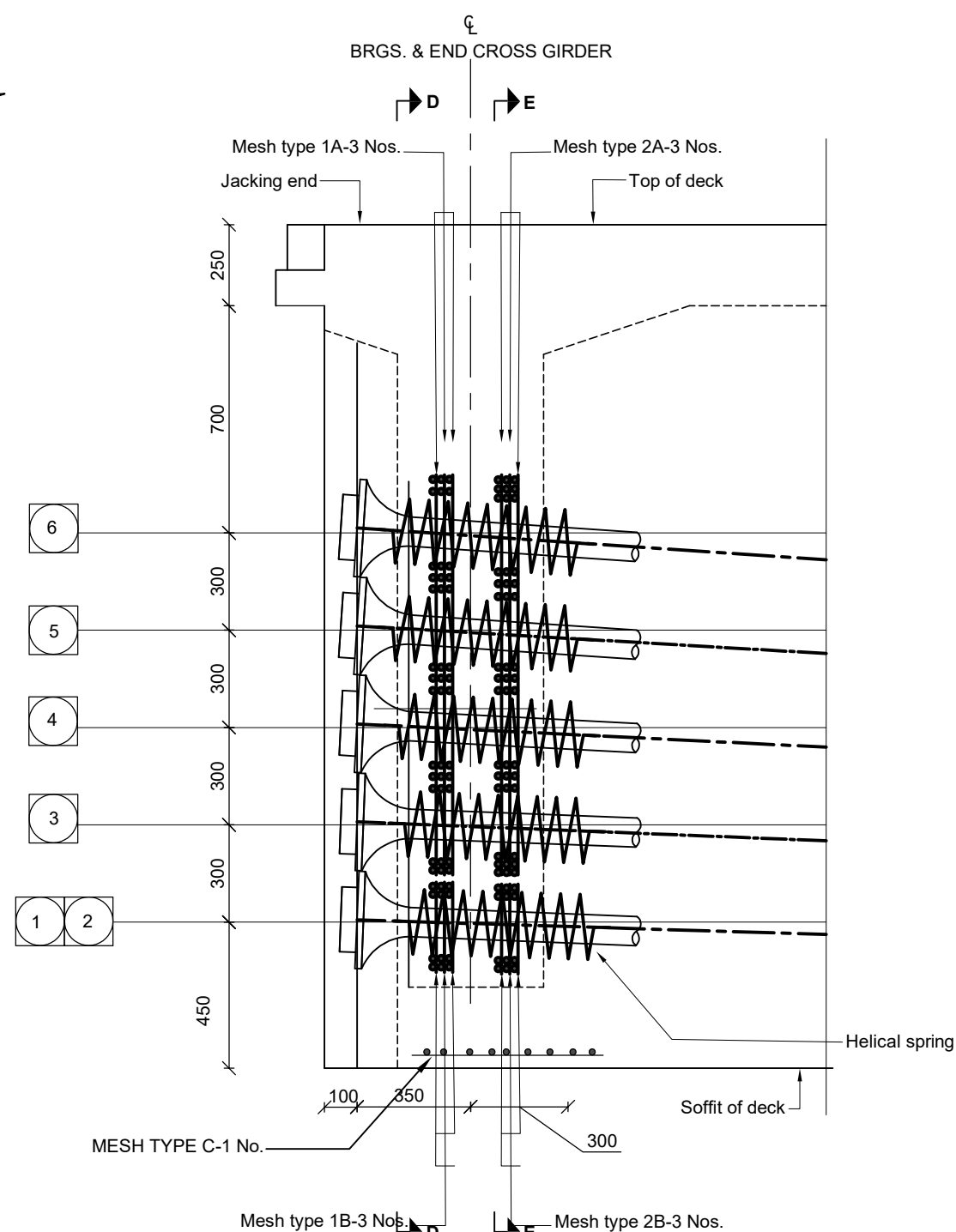
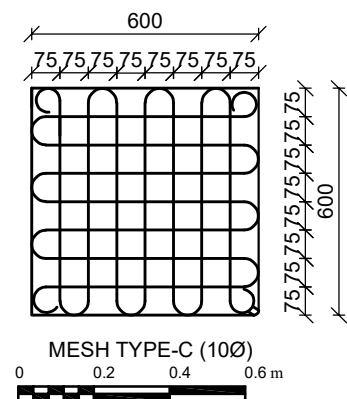
BEARING DESIGN DATA							
45.0 m		Bearing Data for Ultimate Limit State (ULS)					
		Vertical Loads (KN)		Horizontal Force (KN)		Translation	Rotation
		Max KN	Min KN	Longitudinal KN	Transverse KN		
Fix Bearing	Non Seismic	2535.00	1745.00	110.00	0.00	0.00	Negligibly Small
	Seismic	2535.00	1745.00	350.00	390.00	0.00	Negligibly Small
Free Bearing	Non Seismic	2535.00	1745.00	0.00	0.00	25.2	Negligibly Small
	Seismic	2535.00	1745.00	0.00	0.00	25.2	Negligibly Small
45.0 m		Bearing Data for Serviceability Limit State (SLS)					
		Vertical Loads (KN)		Horizontal Force (KN)		Translation	Rotation
		Max KN	Min KN	Longitudinal KN	Transverse KN		
Fix Bearing	Non Seismic	1825.00	1295.00	80.00	0.00	0.00	Negligibly Small
	Seismic	1825.00	1295.00	0.00	0.00	0.00	Negligibly Small
Free Bearing	Non Seismic	1825.00	1295.00	0.00	0.00	25.2	Negligibly Small
	Seismic	1825.00	1295.00	0.00	0.00	25.2	Negligibly Small

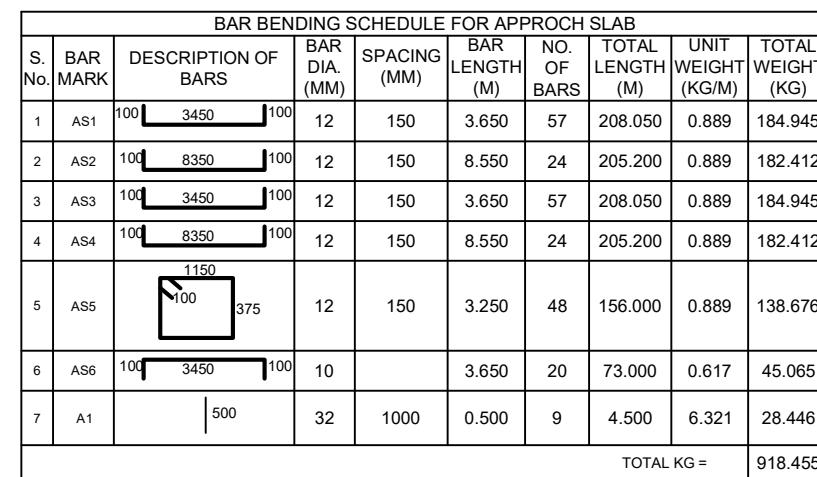
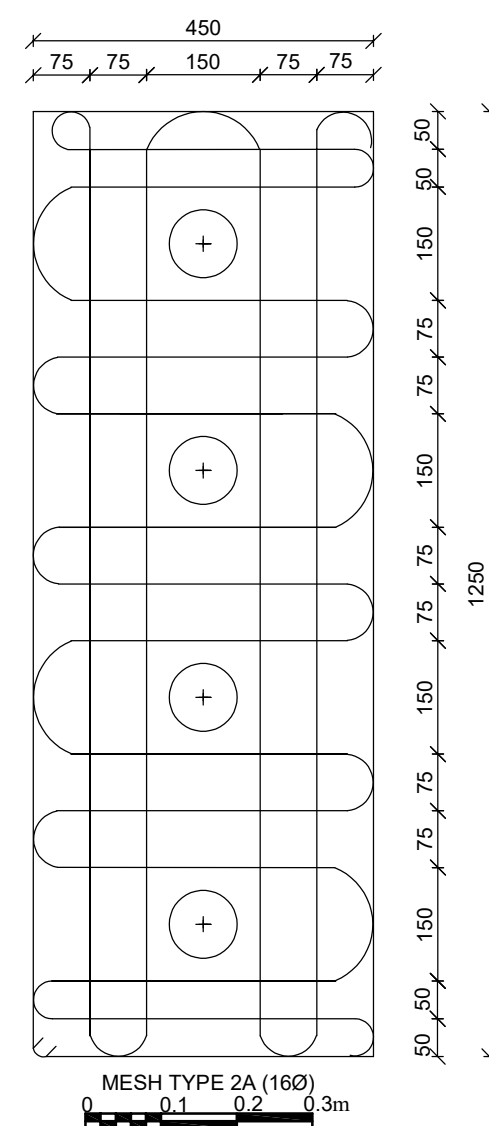
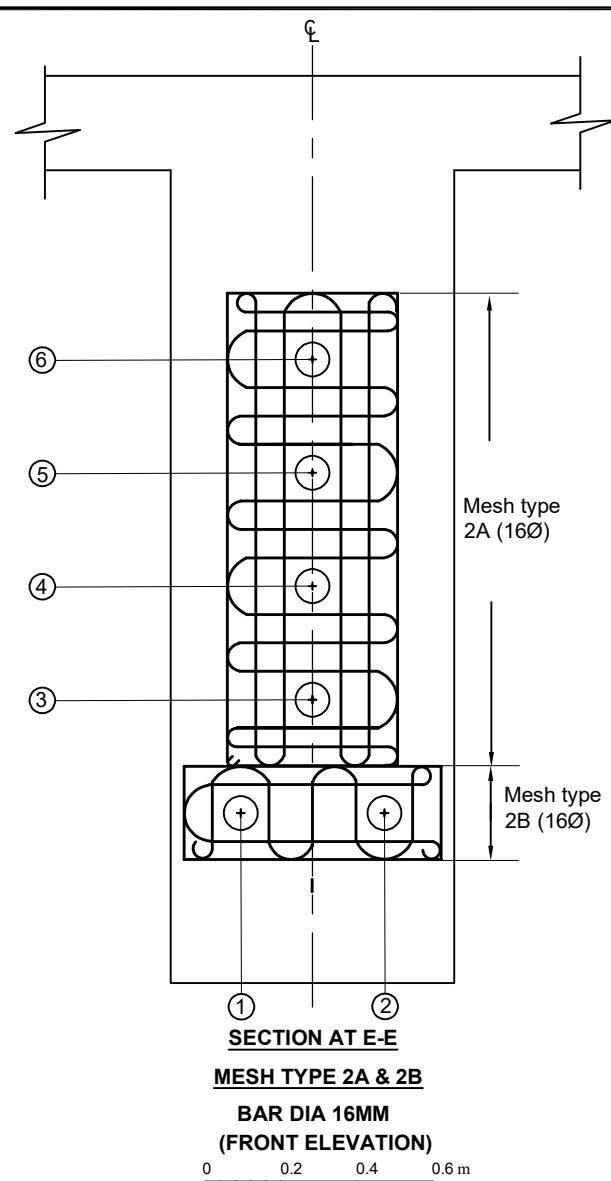
LIST OF DRAWINGS				
DWG.NO.	DESCRIPTION	DATE	REVISION NO.	REVISION DATE
SD-1	GENERAL NOTES-1			
SD-2	GENERAL NOTES-2			
SD-3	GENERAL NOTES-3/ LIST OF DRAWINGS			
SD-4	GENERAL ARRANGEMENT			
SD-5	CABLE PROFILE DETAILS			
SD-6	ANCHORAGE DETAILS-1			
SD-7	ANCHORAGE DETAILS-2			
SD-8	REINFORCEMENT DETAILS-1			
SD-9	CROSS GIRDER & MISCELLANEOUS			



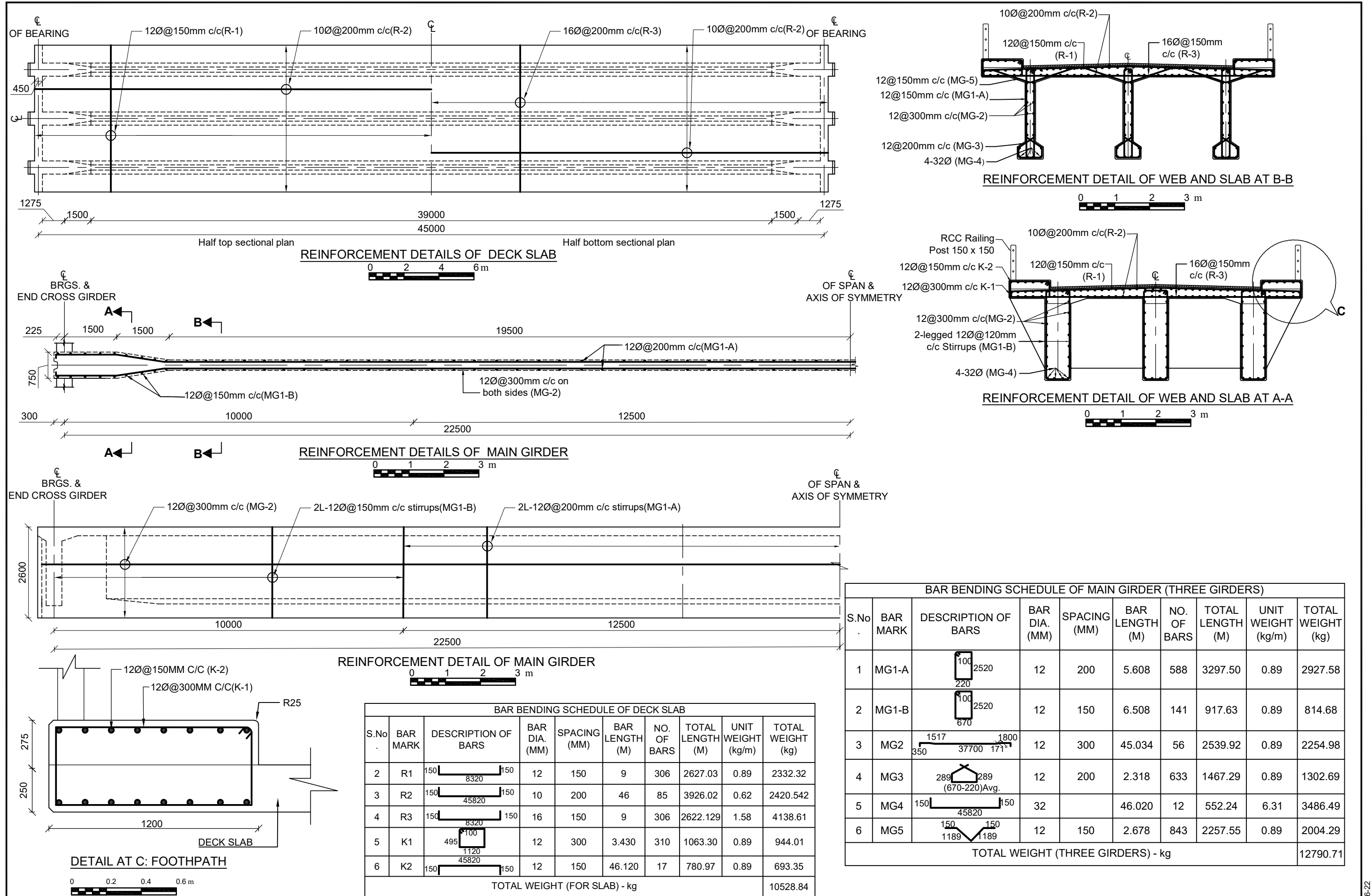
<p>Government of Nepal Ministry of Federal Affairs and General Administration Department of Local Infrastructure (DoLI) Local Roads Bridge Programme (LRBP)</p>	<p>STANDARD SUPERSTRUCTURE</p> <p>Road Carriageway Width: 6.00m plus 2 Footpaths each 1.20 m wide</p> <p>Effective Simply Supported Span (Center to Centre of Bearings): 45m</p>	<p>Bridge Type: Pre-Stress Concrete</p> <p>Overall Deck Width: 8.4 m</p>	<p>DRAWING TITLE</p> <p>GENERAL ARRANGEMENT</p>	<p>Prepared by: Local Roads Bridge Support Unit (LRBSU) Manbhawan, Lalitpur Tel: 01-5549589, 5532019 email: lrbsu@lrbsu.gov.np</p>	Designed by:	Sign:	Date:	Date: July, 2021
					Drawn by:			Dwg No. SD-4
					Checked by:			Rev:
					Approved by:			

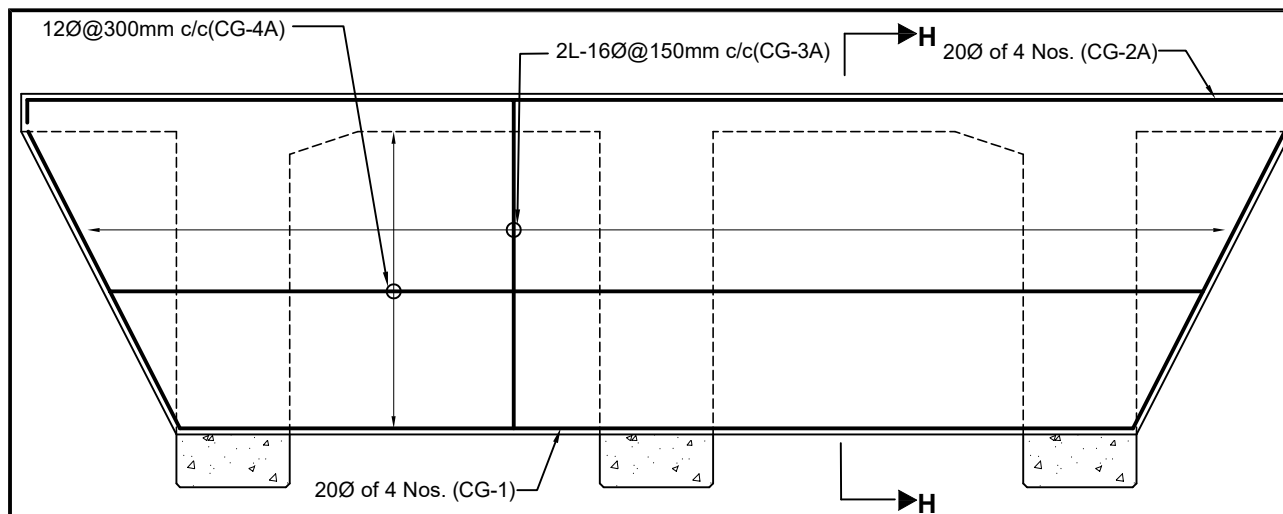




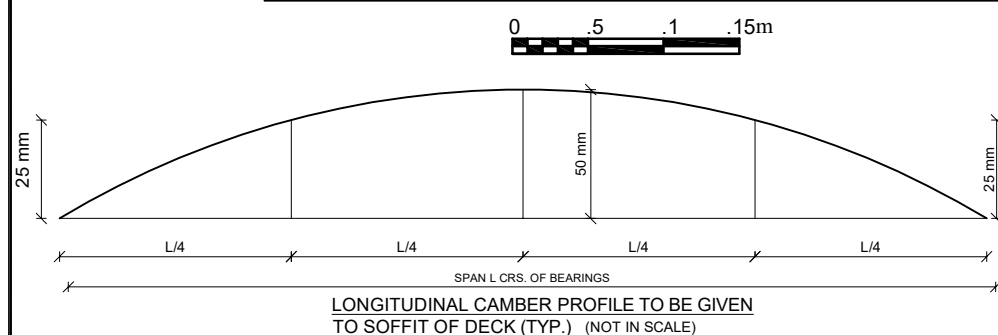


BAR BENDING SCHEDULE OF MESH TYPES AND HELICAL SPRING								
S.No.	BAR MARK	NO. OF MESH	BAR DIA. (MM)	VERTICAL BAR LENGTH (M)	HORIZONTAL BAR LENGTH (M)	TOTAL BAR LENGTH(M)	UNIT WEIGHT (kg/m)	TOTAL WEIGHT (kg)
1	MESH TYPE 1A	6	16	7.43	5.33	76.560	1.58	120.838
2	MESH TYPE 2A	6	16	7.44	6.48	83.520	1.58	131.823
3	MESH TYPE 1B	6	16	1.63	2.64	25.620	1.58	40.437
4	MESH TYPE 2B	6	16	1.00	2.64	21.816	1.58	34.433
5	MESH TYPE C	2	10	1.75	5.16	13.814	0.62	8.517
6	HELICAL SPRING	12	16	3.75		44.952	1.58	70.950
TOTAL WEIGHT - KG								407.00





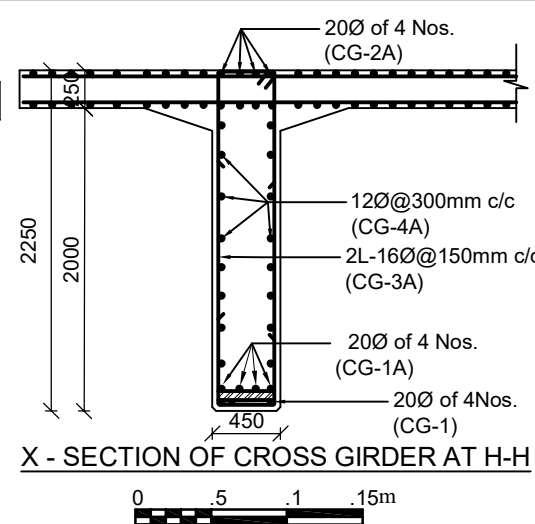
LONGITUDINAL SECTION OF CROSS GIRDER AT SUPPORT



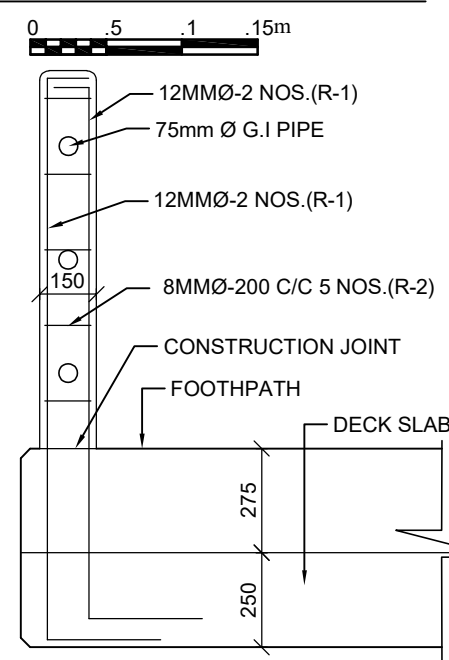
LONGITUDINAL CAMBER PROFILE TO BE GIVEN TO SOFFIT OF DECK (TYP.) (NOT IN SCALE)

BAR SCHEDULE FOR RAILING POST									
S.No.	BAR MARK	DESCRIPTION OF BARS	BAR DIA. (MM)	SPACING (MM)	BAR LENGTH (M)	NO. OF BARS	TOTAL LENGTH (M)	UNIT WEIGHT (kg/m)	TOTAL WEIGHT (kg)
1	R1		12		1.83	240	438.00	0.889	389.36
2	R2		8	200	0.50	345.0000	172.50	0.395	68.15
TOTAL WEIGHT FOR POSTS=									457.51

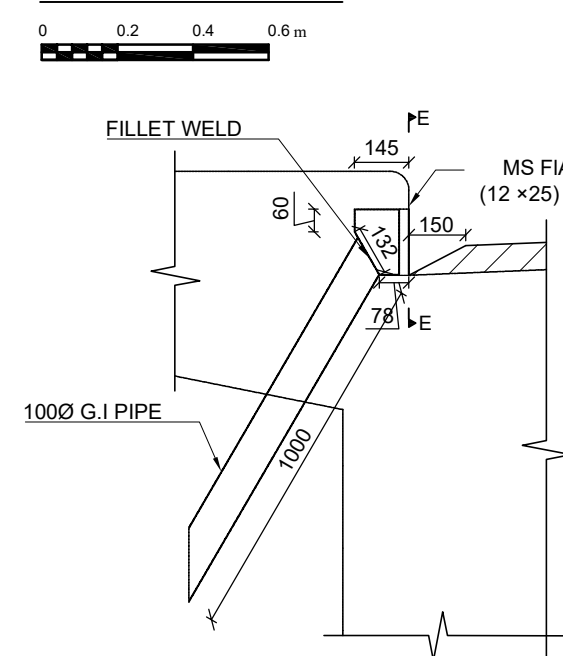
BAR BENDING SCHEDULE OF CROSS GIRDER AT SUPPORT									
S.N o.	BAR MARK	DESCRIPTION OF BARS	BAR DIA. (MM)	SPACING (MM)	BAR LENGTH (M)	NO. OF BARS	TOTAL LENGTH (M)	UNIT WEIGHT (kg/m)	TOTAL WEIGHT (kg)
1	CG-1		20		10.181	4	40.72	2.47	100.43
2	CG1-A		20		10.181	4	40.72	2.47	100.43
3	CG-2A		20		8.620	4	34.48	2.47	85.03
4	CG-3A		16	150	4.680	43	202.80	1.58	320.09
5	CG3A Wing Side		16	150	4.680	15	68.64	1.58	108.34
6	CG-4A		12	300	7.335	12	86.55	0.89	76.84
TOTAL WEIGHT - kg									791.16
TOTAL WEIGHT OF TWO CROSS GIRDERS									1582.329



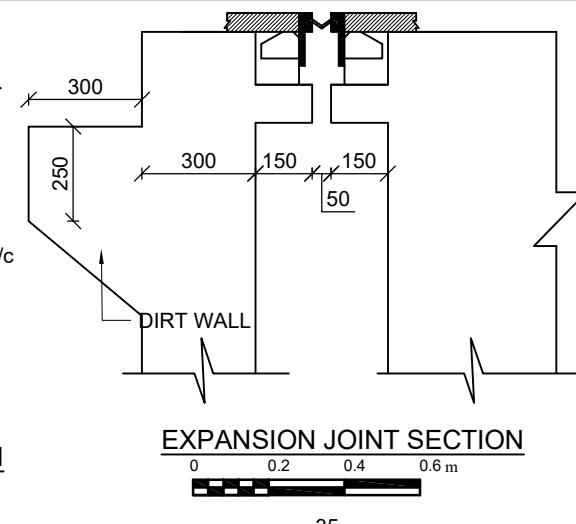
X - SECTION OF CROSS GIRDER AT H-H



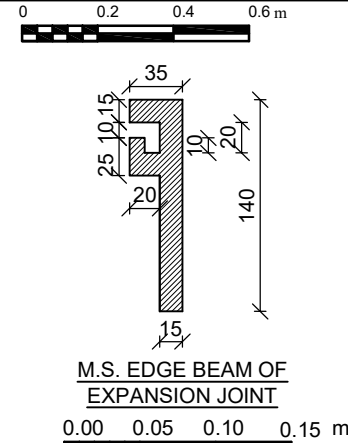
PARAPET POST DETAIL



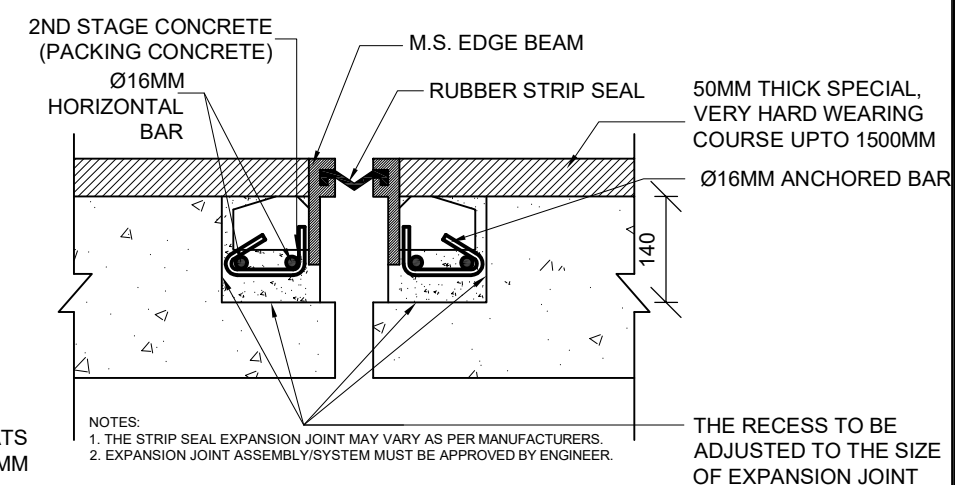
DETAIL AT D-DRAINAGE SPOUT



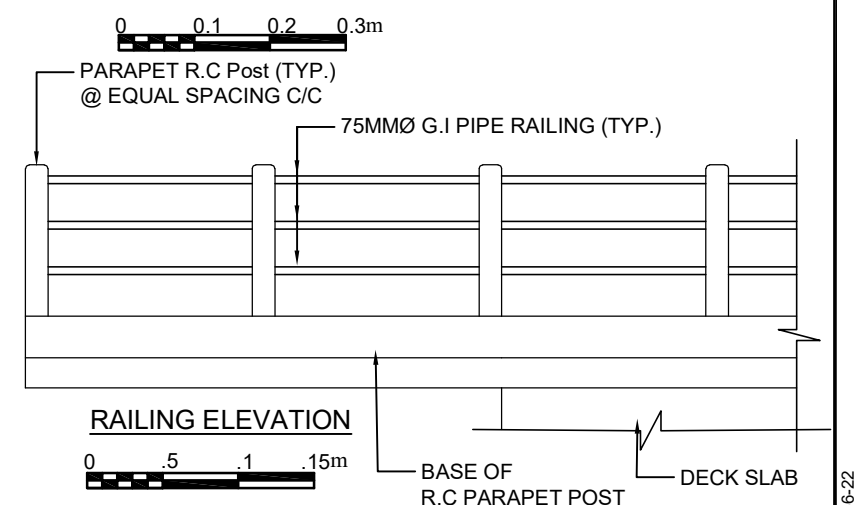
EXPANSION JOINT SECTION



M.S. EDGE BEAM OF EXPANSION JOINT



TYPICAL STRIP SEAL EXPANSION JOINT ASSEMBLY/SYSTEM



RAILING ELEVATION