BIDDING DOCUMENTS

Issued on: _____

for

Procurement of

International Competitive Bidding

DATE: 26-11-2009
IFB No: 12/2009-10
PROJECT ID: P110371

Volume-II of IV

...e of Work:

Design and Construction of Flyover and ROB at Nashik Phata on Old Mumbai Pune NH-4 Including Bridge on River Pawana.

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EXECUTIVE ENGINEER,
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Design and construction of Flyover and ROB at Nashik Phata on old Mumbai Pune NH. 4 Including Bridge on River Pawana

VOLUME II

SECTION VI
Employers Requirements

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The Tender form issued to
Shri/M/s IFB No. 12/2009-10
R/O EE9306
31921oe

Contractor

Exe. Engineer (Project), PCMC

Units, Abbreviations & Terminology Used

Units of measurement, symbols and abbreviations expressed in the Bid Documents Bidder shall comply with the Systeme Internationale d' Unites (SI Units).

Bus Rapid Transit System	BRTS
General Arrangement Drawing	GAD
General Conditions of Contract	GCC
Government of Maharashtra	GOM
Indian National Rupees	INR
Jawaharlal Nehru National Urban Renewal Mission	JNNURM
Kilometer	km
First Floor Level, Second Floor Level, ...	Level 1, 2, ...
Ministry of Road Transport and Highway	MORT&H
National Highway	NH-
National Highway Authority of India	NHAI
Number	No.
Particular Conditions	PC
Pimpri Chinchwad Municipal Corporation	PCMC
Provisional Sum	PS
Public Work Department	PWD
Rail Over Bridge	ROB
Safe Bearing Capacity	SBC
State Bank of India Prime Lending Rate	SBI PLR

SECTION VI

EMPLOYER'S REQUIREMENTS

CHAPTER – I

PREAMBLE AND BROAD PROVISIONS

1.0 PREAMBLE

1.1 INTRODUCTION

Data provided here is tentative. It is provided in two parts – The Employers Requirements and Design Criteria. Bidder is advised to ascertain accurate facts and details from his own due diligence. Obligatory requirements given herein shall be followed scrupulously in design of the Highway and Structures. The modality of preparation and submission of design and drawings by the contractor and approval by the Engineer is given in "Design Criteria",

1.2 CONTRACTOR'S GENERAL ENGINEERING, DESIGN & PROCUREMENT OBLIGATIONS

The Contractor shall be solely responsible for the Engineering, Procurement and Design of the work and for the adequacy thereof. Contractor's responsibility in any way shall neither be diminished nor shall the Contractor's design approach be limited by the Employer's acceptance to engineering standards and design specifications, or by Employer's approval, suggestions or recommendations on any aspect of the engineering or design. The work shall be carried out as per the design prepared by the bidder and approved by the Employer. The Work shall also include shifting of utilities, removal of electric poles, cutting and removal of trees, the details of which are given separately.

1.3 INSPECTION, QUALITY ASSURANCE AND QUALITY AUDIT

The Contractor shall permit access by the Employer, Engineer's Representative (ER) or its Quality Assurance Representatives to the Contractor's premises where the works will be performed and will use reasonable endeavors to secure Rights of Access to the premises of its sub contractors where the works will be performed, having subcontracts or orders in the amount specified in Volume-I or more, in accordance with the Contractor's contractual arrangements with its Subcontractors and allow the Employer, ER or its QA Representative to:

(a) audit the Contractor's quality assurance system and its application to the works, including manufacture, development and raw materials and components provision;

(b) inspect all parts of the works to the extent reasonably practicable to ensure that these meets the quality standards and the specification; and

(c) perform activities with respect to civil works such as, but not limited to, survey, installation, commissioning, acceptance and other construction and/or operational activities. Each of the foregoing rights of access shall be conditional upon (i) Employer giving Contractor reasonable notice, (ii) the Employer and/or the QA Representatives accessing such premises in a manner that avoids disruption of the works that is being performed on such premises. The Employer shall provide the name(s) of each such visitor prior to the visit. Any right of access shall not be construed as creating any

obligation requiring the Contractor or its Subcontractors to disclose trade secrets or proprietary information. Further, such right of access may be conditioned on the execution of a confidentiality and non-disclosure agreement and/or subject to routine building or security rules, regulations or procedures.

2.0 BROAD PROVISIONS

2.1 DESCRIPTION OF PROJECT

The Project envisages Design cum Construction of a Flyover and ROB at Nashik Phata on old Mumbai Pune NH-4 including Bridge across River Pawana, a pedestrian Subway across Mumbai-Pune road, a pedestrian subway across NH-50, BRTS Infrastructure, Electrically operated Escalators, and other related Infrastructure. The term Flyover project shall mentioned in this Section VI (Volume II) shall mean complete Project which includes all components of the work such as the First Floor Level Flyover, the Second Floor Level Flyover, the Service roads of NH-50 and Mumbai Pune Road, the Subways, the Slab Drain (Culvert), the Staircases, the Lifts, the Escalators and all related works.

For guidance of bidders, General Arrangement (GA) drawings showing the arrangement of first and second floor Flyovers, Ramps, ROB etc. along with Obligatory requirements, as contemplated by the Employer are attached. However the bid is to be awarded on the Contractor's own design complying with the various obligatory requirements indicated herein as well as in the Design Criteria. For this purpose obligatory details shown in the typical GA drawings enclosed, certain salient parameters which have been specified herein and in the Design Criteria are mandatory requirements. All other details are to be taken as indicative. The Contractor's design should provide for specifications comparable or superior to those mentioned in the Volume-III and as shown in the drawings and provided for in the bid.

The requirements of the obligatory span and other spans for the Flyover shall be as indicated in the GAD enclosed in Volume - IV.

While the scope of work is described in different parts as above, the work shall include all such details of construction which are obviously and fairly intended and which may not have been referred to in these documents, but which are essential for the entire completion of the Works.

GAD prepared by the PCMC (as provided in Vol IV) through their Consultants are intended to give a fair idea of scope of work. The same are enclosed in Tender Document. However it should be clearly understood that

i. The Bidder is required to give lump sum offer based on **his own design** for the entire work - Structures, ramps, junction improvements, filling/grading of low lying areas wherever necessary, fittings / fixtures, ducts for street lighting/electrical work, drainage work, road signages,

markings, crash barriers, kerbs etc. as per detailed Employers requirements.

ii. The Bidder is deemed to have understood and visualized the nature and type of work contemplated with due consideration of qualitative and quantitative requirements of the job consistent with the site conditions, complexities of work which have a bearing on the actual execution/construction etc. While doing so, however, he **must** strictly adhere to salient parameters & obligatory requirement which are indicated herein later.

iii. The spans for ROB [obligatory span] on Central Railway corridor are as per approval by Central Railway and are mandatory. The concrete pavement, service roads and BRTS lanes at grade of old Mumbai-Pune Road shall remain unchanged.

SECTION VI

EMPLOYER'S REQUIREMENTS

CHAPTER – II

EMPLOYERS REQUIREMENT IN DETAIL

Employers Requirement in Detail

The Nashik Phata Flyover project is proposed at the junction of Mumbai-Pune road and NH-50. The proposed Interchange provides facility for crossing the existing Mumbai Pune road, Mumbai-Pune Railway Line, Pawana River etc.

The Components of the Project are as follows. The Components are shown in the drawing, key plan for Components of the Drawing Volume IV of IV for reference.

Component No.	Description of the Component
1	**Two Lane Second Floor Level Flyover** of 9.85m overall width, 1100m long.
2	**Six Lane First Floor Level main Flyover** crossing the Pawana River, Central Railway Line, Mumbai Pune Road and landing on NH-50, 30.7m overall width with central median. The main flyover consists of two separate carriageway of 15.3m each with varying central median and crash barrier on either side of individual carriageway between Ch 475+000 to Ch 665+000. From Ch 475+000 to Ch 665+000, the median shall vary (increase) to accommodate piers of second floor level flyover. The length of First Floor Level main Flyover is 1000m long.
3	Loop (LP1) for exit to Pune from Main First floor level Flyover.
4	Ascending Ramp 2 (Right) from Service Road of Mumbai Pune road to the Main First Floor Level Flyover.
5	Descending Ramp 2 (Left) from Main First Floor Level Flyover to Service Road of Mumbai Pune Road.
6	Ascending / Descending Ramp on Left of the Main Carriageway -Ramp 1 (Left) branching out between River and Railway Line.
7	Ascending / Descending Ramp on Right of the Main Carriageway -Ramp 1 (Right) branching out between River and Railway Line.
8	Pedestrian Facilities such as Escalators, Staircase, Cycle cum pedestrian Subways Mumbai Pune Road and NH-50, Footpaths and Cycle Tracks.
9	Slab and Pipe Culverts.
10	BRTS Bus Platforms, utility crossings connecting ramps from footpaths and subways.
11	Construction/Improvement to the Mumbai Pune road and its service roads in the Flyover area.
12	Construction/Improvement to the Nashik Highway (NH-50), service roads of NH-50 in the Flyover area and merging with the main National Highway.
13	Service Roads of Flyover between Railway Line and River.
14	Road markings, signage, and road furniture.
15	Traffic Diversion and Management.

The Detailed Employer's requirement in respect of the components of the project as mentioned above is as follows,

Component 1:

Two Lane Second Floor Level Flyover of 9.85m overall width, 1100m long.:
The proposed second floor level Flyover starts at Kasarwadi, the 0+00 chainage is located on the existing Subway at Kasarwadi. It is a Two Lane Flyover of 9.85m overall width and 1100m long ending near the CIRT gate on the NH-50. The chainage of the National Highway (NH-50) where the Second Floor Level Flyover ends is 12+650.

The detailed list of work involves,

- Design and Construction of the Second Floor Flyover including Foundations, Substructure, Superstructure, Wearing Coat, Crash Barriers, POT-PPTFE Bearings, and all related works to conform to the Design Data mentioned in this Volume of Tender Document.
- The Longitudinal Profile as shown in the Drawing Volume (Volume IV) as obligatory requirement.
- Solid ramps of Flyovers behind Abutments from Ch:0+00 to 0+150 and CH: 0+910 to 1+100.
- Reinforced Earth Wall for Solid ramps.
- Traffic Management measures during construction to maintain unhindered smooth flow of traffic.
- Barricading of the entire area of Flyover with Type of Barricading described in Annexure-3 of Design Data.
- Reinstating existing median and kerb lines of existing footpaths and carriageways.
- Construction of footpaths with Paver blocks.
- Road furniture including guard rails, Kerb painting, road marking (center and edge lines, pedestrian crossings, chevrons, arrows, stop lines etc.) and road signage (informatory, cautionary, mandatory signs, over head gantry and over hang cantilever signs).
- Paving with Paver Blocks under the Flyover for Parking and Landscaping cum Arboriculture in remaining areas where vertical clearance is less than 2.4m.
- Rehabilitation, repair, re-construction and maintenance of the adjacent roads. The carriageway capacity of the existing roads adjacent to the Second Floor Level Flyover shall be maintained to same configuration as per existing.
- The Staging and Centering arrangement such as to maintain the existing lane configuration of the road below obligatory spans, viaduct spans and complete stretch adjacent to the Second Floor Level Flyover.
- Providing men & machinery for demolition, cleaning and removal after relocation of Encroachments and disposal of the muck.
- Clearing the existing corridor of all encroachments after relocation of existing encroachment.
- Tree cutting and compensatory plantation. Transplantation of eligible trees.

- Drainage spouts as per Standard IRC drawings including Construction of Storm water down take arrangement from wearing coat and connecting it to the nearest Storm water line by laying underground pipelines.
- Wearing coat on completed Superstructure along with waterproofing membrane as per design data and specifications.
- Smooth matching of the Ramp on Pune end near Chainage 0+00 with the existing Carriageway for a length of atleast 50m from touch down point. The crust shall be as per the design data hereunder.
- Smooth matching of the Ramp on Nashik end near Chainage 1+100 with the existing Carriageway of NH-50 including merging in horizontal direction for a length of at least 50m from touch down point. The crust shall be as per the design data hereunder.
- Construction of facility for carrying Utilities lines all along the Flyover, in anti-crash barriers, footpaths.
- Supply and Erection of Street Light Poles to satisfy the illumination requirements of the Flyover for traffic, as per IRC, moving at design speed. All necessary cable laying, provision of junction boxes, earthling, light fixtures, lamps, fittings, Feeder pillars, transformer, switch yards, switchgear timers, etc. complete in all respect.
- Construction of Footpaths with paver blocks arrangement as per the widths specified in Design Data.

Component 2:

Six Lane First Floor Level main Flyover crossing the Pawana River, Central Railway Line, Mumbai Pune Road and landing on NH-50, 30.7m overall width with central median. The main flyover consists of two separate carriageway of 15.3m each with varying central median and crash barrier on either side of individual carriageway between Ch 475+000 to Ch 665+000. From Ch 475+000 to Ch 665+000, the median shall vary (increase) to accommodate piers of second floor level flyover. The length of First Floor Level main Flyover is and 1000m long.

The proposed Six-lane first floor (Level 1) Flyover (main flyover) with footpath on either side is proposed east-west across old Mumbai-Pune NH-4 from south-west of existing Nashik Phata starting at proposed Ch. 0+000 to Ch.1+000. The Flyover starts from south-west of the Pawana River to the North of the Mumbai Pune road (refer Drawing Volume IV of IV). It is a single continuous Flyover structure crossing the River Pawana, the Mumbai Pune Central Railway Line, the Mumbai Pune road (61m wide) and terminates on Pune-Nashik Highway NH-50 (Ch.1+000).

The proposed First floor level Flyover referred to in this Bid Document shall refer to the complete structure which includes the Railway Over-Bridge (ROB), River Bridge (on River Pawana), the Flyover Mumbai Pune Road, the Viaduct portion connecting the River Bridge and ROB. The components of this main Flyover are,

a. The Solid Ramps on ether end of the Flyover.
b. The River Bridge portion
c. The Viaduct Portion from the River Bridge to ROB
d. The Railway Over-Bridge
e. The Flyover on the Mumbai Pune Road.

The Details of the Work involved in Component 2:-

- Main First Floor Level Flyover including the River Bridge and ROB as mentioned above including Foundations, Substructure, Superstructure, Wearing Coat, Crash Barriers, POT-PTFE Bearings, and all related works to conform to the Design Data mentioned in this Volume. Longitudinal Profile and horizontal geometry shall remain unchanged as shown in the Drawing Volume (Volume IV) as obligatory requirement.
- Solid ramps of Flyovers behind Abutments from Ch:0+00 to 0+190 and CH: 0+700 to 0+920.
- Reinforced Earth Wall for Solid ramps.
- Traffic Management measures during construction to maintain unhindered smooth flow of traffic.
- Barricading of the entire area of Flyover with Type of Barricading described in Annexure-3 of Design Data.
- Reinstating existing median and kerb lines of existing footpaths and carriageways.
- 8.75 Service roads on NH50 from Nashik phata junction to the Merging point with existing NH-50 after the end of Solid ramp of Second Floor Level Flyover as per detailed requirements mentioned in this document.
- Service roads along flyover between river and Central Railway Line.
- Construction of footpaths with Paver blocks along the flyover and service roads as per the design data and Typical Cross Sections in Tender Drawings (Volume IV).
- Road furniture including guard rails, Kerb painting, road marking (center and edge lines, pedestrian crossings, chevrons, arrows, stop lines etc.) and road signage (informatory, cautionary, mandatory signs, over head gantry and over hang cantilever signs.
- Paving with Paver Blocks under the Flyover for Parking and Landscaping cum Arboriculture in remaining areas where vertical clearance is less than 2.4m.
- Rehabilitation, repair, re-construction and maintenance of the adjacent roads. The carriageway capacity of the existing roads adjacent to the Flyover shall be maintained to same configuration as per existing.
- The Staging and centering arrangement such as to maintain the existing lane configuration of the road below obligatory spans, viaduct spans and complete stretch adjacent to the Second Floor Level Flyover.
- Providing men & machinery for demolition, cleaning and removal after relocation of Encroachments and disposal of the muck.
- Clearing the existing corridor of all encroachments after relocation of existing encroachment.
- Tree cutting and compensatory plantation. Transplantation of all eligible trees.
- Drainage spouts as per Standard IRC drawings including Construction of Storm water down take arrangement from wearing coat and connecting it to the nearest Storm water line by laying underground pipelines.

- Wearing coat on completed Superstructure along with waterproofing membrane as per design data and specifications.
- Smooth matching of the Ramp on Pune end near Chainage 0+00 with the existing Carriageway for a length of at least 50m from touch down point. The crust shall be as per the design data hereunder.
- Smooth matching of the Ramp on Nashik end near Chainage 1+000 with the existing Carriageway of NH-50 including merging in horizontal direction for a length of at least 100m from touch down point. The crust shall be as per the design data hereunder.
- Construction of facility for carrying Utilities lines all along the Flyover, in anti-crash barriers, footpaths and any other suitable arrangements conforming to the Design requirements.
- Supply and Erection of Street Light Poles to satisfy the illumination requirements of the Flyover for traffic, as per IRC, moving at design speed. All necessary cable laying, provision of junction boxes, earthling, light fixtures, lamps, fittings, Feeder pillars, transformer, switch yards, switchgear timers, etc. complete in all respect.
- Construction of Footpaths with paver blocks arrangement as per the widths specified in Design Data.
- Junction improvements and paving of junctions with paver blocks and Bituminous crust.

Component 3:

Loop (LP1) for exit to Pune from Main First floor level Flyover.

a. The proposed exit ramp i.e. Loop LP1 is proposed for vehicles intending to move towards Pune after exit from the main First Floor Level Flyover. The proposed loop shall have a 5.5m carriageway and 3m footpath cum cycle track arrangement with overall width of 9.6m. The proposed loop merges out from the Left carriageway of the main first floor level Flyover at the chainage 0+670. The 154m Loop starts at 0+00 chainage and ends at 0+154 chainage on the Service road of the Mumbai Pune Road. The detailed geometry and profile shall be mandatory as shown in the Drawing Volume IV of the Tender Document.

The Details of the Work involved in Component 3:-

- Main Ramp including Viaduct and Solid Ramp portion of R.E. Walls including Foundations, Substructure, Superstructure, Wearing Coat, Crash Barriers, POT-PTFE Bearings, and all related works to conform to the Design Data mentioned in this Volume. Longitudinal Profile and horizontal geometry shall remain unchanged as shown in the Drawing Volume (Volume IV) as obligatory requirement.
- Traffic Management measures during construction to maintain unhindered smooth flow of traffic.
- Barricading of the entire area of Flyover with Type of Barricading described in Annexure-3 of Design Data.

- Reinstating existing median and kerb lines of existing footpaths and carriageways.
- 5.5m Service road moving tangentially to the Loop and connecting the Service road of Mumbai Pune road and 8.75m wide carriageway of the NH50.
- Development of Junction of the Service road with Mumbai Pune road and NH-50 as per IRC standards.
- Construction of footpaths with Paver blocks along the loop LP1 (ramp) and service roads as per the design data and Typical Cross Sections in Tender Drawings (Volume IV).
- Road furniture including guard rails, Kerb painting, road marking (center and edge lines, pedestrian crossings, chevrons, arrows, stop lines etc.) and road signage (informatory, cautionary, mandatory signs, over head gantry and over hang cantilever signs.
- Landscaping and Arboriculture in the area enclosed within the Circular Loop, Mumbai Pune road and NH50.
- Rehabilitation, repair, re-construction and maintenance of the adjacent roads. The carriageway capacity of the existing roads adjacent to the Flyover shall be maintained to same configuration as per existing.
- The Staging and centering arrangement such as to maintain the existing lane configuration of the existing road.
- Providing men & machinery for demolition, cleaning and removal after relocation of Encroachments and disposal of the muck.
- Clearing the existing corridor of all encroachments after relocation of existing encroachment.
- Tree cutting and compensatory plantation. Transplantation of all eligible trees.
- Drainage spouts as per Standard IRC drawings including Construction of Storm water down take arrangement from wearing coat and connecting it to the nearest Storm water line by laying underground pipelines.
- Wearing coat on completed Superstructure along with waterproofing membrane as per design data and specifications.
- Smooth matching of the Ramp on Pune end near Chainage 0+150 with the existing service road Carriageway for a length of at least 50m from touch down point. The crust shall be as per the design data of this Volume.
- Construction of facility for carrying Utilities lines all along the Flyover, in anti-crash barriers, footpaths and any other suitable arrangements conforming to the Design requirements.
- Supply and Erection of Street Light Poles to satisfy the illumination requirements of the Flyover for traffic, as per IRC, moving at design speed. All necessary cable laying, provision of junction boxes, earthling, light fixtures, lamps, fittings, Feeder pillars, transformer, switch yards, switchgear timers, etc. complete in all respect.
- Construction of Footpaths with paver blocks arrangement as per the widths specified in Design Data.

Component 4:

Ascending Ramp 2 (Right) from Service Road of Mumbai Pune road to the Main First Floor Level Flyover.

The proposed entry ramp from Service road of Mumbai Pune road (from Kasarwadi) is proposed for vehicles intending ascend to the First Floor Level Flyover coming from Kasarwadi/Pune side. The proposed Ascending ramp shall have a 5.5m carriageway and 3m footpath cum cycle track arrangement with overall width of 9.6m. The proposed Ascending ramp takes off from adjacent to the Service road of Mumbai Pune road at Chainage 0+380 of second floor level flyover. The ramp merges with the First Floor Level Flyover at Chainage 0+276 of the ascending ramp and 0+510 of the Right Carriageway of First Floor Level Flyover. The detailed geometry and longitudinal profile shall be mandatory as shown in the Drawing Volume IV of the Tender Document.

The Details of the Work involved in Component 4:-

- Main Ramp including Viaduct and Solid Ramp portion of R.E. Walls including Foundations, Substructure, Superstructure, Wearing Coat, Crash Barriers, POT-PTFE Bearings, and all related works to conform to the Design Data mentioned in this Volume. Longitudinal Profile and horizontal geometry shall remain unchanged as shown in the Drawing Volume (Volume IV) as obligatory requirement.
- Solid ramps behind Abutments from @ Ch:0+00 to 0+150
- Reinforced Earth Wall for Solid ramps.
- Traffic Management measures during construction to maintain unhindered smooth flow of traffic.
- Barricading of the entire area of Flyover with Type of Barricading described in Annexure-3 of Design Data.
- Reinstating existing median and kerb lines of existing footpaths and carriageways.
- Development of Junction of the Service road with Mumbai Pune road as per IRC standards.
- Construction of footpaths with Paver blocks along the Ramp and service roads as per the design data and Typical Cross Sections in Tender Drawings (Volume IV).
- Road furniture including guard rails, Kerb painting, road marking (center and edge lines, pedestrian crossings, chevrons, arrows, stop lines etc.) and road signage (informatory, cautionary, mandatory signs, over head gantry and over hang cantilever signs.
- Paving with Paver Blocks under the Flyover for Parking and Landscaping cum Arboriculture in remaining areas where vertical clearance is less than 2.4m.
- Rehabilitation, repair, re-construction and maintenance of the adjacent roads. The carriageway capacity of the existing roads adjacent to the Flyover shall be maintained to same configuration as per existing.
- The Staging and centering arrangement such as to maintain the existing lane configuration of the existing road.

- Providing men & machinery for demolition, cleaning and removal after relocation of Encroachments and disposal of the muck.
- Clearing the existing corridor of all encroachments after relocation of existing encroachment.
- Tree cutting and compensatory plantation. Transplantation of all eligible trees.
- Drainage spouts as per Standard IRC drawings including Construction of Storm water down take arrangement from wearing coat and connecting it to the nearest Storm water line by laying underground pipelines.
- Wearing coat on completed Superstructure along with waterproofing membrane as per design data and specifications.
- Smooth matching of the Ramp on Pune end near Chainage 0+00 with the existing service road Carriageway for a length of at least 50m from touch down point. The crust shall be as per the design data of this Volume.
- Construction of facility for carrying Utilities lines all along the Flyover, in anti-crash barriers, footpaths and any other suitable arrangements conforming to the Design requirements.
- Supply and Erection of Street Light Poles to satisfy the illumination requirements of the Flyover for traffic, as per IRC, moving at design speed. All necessary cable laying, provision of junction boxes, earthling, light fixtures, lamps, fittings, Feeder pillars, transformer, switch yards, switchgear timers, etc. complete in all respect.
- Construction of Footpaths with paver blocks arrangement as per the widths specified in Design Data.

Component 5:

Descending Ramp 2 (Left) from Main First Floor Level Flyover to Service Road of Mumbai Pune Road.

The proposed exit ramp merges out from Main First Floor Level Flyover to Service Road of Mumbai Pune road in front of the Kasarwadi Railway Station and is proposed for vehicles intending exit from the Main First Floor Level Flyover to move towards Pimpri. The proposed descending ramp shall have a 5.5m carriageway and 3m footpath cum cycle track arrangement with overall width of 9.6m. The proposed Ascending ramp takes off from Main First Floor Level Flyover at CH:0+525 of right carriageway of Main Flyover which is CH: 276 of the descending ramp. The ramp merges with the Service road of Mumbai Pune road at Ch:0+00 of the Ramp. The detailed geometry and longitudinal profile shall be mandatory as shown in the Drawing Volume IV of the Tender Document.

The Details of the Work involved in Component 5:-

- Main Ramp including Viaduct and Solid Ramp portion of R.E. Walls including Foundations, Substructure, Superstructure, Wearing Coat, Crash Barriers, POT-PTFE Bearings, and all related works to conform to the Design Data mentioned in this Volume. Longitudinal Profile and horizontal geometry shall

remain unchanged as shown in the Drawing Volume (Volume IV) as obligatory requirement.

- Solid ramps behind Abutments from @ Ch:0+00 to 0+140
- Reinforced Earth Wall for Solid ramps.
- Traffic Management measures during construction to maintain unhindered smooth flow of traffic.
- Barricading of the entire area of Flyover with Type of Barricading described in Annexure-3 of Design Data.
- Reinstating existing median and kerb lines of existing footpaths and carriageways.
- Development of Junction of the Service road with Mumbai Pune road as per IRC standards.
- Construction of footpaths with Paver blocks along the Ramp and service roads as per the design data and Typical Cross Sections in Tender Drawings (Volume IV).
- Road furniture including guard rails, Kerb painting, road marking (center and edge lines, pedestrian crossings, chevrons, arrows, stop lines etc.) and road signage (informatory, cautionary, mandatory signs, over head gantry and over hang cantilever signs.
- Paving with Paver Blocks under the Flyover for Parking and Landscaping cum Arboriculture in remaining areas where vertical clearance is less than 2.4m.
- Rehabilitation, repair, re-construction and maintenance of the adjacent roads. The carriageway capacity of the existing roads adjacent to the Flyover shall be maintained to same configuration as per existing.
- The Staging and centering arrangement such as to maintain the existing lane configuration of the existing road.
- Providing men & machinery for demolition, cleaning and removal after relocation of Encroachments and disposal of the muck.
- Clearing the existing corridor of all encroachments after relocation of existing encroachment.
- Tree cutting and compensatory plantation. Transplantation of all eligible trees.
- Drainage spouts as per Standard IRC drawings including Construction of Storm water down take arrangement from wearing coat and connecting it to the nearest Storm water line by laying underground pipelines.
- Wearing coat on completed Superstructure along with waterproofing membrane as per design data and specifications.
- Smooth matching of the Ramp on Pimpri end near Chainage 0+00 with the existing service road Carriageway for a length of at least 50m from touch down point. The crust shall be as per the design data of this Volume.
- Construction of facility for carrying Utilities lines all along the Flyover, in anti-crash barriers, footpaths and any other suitable arrangements conforming to the Design requirements.
- Supply and Erection of Street Light Poles to satisfy the illumination requirements of the Flyover for traffic, as per IRC, moving at design speed. All necessary cable laying, provision of junction boxes, earthling, light

fixtures, lamps, fittings, Feeder pillars, transformer, switch yards, switchgear timers, etc. complete in all respect.
- Construction of Footpaths with paver blocks arrangement as per the widths specified in Design Data.

Component 6 and 7:

Ascending / Descending Ramps on Left and right of the Main Carriageway - Ramp 1 (Left) and Ramp-1 (Right) branching out between River and Railway Line.

The proposed ramps Ramp-1 (Left) and Ramp-1 (Right) each merge out from Main First Floor Level Flyover to Service Road adjacent to Mumbai Pune Central Railway ROW. The proposed ramps shall have a 7.5m carriageway and 3m footpath cum cycle track arrangement on one side with overall width of 11.6m. The proposed ramps take off from Main First Floor Level Flyover at CH:0+315. The ramps merge with the Service road 0+200. The detailed geometry and longitudinal profile shall be mandatory as shown in the Drawing Volume IV of the Tender Document.

The Details of the Work involved in Component 6 and 7 each:-

- Main Ramps including Viaduct and Solid Ramp portion of R.E. Walls including Foundations, Substructure, Superstructure, Wearing Coat, Crash Barriers, POT-PTFE Bearings, and all related works to conform to the Design Data mentioned in this Volume. Longitudinal Profile and horizontal geometry shall remain unchanged as shown in the Drawing Volume (Volume IV) as obligatory requirement. Modifications in the horizontal geometry may be permitted at the discretion of Engineer.
- Solid ramps behind Abutments from @ Ch:0+100 to 0+200
- Reinforced Earth Wall for Solid ramps.
- Traffic Management measures during construction to maintain unhindered smooth flow of traffic.
- Barricading of the entire area of ramps with Type of Barricading described in Annexure-3 of Design Data.
- Reinstating existing median and kerb lines of existing footpaths and carriageways.
- Development of Junction of the ramp with Service road as per IRC standards.
- Construction of footpaths with Paver blocks along the Ramp and service roads as per the design data and Typical Cross Sections in Tender Drawings (Volume IV).
- Road furniture including guard rails, Kerb painting, road marking (center and edge lines, pedestrian crossings, chevrons, arrows, stop lines etc.) and road signage (informatory, cautionary, mandatory signs, over head gantry and over hang cantilever signs.
- Paving with Paver Blocks under the Flyover for Parking and Landscaping cum Arboriculture in remaining areas where vertical clearance is less than

2.4m. In addition, Landscaping and Arboriculture shall be carried out in the open area between main first floor level flyover and the Ramps.

- Rehabilitation, repair, re-construction and maintenance of the adjacent roads. The carriageway capacity of the existing roads adjacent to the Flyover shall be maintained to same configuration as per existing.
- The Staging and centering arrangement such as to maintain the existing lane configuration of the existing road.
- Providing men & machinery for demolition, cleaning and removal after relocation of Encroachments and disposal of the muck.
- Clearing the existing corridor of all encroachments after relocation of existing encroachment.
- Tree cutting and compensatory plantation. Transplantation of all eligible trees.
- Drainage spouts as per Standard IRC drawings including Construction of Storm water down take arrangement from wearing coat and connecting it to the nearest Storm water line by laying underground pipelines.
- Wearing coat on completed Superstructure along with waterproofing membrane as per design data and specifications.
- Smooth matching of the Ramps with Service road Carriageway for a length of at least 50m from touch down point. The crust shall be as per the design data of this Volume.
- Construction of facility for carrying Utilities lines all along the Flyover, in anti-crash barriers, footpaths and any other suitable arrangements conforming to the Design requirements.
- Supply and Erection of Street Light Poles to satisfy the illumination requirements of the Flyover for traffic, as per IRC, moving at design speed. All necessary cable laying, provision of junction boxes, earthling, light fixtures, lamps, fittings, Feeder pillars, transformer, switch yards, switchgear timers, etc. complete in all respect.
- Construction of Footpaths with paver blocks arrangement as per the widths specified in Design Data.

Component 8:

Pedestrian Facilities such as Escalators, Staircase, Cycle cum pedestrian Subways Mumbai Pune Road and NH-50, Footpaths and Cycle Tracks.

The proposed pedestrian facilities are to be provided for movement of pedestrians and Cyclists from any point to any point in the complete Interchange/Flyover Project without direct conflict with the traffic. For ascending Descending Escalators and staircase arrangements as described below are proposed. For crossing the Mumbai Pune road and NH-50, subways are proposed which must give access to the footpaths along service roads and also to the Bus-stops proposed in the divider between Main carriageway and Service road of the Mumbai-Pune road. The Footpath cum cycle track all along the flyover is proposed to be 3m.

The Details of the Work involved in Component 8:-

- Raised Footpath cum cycle track all along the components of the Flyover as mentioned below,
    a. Main First Floor Flyover (from (Ch: 0+00) to 1+000 of 3m width as shown in the drawings on both the edges of the six lane flyover. The width of Footpath at the Bus stop location as shown on the drawing shall be 4.5m to accommodate the bus platform.
    b. Raised Footpath cum cycle track all along the Ascending Descending Ramps Ramp-1 (Left +right), Ramp-2 (Left +Right) Loop LP1. The width of the Footpath cum cycle track along these ramps and loops shall be on one side and of 3m width as shown in the drawings
    c. Raised Footpath along the Service roads of NH-50, Mumbai Pune road and Service roads between River and Railway Line as per Tender drawings.
    d. Merging and matching of all footpaths cum cycle tracks with existing facilities along NH50, Mumbai Pune road and service roads of 45m DP road towards Wakad.

- Facilities for Pedestrians to ascend / descend the Flyover, cross the Mumbai Pune road, the NH-50 as mentioned below,
    Four units including staircase and electrically operated Escalators (up and down) with an electrically operated lift for the physically handicapped as shown in the Drawing Volume IV of IV. One Individual unit for ascending and descending comprises of the following,
    a. One electrically operated passenger escalator for ascending to the Flyover. The clear width of the escalator shall be minimum 1m.
    b. One electrically operated passenger escalator for descending from the Flyover. The clear width of the escalator shall be minimum 1m.
    c. One RCC Staircase of 2.5m clear width for ascending/descending.
    d. One electrically operated Lift for physically challenged people of carrying capacity of 15 people.
    e. Polycarbonate sheeting with proper MS framework required for covering the pedestrian descending/ascending facility and platform/landing area from all sides with minimum vertical clearance of 2.4m from top of the platform/steps.
    f. MS Handrails for the RCC Staircase to be provided at both edges.
    g. Electrical and Mechanical arrangements for Escalators.
    h. Structure to support and commission the Escalators.
    i. RCC Control Room Building of 100 Sq.m. with all infrastructure for control of Escalators. The control room shall have RCC framed structure, Brickwork walls, doors, windows, plaster, painting, waterproofing, electrification, lighting etc. complete in all respects.
    j. Laying of underground utility lines from escalators to control room
    k. Installation of Feeder Pillars, Transformers etc. for Electricity supply to Electrically operated Escalators.
- RCC Dog Legged Staircase unit at two locations of clear width 2.4m as shown in the Drawings. The staircase arrangement shall also be covered with Poly-carbonate sheet canopy.

- RCC Subway for pedestrians and cyclists across Mumbai Pune road at location and sections as shown in the Tender drawings. The dimensions are minimum requirements.
- RCC Subway for pedestrians and cyclists across Mumbai Pune road at location and sections as shown in the Tender drawings (Chainage 0+650 of Second Floor Level Flyover). The dimensions are minimum requirements.
- Water-Proofing of entire external face of the Subway on NH-50 and Mumbai Pune road
- Tiling and beautification of the subway on NH-50 and Mumbai Pune road
- Lighting and illumination of the Subway on NH-50 and Mumbai Pune road.
- Provision of pumping arrangement and Storm water drainage arrangements for the Subways on NH-50 and Mumbai Pune road

Component 9:

Slab and Pipe Culverts.

- Demolition of existing Slab Drain at 0+545 of Second Floor Level Flyover
- Clearing and removal of Muck of demolished Slab drain from site.
- Traffic Management measures during construction to maintain unhindered smooth flow of traffic.
- Barricading of the entire area of excavation with Type of Barricading described in Annexure-3 of Design Data.
- Construction of the Slab Drain, at CH:0+545 of second floor level flyover, across Mumbai Pune road. The minimum dimensions for the Slab drain are shown in the Tender Drawing.
- Re-construction of Slab Drain at Ch:0+070 of the Ramp-1 (Right) between the River and Railway Line.
- Diversion of nala running along the alignment of Ramp-1 (Right) between River and Railway Line.
- Construction of protective Retaining Wall all along the diverted Nala on both the banks of nala from Railway Boundary to the Discharge point in River Pawana.
- Construction of Retaining Wall along the Pawana River for a length of 50m each on both the banks at suitable location as directed by Engineer.
- Construction of 2 Row 1.2m dia NP4 Storm water Crossing arrangements at minimum Four Locations including protection works such as headwalls upto 4m height as directed by the Engineer.
- Reinstating existing median and kerb lines of existing footpaths and carriageways.
- Rehabilitation, repair, re-construction and maintenance of the adjacent roads. The carriageway capacity of the existing roads adjacent to the Flyover shall be maintained to same configuration as per existing.
- The Staging and centering arrangement such as to maintain the existing lane configuration of the existing road.
- Tree cutting and compensatory plantation. Transplantation of all eligible trees.
- Construction of Storm Water Lines with following provisions

a. 1m diameter NP4 pipe lines to discharge in nearest Nalla and river on outer edges of service roads and below Footpaths. These storm water lines should be laid with invert at least 2m below ground, all along the First Floor Level Flyover, Second Floor Level Flyover, Service Roads, Mumbai Pune road and NH-50. The existing network may be made use of if sufficient to carry the calculated discharge.
b. Construction of RCC Manholes at every 30m interval. Additional Manholes shall be constructed at junctions, node of change in storm water alignments, additional manholes at all low points of proposed road network.
c. Construction of Water Entrances from road levels to Storm water Drains.

Component 10:

BRTS Bus Platforms, Utility Crossings, Connecting Ramps from Footpaths and Subways.

- Construction of Bus Platforms for BRTS bus halting at Four locations. Two locations are on the Mumbai Pune road and two locations are on the Main First Floor Level Flyover as shown in the drawings.
- Service Utility crossing arrangements of minimum 4 row RCC NP3 pipes of dia 300mm at bus stop locations.
- Manholes for Service Utility Crossings below Footpaths, in medians and at locations below the Bus stop platforms.
- Connecting Ramps and Staircase from BRTS Platforms on Mumbai Pune road to the Subway across Mumbai Pune road.
- Electrification arrangements such as laying of cables and Optical Fiber lines for future requirements of BRTS Bus stop.
- Supply and Erection of Street Light Poles to satisfy the illumination requirements of the Flyover for traffic, as per IRC, moving at design speed. All necessary cable laying, provision of junction boxes, earthling, light fixtures, lamps, fittings, Feeder pillars, transformer, switch yards, switchgear timers, etc. complete in all respect.

Component 11:

Construction of Mumbai Pune Road and its Service Roads in the Flyover Area. The Flyover area shall be defined as the area adjacent to First Floor Level Flyover, Second Floor Level Flyover, Ramps and Loops.

- Reinstating existing median and Kerb lines of existing footpaths
- Construction of footpaths with Paver blocks.
- Road furniture including guard rails, kerb painting, road marking (center and edge lines, pedestrian crossings, chevrons, arrows, stop lines etc.) and road signage (informatory, cautionary, mandatory signs, over head gantry and over hang cantilever signs.
- Landscaping and Arboriculture.
- Traffic Management measures during construction.

- Providing men & machinery for demolition, cleaning and removal after relocation of Encroachments and disposal of the muck.
- Clearing the existing corridor of all encroachments after relocation of existing encroachment.
- Tree cutting and compensatory plantation. Transplantation of eligible trees.
- Construction of Paver block strips in carriageway (abutting existing concrete road) as per requirements.
- Removal and reconstruction of stretches/pockets of existing concrete pavement that are in poor condition.
- Renewal of joints of existing concrete pavement and crack filling wherever required
- Junction improvement and paving of the Nashik Phata junctions with Paver blocks
- Construction of Storm Water Lines with minimum 1000mm dia NP4 pipes all along the Service roads of the Flyover and connecting them to the nearest Nalla. The Storm water lines shall have manholes with covers suitable for water collection at every 30m interval.
- Construction of Water Entrances to Storm water Drains.
- Provision of 4 rows of 300 mm dia. RCC pipes (NP3) for crossing of utilities at junctions and at every 100m c/c along the road.
- Road furniture including guard rails, kerb painting, road marking (center and edge lines, pedestrian crossings, chevrons, arrows, stop lines etc.) and road signage (informatory, cautionary, mandatory signs, overhead gantry and overhang cantilever signs.
- Landscaping and Arboriculture.
- Street lighting - ducting and providing fixtures for foundations of poles, Installation of Poles and Fixtures to satisfy illumination requirements as per the IRC standards all along the proposed roads.
- Traffic Management measures during construction.
- Smooth Matching of the Main Carriageway in horizontal alignment and vertical profile with the existing Carriageway for a length of at least 50m from end point. The crust shall be as per the design data hereunder.
- Smooth Matching of the Service Roads in horizontal alignment and vertical profile with the existing Carriageway for a length of at least 50m from end point. The crust shall be as per the design data hereunder.

Component 12:

Construction/Improvement of Nashik Highway (NH-50), service roads of NH-50 in the Flyover area and merging with the National Highway.

- Reinstating existing median and kerb lines of existing footpaths
- Construction of footpaths of 1.5m width all along the NH-50 on both edges with Paver blocks.
- Road furniture including guard rails, kerb painting, road marking (center and edge lines, pedestrian crossings, chevrons, arrows, stop lines etc.) and road signage (informatory, cautionary, mandatory signs, over head gantry and over hang cantilever signs.

- Landscaping and Arboriculture.
- Traffic Management measures during construction.
- Providing men & machinery for demolition, cleaning and removal after relocation of Encroachments and disposal of the muck.
- Clearing the existing corridor of all encroachments after relocation of existing encroachment.
- Tree cutting and compensatory plantation. Transplantation of eligible trees.
- Construction of footpaths with Paver blocks.
- Construction of Paver block strips in carriageway (abutting existing concrete road).
- Removal and reconstruction of stretches/pockets of existing concrete pavement that are in poor condition.
- Construction of separate New carriageways in both directions of 8.75m width from Ch: 0+600 (Nashik Phata junction) to Ch: 1+200 of Second floor level Flyover with footpaths as shown in the cross sections (Volume IV)
- Renewal of joints of existing concrete pavement and crack filling wherever required
- Junction Improvements and paving of junctions with paver blocks
- Construction of Storm Water Lines with minimum 1000mm dia NP4 pipes all along the Service roads of the Flyover and connecting them to the nearest Nalla. The Storm water lines shall have manholes with covers suitable for water collection at every 30m interval.
- Construction of Water Entrances to Storm water Drains.
- Provision of 300 mm dia. RCC pipes (NP3) for crossing of utilities at junctions and at every 200m on service roads.
- Road furniture including guard rails, kerb painting, road marking (center and edge lines, pedestrian crossings, chevrons, arrows, stop lines etc.) and road signage (informatory, cautionary, mandatory signs, overhead gantry and overhang cantilever signs.
- Landscaping and Arboriculture.
- Street lighting - ducting and providing fixtures for foundations of poles, Installation of Poles and Fixtures to satisfy illumination requirements as per the IRC standards all along the proposed roads.
- Traffic Management measures during construction.
- Smooth Matching of the Ramp on Pune end near Chainage 0+00 with the existing Carriageway for a length of atleast 50m from touch down point. The crust shall be as per the design data hereunder.
- Smooth Matching of the Ramp on Nashik end near Chainage 1+100 with the existing Carriageway for a length of at least 50m from touch down point. The crust shall be as per the design data hereunder.

Component 13:

Service roads of Flyover between Railway Line and River

- Construction of Service roads 500m long of Carriageway width 7.5m. The plan is as shown in the drawings.

- Construction of 1.5m wide footpath with Paver Blocks all along the Service roads.
- Crust of the Service Roads shall be as per the Design Criteria.
- Reinstating existing median and kerb lines of existing footpaths.
- Road furniture including guard rails, kerb painting, road marking (center and edge lines, pedestrian crossings, chevrons, arrows, stop lines etc.) and road signage (informatory, cautionary, mandatory signs, over head gantry and over hang cantilever signs.
- Landscaping and Arboriculture in the area between service roads and the main Flyover.
- Traffic Management measures during construction.
- Providing men & machinery for demolition, cleaning and removal after relocation of Encroachments and disposal of the muck.
- Clearing the existing corridor of all encroachments after relocation of existing encroachment.
- Tree cutting and compensatory plantation. Transplantation of eligible trees.
- Construction of Paver block strips in carriageway (abutting existing concrete road).
- Removal and reconstruction of stretches/pockets of existing concrete pavement that are in poor condition.
- Junction improvements and paving of junctions with paver blocks
- Construction of Storm Water Lines with minimum 1000mm dia NP4 pipes all along the Service roads and connecting them to the nearest Nalla. The Storm water lines shall have manholes with covers suitable for water collection at every 30m interval.
- Construction of Water Entrances to Storm water Drains.
- Provision of 300 mm dia. RCC pipes (NP3) for crossing of utilities at junctions and at every 100m on service roads.
- Road furniture including guard rails, kerb painting, road marking (center and edge lines, pedestrian crossings, chevrons, arrows, stop lines etc.) and road signage (informatory, cautionary, mandatory signs, overhead gantry and overhang cantilever signs.
- Landscaping and Arboriculture.
- Street lighting - ducting and providing fixtures for foundations of poles, Installation of Poles and Fixtures to satisfy illumination requirements as per the IRC standards all along the proposed roads.
- Traffic Management measures during construction.
- Smooth Matching of the service roads with the existing Carriageway for a length of at least 50m from touch down point. The crust shall be as per the design data hereunder.

Component 14:

Road Markings, Signages and Road Furniture.

- Supply, installation and erection of 30m span Gantry Type Overhead Signages including Steel Framed structure, Signage boards 1.2m tall, Sheeting of ASTM type IX specifications, at following locations.

a. Before the start of the First Floor Level Flyover
b. At Two locations along the First Floor Level Flyover
c. After the end of the Flyover

- Supply, installation and erection of 9.85m span Gantry Type Overhead Signages including Steel Framed structure, Signage boards 1.2m tall, Sheeting of ASTM type IX specifications, at following locations.
  a. Before the start of the Second Floor Level Flyover
  b. After the end of the Second Floor Level Flyover before merging with the existing NH50.
  c. At starting points of all the Ramps, Ramp R-1 (Left), Ramp R-1 (Right), Ramp R-2 (Left), Ramp R-2 (Right), Loop LP1.

- Supply, installation and erection of Cantilever Type Informatory Sign Boards including Steel Framed structure, Signage boards 1.2m tall and 2.4m wide, Sheeting of ASTM type IX specifications, at Five locations.
- Supply, installation and erection of Cautionary, Mandatory and informatory sign boards at locations like curves, steep gradients, and low vertical clearances.
- All the Parking areas, Service roads, ramps, loops, subways, staircase, Bus stops etc. shall have necessary cautionary, mandatory and informatory sign boards.
- The paved areas, service roads, Wearing Coat of Flyovers shall be ,Marked with Thermoplastic paint for,
  a. Edge markings
  b. Lane Markings,
  c. Direction arrows.
  d. Chevrons
  e. Stop Lines
  f. Pedestrian crossings
  g. Other necessary markings
  h. Kerb lines
- Supply and installation Decorative Seating arrangements in the Landscaped area atleast at Ten suitable locations as directed by the Engineer.

Component 15:

Traffic Diversion and Management

- Installation of Barricades all along the Cordoned area where work is going on.
- Installation of warning signs blinkers and barricades as per Specifications in Volume III.
- Repair and maintenance of distress, potholes in existing roads to ensure smooth flow of traffic.
- The complete are traffic management during construction shall be such that at any given point of time the lane configuration available for existing traffic shall not be less than the existing carriageway configurations.

- Removal, shifting and rehabilitation of underground and overhead utilities shall be carried out through the approved agencies of concerned authorities under provisional sums.

While the scope of work is described in different parts/components as above, the work shall include all such details of construction which are obviously and fairly intended and which may not have been referred to in these documents, but which are essential for the entire completion of the Works.

GAD prepared by the PCMC (as provided in Vol IV) through their Consultants are intended to give a fair idea of scope of work and Obligatory Requirements. It may please be noted here the span arrangements, horizontal and vertical geometry shown in drawings are mandatory. The same are enclosed in Tender Document. However it should be clearly understood that

i. The Bidder is required to give lump sum offer based on his own design for the entire work - Structures, ramps, junction improvements, fittings / fixtures, ducts for street lighting/electrical work, drainage work, road signages, markings, crash barriers, kerbs etc. as per detailed Employers requirements.

ii. The Bidder is deemed to have understood and visualized the nature and type of work contemplated with due consideration of qualitative and quantitative requirements of the job consistent with the site conditions, complexities of work which have a bearing on the actual execution/construction etc. While doing so, however, he must strictly adhere to salient parameters & obligatory requirement which are indicated herein later.

iii. The spans for ROB [obligatory span] on Central Railway corridor are as per approval by Central Railway and are mandatory. The concrete pavement, service roads and BRTS lanes at grade of old Mumbai-Pune Road shall remain unchanged.

SECTION VI

EMPLOYER'S REQUIREMENTS

CHAPTER – III

DESIGN CRITERIA FOR ROADS AND HIGHWAYS.

1.0 DESIGN DATA FOR ROADS/HIGHWAYS

S. No	Attributes	Standards
1	Category of Road	Arterial
2	Design Speed	80 Km/Hr
3	Width Carriageway Lane	• 8.75m for NH 50 • 11.5m for Mumbai Pune Road Service Roads • 9m for Mumbai Pune Main Concrete Carriageway • 7.5m for Service roads proposed between River and Railway line • Other Lane configurations as per Volume-IV Drawings
4	Edge Strip Adjacent to Median and Footpath Kerb	0.25m
5	Paved Shoulder	1.9 m (Max) 1.5 m (Min)
6	Earthen/Granular Shoulder	1.0 m To 1.6m
7	Median	0.6 m To 2.1m
8	Footpath	3.0m for complete Flyover including Ramps, ROB, River Bridge portion and 1.5m for Nashik Bound Service Road of NH-50 3.0m for Pune Bound Service Road of NH-50 4.5m for Mumbai Pune road Service Roads.
9 a	Camber Carriageway and Paved Shoulder • Rigid • Flexible • Over Flyover	 2.0 % 2.5 % 2.5 %
b	Earthen Shoulder	3.0 %
10	Maximum Super-Elevation - Road at Grade Over Elevated Corridor	 5.0 % 4.0 %
11	Longitudinal Gradient • Rulng • Limiting Gradient	 3.33 % 4.5 % (in unavoidable circumstances)

(i) Lane width on curves may be adjusted upwards according to traffic composition and degree of curve.

(ii) Minimum Intersection turning radius shall be 25 m.

(iii) Super elevation run-off shall be at the rate of 1:150

(iv) Super elevation shall be as per provisions of IRC-86 and IRC-38.

2.0 GENERAL OBLIGATORY REQUIREMNTS:-

2.1 In the road construction obligatory requirements include

- Demolition and reconstruction of existing pavement in poor condition wherever required for construction of pier for elevated corridor.
- Design, plan and execute rigid pavement wherever damages due to construction of piers, locations of poor pavement condition, slip roads including restoring crust.
- Paver blocks in the footpath, rehabilitation of kerb and medians.
- Road furniture, lighting, landscaping for the entire length
- Removal, shifting and rehabilitation of underground and overhead utilities shall be carried out through the approved agencies of concerned authorities under provisional sums.
- Contractor shall handle missing links first, carry out ground improvement works and monitor the settlement over the period of time.

The Crust for the Proposed Road work and Solid Ramp Portion shall be as follows,

	BRIEF DESCRIPTION		**Layer thickness**
a)	Subgrade with selected fill material having CBR >8%, complying with MoSRT&H specification. (Clause 305 of MoSRT&H specs.)	:	500 mm
b)	**Granular Sub Base (GSB)**	:	300 mm
	150 mm thick drainage layer of grade II metal (Table 400.2 MOSRT&H).		
	150 mm thick structural layer of grade II metal (Table 400.1 MOSRT&H).(Compacted with Vibratory Roller - a single layer thickness not to exceed 100 mm).		
c)	W.M.M. with graded crushed stone layers with single layer not exceeding 200 mm. (Clause 406 of MoSRT&H specs.) (Compacted with Vibratory Roller)	:	300 mm
d)	**Dense Bituminous Macadam** with a single layer not exceeding 50 - 100 mm, 30 / 40 grade bitumen @ 4.5% bitumen by weight of mix, graded aggregate as specified in MOSRT&H including prime coat (of 10 kg/10 Sq.m of 80 / 100 bitumen) and tack coats (5 kg / 10 Sq.m of 80 / 100 bitumen). (Compacted with Vibratory Roller) (Clause 507 of MoSRT&H specs.)	:	150 mm (in two layers of 75mm each)
e)	**Wearing coat of Bituminous Concrete** with minimum 5.5% Bitumen of 30/40 grade, single layer of 25 - 50 mm including tack coat (bitumen - 80 / 100) at 5 kg/10 Sq.m. (using lime as filler material, Compacted with Vibratory Roller) (Clause 512 of MoSRT&H specs.)	:	50 mm

Providing wearing course over the bridge superstructures as follows: 50mm DBM overlaid by 50mm BC as per MoSRT&H specifications. Merging of ramps / loop with either service roads / main carriage way of Mumbai Pune road, NH-50etc. shall have road crusts similar to that solid ramps
Profile correction for camber, super elevation, and vertical curve shall be provided in deck itself.

2.2 Alignment and location

Alignment and location of the Flyover Structure and ROB shall be as shown in the Departmental drawings provided (Volume IV of IV). The Co-ordinates and levels shall be approved by The Engineer. The Bench Mark is located on the Platform of the Kasarwadi Railway Station.

2.3 Geometrics

The Contractor's proposal shall provide for a River Bridge, ROB cum Flyover of length to suit the requirements of minimum horizontal and vertical clearances in the obligatory spans at junction and other obligatory requirements and gradient not steeper than those shown on the departmental drawing. The Contractor shall provide the Flyover conforming to these requirements and including properly designed horizontal & vertical curves for a design speed as per the **Design Criteria**

The radii of horizontal curves shall not be less than as shown in the departmental drawings. The minimum length of open structure portion shall not be less than those shown in the departmental drawings. The maximum height of solid ramp at abutment location shall not be more than those shown in the departmental drawings.

The Carriageway width for Level 1 and Level 2 Flyover, ROB and ramp shall not be less than that shown in the departmental drawings (Volume IV of IV).

The retaining structure of the ramp shall be provided upto the inner half portion of the valley curve. In the remaining half portion of valley curve on the extreme end of Flyover merging with existing road, crash barriers shall be taken min. 30 cm below the top of existing road. The foundation of crash barriers in this portion shall rest at 60 cm below the existing road level.

2.4 Camber and Super Elevation

Minimum camber to be provided on the carriageway shall be 2% as shown in the departmental drawing. Super elevation wherever required shall be as per actual design subject to a maximum of 4%. The carriageway width of 11.2 m for first floor level Flyover and 8.75m for second floor level Flyover has been decided considering movement of multi axle trailers with containers / oversized vehicles and traffic requirements and also extra widening required on curves. The widened width of carriageway at horizontal curves shall not be less than that shown in the departmental drawings.

2.5 Traffic Diversion

The Contractor may adopt a suitable traffic diversion scheme during construction which shall be got approved from local Traffic Police Department. The responsibility of obtaining the permissions for proposed traffic diversion from concerned authorities e.g. Traffic Police Department shall be that of the contractor.

Contractor shall enclose the scheme of construction of superstructure of main obligatory spans and ROB portion along with his technical proposal.

Programme of construction of the obligatory spans and ROB portion shall be arranged in such a way that it is completed in the shortest time period with least possible hindrance to traffic.

Providing and maintaining necessary traffic diversion, barricading of site during construction, providing necessary traffic safety measures etc as per provisions given in Special Conditions of Contract.

The Traffic of NH-50 shall be diverted after construction of Service roads on NH-50 as per MoSRT&H requirements. This diversion shall be completed before start of Flyover work on NH-50.

2.6 Site Clearance / Setting Out:

Carrying out topographic survey and marking out the center line of the Flyover bridge and various other components and complete lining out using concrete pillars for proper lines and levels with precision total survey, including constructing control stations, bench marks, etc. as directed. This includes all the allied works like clearing the road, other existing utilities like signals, electrical poles, telephone ducts, hoarding, etc. side line removing and stacking of the existing kerb stones, obstructing bushes, etc. cutting / relocating of trees as per list given in tender, as directed by Engineer. The surveying instruments used on the work shall be modern electronic equipment like precise total station. And all the levels should be referred to particular B.M value established on the Kasarwadi Pune-bound Railway Platform as shown in the GAD.

2.7 Designs, Drawings and Documentation – Contract Drawings

The drawings provided with the tender are intended to give only a fair idea of the scope of work, while the offers are invited on the basis of design to be furnished by the Contractor. Hence, the drawings submitted by the Contractor along with his tender shall be treated as Contract Drawings subject to conditions laid down in the Contract.

The Contractor shall submit all detailed design for approval to the PCMC. Only after approval from PCMC the drawings shall be used for Construction.

2.8 Construction activities

It shall be noted by the Contractor that

i. The responsibility of obtaining necessary design and construction permission/s from appropriate authorities like PCMC/Central Railways/MoSRT&H etc., for all the construction activities including those for shifting any utilities etc., if required, shall be that of the contractor. PCMC will give necessary assistance to the Contractor.
ii. It shall be the Contractor's responsibility to see that there is no hindrance to existing traffic during Construction of Flyover and the roadway is free from haphazardly stacked / thrown materials, pot-holes, muck, construction equipments etc. The area being tackled during construction shall be cordoned with Barricades self standing and having blinkers on them.
iii. It shall be contractor's responsibility that the scheme of construction shall be got approved from concerned authorities.
iv. The second floor level Flyover for Nashik bound traffic shall be completed on priority in first 12 months.
v. Before starting work of the second floor Level and First floor level flyovers, the 8.75m wide Service roads along NH-50 shall be completed to allow smooth traffic movements.
vi. The Contractor shall submit all detailed design for approval to the PCMC. Only after approval from PCMC the drawings shall be used for Construction.

2.9 Clearance, Survey, Line out etc.

The center line of Fly-over shall have to be got confirmed before execution of Work.

i. Carry out complete line-out of the River Bridge/ ROB/ Flyover, ramp and various other components using modern electronic surveying equipment including constructing masonry and concrete pillars for providing requisite reference lines and levels,. Constructing control stations, bench marks etc. as directed by the Engineer.
ii. Carry out all, allied works like clearing the road side line, removing and stacking of the existing kerb stones, removing obstructing bushes and trimming trees etc. as directed by the Engineer.
iii. Relocation of underground / overground utilities / services as directed by the Engineer.
iv. Cutting / relocation of trees as directed by Engineer.
v. Removal / relocation of electrical, telephone poles, cables as directed by Engineer.

2.10 Preliminary Site Preparations

i. Providing site office as per detailed specifications in Volume-III
ii. Providing site laboratory and survey equipments.
iii. Providing casting & stacking yard for pre-cast elements if proposed.

iv. Providing batching plant for preparation of concrete.
v. Mobilising all necessary plant and equipments.

2.11 PIER PROTECTION / ROAD SIDE KERBS:

Providing pier protection to all piers of obligatory spans, all piers on either side of service road, slip roads by constructing R.C.C. wall of 20 cm thick (in M-20) around piers to a height of 1.25 m above existing road level / G. L. with a gap of one meter between pier and wall and filling it with murum and 150 mm rubble soling over laid by P.C.C. of M-15 grade of 100 mm thick. The vertical reinforcement of 16 mm dia at 200 mm center to center and 10 mm dia at 200 mm center to center as distribution steel shall be provided on the outer face and nominal steel on inner face (10 mm dia at 200 mm center both ways) in the RCC wall.

Foundation of wall shall be taken minimum 1.0 m below GL and shall have minimum size 0.45 m x 0.50 m in M-15 over rubble soling of 0.15 m thick.

2.12 MISCELLANEOUS ITEMS AND ROAD APPURTENANCES ETC.

(a) Providing Traffic Safety Devices as per the following brief particulars. For detailed specifications refer Volume- III.

(i) **During Construction Stage - Temporary**:- Providing self standing MS sheet barricading with proper lighting, providing and maintaining safety gadgets like rotaro blinkers, caution boards, cones and cat-eyes etc., including day-to-day maintenance of such traffic diversion system and preparation of traffic planning for the approval of the competent authority such as traffic police, PCMC etc. as specified in the Tender Document or as directed by the Engineer.

(ii) **On the Structure - Permanent**:-Providing traffic lane line strips 100 mm in width with approved thermoplastic road marking paint in two coats over the superstructure as directed by the Engineer. Zebra crossing for pedestrians at appropriate location. Informatory / warning / mandatory sign boards of required shape and size with retro-reflective sheeting of high intensity grade as per requirement including supporting columns gantries / trusses etc as directed by the Engineer and other arrangements as per MoSRT&H specifications. Traffic signpost including sign boards number shall be as per MoSRT&H specifications and traffic department requirement. The gantries and trusses shall be required to span over the road and be supported only at two points outside the ROW width as directed by Engineer. Total number of such gantries shall be 3 Nos. The gantries and trusses shall be as per the drawing attached.

(b) Providing suitable arrangements in the bridge superstructure for erecting electric poles, cables etc for lighting the Flyover, ramps and service roads as well as providing suitable cable ducting etc. for lighting and

illumination under the obligatory span and slip road and fixing with fixtures - all as per the requirement of PCMC or as directed by the Engineer.

(c) Public Utilities

Details of utilities passing through the corridor have been mapped based on the information collected from the various sources. Any / some of the utilities are likely to cause hindrance to the foundations. These need to be relocated or diverted before taking up the piling / foundation work. These operations need to be done in consultation with the utility provider (owner).

Some of the utilities as could be traced out by the Employer through the Utility providers and Pimpri Chinchwad Municipal Corporation (PCMC) have been listed in the Drawing Volume Contractor is advised use to his own national/international practices of tracing out or locating these utilities below the ground at no cost to the Employer.

Contractor shall obtain necessary permits/approvals from the respective Utility Provider/Owner well in advance of starting the shifting work. The shifting works shall be carried out through the authorized sub contractor's of the Utility providers without causing any inconvenience to the utility users at large.

Drawings showing the affected services like electric lines, telephone lines, water pipes, sewers, oil pipelines, cables, gas ducts etc. owned by various authorities including Public Undertakings and Local Authorities are indicated on the drawings. The contractor's alternative proposal shall be such that the shifting of utilities is not required. If during the course of execution such utilities are encountered then the contractor shall shift the utilities and will be reimbursed as per the estimate prepared by the concerned department and approved by Employer. The work shall be carried out under the supervision of the concerned department. In case in the opinion of the Engineer it is not possible to divert the utilities, the Contractor shall make necessary modifications in the structure at no extra cost to the Employer.

2.13 CONTRACTOR'S DOCUMENTS

Contractor's documents envisaged under sub clause 5.2 to be submitted to the Employer required to satisfy all Regulatory Approvals and data, information, design calculations (classical and software generated/use) along with any criteria for patent registered design etc. shall comprise of :

(i) Information collected during engineering such as survey data, bore logs, levels, proposed instrumentation for ground improvements, monitoring and settlement etc.,
(ii) Design assumptions, calculations (excel sheets, STAAD files etc.,), software used and drawings good for construction,
(iii) Test procedures followed during construction and

(iv) Test after completion along with Interpretation and Specialist's Opinion.
(v) Quality Assurance Manual & Maintenance Manual

Documents shall be submitted to the Employer for review together with a notice as envisaged in the Conditions of Contract.

Employer/ER reserves the right to discuss, correct the design/calculations and propose any modifications as per the requirements of national/international code of practice. Such changes if required to be carried out shall be at the cost of Contractor and no separate payments shall be entertained.

2.14 Documentation:

The Contractor shall furnish the following documents to the Engineer and the Contractor's quoted price is deemed to be inclusive of the same.

(a) All "as built" drawings and Compact Discs containing soft copies of Drawings shall be supplied by the Contractor free of cost.

(b) 3 sets of site photographs and Video film DVD of 180 minute duration each of the bridge covering the different phases of construction from start to finish shall be supplied by the Contractor free of cost.

(c) A "Maintenance Manual" describing access arrangements, important obligatory precautions from the point of view of structural safety, and procedure for minor and major repairs of each component of the bridge, renewals of finishes and treatments periodically shall be supplied by the Contractor free of cost.

(d) A "Quality Assurance Manual" covering designs and drawings, mix-designs, materials testing, soil and rock properties, statistical quality control, etc. shall be prepared by the Contractor free of cost well before starting the work.

(e) A "Construction Manual" covering various aspects of construction methods, difficulties faced and how they were overcome during execution etc. shall be supplied by the Contractor free of cost at the time of finalisation of work.

(f) Arrangement for internal (below the elevated corridor) and external lighting duly approved from competent authority.

(g) Detailed design calculations and working drawings of all the component of the Flyover including launching scheme shall be submitted well in advance of execution, in accordance with the above programme. Three sets of such design calculations and drawings accompanied by complete information and sufficient data shall be submitted to the Engineer after getting the same proof checked & approved by the structural consultant appointed by PCMC and Railways. The designs and drawings shall be submitted progressively. Only drawings will be approved and corrections to the designs shall be carried out as per requirement of approval for record. If computer is used for design or analysis, the contractor shall submit with design and soft copy of design, the detailed

description of method of analysis with explanatory notes and manually done sample calculations for adequate number of typical cases. The Computer Programme as submitted will be tested by comparison with solutions as worked examples.

(h) For the Railway portion the structural design and drawing for main structure, temporary structure drawing, launching scheme along with supporting design and calculation shall have to be proof checked by PCMC approved Consultant and also Proof Consultant approved by Railway and further approval for Railway Engineer.

(i) Drawings and designs shall be in S.I. units. Calculations shall be neat and clear and supplemental by full explanatory notes and sketches wherever required. The drawings of initial submission and final approval shall be in AutoCAD and in A-1 size only.

(j) If during the scrutiny of detailed design calculations and drawings for Flyover, including temporary arrangements for launching, any changes therein are found necessary in the opinion of approving Consultant / Railways / PCMC/Engineer, they shall be incorporated without altering the Lump-sum price quoted. It will be entirely the responsibility of the contractor to submit properly prepared designs & drawings in good time to enable the competent authority to approve them in time.

(k) Schedule of reinforcement and the rate of reinforcement per cum of concrete quantity (and also percentage with respect to gross cross sectional area of the component) should also be shown on each drawing.

(l) Eight sets at approved working drawing including one set on reproduction tracing film and 4 sets at approved design calculations shall then supplied by the contractor which will be formally authenticated by the Engineer-In-Charge (4 copies of drawings and one set of design calculations for field officers, one set to be returned to the contractor and three to be retained by Engineer). These drawings shall be submitted in approved plastic folders and calculations in approved plastic files free of cost.

(m) After completion of each stage of work, 3 sets of record plans and one set of final design calculations based on the work actually executed including one soft copy on CD compatible to window 98, office 2000 & AutoCAD 2000 or 2006, shall be supplied by the contractor to the Engineer / PCMC as directed.

(n) Approval to drawings and design calculation by the Engineer shall not in any way relieve the contractor of his responsibility for the correctness, soundness, structural stability and safety of the structure.

(o) The approved drawings and design calculations of the Flyover & ROB shall be the property of the Employer.

SECTION VI

EMPLOYER'S REQUIREMENTS

CHAPTER – IV
DESIGN CRITERIA FOR STRUCTURES

DATA AND DESIGN CRITERIA FOR STRUCTURES.

I. Design Data for Structures.

i) Main Carriageway for structures and Solid Ramps

1. Carriageway Width : Clear carriageway of 8.75 m for Level 2 Flyover and 11.2m for Level 1 Flyover.

2. Width of Median Verge : Varies. Minimum 1.2 m

3. Crash Barrier : 0.5m on both sides.

4. Overall Width of Carriageway : **30.7 m** for Level 1 with central median. The main flyover consists of two separate carriageway of 15.3m each with varying central median and crash barrier on either side of individual carriageway between Ch 475+000 to Ch 665+000. From Ch 475+000 to Ch 665+000, the median shall vary (increase) to accommodate piers of second floor level flyover and **9.85 m** for Level 2 Flyover.

Footpaths shall be 3m wide in general everywhere. However at BRTS Bus Stop Locations footpath shall be 4.5m wide to accommodate Bus Shelter and Platform. Further widening of Footpaths shall be done to accommodate landing of escalators, staircase and Lifts wherever necessary.

5. Seismic Effects

i. Seismic Zone : Zone III

ii. Importance Factor (λ) : 1.5

6. Speed of Vehicles : 80 KMPH

7. Longitudinal Gradient : As shown in GAD.

8. Exposure Condition : Moderate

9. Temperature range : 0 to 47^{0}C

10. Underground Water Table : As per Soil Investigation.

11. i) Minimum vertical Clearance to be maintained for traffic :

- 5.5m above roads at obligatory spans
- 6.525m over Railway tracks.
- 1.5 m freeboard over HFL of River Pawana.

ii) Minimum horizontal Clearance : As per the approved railway drawing for ROB.

12. Max Temp. = **'t'** : $47^{o}C$

13. Live load

For Level 1Flyover : As per IRC: 6 (Latest).

For Level 2 Flyover : As per IRC: 6 (Latest).

For every of 7.5m width of carriageway: 1) 2 lanes of class A

OR

1 lane of Class 70R

which ever is severe.

The impact factor shall be applied as per IRC-6. In case of continuous structure, impact factor of the shortest span shall be considered.

14. Bearing type : POT-PTFE as per IRC-83(Part III)

15. Expansion Joint : Strip seal type/Modular type.

16. Waterproofing of Deck : 3 mm thick polymer waterproofing membrane (as per International Standard Practice).

17. Wearing Course : 50 mm thick BC laid on 50 mm thick DBM over water proofing membrane.

18. Foundation Type : 1. Pile Foundation with min 1200 dia.
2. Open foundation only for foundations in river Bed.

19. Founding level of piles and Open Foundations for Tender purposes: **:-**

Sl. No.	**Stretch**	**Founding Level Below ground Level. (The Ground Level shall be as per joint measurement survey by Engineer and Contractor.)**
1.	From Pawana River Abutment (Abutment LA1 & RA1) to the Pune Mumbai Railway boundary on NH4 side (PL11 and PR11) including Ramp-1 Left and Ramp-1 Right.	6m below Ground Level
2.	From PL12 and PR12 to Abutment A2 (LA2 and RA2) of First Floor Level Flyover.	8m below Ground Level
3.	Second Floor Level Flyover from Kasarwadi Abutment (A1) to Pier P13	6m Below Ground Level
4.	Second Floor Level Flyover from Pier P14 to Abutment (A2) on Nashik Road	8m below Ground Level
5.	Ramp-2 Left and Ramp-2 Right	6m Below Ground Level
6.	Loop LP1	8m below Ground Level

* The depth of foundations given in the table are for tender purpose and to have common platform. Actual levels shall be decided on merit of the strata. The above table mentioning depth of foundation shall form a basis for payments under table for adjustment of contract price.

20. Velocity of water at H.F.L. : 4.9 m/sec

21. Scour level for river span : Rock level

22. Founding level for river span : 1500 mm below scour level.

23. Safe Bearing Capacity for river span: 100 T / m^2.

ii) For Up ramp and Down ramps from Pune-Mumbai road service road to the Main First Floor Level Flyover (Ramp-2 Left (L2), Ramp-2 Right (R2))

1.	Carriageway width	:	5.50 m
2.	Overall width	:	9.6 m
3.	Footpath width	:	3.0 m
4	Crash Barrier	:	0.5m on both sides.
5.	Seismic effect	:	a) Seismic Zone = Zone III b) Importance Factor (λ)=1.5
6.	Design speed of vehicles	:	40 Kmph
7	Longitudinal Gradient	:	As shown in GAD (Vol. IV)
8.	Max. Superelevation	:	4%
9.	Live Load	:	As per IRC: 6 (Latest).

(**Note:** Other details are same as 2.1 above and as per Volume IV of IV).

iii) Ramps (Ramp-1 Left (L1), Ramp-1 Right (R1)) from First floor level Flyover to 18m DP road adjacent to Railway line.

1.	Carriageway width	:	7.50 m
2.	Overall width	:	11.60 m
3.	Footpath width	:	3.0m
4.	Crash Barrier	:	0.5m on both sides.
5.	Seismic effect	:	a) Seismic Zone = Zone III b) Importance Factor (λ)=1.5
6.	Design speed of vehicles	:	40 Kmph
7.	Longitudinal Gradient	:	As shown in GAD (Vol. IV)
8.	Max. Superelevation	:	4%
9.	Live Load	:	As per IRC: 6 (Latest).

(**Note:** Other details are same as 2.1 above and as per Volume IV of IV).

iv) LOOP LP1 (from First floor level Flyover to Mumbai-Pune road)

1.	Carriageway width	:	5.50 m
2.	Overall width	:	9.6 m
3.	Footpath width	:	3.0 m
4.	Seismic effect	:	a) Seismic Zone = Zone III
			b) Importance Factor (λ)=1.5
5.	Design speed of vehicles	:	25 Kmph
6.	Longitudinal Gradient	:	As shown in GAD
7.	Max. Superelevation	:	4%
8.	Live Load	:	As per IRC:6 (Latest).

(**Note:** Other details are same as 2.1 above and as per Volume IV of IV).

v) Slab culvert at Ch. 0+540 (Of Second Floor Level Flyover).

1.	Overall Length	:	61 m
2.	Design speed of vehicles	:	80 Kmph
3.	Longitudinal Gradient	:	As shown in GAD (Vol. IV)
4.	Live Load	:	As per IRC: 6 (Latest).

(**Note:** Other details are same as 2.1 above and as per Volume IV of IV).

vi) Provision of Ascending/Descending Unit for Pedestrians.

1. 4 units comprising of the following:

a) 1m wide (Min. clear width) electrically operated Escalator for **ascending** of "Hyundai make W-BT 35 degree" type escalator or similar of Schindler or OTIS brands with FRP canopy covering the entire escalator.

b) 1m wide (Min. clear width) electrically operated Escalator for **descending** of "Hyundai make W-BT 35 degree" type escalator or similar of Schindler or OTIS brands with FRP canopy covering the entire escalator.

c) One Lift of 15 person capacity for physically handicapped people of "OTIS" or other equivalent brand makes.

d) RCC staircase of 2.5m clear width with canopy covering.

1.	Three Units of doglegged staircase having 2m clear width.		
2.	Locations	:	As shown in GAD.
3.	Width of flight	:	as above
4.	Height of Riser	:	150mm (Max.)
5.	Width of Tread	:	300mm (Min.)

6. Shade/ Canopy : Poly carbonate sheeting with MS frame work for covering from all sides of the Staircase arrangement.

II. DESIGN CRITERIA FOR STRUCTURES

1. GENERAL:

The detailed highway and structural design for the work mentioned in the scope of work is to be done by the bidder. The bidder shall quote on his own design for span arrangement proposed in GAD tender drawing. It shall generally satisfy the following requirements: -

(i) It shall ensure soundness of the structure, its durability and architectural beauty as a whole in harmony with the surroundings.

(ii) It shall ensure speedy construction and lead to appreciable economy.

(iii) It shall be accompanied by preliminary but fairly detailed dimensioned drawings and detailed description of work and specification of materials and items. If called upon, bidder shall furnish any additional information necessary for appreciation and comparison with alternative proposals received from other bidders.

(iv) At the time of detailed design the contractor shall not deviate from the basic scheme and employer's requirement.

(v) The superstructure shall have minimum number of expansion joints for better riding surface. It shall involve modern construction techniques which will cause minimum hindrance to the local traffic.

(vi) As far as possible structure shall have uniform aesthetical appearance to enhance the overall look and thereby the vicinity. Aesthetic finishes like grooves, embossed or surface textures (form finished) to be provided for substructure and superstructure as per the detailed drawing approved by the Engineer.

(vii) The entire substructure shall be of uniform type except otherwise necessary.

(viii) For the construction of piers of level 1 & level 2 Flyover, contractor may use slip form shuttering.

(ix) Minimum length of span for Main first and second floor level Flyovers shall not be less than 30m. Other ramps shall have span arrangements as approved by Engineer.

2. RESTRICTIONS ON TYPE OF STRUCTURES:

The following types of structural arrangements shall not be permitted:

(i) Structures sensitive to unequal settlement of foundations, indeterminate structures like continuous, rigid frames, etc. on yielding type of foundations.

(ii) Abutments resting on approach embankments.

(iii) A design in which stability of one or more span is endangered due to failure of some other span or spans.

(iv) Superstructure with joints at the tip of long cantilevers with hinges, gap slab and short suspended spans.

(v) Structures with continuity only in deck slab, in transverse direction. Superstructure more than 4 lanes resting on independent foundations should not be interconnected.

(vi) Piers in the form of multiple columns with isolated / separate footings resting on yielding type strata.

(vii) Superstructures on which the roadway cannot be easily widened in future, such as bowstring girders, through trusses, etc.

(viii) Steel structures or composite construction.

(ix) Girder slab system for superstructure other than ROB portion.

(x) Hollow piers for spans, which are susceptible for impact of vehicles.

(xi) Any type of RCC superstructure.

3. SPECIFICATIONS FOR DESIGN AND CODES TO BE FOLLOWED:

The design of structural components shall conform to the criteria laid down in the latest editions of the following codes of Practice and Standard specifications published upto 3 months prior to last date of issue of tender form and subject to the departures stipulated in these tender documents.

(A) I.R.C. Standard Specifications and Codes of Practice for Road Bridges. :

Section - I	I.R.C. 5	General features of design.
Section -II	I.R.C. 6	Loads and stresses.
Section -III	I.R.C.21	Cement concrete plain and Reinforced (Second Revision).
Section - V	I.R.C.24	Steel road bridges for permissible stress only. (Other provisions as per AASHTO Code)
Section -VI	I.R.C.22	Composite construction for road bridges (for permissible stresses only) (Other provisions as per B.S.5400 part 3, 5, 6).
Section -VII	I.R.C.78	Foundation and substructure.

Section -IX	I.R.C.83	(Part-I) Metallic Bearings.
Section -IX	I.R.C.83	(Part-III) POT, POT CUM PTFE PIN AND METALLIC GUIDE BEARINGS.
	I.R.C: 18	Design criteria for prestressed concrete Road Bridges (Post tensioned concrete).
	I.R.C: SP 64	Guidelines for design of voided slabs
	I.R.C: SP 65	Guidelines for design of segmental bridges.
	I.R.C: SP 66	Guidelines for design of continuous bridges.
	I.R.C: SP 70	Guidelines for the use of High Performance Concrete bridges.
	I.R.C: SP 71	Guidelines for design and construction of precast pre-tensioned girders for bridges.
	IS 2911	Code of practice for design and construction of pile foundations.
	IS 13920	Ductile detailing of reinforced concrete structures subjected to seismic forces - Code of practice.
	IS 1893 (Part I)	Criteria for earthquake resistant Design of structures.

MORT&H specifications for Road and Bridge Work-2001.

Provision of seismic details as per India Highway Publication.

For structure within Railway area provision as per following Indian Railway Standard Code shall be made.

a) Code of Practice for Plain, Reinforced and Pre-stressed Concrete for general Bridge Construction (Concrete Bridge Code) Second Revision – 1997.

b) Code of Practice for the design of sub-structures and foundations for Bridges (Bridge sub-structures foundation code).

c) Specification for RCC/ PSC for the construction, Rehabilitation of Concrete Bridges and structures on Central Railway (open line) issued on 1/12/2000.

(B) Any I.R.C. standard specifications and codes of practice or criteria for road bridges other than "A" above, but published 3 months prior to last date of issue of tender form.

(C) For any item not covered by A & B above, specification for Road and Bridge works published by I.R.C. for Ministry of Road Transport and Highways, Government of India.

(D) For items not covered by any of the A, B & C above relevant provisions of IS codes of practice.

(E) For any item not covered by A, B, C & D above, the relevant provisions from B.S. Codes of Practice.

(F) For items not covered by any of the above Standards and Specifications, sound Engineering practice and provisions in the Departmental design and provisions of relevant Codes of other nation shall be referred. In this regard decision of the Engineer's Representative shall be final and binding.

4. OBLIGATORY PROVISIONS

4.1 Alignment and location

Alignment and location of the Flyover Structure and ROB shall be as shown in the Departmental drawings. The Co-ordinates and levels shall be approved by The Engineer.

4.2 The Length of main Flyover Structure and ROB:-

The length of the Flyover shall satisfy the following criteria.

(a) The centre line of the various structures as shown on the GADs should not be changed, except under unavoidable circumstances with approval from the Employer.

(b) Maximum height of embankment at abutment location shall not be more than 4.5m and clear height below the soffit shall not be less than 1.5m.

(c) Longitudinal gradient shall not be steeper than those shown in departmental drawings. The Vertical and Horizontal curves should be smooth with radius not less than shown in GAD.

(d) Restrictions on terminal points if specially mentioned in departmental drawings.

(e) Any other criteria shown on the departmental drawings / supplementary data.

(f) Overall length of River Bridge/ Flyover/ ROB proper and structural viaduct shall not be less than the length shown in departmental drawings.

(g) In case of Flyover, the horizontal and vertical clearances and pier locations shown for the obligatory spans shall be as per departmental drawings.

(h) Locations of obligatory spans shall be as shown in the Departmental Drawings. They may be changed slightly during execution as per site requirements with approval from the Employer.

(i) In case of ROB, the minimum Vertical and Horizontal Clearances under the Railway Bridge Portion shall not be less than those shown in departmental drawing i.e. approved GAD from Railways.

(k) It is obligatory to locate pier No PL13 (Level-1 Flyover), PR13 (Level-1 Flyover), P14 (Level-2 Flyover) in the median only and the width of the pier shall not exceed 2m.

(l) Size and shape of pier shall be kept uniform for all piers of same carriageway width.

4.3 Road Level on the Flyover and Roadway Particulars:

(a) Roadway particulars and carriageway widths shall be as per relevant Departmental drawing.

(b) The vertical geometry of the finished surface of deck slab and wearing course shall be in the form of a smooth curve where change in gradient occurs. The design of curves shall be got approved from the Engineer. Super-elevation, camber & widening on curves shall be suitably considered. The design of curves shall be such that rate of change of vertical curvature ('K' value) shall not be less than those shown in tender drawing. The design speed on curve shall be as stipulated in Design Data.

4.4 The span arrangement for complete project, horizontal and vertical geometry shall remain unchanged. Under unavoidable circumstances minor modifications can be permitted after approval by the Engineer in-charge.

5. BORING DATA AND SOIL AT SITE.

5.1 The Soil Investigation report is attached herewith in **Volume III** of the Tender Document as **"Annexure A to Volume III"**.

5.2 The contractor shall have to take borings by double tube boring machine for each carriageway at the final location of each pier and abutment prior to the commencement of the work to ascertain the rock levels/quality at the location of the foundations and this shall form part of the contract and no payments will be made by the Department for boring, soil sampling and testing etc.

(a) During execution of the work, the samples from the bore taken at each foundation shall be tested for relevant tests and analyzed in the laboratory approved by the department for establishing design parameters. Tests such as standard penetration test, compression and shear test on undisturbed soil samples, etc., shall be carried out in conformity with the specifications. The Contractor shall submit the entire data to the Engineer along with his own/laboratory recommendations and obtain approval to the design-parameters. Necessary interpretation of the result of tests shall be furnished to the Engineer for scrutiny of design of foundations.

(b) The cost of these test and interpretation of the test results shall be included in the tendered amount. No payment will be made separately for the testing of soil or rock.

(c) The S.B.C. at the foundation level shall be verified during construction so as to ensure that the stresses imposed on the foundation strata are within permissible limit. However, if some additional borings are required by the department such requirement shall be ordered in writing and shall be deemed to be an additional work. The Contractor shall quote the rate for such boring, soil sampling and testing, separately along with his tender. The taking out of samples and carrying out required tests shall be in conformity with the departmental specifications. The Contractor shall then submit the entire data to the Department along with his own/laboratory recommendation and obtain approval to the design parameters.

6. FOUNDATIONS:

6.1 Piers/Abutments:

6.1.1 For bidding and for the purpose of tender, general foundation levels proposed for the piers & abutments shall not be higher than those proposed in the Employers design. Where pier positions differ from the departmental design, the levels shall be interpolated for the purpose of this clause.

The Founding Levels to be considered as a benchmark in deciding the +/- variations (Pursuant to the Schedule of Variations of Volume-I) shall be as per 19 of Data and Design criteria for structures.

6.1.2 Detailed design shall be carried out only with pile foundation for abutments and piers (except for pier P2 and P3 of first floor Flyover and river span).

6.1.3 The maximum base pressure under worst combination of loads & stresses condition for open foundation shall not exceed 100 T/m^2. The allowable stresses shall be as per codal provisions.

6.1.4 Buoyancy to be considered shall be 100% for open as well as pile foundation.

6.1.5 Abutment structure shall be fully retaining Reinforced Concrete structure. No passive pressure shall be considered for the design of abutment.

6.1.6 While checking the stresses at the base of foundations it shall be ensured that under the worst combination of forces there is no tension.

6.2 Ramp / Retaining walls

6.2.1 The solid ramp portion of the Flyover shall be a Reinforced Soil retaining structure with decorative facia. Open foundation for retaining structure is acceptable. The foundation shall be taken minimum 1.5m below road level with SBC of 20 T/m^2.

6.2.2 For foundation of Retaining structure if design requires increasing SBC at foundation level by any soil stabilization method, the cost of this stabilization shall be borne by the Contractor.

6.2.3 Kerb stones shall be provided parallel to the retaining wall to protect it from damages and to channelize the traffic running on side roads. The gap between the kerb & Retaining wall shall be filled up with sand and covered with interlocking blocks atleast 500 mm on either side.

6.3 Pile foundations

6.3.1 The pile foundation shall be designed considering various load combination forces and permissible stresses as per the latest edition of I.R.C.78. The piling shall be done by hydraulically operated rotary drilling machine only.

a. 6 mm thick M.S. liner with end stiffeners of 300 mm height and of equal thickness at the bottom shall be provided to the piles from the bottom of pile cap up to rock level with anticorrosive treatment specified under Clause 2.22 for the piles in the ROB portion at pier locations PL10, PL11, PR10 & PR11 (Refer Dwg. GAD for Railway span of vol IV). For piles at other location, temporary liner may be provided wherever it is necessary.

b. Shift and tilt of pile shall be considered as per IRC: 78 – 2000.

6.3.2 The following criteria shall be considered for deciding the length of embedment.

1. The minimum embedment of piles in hard rock (RMR value more than 70 as per IS: 12070) shall not be less than 1.25 times diameter of pile. The pile capacity in rock shall be calculated as per IRC: 78 (latest edition).

2. A Factor of Safety (FOS) 5 shall be adopted to compute Safe Bearing Capacity of rock from U.C.S. calculated as per IS 12070. In no case shall the enhanced SBC be more than 500 T/Sq.m even with all the above embedment. Minimum embedment is required to be provided despite this limitation of SBC. No further enhancement to pile capacity will be allowed. These values incorporate all enhancements possible like skin friction, global effects etc.

3. The piles shall be designed as fixed end bearing. Fixity shall be considered at the top of rock where the socketing begins and at the center of pilecap. Side friction from G.L. up to embedment level shall not be considered for design. Support from surrounding strata shall not be considered for design of piles.

6.3.3 The pile capacity shall be confirmed by pile load test as per IS-2911 (Part IV).

1. The vertical and horizontal design capacity assumed for the piles shall be verified by the initial load testing of test piles in non-working areas, in the vicinity of the bridge site. These piles shall be tested for 2.5 times the design load. Initial test shall be carried out on one pile per dia. for viaduct portion and one pile for ROB portion. Additional one pile per dia., which is actually going to be used for piers and abutments, shall be tested for 1.5 times the design load. These tests and the routine tests shall be as per I.R.C. 78 (Latest edition). The dynamic load test and the pile integrity test may be permitted subject to verification of the results with static load test performed on the same pile.
2. The lateral Load carrying capacity of pile shall be assessed by carrying out lateral load test on a single pile for a deflection of 5 mm at top.
3. Side friction (Skin Friction) from G.L. upto embedment level shall not be considered during design.
4. The piles shall be designed as end bearing considering fixity as mentioned above. There shall be no tension at the base of pile under any load combination.
5. The minimum dia. of piles shall be 1200mm.
6. Annular piles filled or unfilled shall not be accepted.
7. Design with single row of piles shall not be accepted.
8. Use of High performance concrete for piles is not permitted (M60 and above).
9. NDT Tests at regular intervals as directed by the Engineer for at least 10% of total number of piles shall have to be carried out by the contractor with no cost to the employer.
10. The cost of all above tests shall be borne by the contractor and no extra payment will be made to the contractor.
11. Only bored cast in situ piles shall be accepted.
12. For piles within ROB, Railway area, minimum dia. of pile, MS liner to pile, provision of anticorrosive treatment to reinforcement, method of construction of pile etc. shall be as per IRC Code and as per drawing approved by Railway authorities.

7. SUBSTRUCTURE

For continuous spans pier, with fixed bearing shall be designed to take all the horizontal forces.

7.1 Minimum *Dimension* of any element of substructure shall not be less than 300 mm.

7.2 Dead man anchors or friction slabs shall not be accepted behind abutment for relieving moments.

7.3 Scope for accessibility for inspection and arrangement for lifting of the superstructure for future replacement of bearings shall be provided for in the design of substructure. The positions of jacks shall be distinctly marked on the drawing and on pier / pier cap.

7.4 The height of pedestals plus bearing shall be min. 150 and maximum 500 mm.

7.5 Slender piers shall be checked for deflection under horizontal and eccentric forces and secondary forces if any. Pier, bearings and expansion joints shall be suitably designed.

7.6 One span dislodged condition shall be considered as erection condition (load combination VI, VII of IRC-6) for the purpose of design.

7.7 Earth retaining structure shall be designed for the earth pressure calculated as per any theory permitted by the IRC Codes.

7.8 Special aesthetic finishes like grooves etc. shall be given to the structures to the satisfaction of the Engineer. Aesthetic finishes shall not form the part of structural requirement of any member.

7.9 All the piers in the central verge (median) shall be designed for a vehicle collision load as per IRC provisions.

8. SUPERSTRUCTURE

General:

(a) Only PSC Box / PSC voided slab -type superstructure is allowed in all locations except in ROB portion if railway authority does not allow for box Type Superstructure. Alternatively pre-cast 'I' girder section may be provided for obligatory span of ROB if insisted by railways as per their requirements.

Stage construction of deck slab is not allowed. Deck slab shall be designed for 40t bogie load (class 70R load) and wheeled vehicle of

Class AA vehicle in addition to loading mentioned in Design Data. Minimum thickness of deck slab, soffit slab, webs shall be as per sketch given in Annexure-1 and satisfy all the provisions of IRC-18 2000.

(b) In case of voided slab minimum thickness of concrete cover to the void shall be 200 mm above the void and 250 mm below the void. The arrangement for draining out water from voids shall be made. Solid slabs are not allowed

(c) Superstructures designed for continuity only under live loads shall be permitted.

(d) Superstructure shall be designed for 10 mm differential lifting at bearing location. This shall be considered as an erection condition.

(e) It shall be obligatory to carry out design based on longitudinal and transverse analysis

(f) The superstructure shall have minimum expansion joints to enhance riding quality. The depth of superstructure shall be such that span to depth ratio is not less than 15 for box girder and 12 for I girder including deck slab.

(g) Special aesthetic finishes like grooves etc. shall be given to the sides and soffit of superstructure to the satisfaction of the Engineer. Aesthetic finishes shall not form the part of structural requirement.

9. DESIGN LOADS:

9.1 Live Loads:

9.1.1 The bridge shall be designed to carry combination of I.R.C loadings, as per clause 207.4 (IRC: 6-2000) whichever produces worst effect.
While checking for one span off condition, live load of IRC Class-A one lane per two lanes without impact shall be taken into account and this shall not be considered in conjunction with seismic / wind force. Braking force shall not be considered.

9.1.2 The design shall cater for renewal / overlaying of wearing coat load of 110 Kg/m^2.

9.1.3 Loads from services facilities viz. electrical cable, telephone cable at 100 Kg/m or actual loads whichever is higher on either side of carriageway.

9.1.4 Loads from other utilities and pedestrian loading shall be as per "Design Data".

9.1.5 For Railway Portion - As per IRC:6 - 2000 or as approved by Railway Authority whichever produces worst effect.

9.2 Construction Loads

The structure shall be designed for the load coming from the launching girder, beam and winch system, segment delivery trailer etc. Impact of such loads shall be considered not less than 10% total load.

9.3 Wind Forces:-

9.3.1 Wind forces shall be considered in the following two ways. The design shall be governed by the one producing the worst effect.

(i) Full wind force at right angles to the superstructure.

(ii) 65 % of wind force as calculated in (i) above acting perpendicular to the superstructure and 35 % acting in traffic direction.

9.4 Temperature-Range:-

(i) For design of structure to account for temperature in formula dL = alpha x L x t, the value of "t" shall be 50 degrees centigrade i.e., ± 25 for extreme atmospheric exposure condition.

Note: - The temperatures variation shall be accounted for in design of structures as per design data.

Alpha is the Coefficient of Expansion or Contraction and L is the length of the member and dL is the expansion or contraction due to a variation of temperature in appropriate units.

(ii) The superstructure shall also be designed for effects of distribution of temperature across the deck depth as per IRC: 6-2000. For calculation of thermal forces effect of 'E' value of concrete should be taken as 50% of the instantaneous value so as to account for effects of creep on thermal strains.

9.5 Soil Properties:

In absence of actual field data the properties of back fill, shall be considered for design purpose as below:

i) Dry Density of Soil - 1.8 T/Cum.

ii) Saturated Density - 2.0 T/Cum.

iii) Ø = 30 Degree, $\delta = 20^{0}$

iv) C = 0

9.6 Seismic Forces:-

For the calculation of fundamental period, as per appendix 2 (amendment No. 6) of IRC: 6 -2000, the length shall be considered from top of the pier cap to top of pilecap/footing.

The seismic coefficient so calculated shall be applied for foundation and substructure design.

10. PERMISSIBLE STRESSES:-

10.1 Allowable stresses for plain and reinforced concrete shall be as per IRC-21 and for prestressed concrete (post tensioned) as per IRC-18.

10.2 The permissible shear stresses shall be as given in IRC-21 & IRC-18.

11. DURABILITY

11.1 Grade of Concrete

11.1.1 Minimum grade of concrete for Foundation shall be M30.

11.1.2 Minimum grade of concrete for substructure shall be M30.

11.1.3 Minimum grade of concrete for superstructure shall be M45.

11.1.4 Minimum grade of concrete for pile foundation shall be M35.

11.2 Minimum Cement Content

11.2.1 For both plain and reinforced concrete, the value given below regarding minimum cement content and maximum water-cement ratio shall be as per Clause 302.6 Table No. 5(A) of IRC: 21-2000

11.2.2 High strength ordinary Portland cement conforming to I.S.12269 will also be permitted.

11.3 The minimum nominal dia. of reinforcement and clear cover shall be as follows

(Only Fe-500 TMT CRS steel shall be used).

11.3.1 The minimum nominal dia. of reinforcement shall be 10 mm.

11.3.2 Minimum clear cover to reinforcement for all grades of concrete shall be as per Clause 304.3 IRC: 21-2000.

11.3.3 The cover shall be measured from the inner face of the groove for substructure and superstructure.

11.4 The H.T.S. strands to be used for P.S.C. structures shall be Stress Relieved Low Relaxation Steel conforming to Class-II of latest IS: 14268.

11.5 Anticorrosive protective paints to foundation, substructure and superstructure shall be as per Clause No. 20.

12. PSC BOX GIRDERS

12.1 For proportioning of the box girder, the sketch given in Annexure-1 of this volume shall be adopted. Overhangs shall not be more than those shown in the drawing in Annexure-1.

The entire box shall be a single unit without any construction joint in longitudinal direction.

12.2 Minimum thickness of intermediate diaphragm provided shall be 300 mm and that of end diaphragm shall be 500 mm.

12.3 Two manholes shall be kept in soffit of every span with arrangement for access inside the box.

12.4 The following method of analyzing and designing box girder is acceptable.

(i) Calculate the main girder moments, shear forces and torsional moments as for a single beam.

(ii) Also add to above, the forces due to the restraint of warping torsion at the ends.

(iii) In addition, calculate the bending moments in the roadway slab considering the slab, the web and soffit slab as a closed frame.

(iv) Reinforcement in the slabs and webs due to the transverse moments must be provided in addition to the steel, which is required for shear or torsion in the box as a main girder.

(v) Distortion of box girder due to transverse moment should be considered in the design.

(vi) In the absence of rigorous analysis (a) for the torsional moment (b) for forces due to restraints of warping torsion at ends the design live load moments and shear force in the longitudinal

direction shall be increased by 20% and transverse reinforcement steel be increased by 5%.

(vii) While designing the various components like bearings, pedestals etc., the maximum and minimum reaction as per detailed transverse analysis shall be considered.

13. PRESTRESSED CONCRETE

(a) Permissible stress in concrete during service shall be as per Clause 7.2 of IRC: 18-2000.

(b) All prestressed members shall have spare cables laid to the profiles approved by the Department. The number of spare cables shall be 5% of the cables required as per design, subject to a minimum of one cable per girder/web. These cables shall be permitted to be removed fully or partly after the final stage of prestressing, if they are not required holes shall be grouted. In case of saline atmosphere these cable holes shall not be grouted but only ends shall be closed properly.

(c) The provision for imparting 20% of design prestress at a future date shall be made in the deck and suitable anchorages; bulkheads diaphragms etc. shall be constructed for the purpose. Arrangement for external prestressing shall be got approved from the Engineer.

(d) Sheathing for post - tensioned superstructure shall be corrugated HDPE type as per IRC: 18-2000.

(e) The ends of prestressing anchorages in case of post-tensioning shall be protected against corrosion.

14. PRECAST SEGMENTAL CONSTRUCTION

14.1 Precast segmental construction if adopted shall be designed as per Clause 7.2.3 of IRC:18-2000 and IRC:SP-65 and Guide specifications for design and construction of concrete segmental bridges (latest).

14.2 Requirements regarding minimum dimensions shall be as per Annexure I of this volume. External prestressing within the box with necessary protection against corrosion shall be allowed.

14.3 For construction with continuous spans the portion over piers, the key segments and end segments at expansion joints may be cast in situ;

all other segments shall be precast. For simply supported spans all the segments shall preferably be precast.

14.4 All the segments shall be match-cast. During match-casting necessary care shall be taken to minimize the effect due to temperature arising from hydration of concrete of adjacent segment.

14.5 The shear keys at the face of segments shall be as under:

(a) On each web single key or multiple keys shall be provided. These keys shall be designed to transmit shear forces.

(b) On the top and bottom slabs keys shall be provided to maintain alignment and level.

14.6 Formwork shall be robust and the foundations of the casting and stacking yard shall be designed to safely support all applied loads without undesirable deformations or settlements.

14.7 In order to achieve smooth profile of prestressing cables and to prevent entry of cement slurry at the joints of matching segments; pipe shall be inserted through the cable duct of both the segments (i.e. matching segment and segment being cast) at the time of concreting.

14.8 Bond breaking agents shall be used while casting the segments so that the segments can be easily separated after casting.

14.9 The joints between adjacent segments shall be treated with appropriate epoxy formulation to facilitate erection and to fill cavities if any. While applying epoxy, care shall be taken to see that the epoxy does not block the openings of the cable ducts.

Epoxy shall be applied on the interfaces of both the segments and the segments shall be subjected to a pressure of minimum 2 Kg/cm^2. This may be achieved either by using temporary pre-stress or by any other method. Permanent cables shall be introduced in the duct and after pre-stressing the required number of cables the temporary pressure can be released.

14.10 The method of erection of segments shall be such that the desired geometric profile of the bridge deck is obtained. During erection stage temporary blockade of one lane of traffic may be allowed with the permission of Employer.

14.11 The segments shall be checked for stresses during handling and erection.

14.12 Reference may be made to document "Guide to good practice: Recommendations for segmental construction in pre-stressed concrete" published by F.I.P.

14.13 The launching/erection of all the precast segmental superstructure segments shall be carried out by over slung method using launching girders. The decision to adopt under slung method for launching/erection shall be as per the discretion of the Engineer.

15. BEARINGS BELOW SUPERSTRUCTURE:

(a) POT-PTFE Bearing from MORT&H approved manufacturers in cast steel shall only be permitted.

(b) The bearings shall be easily accessible for inspection.

(c) Scope for lifting the superstructure for future replacement of bearings shall be provided for in the design of bearing. The scheme of lifting shall be indicated on the drawing to be submitted at the time of tendering.

(d) The contact surface of superstructure shall project beyond the edge of the bearing plate by a minimum distance of 100 mm at any location.

16. EXPANSION JOINTS:

16.1 Only strip seal joints (for horizontal movement upto 80 mm), modular strip joints (for horizontal movement beyond 80 mm) shall be permitted, conforming to modified interim specifications for expansion joints.

16.2 The expansion joints should generally be spaced at not less than 80 m. except in case of unavoidable circumstances.

16.3 Uniform type of expansion joint shall be provided for the entire deck.

16.4 All the expansion joints shall be water tight.

16.5 Expansion joints shall conform to MORT&H specifications and procured from MORT&H approved manufacturers.

17. RAILINGS, PARAPET, CRASH BARRIERS AND MEDIAN VERGE:

17.1 Anti crash barriers having a typical cross section as shown in Annexure-2 shall be provided.

17.2 Providing R.C.C. median, sand filling inside median, DWC pipes 4 Nos., interlocking blocks, bitumen pad in expansion gap etc. as per tender drawing.

17.3 For 2nd FLOOR FLYOVER P-3: type high containment crash barrier with a min height of 1550 mm and as per cl. 209.7 of IRC: 6 -2000 shall be provided.

18. WATER SPOUTS

Water spouts as per MORT&H Type design No.SD/303 shall be provided. However, the diameter of pipe shall be 150 mm.

Waterspout shall be 150 mm ϕ G.I. and connected to runner pipe (HDPE type) of suitable diameter (Minimum 150 mm) and taken down by down take HDPE pipes of suitable diameter at approved locations. Arrangement for clean out plug shall be made.

Collection chamber shall be made and shall be connected to nearest S.W. drain through 300mm dia. NP4 pipe.

19. WEARING COAT:

A wearing course of 50mm Bituminous Concrete laid on 50mm Dense Bituminous Macadam over 3 mm thick waterproofing membrane shall be provided over the concrete deck. However on approaches a flexible wearing course as shown in the departmental drawing shall be provided.

20. ANTICORROSIVE PAINT:

Anti-corrosive protective paint as mentioned below and approved by the Engineer shall be provided. This paint shall be got tested from the approved laboratory and shall be of approved quality, colour and shade.
The protective coating shall be applied to:

(a) Superstructure and Part of substructure exposed to atmosphere - Anti carbonation acrylic paint of synthetic enamel in two coats each of minimum 70 micron shall be provided.

(b) Part of foundation / substructure in contact with earth upto GL or in contact with water - one coat of primer and two coats of coal tar epoxy. Total DFT 210.

(d) The superstructure shall be treated with following protective coatings.

(i) **Parapets/ Railings / Crash Barriers**

Waterproof cement based paint of approved quality and colour in three coats.

(ii) **Deck/Girder/box and inner surface of the Superstructure**
Waterproof cement based paint in three coats of approved quality and colour.

21. ELECTRICAL WORK / STREET LIGHTING:

The scope of work covers providing and fixing following items as per details given in tender

1. Junction boxes, pullout boxes.
2. Sleeves, base plate and anchor bolt for fixing electrical poles.
3. Provide 110 mm ϕ Double Wall Corrugated (DWC) pipe of PE with IS 14930 Part-II mark, one in each crash barrier for entire length of Flyover and up to nearest junction box.
4. Providing 110 mm ϕ Double Wall Corrugated (DWC) pipe of PE with IS 14930 Part-II mark 4 Nos. in median (as shown in tender drawing) for entire length of Flyover and up to nearest junction box.
5. All the material shall be new and conform to latest IS Specification and shall be procured from approved manufacturer only.
6. Providing and fixing electrical poles along with complete fixtures and lights of appropriate lux as per IRC Standards through out the length on Flyover and road below the Flyover.
7. Lighting below the Flyover shall be carried out with appropriate fittings and illumination not less than 80 lux.
8. The work of landscaping shall be carried out in the all medians, islands, channelisers and open spaces within the ROW.

The Contractor shall carry out and complete the said work (including labour, material, appliances, equipment etc.) under this contract in every respect in conformity with current rules & regulations of local electricity authority, Indian Standard Institution and with the directions and to the satisfaction of the Engineer. For more details refer SP- 7 of vol III of tender document.

22. MISCELLANEOUS:

i. Pillars with granite tablets:

Provision of suitable pillars, one at each corner of the bridge, of suitable architectural design to define the ends of the Flyover with suitable pedestals to house granite tablets as per details to be got approved by the Engineer.

ii. Lane markings:

Provision of necessary lane markings with thermoplastic paint, reflecting lane studs etc., on the Flyovers, ramps and service roads.

iv. Design and construction of staircases as shown in Departmental Drawing.

v. Providing RCC Road Kerb, Median, Sand filling in median, service ducts, interlocking blocks over median, wearing coat, bearing, expansion joint and protective coat for Flyover as per tender.

vi. Resurfacing:

The road surface below Flyover and service road shall be cleaned properly and resurfaced to bring to original condition before completion of work.

vii. Overhead Gantry / Sign Boards / Signals:

Providing and fixing in position overhead Gantry frame, trustles sign boards/signals as per approved drawings and specifications.

viii. Architectural treatment:

Providing architectural treatment/ features as per approved drawings and as suggested by the Architect of Consultants to PCMC during the course of execution.

ix) Traffic diversion:

Providing and maintaining necessary traffic diversion, barricading of site during construction such that 7.5 m clear carriage way is available on both sides at any given point of time. Details of barricading shall be as per annexure III. The complete area of work shall be cordoned off with necessary barricading as mentioned herein. There should not be any hindrance to the traffic. Centering scheme shall be designed on the same basis as that of barricading.

23. ENVIRONMENT & DURABILITY:

Some of the most important issues in this connection are as under:

i. High tensile steel shall be stored as per stipulated in I.S. codes and duly protected during storage. It shall be procured properly sealed and protected from rusting using all possible measures.

ii. Restricting the water cement ratio of concrete and increasing the workability by the use of carefully selected plasticizers / additives approved by the Engineer.

iii. Employment of large pre-stressing unit whose strands can be threaded after concreting and use of multi-strand pre-stressing jacks which can stress all the strands of a cable at the same time.

iv. Special efforts with very close supervision shall be made to control the grouting operation by keeping water cement ratio as close as 0.35 as possible (though IRC 18 provides for W/C ratio as 0.45). The admixture shall be selected by the proper care and as approved by the Engineer.

NOTE: 1) All other works as detailed in Design Criteria and tender drawings and as are essential for the entire completion of the works and as directed by the Engineer.

2) Providing all Specifications of the normal items of the Flyover shall be as per Ministry of Surface Transport, the Standard Specifications of PWD subject to the other special provisions described herein. If the Contractor provides the use of any special type of materials not covered by the standard specifications of PWD/ Specifications of the Ministry of Transport, the contractor shall furnish the specification along with his standard and these shall be got approved from the department.

24. SPECIAL PROVISIONS:-

Following provisions shall supersede those provided in relevant clause of IRC / IS Codes.

i. All the structural elements of this project shall be designed as per IRC - Working Stress Method.

ii. For design purpose unit weight of reinforced cement concrete shall be considered as 2.5 T/m^3 and that for prestressed concrete as 2.6 T/m^3.

iii. The distribution reinforcement in deck slab shall be provided as per 0.3 x (LL moment + DL moment).

iv. The piers/columns under service condition shall be checked considering effective length as 1.5xL ('L' measured from top of pier cap to top of pilecap/footing.

v. Minimum eccentricity of 75mm in each direction due to likely shifting shall be considered in the design of piles.

vi. Irrespective of the % of voids provided in the voided slab, reinforcement detailing in the voided slabs shall be as per IRC:SP 64 (Guidelines for design of voided slabs).

vii. In a curved Box Girder, minimum two nos. of intermediate diaphragms shall be provided.

viii. Pier including pier-cap shall be cast in single pour and without any construction joint.

25. LOAD TEST:

25.1 In case a structure or a component of structures proposed by the contractor, in the opinion of the Engineer is of unusual nature, then the Engineer shall have the right to call upon the contractor to carryout model testing and/or load testing of the structure or component to prove its suitability. The cost of such test shall be borne by the contractor.

25.2 The Contractor shall have to carryout a load test on one unit of the structure across railway line and one unit of structure other than railway span, for the design static loads or their equivalent and in a manner as may be decided by the Engineer.

25.3 In the event of load testing being ordered the contractor shall:

(i) Prepare well in time all necessary calculations and details of arrangements for such load testing, e.g. the magnitude of the test load, mode and method of carrying out the test, the application of loads, duration of keeping the load, the equipments to be provided and observations to be made during and after placing the loads in position etc.

(ii) Make all necessary arrangements for observations, centering, equipments etc., that may be needed for measuring the settlement, deflections etc., required for the test, to the entire satisfaction of the Engineer and

(iii) Provide labour and make all observations during the test

25.4 After the test, the contractor shall submit a report on the results of the tests. The Engineer shall then communicate as to whether the test has been satisfactory or not. Any further tests or reconstruction or strengthening as may be necessary shall be decided.

25.5 When the tests are declared by the Engineer as having been completed, the contractor shall remove all loading which might still be on the bridge as well as in the surroundings.

25.6 Any defect noticed in the structure or any damage done to the bridge at the time of testing, which affects or is likely to affect the strength of the bridge shall be rectified by contractor at his own cost by remedial measures or replacement as approved by the Engineer.

25.7 The test shall be carried out in the presence of Engineer.

25.8 Acceptance Criteria for Load Test:

25.8.1 The criterion of acceptance is based on recovery of deflection after removal of test load. The following table gives the criteria for R.C.C. and P.S.C. superstructures.

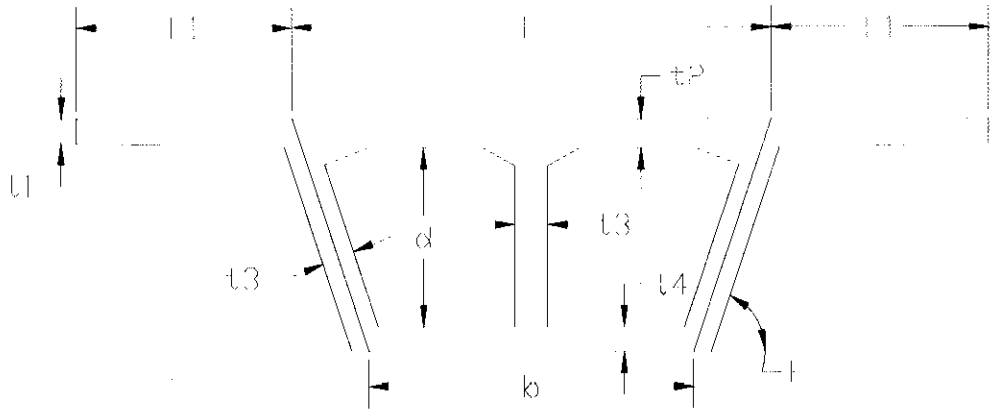
Sr. No.	Type of Bridge	Load Intensity for Testing	Duration of retention of test loads (hours)	Maximum deflection	Min. % recovery of deflection after 24 hours
1	Reinforced concrete	1.0 D + 1.1 L	24	$40l^2 \times 10^6/d$	75
2	Prestressed concrete	1.0 D + 1.15 L	24	$40l^2 \times 10^6/d$	80

Where l - Length of span (mm) D - Dead load.
d - Depth of main beam (mm) L - Live load without impact
It should be ensured that moment generated by the test load is equal to design live load moment.

25.8.2 The test load on bridge shall be applied in not less than 4 approximately equal increments so that no untoward distress occurs in the structure. Assuming that the maximum of 100% of the design live load is to be applied, the 1st stage of loading (including the dead load of stacking platform) could be 60% which can be increased in steps of 70%, 80%, 90%, 100% done in the same stages. It shall be ensured that the total duration of loading and unloading operations is same.

ANNEXURE-1

DIMENSION OF BOX GIRDER



MINIMUM DIMENSIONS

t1	200 mm
t2	240 mm
t3	300 mm
t4	200 mm
b	3000 mm
d	1500 mm

LIMITATION OF OTHER PARAMETER

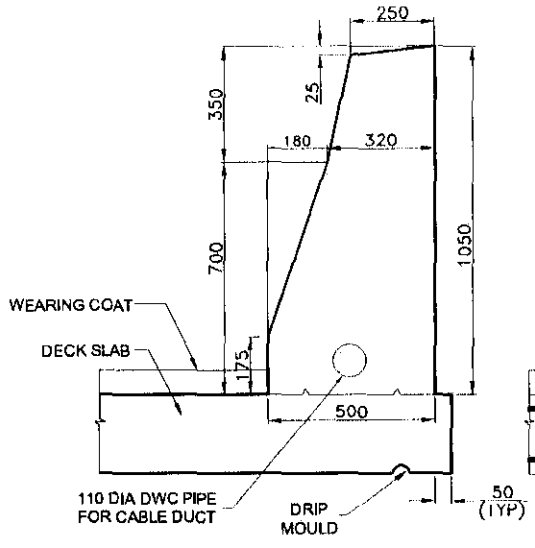
L1 SHALL NOT BE MORE THAN LEAST OF 0.45L AND 3 m.

F NOT LESS THAN 70^0

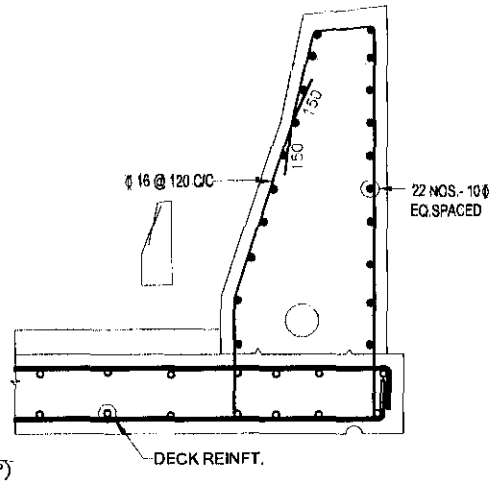
OPENING IN DIAPHRAGM NOT MORE THAN 50% OF AREA AND NOT LESS THAN 900 x 900 mm.

Note : REFERENCE MAY BE MADE TO SCHEEF AND SCHAICH'S BOOK FOR DETAILING.

ANNEXURE-2



DIMENSIONAL DETAILS

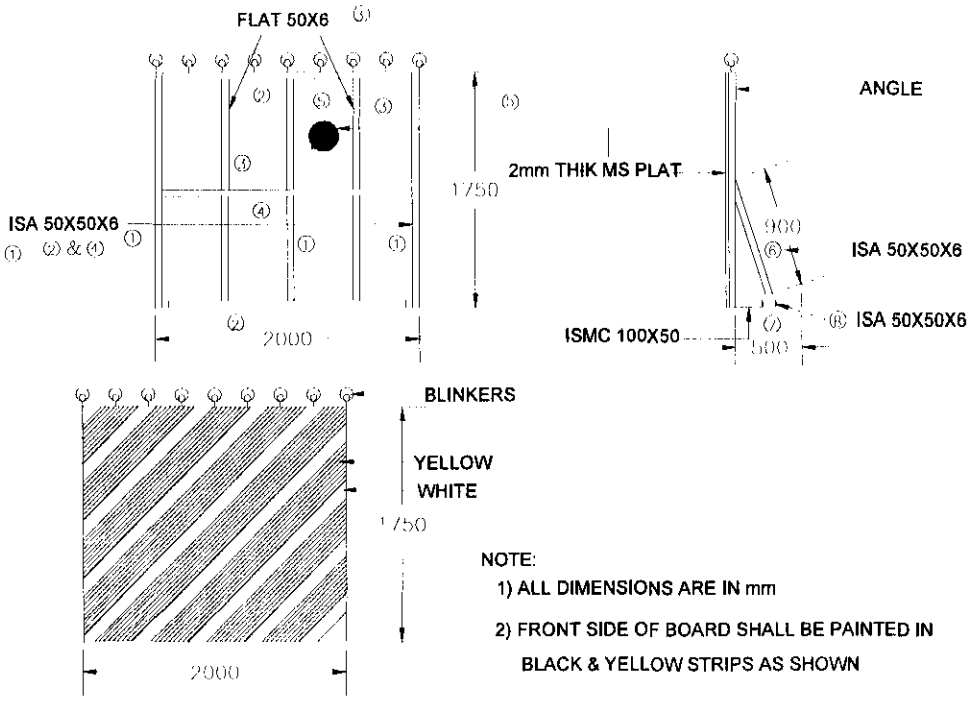


REINFORCEMENT DETAILS

DETAILS OF ANTI CRASH BARRIER

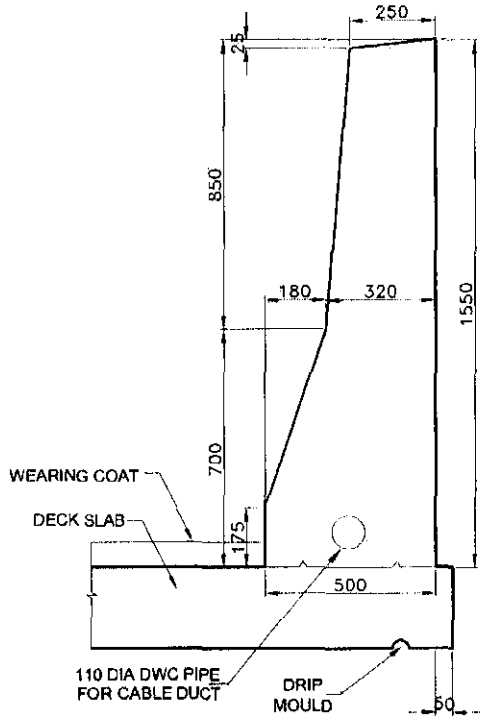
ANNEXURE-3

DETAILS OF BARRICADING.

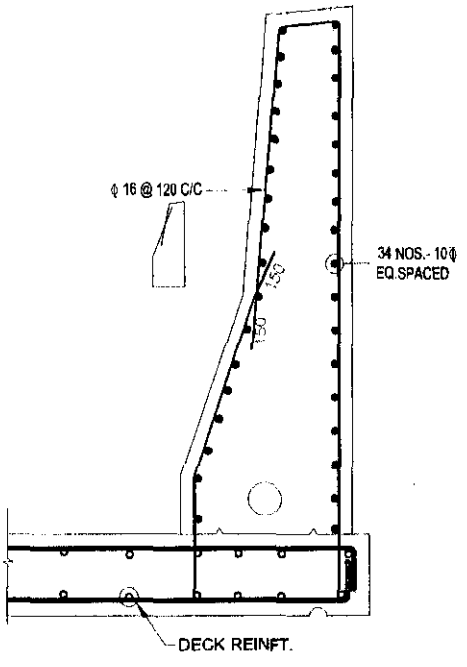


TYPICAL DETAILS OF BARRICADING BOARD

ANNEXURE-4



DIMENSIONAL DETAIL



REINFORCEMENT DETAIL

HIGH CONTAINMENT ANTI CRASH BARRIER.

Contractor

Exe. Engineer (Project), PCMC

SECTION VI

EMPLOYER'S REQUIREMENTS

CHAPTER – v

SPECIAL CONDITIONS OF CONTRACT

SPECIAL CONDITIONS OF CONTRACT/SUPPLEMENTARY INFORMATION

The following conditions shall prevail:

1.0 CEMENT FOR WORKS

The Contractor shall make his own arrangement for cement. The cement shall be OPC grade 43/53 for structure by approval of Engineer. The supply of cement shall be of approved brand by the Engineer.

2.0 ELECTRIC POWER SUPPLY

The Contractor shall make all the necessary arrangement for procurement of electric power required for the work. The Contractor shall submit his requirement of Electric Power Supply for carrying out permanent works, operating plants and equipments, labourers camp and field offices etc., as a part of his work plan. The employer will issue the necessary certificates, letters of recommendation etc., to the contractor for obtaining the power supply. However, the employer shall accept no responsibility for any delays in obtaining the power connections. In addition, the contractor shall maintain standby diesel generators of adequate capacity. Non-availability of electric power will not be considered as a reason for delay in progress.

3.0 WATER SUPPLY FOR CONSTRUCTION, LABOUR CAMPS, OFFICES ETC.

The Contractor shall make all necessary arrangements for the procurement of water required for construction and labour complete. The employer shall issue the necessary certificates, letters of recommendation etc., for obtaining the necessary permissions. The employer shall assume no responsibility for delay in progress due to delay in obtaining the permissions. The Contractor may drill bore wells as a source of construction water. The water shall be got tested by the contractor at his own expense and certificates regarding the suitability for construction shall be submitted to the Engineer regularly as per his requirements.

4.0 TELEPHONES / WIRELESS COMMUNICATION FACILITIES

These will be arranged by contractor at his own cost. The employer shall give the necessary certificates and letters of recommendation etc., to the contractor.

5.0 LAND FOR TEMPORARY USE

Land for labour camps, storage yards temporary site sheds etc., will be arranged by the contractor at his own cost.

6.0 CONTRACTOR'S MATERIALS, LABOUR ETC.

The Contractor shall provide everything necessary (except for items to be provided by the Employer specifically mentioned in the conditions) for the proper execution of the works according to the intent and meaning of the Drawings, Notes, Bill of Quantities and Specifications taken together, whether the same is or is not particularly shown or described therein; provided the same can be reasonably in forced there from. If the contractor finds any discrepancy therein he shall immediately and in writing refer the same to the engineer. The decision of the engineer shall be final and binding on the contractor. Figured dimensions shall be followed and the drawings shall not be scaled from.

7.0 ENABLING WORKS

The Contractor shall supply, fix and maintain at his own cost during the execution of works, all the necessary centering, and scaffolding, staging, planking, timbering, strutting, shoring, pumping, fencing, hoarding, watching and lighting by night as well as the necessary equipment for protection of public and safety of any adjacent roads and railway lines. The contractor shall remove any or all such centering scaffolding, staging planking and equipment when ordered to do so by the engineer and make good all matters and things disturbed during the execution of works to the satisfaction of the engineer.

8.0 WORK ORDER BOOK

A work order book shall be maintained on the work and the contractor of his authorised representative shall acknowledge and sign the orders given therein by the Engineer and shall comply these promptly and correctly.

9.0 DISCOVERIES

In the event of discovery by the contractor or his employees, during the progress of work, of any treasure, fossils materials or other articles of value of interest, the contractor shall give immediate notice thereof to the Engineer of such treasure or things which shall be the property of the Government of India and shall not be removed by the contractor under any circumstances.

10.0 TEMPORARY DIVERSIONS, MAINTENANCE OF SAME AND TRAFFIC MANAGEMENT

In addition to provisions made in the technical specifications, it is stipulated that the contractor shall construct, maintain and carryout the traffic management including safety features, for all temporary diversions.

11.0 OPPORTUNITIES AND FACILITIES FOR OTHER CONTRACTORS AGENCIES ETC.

The contractor shall, in accordance with the requirements of the Engineer afford all reasonable opportunities for carrying out their work to any other contractors employed by the Employer and their workmen and to the workmen of the Employer and of any other duly constituted authorities who may be employed in the execution on or near the site of any work not included in the Contract or of any contract which the Employer may enter into in connection with or ancillary to the works. If, however, the contractor shall on the written request of the Engineer or Engineer's representative make available to any such other contractor or to the Employer or any such authority any roads or ways for the maintenance of which the contractor is responsible or permit the use of by any such of the Contractor's scaffolding or any other plant on the site or provide any other service of whatsoever nature, for any such the Employer shall pay to the Contractor in respect of such use of service such sum or sums as shall in the opinion of the Engineer be reasonable.

12.0 ENVIRONMENTAL SAFEGUARDS

The Contractor shall take action of following points and note the stipulations as under as regards environmental safeguards as stipulated by the Ministry of Environment and Forests.

12.1 Appropriate measures shall be undertaken while undertaking digging activities to avoid degradation of water quality.

12.2 Borrow pits and other scars created during the road construction shall be properly leveled and treated.

12.3 Adequate provision for infrastructural facilities, i.e. water supply, fuel, sanitation, etc. shall be ensured for labourers during construction period in order to avoid damage to the environment.

12.4 No excavation from or dumping of waste materials into any water body / wetlands shall be done.

12.5 Borrow sites for earth, quarry sites for road construction and dump site shall be identified keeping in view:

12.6 No excavation or dumping on private property is carried out without written consent of the owner.

12.7 No excavation or dumping shall be allowed or wetlands, forests areas or other ecologically valuable or sensitive locations.

12.8 The excavation work shall be done in consultation with soil conservation and watershed development agencies working in the area:

12.9 Construction spoil including bituminous material and other hazardous material must not be allowed to contaminate water course and the dump sites for such materials must be identified well in advances before construction and lined properly so that they do not leach into the ground water.

12.10 The trees, which are necessary to be felled should be identified before hand and necessary approval from the competent authority should be obtained for felling the same. Sufficient number of trees of suitable species should be planted in lieu of the trees felled.

12.11 A contingency plan shall be prepared to combat with accidents so that the victims of accident can be provided immediate medical help. Some essential equipment, building and other facilities may be required for the purpose.

12.12 The Employer or any other competent authority may stipulate any other condition for environmental safeguard, subsequently, if deemed necessary, which should be compiled with.

12.13 The above mentioned stipulations shall be enforced among others under the Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and Control of Pollution) Act, 1981 the Environment (Protection) Act 1986, the Hazardous Chemicals (Manufacture, Storage and Import) Rule, 1989, the Environmental Impact Assessment (EIA) Notification 1994 and its amendment of May 1994, April 1997, January 2000, the Public Liability Insurance Act 1991 and the rules made there under from time to time.

13.0 PETROL PUMPS

The Employer may give permission to Petroleum Companies to establish Petrol / Diesel Pumps adjacent to the site of work. The suitable location shall be identified by the contractor, after which Employer will take necessary action in the matter.

14.0 REMOVAL / DIVERSION OF UTILITY SERVICE

As far as possible, the Contractor's alternative proposal shall be such that the shifting of utility services is not required. However, if the over ground / underground utility services like electric poles, telephone poles, water supply

pipe lines, sewer lines, oil pipe lines, cables, gas ducts etc. owned by various authorities including Public Undertakings and local authorities encountered during construction shall be diverted by the Contractor and will be reimbursed as per the estimate prepared by the concerned PCMC department / other agency and approved by Employer. The work shall be carried out under the supervision of concerned PCMC department / other agency. In case in the opinion of the Engineer it is not possible to divert the utilities, the Contractor shall make necessary modifications in the structure at no extra cost to the client.

15.0 TAXES – Refer Clause Clause 14.1 (b) of GC.

16.0 QUARRIES

The contractor will have to make his own arrangement of acquiring land for quarries. The contractor shall carry out all quarrying operations without endangering the environment and natural beauty of surrounding.

All excess and un-useful excavated materials shall be stacked at dumping places if available, identified by the Employer as directed by the Engineer; otherwise the contractor has to make his own arrangement for the same.

17.0 Additional Obligations:-

1. Any Structure or portion of work if rejected by Employer's Engineer has to be dismantled and removed after receipt of written advice from the Employer's Engineer and redone or modified as per specification and drawing. Cost of which is to be borne by the Contractor.
2. The work of Railway ROB shall be carried under supervision and presence of concerned Railway Engineer or an authorized Railway supervising Engineer appointed by him. The final acceptance of the work shall be subject to his satisfaction. In case of any rejection of any such portion of work shall be dismantled by the contractor and re-done under Railway's Supervision
3. Design Drawings / Working Drawings before releasing for work shall be submitted to Consulting Engineer appointed by the Employer for Proof Checking of Design done by Contractor's Engineer.
4. Any discrepancy pointed by the Consulting Engineer of Employer shall be corrected and re submitted.
5. The Design and all Drawings of Railway portion of work within Railway Boundary shall be proof checked by Railway approved consulting Engineer and submitted at Design Cell of Central Railway's Chief Engineer's Office by the contractor for final checking and final approval. This also includes for all temporary works erected in Railway portion as well as for launching Scheme of PSC I Girders. All necessary co-ordination with Railway during approval of drawings and during execution of work shall be done by Contractor.

18.0 Special Conditions while working in the Railway Area.:-

18.1 No work within Railway area shall be done without the presence of Railway's Engineer or Railway's authorized staff.

18.2 No work on Railway track shall be undertaken by the contractor unless the traffic Block is sanctioned and arranged by Railway Engineer. The work shall be carried in planned way within duration of sanctioned power and traffic Block in presence of Railway Engineer.

18.3 During the traffic Block the railway Track shall be protected only by authorized Railway staff deployed by Railway Engineer as per Railway General and subsidiary Rules.

18.4 No Tools or Equipment or machinery or plant shall be brought or kept in side Railway area without the written permission of Railway Engineer. No tools or equipment shall be kept in side area of Railway track for safe movement of Trains.

18.5 No material shall be stacked inside Railway without written orders given by Railway Engineer.

18.6 Any excavation for foundation within 5 meters near Railway track shall be carried only after approval of Railway Engineer. The excavated area shall be barricaded by fencing and it is ensured that such barricade shall be provided at safe distance from Railway Track as per Indian Railways Schedule of Dimensions 2004 and according to specific instruction of Railway Engineer.

18.7 Contractor shall submit a launching scheme and drawing for launching of PSC I Girders with design calculation and Requirement of traffic blocks etc. for each Phase work for approval or Railways before undertaking such works. The PSC I Girders shall be provided with temporary steel brackets to secure its stability after launching till RCC diaphragms are cast which shall be shown in the launching scheme. If launching is done by Road cranes in the case capacity of the cranes shall be written in the launching scheme. Minimum three cranes shall be used out of which third crane will remain at site as stand by in case of failure of any of the working crane. In case steel launching girder is use for launching of PSC I Girders, its structural details drawing with design calculation shall be submitted by the contractor duly proof checked by Railway approved proof checking Engineer for final approval of Railway. The Drawings shall also include Shuttering Arrangement for Deck Slab.

18.8 No vehicles of contractor are permitted to ply within 15m from Railway Track. If it is required to do so, the matter shall be informed well in advance to Railway Engineer so that he may depute his authorized staff with necessary Red flag and protection equipments for such work for safety of Running trains.

18.9 The Vehicle and Crane Drivers of Contractor should have necessary Driving licence and competency certificate which shall be produced to Railway Engineer before deployment by the contractor. These drivers should have Photo Identity cards issued by the Contractor. Any Change of such staff should be brought in the knowledge of Railway Engineer in charge well in advance. Railway Engineer shall have right to demand for changing of any such staff who in his view is found incompetent and doing unsafe work in Railway area.

18.10 All staff of Contractor shall maintain Identity card while working in Railway Area. Copy of the same with list of such staff shall be submitted by the contractor to Railway Engineer well in advance. Any change of such staff for the work of Railway area should be informed to Railway Engineer well in advance.

18.11 Contractor has to deploy supervisor and site Engineer who has previous experience to work in the Railway suburban area in view of safety of running trains.

18.12 PSC I Girders shall be precast outside and then launched for the ROB by adopting method after Railway Approves Contractor's launching scheme.

18.13 Railway shall neither be responsible in any way for any injury to Contractor's staff or supervisors during the course of work nor it shall be a part for any such injury covered under workman's compensation Act. The contractor has to train his staff to learn Railway safety Rules before deputing them to work in Railway area in consultation with Railway Engineer.

18.14 No scaffolding or ladder shall be provided without presence of Railway Engineer or his authorized staff within 7.5 meter distance from any Railway track.

18.15 While casting Deck Slab of the ROB or providing shuttering work the Contractor shall ensure that no materials or tools fall from ROB over Railway Track to ensure safety of running trains.

18.16 Flyover shall not be commissioned even after completion of the work by the contractor unless necessary formalities are completed and the contractor obtains a satisfactory completion certificate from Railway Engineer for ROB portion.

18.17 During the Defect Liability period the contractor has to attend any maintenance of the ROB as per inspection report of Railway Engineer in presence and under the supervision of Railway Engineer or a authorized supervisor nominated by him.

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EXECUTIVE ENGINEER,
P.C.M.C. Pimpri-411 018