

Part-B

Technical Specifications for Flyover(s)

Name of Work: I. Design and Construction of Flyover Connecting North bound traffic on EEH to Wadala Anik Road.

II. Design and Construction of Subway/Flyover in front of ISBT.

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This document has to be read in conjunction with RFP, Draft Concession Agreement

Units & Abbreviations

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

Abbreviation

The following abbreviations shall be used in the Document:

Authority	MMRDA
Chainage	CH
IE	Independent Engineer
Government of Maharashtra	GOM
Indian National Rupees	INR
Kilometer	km
Mumbai Metropolitan Region Development Authority	MMRDA
Maharashtra State Road Development Corporation Ltd.	MSRDC
Mumbai Urban Infrastructure Project	MUIP
Municipal Corporation of Greater Mumbai	MCGM
Public Works Department	PWD
Number	No.
Reinforced Cement Concrete	RCC
Safe Bearing Capacity	SBC
Slum Rehabilitation Authority	SRA
State Bank of India Prime Lending Rate	SBI PLR

SECTION I

AUTHORITY'S REQUIREMENT

Authority's Requirements

Preamble

Data provided here is tentative. Physical Data is available at the site and Obligatory Data to be considered by the bidder for preparation of his proposal. 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.

Concessionaire's General Engineering, Procurement & Design Obligations

The **Concessionaire** shall be solely responsible for the Engineering, procurement, design and construction of all work and for all details of the works and the adequacy thereof. **Concessionaire's** responsibility shall not be in any way be diminished nor shall the **Concessionaire's** design approach be limited by the IE/Authority's acceptance of the **Concessionaire's** guidance or recommendations as to engineering standards and design specifications, or by Authority'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 Concessionaire and approved by the IE/Authority. The Work shall also include shifting of utilities, removal of electric poles, cutting and removal of trees. The **Concessionaire** has to submit his own detailed design drawings for the said project

Inspection, Quality Assurance and Quality Audit

The **Concessionaire** shall permit access to the Authority personnel's, Representatives of the Independent Engineer, or any other person authorized by the Authority to the **Concessionaire's** premises where the works will be performed and will use reasonable endeavors to secure Rights of Access to the premises of its Subcontractors where the works will be performed, having Subcontracts or orders in the amount of or equivalent to 1 Cr Indian Rupees (Rs. One Crore) or more, in accordance with the **Concessionaire's** contractual arrangements with its Subcontractors and allow him to:

- (a) audit the **Concessionaire'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 their quality meets the specification; and
- (c) Perform activities with respect to civil works such as, but not limited to, survey, installation, commissioning, acceptance and other Design & Construction and/or operational activities. Each of the foregoing rights of access shall be conditional upon (i) Authority /IE giving **Concessionaire** reasonable notice, (ii) the Authority /IE accessing such premises in a manner that avoids disruption of the works that is being performed on such premises. The IE/Authority 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 Concessionaire 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.

Scope of work to be carried out but not limited to:

Each component of the project has been elaborately explained above and obligatory requirements are as under but not limited to following.

- a) Concessionaire is required to carry out detailed design for all the components of the project following relevant codal requirement and using modern technology. Use of high quality materials is preferred. Materials proposed to be incorporated shall be able to withstand severe environmental conditions in Mumbai on a long term basis.
- b) Retaining Earth (RE) walls shall be designed properly with friction ties and shall be as per approval by the competent authority.
- c) Flyover shall be designed for design criteria mentioned elsewhere in this document. The design shall be elegant and aesthetically sound and with a pleasing view. Use of modern materials and latest design techniques shall be adopted.
- d) Detailed Structural Design and Drawings with design calculations and cost shall be submitted as essential part of the bid. However, the design to be followed shall be as per the approval by competent authority.
- e) Proper design for kerb stone, side parapet wall and landscape lanes shall be carried out and submitted with the bid.
- f) Proper design for Landscape and Arboriculture shall be submitted with suitable species of plants and shrubbery which can grow healthy in this region.
- g) Elaborate details of road signage and lane marking with detailed sketches shall form a part of bid. IRC - 67 and IRC -35 shall be followed and the concessionaire may suggest grade for signages and use of thermoplastic print to be used along with specification and indicative cost with names of manufactures and suppliers.
- h) It is also proposed to receive detailed scheme for street lighting system along with detailed specification and item proposed such as poles on the Viaduct with foundation details, type of light fitting etc.
- i) Traffic management plan / Traffic diversion plan with all related requirements shall be submitted for prior approval and during construction stages.
- j) Methodology for the structural components for casting, transportation and erection along with deployment of manpower and machinery shall be submitted as per the design proposed by the Concessionaire.
- k) The detailed plan for shifting of Utilities with names of agencies and methodology for shifting / relocation shall be submitted.
- l) concessionaire is required to reinstate to original condition entire project area including areas like gardens, roads (CC/BT), footpaths, electrical installations, compound walls etc at no extra cost to MMRDA.
- m) All external surfaces of substructures / super structures and all other exposed faces shall have to be formed only with special form liners. No intrusive forming created by rendering on formed surfaces will be permitted. All form liners designs shall to be got approved from the Independent Engineer / Authority. Rubberized form liners with specific numbers of repetitions as may be ordered by Independent Engineer will be required to be used.

Design Parameters and Design Elements

The flyovers have been proposed considering their need and importance for future traffic demand and forms part of upgradation / modernisation of Mumbai Public Transportation system. Due consideration will have also to be given to the anticipated surrounding development along these links with due

weightage for land, social, environmental, aesthetic and economic issues. Standards for the design of various components and facilities for the flyovers have been developed, accordingly.

I. Road Work

S. No	Attributes	Standards	Remarks
1	Rigid Pavement	Major Urban Link Roads	
2	Design Speed A) Free Flow B) Restricted Flow	100 Km/Hr 60 Km/Hr	For 60 Km/Hr along proposed links
3	Width Carriageway one lane width	3.5m	3.5 m
5	Camber / Cross Slope Carriageway • Rigid • Flexible	2.0 % 2.5 %	2.5%
6	Longitudinal Gradient • Ruling	5 %	5.63%

- (1) Minimum intersection turning radius shall be 25 metres
- (2) Maximum super elevation of 4% shall be maintained.
- (3) Vertical Curves and sight distance shall be as per IRC standards.

II Up and Down Ramps

Entry and Exist to traffic is through the up and down ramps.

a) Up / Down Ramps

- Clear carriage way width 7.50m
- Crust
500 mm sub grade
300 mm GSB
300 mm WMM
10kg/ 10 sqm Prime coat
150mm thick DBM
5kg/ 10 sqm tack coat
40mm asphaltic conc
25mm mastic

III Length (Sion to Wadala direction) = 815 m

- 45.0m solid ramp (7.50m wide)- Sion side

- solid ramp (7.50m wide)- Wadala Side- 43.23 m
- Obligatory span-1(7.50m wide)- 27.50m
- Obligatory span-2 (7.50m wide)- 32.50m
- Obligatory span-3 (7.50m wide)- 25.0
- Via Duct portion- 641.50m

Type : Viaduct on Columns and Piers supported on pile foundation

IV Vertical Clearance Requirement

At all obligatory spans across road crossings	5.5 m
At level 2 crossing from existing Flyover	5.5 m
Clear carriagewaywidth	7.5 m
Crash Barriers.	RCC

A. DESIGN DATA FOR FLYOVER

Main Carriageway as well as Up and Down Ramps

1. Carriageway width	:	7.5m
2. Overall Width of Elevated Road	:	8.5m
3. Seismic Effects		
a) Seismic Zone	:	Zone III
b) Importance Factor (λ)	:	1.25
4. Design Speed of Vehicles	:	60 KMPH
5. Super Elevation (max.)	:	restricted to 4.0%
6. Radius	:	As per design.
7. Horizontal curves	:	60 kmph.
8. Vertical curves	:	60 kmph.
9. Exposure Condition	:	Severe
10. Temperature range	:	12 to 43 ^o C
11. Underground Water Table	:	As per Soil Investigation.
12. Minimum Clearance to be maintained for traffic	:	5.5m
13. Live load	:	As per IRC: 6 (Latest).
For every of 7.5 m width of Carriageway	:	2 Lanes of Class A OR 1 Lane of Class 70 R whichever is severe.
14. Bearing type	:	POT-PTFE
15. Expansion Joint	:	Strip seal / Modular type
16. Wearing Course	:	25 mm mastic over and 40 mm thick AC
17. Foundation Type	:	Pile Foundation.
18. Minimum Pile	:	dia. 1200 mm
19. Founding level of piles	:	As per bore data *
20. Camber for Flyover	:	2.5%

B. DESIGN CRITERIA FOR STRUCTURES

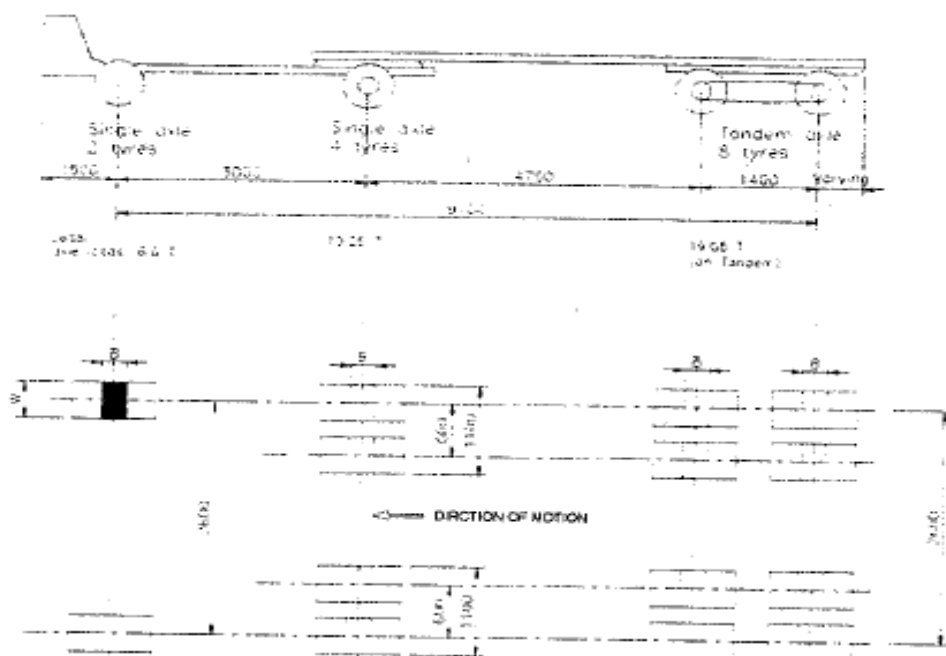
1. General Requirements:

The concessionaire shall generally satisfy the following design requirements: -

- (i) It shall ensure soundness of the structure, its durability and aesthetics 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 drawings and detailed description of work and specification of materials and items. If called upon, concessionaire 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 concessionaire shall not deviate from the Authority Requirement and also basic scheme proposed by him. However the concessionaire may come up with suggestions on adjusting the length of the Viaducts and Solid ramps.
- (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 Flyover proper shall have uniform aesthetical appearance to enhance the overall look and thereby the vicinity. Aesthetic finishes like grooves, embossed or surface textures to be provided for substructure and superstructure as per the detailed drawing approved by the Independent Engineer/Authority.
- (vii) For viaduct / obligatory span, only top launching with Overhead trusses (launcher) is allowed. For approach towards Thane side flyover, concessionaire may submit his scheme without hindrance to traffic at grade.
- (viii) All the substructures shall be of uniform type except otherwise necessary.
- (ix) In the design of superstructure combination of IRC Loading as per the Clause 207.4 (IRC: 6 - 2000) and additional load case (special vehicle) a train of containers carrying tractor as shown in figure 1.1 below shall be considered.

Reference Vehicles

Container carrying tractor / trailer assembly shown in Fig. D-1 shall be the reference vehicle used for additional loading purpose. The average overload factor over design axle load should be taken as 1.3 for design purpose, (legal axle loads to be increased).


Table D-1 Ground Contract Area in mm (each type)

Sr. No	Type	'B' Along Traffic	'W' Across Traffic
1	Single 2 tyre spaced at 1.8 m c/c	200	400
2	Single 4 tyres	300	500
3	Tendons 8 tyres	300	500

Longitudinal Effects: Train of Vehicles

For superstructures consisting of 2 lane carriageway, bridge has to be designed for 'Traffic Jam' condition for two lanes occupied by a train of reference vehicles with all axles loaded with average over load values indicated in (a) above as a static loading (i.e without impact factor) and with successive vehicles of the train spaced at front – axle to back axle distance of 3.0 m centers. The length of the train (i.e number of vehicles in train) and its position on the bridge is to be chosen such as to produce the maximum value of the effect under verification.

2. Restriction on Type of Structures

The following types of structural arrangement 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) Abutment resting on approach embankments.
- (iii) A design in which stability of one or more spans 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 of short suspended spans.
- (v) Structures with continuity only in deck slab, in transverse direction. (wider Superstructure more than 4 lane resting on independent foundation should not be interconnected.)
- (vi) Piers in the form of multiple columns with isolated / separate footings resting on yielding type strata.
- (vii) Superstructure with which the roadway cannot be easily widened in future, such as bowstring girders, through trusses, etc.
- (viii) Steel structures.
- (ix) Unprotected hollow piers for spans, which are susceptible for impact of vehicles.
- (x) Any type RCC Superstructure.

3. Specification 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 specification published upto 3 months prior to last date of issue of Bid Documents and subject to the departures stipulated in these Bid documents.

I.R.C.5	General features of design.
I.R.C.6	Loads and stresses.
I.R.C.21	Cement concrete plain and Reinforced (Second Revision).
I.R.C.24	Steel road bridges for permissible stress only. (Other provisions as per AASHTO Code)
I.R.C.22	Composite construction for road bridge (for permissible stresses only) . Other provisions as per B.S 5400 part 3, 5, 6/ ASHTO Code).
I.R.C.78	Foundation and substructures
I.R.C.83	(Part-I) Metallic Bearings.
I.R.C.83	(Part-II) POT, POT CUM PTFE PIN AND METALLIC GUIDE BEARINGS
I.R.C 18(2000)	Design Criteria for prestressed concrete Road/ Bridges (Post tensioned concrete) MORT & H specifications for Roads and Bridges works - 2001
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

(A) MORT&H specifications for Road and Bridge Works – 2001 Suitable Seismic Arresters to prevent superstructures sliding off bearings shall be provided.

- (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 Bid documents.
- (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 provision from B.S and AASHTO Codes of Practice.
- (F) For items not covered by any of the above Standards and Specifications sound Engineering practice and provision in the design and provisions of relevant Codes of other nation shall be referred. In this regard decision of the IE/Authority shall be final and binding.
- (G) IS 13620- Specification for Anticorrosive treatment to reinforcement bars including required handling, application, touchup and maintenance till concreting by Fusion Bonded epoxy coating- Applicable for Terminal Building as well.