National Highways & Infrastructure Development Corporation Limited

(Ministry of Road, Transport & Highways)
(Government of India)

International Competitive Bidding Process for

CONSTRUCTION, OPERATION AND MAINTENANCE OF Z-MORH TUNNEL INCLUDING APPROACHES ON NATIONAL HIGHWAY NO. 1 (SRINAGAR SONMARG GUMRI ROAD) IN THE STATE OF J&K ON DESIGN, BUILD, FINANCE, OPERATE AND TRANSFER (DBFOT) ANNUITY BASIS

REQUEST FOR PROPOSAL (RFP)

BID DOCUMENT

VOLUME -III

Schedules

June 2019

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SCHEDULE-A

(See Clause 10.1)

SITE OF PROJECT HIGHWAY

1.0 THE SITE

1.1 Project Area

The project area of the approximately 6.5 km long Z-Morh Tunnel and the approaches to the portals is located north-east of the city of Srinagar along the National Highway 1(Srinagar-Leh section) in the State of Jammu and Kashmir. The tunnel shall be constructed between the villages Rezan(Km 69) and Shetkari (Km 82), approximately 2 km west of the village Sonamarg.

1.2 Site of the Project Highway shall include the land, buildings, structures and road works as described in Annex-I of this Schedule-A.

1.3 An inventory of the Site including the land, buildings, structures, road works, trees and any other immovable property on or attached to the Site shall be prepared jointly by the Authority Representative and the Concessionaire and such inventory shall form part of the memorandum referred to in Clause 10.3.1 of the Agreement.

1.4 Additional land required for, Traffic Aid Posts, Medical Aid Posts and vehicle rescue posts or for construction of works specified in Change of Scope Order shall be acquired in accordance with the provisions of this Agreement on the request of the concessionaire. Upon acquisition, such land shall form part of the Site and vest in the Authority.

Annex - I

(Schedule-A)

SITE OF PROJECT HIGHWAY

1.1 The Site

The Project Highway aims at construction of :-

- **6.426 km long two lane bidirectional single tube tunnel** with parallel 6.412 km long escape tunnel and 0.575 km ventilation tunnel on new alignment between Rezan & Sonamarg along the existing NH-1in the State of J&K.
- **Approach to the Western(Srinagar side) Portal**- The take off point of the approximately 4.636 Km long approach road to the western portal is approximately at Km stone 69 on the Srinagar-Sonamarg section of NH1. The approach is to be constructed as two lane highway along with the provision of creeper lane and snow storage berm as per given details and specifications and includes construction of one major and one minor bridge.
- **Approach to the Eastern (Sonamarg side) Portal-** The junction of the approximately 0.932 Km long approach road to the eastern portal is approximately at KM stone 81.3 on the Srinagar-Sonamarg section of NH1. The approach is to be constructed as two lane highway as per given/approved specifications and includes construction of one major bridge.
- **Approach to the Construction/Ventilation adit (intermediate) Portal**- The junction of the approximately 0.876 Km long approach road to the intermediate portal is approximately at KM stone 76.5 on the Srinagar-Sonamarg section of NH1. The approach is to be constructed as two lane highway as per given/approved specifications.

1.2 Description of the Project Highway

An index map and location plan of the Project Highway is given at Appendix A-I.

Road:	Srinagar to Sonamarg
Object:	Single tube highway tunnel with two traffic lanes in bi-directional traffic Main structures: traffic tunnel, separate parallel egress tunnel, construction/ventilation tunnel Additional structures: Portal structures, cut & cover tunnel, ventilation cavern, muck disposal areas, cross passages Approaches to the western, eastern and intermediate portals including the bridges. Service and control buildings and other project facilities as specified.
Location:	India, Jammu and Kashmir
Client:	National Highways Infrastructure Development Corporation Limited
Portals:	West Portal at approx. km 74 NH-1 in the area of Rezan/Gagangir approx. 30 km east of Kangan East Portal at approx. km 81 on NH-1, approx. 3 km west of Sonamarg Portal of ventilation tunnel & construction adit at approx. km 76.5

NH-1

Elevation: West Portal at elevation approx. 2489 m
East Portal at elevation approx. 2634 m
Portal of ventilation tunnel & construction adit at elevation approx. 2570 m

Tunnel length: approx. 6.462 km

Egress tunnel length: approx. 6.412 km

Construction/ventilation tunnel length: approx. 575 m (including Cavern)

Max. overburden: approx. 1075 m

Gradient in tunnel : +2.27 % (1:44) from the West Portal to the East Portal

Approach roads: Western Portal from near KM stone 69.500 on Srinagar-Sonamarg section of NH 1
Eastern Portal from near KM 81.3 on Srinagar-Sonamarg section of NH 1
Construction adit from near KM 76.5. on Srinagar-Sonamarg section of NH 1

1.3 Latitudes & Longitudes

The approximate longitude and latitude of the region is 34°-17' Northing and longitude 75°-10' to 75°-16'Easting.

1.4 Seismicity

The project area lies within seismic zones V, of the seismic zoning map of India. Earthquakes of sizeable magnitude are not uncommon to the area. In the last 50 years, several major earthquakes with a magnitude in excess of 6 on the Richter Scale have occurred in North-West Himalayas. The last significant seismic activity struck the area in October 2005, and with a magnitude of 7.6, it was with catastrophic results throughout the entire region.

1.5 Geology

Geological Description and Rock Mass Classification

The geological investigations show that the project area is located in Permo-Carboniferous metamorphic rocks of Panjal Trap formation and Zojila formation (see fig below). Especially at the portal areas the metamorphic bedrock is covered by thick accumulations of block and rock fall debris.

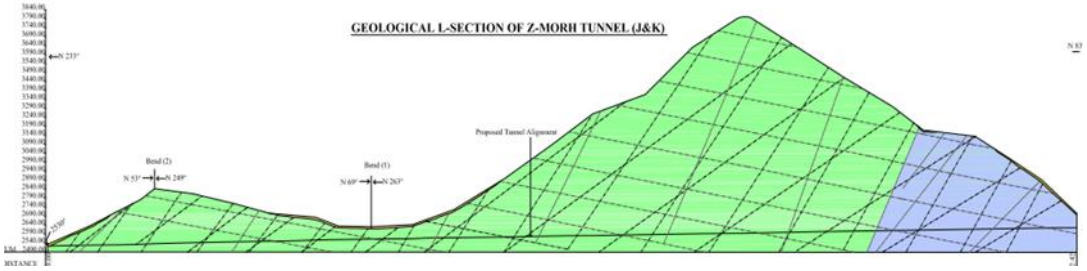

Fig.: Geological L-Section of Z-Morh Tunnel; green…Panjal Trap, blue…Zojila formation

Rock fall and slope debris are encountered at both portal areas of proposed Z-Morh Tunnel. The rock mass can be described as "Block in Matrix" material with 'soil-like' matrix and competent, intact rock blocks of bedrock (Metabasite, respectively Phyllites). The thickness of the debris accumulations ranges from a few meters up to several decametres at the toe of the valley slopes.

The 'Panjal Trap' mainly consists of dark-grey, basic metamorphic rocks ("Metabasites"), which are slightly weathered (discoloured discontinuity surfaces).

The mineralogical composition is dominated by Amphiboles, Plagioclase, Pyroxene and Olivine. Volcanic textures and structures like pillow lavas or porphyritic textures are preserved commonly. First laboratory tests and simple manual field index tests indicate a dominance of very strong uniaxial compressive strength (UCS: approx. 100 - 250 MPa). This Metabasites are dominated by massive rock mass with thickly (60-200 cm) to very thickly (>200 cm) spaced foliation planes. Additionally, schistose types with thinly to medium spaced (6-60 cm) foliation planes are encountered.

The 'Zojila formation' is encountered at the eastern section of Z-Morh Tunnel and consists mainly of dark grey, fine-grained, finely foliated graphitic, partly carbonaceous, phyllites and slates. Due to intensive foliation and slaty cleavage the rock mass is highly anisotropic. The spacing of the foliation planes is very thinly to thinly (2-20 cm).

Three to five discontinuity sets (Foliation and two to four joint-sets) are characteristic

for the project area. The foliation planes are striking E-W to SE-NW and dipping medium steeply to steeply towards SW (eastern project area), respectively towards N (western project area). The two dominating joint sets are striking ENE-WSW to NE-SW and dipping medium steeply towards NW and towards SSE. Potential larger shear zones or faults are expected especially in the eastern section of Z-Morh Tunnel within the Phyllites of 'Zojila-Formation' and at the border between Phyllites and Metabasites.

The rock mass classification is done according to the Austrian Guideline for NATM tunnelling into Ground Type (GT) and Behaviour Types (BT).

For the project area 5 different Ground Types and 7 Behaviour Types are defined. The predicted distribution along Z-Morh tunnel is summarized in the table below.

Tab. 1 Predicted distribution of Ground Types (GT) and Behaviour Types (BT) for mined Z-Morh tunnel

		Section 1	Section 2
		TM 130-5690	TM 5690-6549
Ground Type	GT 1	--	0-5%
	GT 2	65-85%	--
	GT 3	10-30%	20-40%
	GT 4	0-5%	50-70%
	GT 5	0-1%	5-15%
Behaviour Type	BT 1	30-45%	-
	BT 2	40-60%	35-55%
	BT 3	2-6%	25-45%
	BT 4	5-10%	10-25%
	BT 5	-	0-5%

The detailed geological description of the site is attached at **Appx A-II**.

1.6 Traffic

Traffic count details as per the survey conducted by design consultant during the month / year July, 2011 on the Project Highway are given at **Appendix A-III**

For the conceptual tunnel design the design traffic for the highway section is considered at 2500 trucks (3 tons and above) and 5000 passenger cars (below 3 tons) per day and both lanes (traffic projection for year 2024).

1.7 Land

The existing available RoW for the project highway is as per enclosed detail.

Annex - II

SCHEDULE-A

SITE OF THE FOUR - LANING

Appendix A-I

INDEX MAP OF PROJECT HIGHWAY

Appendix A –II

Geological Report

The detailed geology is enclosed.

Appendix A-III

TRAFFIC TABLE

(Enclosed)

SCHEDULE-B

DEVELOPMENT OF THE PROJECT HIGHWAY

1. DEVELOPMENT OF THE PROJECT HIGHWAY

Development of the Project Highway shall include construction of the Z Morh Tunnel and the approaches as described in this Annex-I of Schedule-B and in Annex-I of Schedule-C

2. CONSTRUCTION OF PROJECT HIGHWAY

2.1 Project Highway shall include construction of the Z Morh Tunnel and the approaches as described in Annex-I of this Schedule-B and Annex-I of Schedule-C.

2.2 Construction of the Project Highway shall be undertaken and completed by the concessionaire in conformity with the specifications and standards set forth in Annex-I of Schedule-D.

Annex - I

(Schedule-B)

DEVELOPMENT OF THE PROJECT HIGHWAY

1 Description of the Tunnel System

1.1 Portals

1.1.1 Western Tunnel Portal

Final portal elevation:	2489 m
Final portal location:	Pos. Y: 518104.2 m UTM Pos. X: 3794909.4 m
Mined tunnel portal location:	Pos. Y: 518130.7 m UTM Pos. X: 3796046.2 m
Cut & cover tunnel length:	30 m. Cross section as indicated in Appendix B-I
Ventilation building:	Situated above the cut & cover tunnel, two axial fans, electrical supply installations
Service and control buildings:	tentative floor space of 800 m². To be constructed as per drawings approved by the Engineer-in-Charge
Authority and Security Building:	tentative floor space of 400 m². To be constructed per drawings approved by the Engineer-in-Charge
Approach road to portal:	Two lane approach road with provision of creeper lane and snow berm of approx. 4626 m length from Rezan . Take off point at approx Km 69 on Srinagar-Sonamarg section of NH 1. Approach roads includes one major bridge of 240 m span and one minor bridge of 30 m span. The junction of the approach road with the existing NH shall enable unhindered traffic flow in both directions without conflict. Cross section indicated in Appendix B-I

1.1.2 Eastern Tunnel Portal

Final portal elevation:	2634 m
Final portal location:	Pos. Y: 524066.2 m UTM Pos. X: 3796057.8 m
Mined tunnel portal location:	Pos. Y: 524038.2 m UTM Pos. X: 3796046.2 m
Cut & cover tunnel length:	21 m. Cross section as indicated in Appendix B-I
Ventilation building:	situated above the cut & cover tunnel, two axial fans, electrical supply installations
Service building:	tentative floor space of 800 m².To be constructed as per the drawings approved by the Engineer-in-Charge
Authority and Security Building:	tentative floor space of 400 m². To be constructed per drawings approved by the Engineer-in-Charge
Approach road to portal:	Two lane approach of approx. 932 m from existing Highway NH1 including bridge construction with tentative span of 110 m. Take off point near Km 81.3 on Srinagar-Sonamarg section of NH1. The junction of the approach road with the existing NH shall enable unhindered traffic flow without conflict in both the directions. This approach road to also allow unhindered flow of traffic on the Sonamarg bypass

road. Additionally, all tunnel traffic flowing in both the directions should have suitable access to the Sonamarg bypass Road

1.2 Vertical and Horizontal Alignment

The vertical and horizontal alignment is given in the drawing at Appendix B-I.

1.3 Cross Section Width and Height

1.3.1 Cut & Cover Tunnel

The cut & cover tunnel is defined as the tunnel section from the final portal to the mined tunnel portal.The length of the cut & cover section is approx. 30 m at the western and 21 m at the eastern portal area. The typical cross section is given in the drawings in Appendix B-I.

A clearance profile with a height of 5.5 m over the carriageway and 2.3 m over the walkway shall be provided.

The width of the cut & cover tunnel shall be 10.8 m with the sections as described below including paved carriageway with a width of 8.3 m and walkways on both sides of the carriageway each 1.25 m wide.

Tab. 2: Cross section elements cut & cover tunnel

Cross Section Element	Width
Walkway:	1.25 m
Hard shoulder:	0.40 m
Driving lane:	3.50 m
Mountable Median:	0.50 m
Driving lane:	3.50 m
Hard shoulder:	0.40 m
Walkway:	1.25 m
Overall:	10.80 m

1.3.2 Mined Tunnel

The mined tunnel is defined as section between the mined tunnel portal West and East with a length of approx. 6400 m. The typical cross section is given in the drawings in Appendix B-I.

A clearance profile with a height of 5.5 m over the carriageway and 2.3 m over the walkway shall be provided.

The width of the clearance profile shall be 10.0 m including the paved carriageway with a width of 8.0 m and walkways on both sides of the carriageway each 1.0 m wide.

Tab. 3: Cross section elements mined tunnel

Cross Section Element	Width
Walkway:	1.00 m
Hard shoulder:	0.50 m
Driving lane:	3.50 m
Driving lane:	3.50 m
Hard shoulder:	0.50 m
Walkway:	1.00 m
Overall:	10.00 m

1.4 Ventilation Concept

The ventilation system consists of a fully transversal ventilation system with four ventilation sections, including one intermediate ventilation cavern and ventilation tunnel. The length of the ventilation sections and cross sections of the ventilation ducts are given below.

Ventilation section length:	Section 1:	2059 m (from western portal)
	Section 2:	1484 m (from ventilation cavern)
	Section 3:	1186 m (from ventilation cavern)
	Section 4:	1762 m (from eastern portal)
Ventilation cross section:	Exhaust air duct:	10.6 m²
	Fresh air duct:	10.6 m²

1.5 Ventilation Cavern

The ventilation cavern is situated perpendicular to the main tunnel at km 3.631 south of the lay-by and with a length of approx. 30 m. The main characteristics of the ventilation cavern are as follows.

Cavern excavation height:	approx. 10.5 m
Cavern excavation width:	approx. 21.0 m
Cavern length:	approx. 30.0 m

1.6 Intermediate Ventilation & Construction Access Tunnel

An intermediate ventilation tunnel connects the ventilation cavern to the outside.

An approach road has to be constructed from the National Highway NH-1 to the construction adit portal. During construction of the main tunnel, the ventilation tunnel can be used as intermediate construction adit.

Tunnel length:	approx. 575 m
Gradient:	approx. 7 % inclined from portal towards cavern
Portal location:	Elevation: 2520 m Pos. Y: 521004.7 m UTM Pos. X: 3795199.3 m
Approach Road:	Length: approx. 876 m This approach road shall be constructed as a permanent road for maintenance purposes but it is not deemed to be a road for public use. Final configuration shall be as per concessionaire's detailed design subject to approval of Independent Engineer.

1.7 Separate Parallel Egress Tunnel and Cross Passages

The separate egress tunnel is parallel to the main tunnel with axis distances of approx. 25 m. The egress tunnel has a cross section suitable for emergency vehicle. Additionally the egress tunnel can be used for site traffic during construction of the main tunnel. The typical cross section is given in the drawings at Appendix B-I.

Egress tunnel length:	approx. 6.426 km
Clearance profile:	approx. 6.0 m width and 3.5 m height
Cross Passages:	At every 250 m, cross passages connect the main tunnel with the separate parallel egress tunnel.

Drivable cross passages connecting the egress tunnel with the main tunnel with interval of 750 m and at lay-bys on the left highway side (L.H.S.). The typical cross section of the drivable cross passage is equal to the egress tunnel.

Pedestrian cross passages connect the egress tunnel with the main tunnel with interval of 250 m. The typical cross section of the drivable cross passage is 3.5 m.

The length of the Cross Passage shall be as per concessionaire's detailed design.

The locations of the cross passages are given in the schematically in the drawing "Tunnel system and installation" in Appendix B-I.

1.8 Lay-by Cabinet

Lay-bys are located on both highway sides (B.H.S.) of the tunnel with interval of 750 m and a tentative length of 40 m.The detailed locations given in the drawing "Tunnel system and installation" in Appendix B-I.

1.9 Jet Fan Cabinet

Jet fan cabinets are located with an interval of approx. 400 to 600 m. The jet fan cabinets are situated at both highway sides (B.H.S.) with a length of approx. 30 m (three inner lining block segments). The detailed location is given in the drawing "Tunnel system and installation" in Appendix B-I.

1.10 Emergency Telephone & Fire Fighting Cabinet

Emergency telephone and fire fighting cabinets are located with an interval of 125 m. The emergency telephone cabinets are situated at the right highway side and the fire fighting cabinets are situated on the left highway side looking along tunnel meterage. The detailed location is given in the drawing "Tunnel system and installation" in Appendix B-I.

1..11 Mountable Median :-

A mountable median of 0.50m width shall be provided in the center of the carriageway to divide the two traffic lanes. Other features of the median shall be as per concessionaire's detailed design in accordance with relevant codes.

1.12. Final Interor Finish:-

The main traffic tunnel shall have a final interior finish of fire resistant material of suitable surface characteristics as per concessionaire's detailed design subject to approval by the Independent Engineer.

1.13 E&M Facilities

The main equipment consists of switchgears, transformers, power distribution boards, luminaries, safety facilities and associated equipment. Details are given in the relevant drawing in Appendix B-I. For the Z-Morh tunnel a high voltage facility with electrical feed from both sides shall be provided. Electrical substations are located at an interval of approximately 750 m in separated niches at each lay-by and

in the ventilation cavern near the middle of the tunnel.

Tunnel safety facilities such as CCTV-Cameras, traffic lights, variable message signs, traffic loop detectors, emergency communications, alarm push buttons, fire detection systems etc. shall be provided.

An alternative source of power –uninterruptible power supply (UPS) equipment shall be provided to maintain supplies of the essential equipment for duration of 80 minutes.

An adequate lighting system shall be provided. The light intensity of the entry and exit zones shall be adapted to the actual outside lighting level according to external conditions (day/night, regulation through measurement of luminous density).

A fire-extinguishing water pipe is installed at one highway side providing fresh water supply to the hydrants in case of an incident or maintenance measures.

The egress tunnel shall also be equipped with lighting and safety facilities such as CCTV-Cameras, fire detection system etc.

Tunnel service buildings are located close to both tunnel portals. The following equipment and installation, contained in the service buildings, has to be provided (list not complete):

- control room
- facilities for the electrical power supply: main electricity substation, HV switchroom, LV switchroom, UPS room, battery room, space for transformers;
- diesel generator, fuel tanks
- plant rooms for the tunnel maintenance and future requirements, stores;
- staff room and toilet facilities (if building is manned);

1.12 Drainage Concept and water proofing Concept

The tunnel shall be designed as dry and drained tunnel as per Concessionaire's detailed design.

The tunnel has two separate drainage systems, one to drain the ground water and the other to dewater the carriageway.

The tunnel high point is equal to the eastern portal which leads to a drainage to the lower western portal (Srinagar) with a gradient of 2.27 % over the whole tunnel length of approx. 6.5 km.

The tunnel vault is sealed against ground water inflows with a water proofing system. The water is drained along the bottom of the side walls with perforated drainage pipes.

1.13 Construction Concept

The construction of the main and the egress tunnel to include the cross passages to be carried out preferably b NATM method. However the concessionaire may adopt any internationally accepted method as per concessionaire's choice with prior approval of NHIDCL in consultation with Independent Engineer,

The final choice of the number of working faces/attack points rests with the concessionaire , however as guideline , the Z morh tunnel may be constructed from both tunnel portals and from the intermediate ventilation/.construction tunnel at tunnel km 3.631 . During winter season construction works from the eastern portal and from the ventilation/construction tunnel may not be feasible due to closure of the National HighwayNH-1 and approach roads.

The parallel egress tunnel in combination with the drivable crosss passages may be

used for the construction of the main tunnel.

The Z-Morh tunnel will be constructed from both tunnel portals and from the intermediate ventilation/construction tunnel at tunnel km 3.631. During winter season construction works from the eastern portal and from the ventilation/construction tunnelwill realistically not be feasible due to closure of the National Highway NH-1 and approach roads.

The parallel egress tunnel in combination with the drivable cross passages shall be used for the construction of the main tunnel.

The Z-Morh tunnel will be excavated by NATM method. The excavation will be carried out by drill and blast or tunnel excavator with a subdivision of the tunnel cross section into top heading, bench and invert. To increase the face stability the tunnel face excavation will be subdivided according to the geotechnical situation.

The typical cross section is separated into a top heading with a height of approximately 6 m, a bench excavation with a height of approximately 4 m and, if required, a invert excavation with a height of approximately 2.5 m.

1.14 Site Installation

Three site installations are considered. A main site installation in the area between Rezan and Gagangir close to the National Highway approx. 1.0 km from the western portal and two additional site installations in the direct vicinity of the eastern portal and the ventilation/construction tunnel. The availability of the land has to be evaluated.

1.15 Muck Dump Disposal

Muck dump disposal sites are available

in the project area. Upto six pockets have been proposed These disposal area are located between approx. km stone 69 (southwest from the western tunnel portal) and Km stone 90 on existing NH 1. Prior to any disposal of muck dump material, necessary permission shall be obtained from the local authorities(Civil administration/Forest/Wildlife) as per law. For estimation of capacity of the individual pockets the concessionaires are required to carry out reconnaissance in coordination with local NHIDCL authorities. Muck disposal and management shall be carried out in accordance with the Environmental Laws of State/Central Govt..

2. Project Facilities

Project facilities shall be constructed in conformity with Annex-I of Schedule-C.

3. Alignment Plan and Longitudinal Section

An alignment plan and vertical profile of the tunnel is given in the drawings at Appendix B-I.

4. Drainage System

The drainage system of the tunnel is described in 1.12 and in relevant drawings in Appendix B-I.

5. Other Features of Project Highway

5.1 Approaches to Western, Eastern and Intermediate portals :

As per concessionaires detailed design in accordance with the criteria described in sub paras of para 1 above and relevant IRC codes

As per Plan/section indicated in **Appendix B-I.**

5.2. Service Road

No Service Roads has been proposed in this reach of Project Highway.

5.3 Proposed Right of Way for approaches

The width of proposed ROW is varying due to site conditions. The details of proposed ROW are marked in the Plan provided in **Appendix B-I.**

5.4 Grade Separated Intersections

Grade separators to be constructed at the junctions to enable unhindered flow of traffic as required in this Project Highway.

5.5 Underpasses/PUP

Two PUPs are in the approach road to western portal of the Project Highway.

5.6 Major bridges

Two major bridge of approx 240 m and 110 m span will be required in this reach of the Project Highway, on the Western and Eastern Portal approach.Typical plan and section provided in Appendix-B-I

5.7 Minor bridges

One Minor Bridges of approx 30 m is required in this reach of the Project Highway, on the Western portal approach. Typical plan and section provided in Appendix-B-I

5.8 Culverts

18 culverts are required in the Project Highway.

5.9 ROB/RUB

No ROB/RUB is required in this reach of the Project Highway.

5.10 Entry /exit ramps

No Entry/exit ramps are required in this reach of the Project Highway.

5.11 Slope protection

Slope protection will be constructed depending upon actual site conditions as per concessionaire's detailed design. These may be required primarily along the western approach in this reach of the Project Highway.Typical details are attached in Appendix-B-I.

5.12 Utilities Provision of accommodating utilities shall be made both over as well as underground wherever required,

5.13 Rainwater Harvesting

As per Ministry of Environment and Forests Notification, New Delhi dated 14. 01.1997(as amended on 13.01.1998, 05.01.1999 & 6.11.2000), the construction of Rain water harvesting structure is mandatory in and around water crisis area, notified by the Central Ground water Board.

6. Specifications and Standards

Design Speed: 60 KMPH

The Project Highway shall be constructed in conformity with the Specifications and Standards specified in Annex-I of Schedule-D.

7. Note to Schedule B

7.1 Outside these minimum requirements spelt out in this schedule, the Concessionaire has design freedom. The detailed design must be done according to the latest international standards and practices of highway tunnels. The minimum functionality to be achieved for the Z Morh Tunnel shall be as per DPR included in the tender documents.

7.2 During the winter period, when the alternate route will be closed due to snowfall, the vehicle carrying hazardous materials and goods would have to be passed from Z-Morh Tunnel only for which Concessionaire is required to develop a Standard Operating Procedure (SOP) in consultation with IE. The ventilation and fire safety provisions for the Z-Morh tunnel must cater for this provision.

APPENDIX B-I

The following drawings are enclosed :

8482B_II-ZMT_GEN-02-12-00	General Layout Tunnel - Plan View
8482B_II-ZMT_GEN-03-12-00	General Layout Tunnel- Longitudinal Section
8482B_II-ZMT_GEOM-01-12-00	TYPICAL CROSS SECTION, CLEARANCE PROFILE AND INSTALLATIONS WITHOUT INVERT SLAB
8482B_II-ZMT_GEOM-02-12-00	TYPICAL CROSS SECTION, CLEARANCE PROFILE AND INSTALLATIONS WITH INVERT SLAB
8482B_II-ZMT_GEOM-19-12-00	TYPICAL CROSS SECTION, CUT & COVER TUNNEL GENERAL LAYOUT AND CLEARANCE PROFILE
8482B_II-ZMT_GEOM-05-12-00	TYPICAL CROSS SECTION, EGRESS TUNNEL
8482B_II-ZMT_GEN-05-12-00	Tunnel system and installations
8482B_II-ZMT_E&M-01-12-00	ELEMENTARY DIAGRAM OF SAFETY INSTALLATIONS

Annex - II

(SCHEDULE-B)

DESCRIPTION OF FOUR LANING

There is no built up areas/stretch for four-laning under the project.

SCHEDULE - C

(See Clause 2.1)

PROJECT FACILITIES

1.0 Project Facilities

The Contractor shall construct the Project Facilities in accordance with provisions of this Agreement, Such Project Facilities shall include:

a. Roadside furniture;

b. Street and Tunnel lighting;

c. Pedestrian facilities;

d. Landscaping and tree plantation in loop area;

e. Rest areas;

f. Truck lay-bys;

g. Bus-bays and bus shelters

h. Vehicular Underpasses and Pedestrian /Cattle crossings

i. Traffic aid posts;

j. Medical aid posts;

k. Vehicle rescue posts;

l. Telecom system; and

m. Highway traffic management system

n. Vehicles for the Authority

o. Training

2.0 Project Facilities for the Tunnel

Project Facilities forming part of Tunnel and to be completed as described in Annex-I of this Schedule-C.

Annex - I

(SCHEDULE-C)

PROJECT FACILITIES TO BE PROVIDED ALONGWITH THE TUNNEL

1.0 Project Facilities

The Contractor shall construct the Project Facilities at the portal locations in accordance with provisions of this Agreement, Such Project Facilities shall include:

a. Roadside furniture;

b. Pedestrian facilities;

c. Tree plantation;

d. Truck lay-bys;

e. Bus-bays and bus shelters; and

f. Others

(i) Highway Lighting

(ii) Highway Patrol

(iii) Ambulances

(iv) Cranes

(v) H.T.M.S.

(vi) Development of site for wayside amenities;

(vii) Traffic aid posts;

(viii) Medical aid posts;

(ix) Vehicle rescue posts

(x) Telecom system

(xi) Project Laboratory.

2.0 Description of Project Facilities

Each of the Project Facilities is briefly described below:

a. Road side Furniture

Road side furniture shall be provided in accordance with Manual of specifications and standards.

b. Street and Tunnel Lighting

Street and Tunnel lighting shall be provided in accordance with Manual of Specifications and Standards along the project highway.

c. Pedestrian Facilities

Pedestrian Facilities shall be provided in accordance with the Manual of Specifications and Standards.

d. Landscaping and Tree Plantation

Landscaping and free plantation shall be provided in accordance with the Manual of specifications and Standards.

e. Rest areas

Rest areas shall be provided in the vicinity of the Western and Eastern portals. They shall include toilets and drinking water facilities.

f. Truck Bays

Truck bays in the vicinity of both the portals shall be provided as indicated by the Authority Engineer / Local authorities during construction.

g. Bus-bays and Bus Shelter

h. Vehicular Underpasses and Pedestrian/Cattle Underpasses

One PUP is to be constructed on West portal approach road.

i. Traffic Aid Posts

Traffic Aid Posts shall be provided out side the Western and Eastern portals to facilitate smooth flow of traffic .

j. Medical Aid Posts

Medical aid posts shall be provided at the Service Buildings.

k. Vehicle rescue posts

Vehicle rescue posts shall be provided at the service building areas in accordance with Specifications and Standards.

l. Telecom system

Telecom posts(at Western and Eastern portal locations) shall be provided for convenience of the users of the Project.

m. Highway traffic management system

Shall be provided in accordance with specifications and Standard.

n. Vehicle for Authority.

The vehicles / passenger cars for the project shall be 4x4 SUVs, petrol or diesel driven having cylinder capacity of minimum 1500cc. The hard top SUVs shall be 4 W Drive either petrol or diesel driven and may be Innova/Toyota Fortuner/Jeep Compass/ Scorpio or equivalent. Two number of vehicles are to be provided by the

Contractor with front and rear AC for inspection and liasoning with other departments for 3500 Kms per month..

The Contractor shall provide within one month from the appointed date and shall be provided and maintained until issue of the provisional Certificate for the complete work

The vehicles shall be maintained in a smooth running condition. All expenses required for keeping the vehicles in smooth running condition such as fuel, lubrication oil and other consumables, necessary service and maintenance, drivers, repairs and replacement etc. are to be met by the Contractor. In the event of any vehicle being off the road for maintenance or on account of breakdown, the Contractor shall provide substitute vehicle(s) immediately. If the Contractor at any time fails to provide vehicle(s) or substitute vehicle(s) as specified above, an amount of Rs. 2500 per day or part thereof for each vehicle (that the Contractor failed to provide) shall be debited to the Contractor's account. Also the number of days for which the vehicle(s) were not provided shall not be included for payment.

o. Training

Training to officers of the Authority for 5 Days (excluding journey time) including all arrangements of Lodging, Food as per 3 star facilities. Training shall include 3 days classroom and 2 days site visit.

Training should be arranged in two batches within one year of Appointed Date, each batch will have 8 participants.

p. Other Facilities

As per the direction of Engineer-in-charge**.**

SCHEDULE-D

SPECIFICATIONS AND STANDARDS

1.0 The Concessionaire shall comply with the specifications and standards set forth in Annexure-I of this Schedule-D for construction of the Z Morh Tunnel.

Annex –-I

(SCHEDULE-D)

SPECIFICATIONS AND STANDARDS FOR CONSTRUCTION FOR TUNNEL

The Construction of Tunnel shall also conform to the Specifications laid down in **Appendix D-I and Appendix D-II.**

Where the codes, standards and specifications are silent on any aspect, the following standards in order of preference shall be adopted in consultation with the Engineer-IC, unless otherwise specified in this Schedule:

a. Urban Road Tunnels Recommendations to managers and operating bodies for design, management, operation and maintenance by PIARC Technical Committee.
b. Specifications for Tunneling, third edition issued by British Tunneling society 2010 with amendments and modifications
c. European Standards, Codes and Guidelines
d. I.E.C/ I.S. specifications
e. Other international Standard Specifications

1.0 Manual of Specifications and Standards to apply

Apart from the tunnel works, wherever road works are deemed to be executed, they shall conform to the following codes/provisions/publications:-

The Construction of road protection works shall conform to the Specifications laid down in **AppendixD-III.**

List of IRC Codes / Standards / Acts for Road/Bridge Works

IRC;	2	-1968	Route Marker Signs for National Highways (First Revision)
IRC:	3	-1983	Dimensions and weight of Road Design vehicles. (First Revision)
IRC:	5	-1998	Standard Specification & Code of Practice for Road Bridges, Section I – General Features of Design (7th Revision)
IRC:	6	-2000	Standard Specifications & Code of Practice for Road Bridges. Section II - Loads and Stresses (Fourth Revision)
IRC:	7	-1971	Recommended Practice for Numbering Bridges and Culverts (First Revision)
IRC:	8	-1980	Type Designs for Highway Kilometer Stones (Second Revision)
IRC:	9	-1972	Traffic Census on non urban roads (First Revision)
IRC:	10	-1961	Recommended Practice for Borrow pits for Road Embankments Constructed by Manual Operation
IRC:	15	-2002	Standard Specifications & Code of Practice for Construction of Concrete Roads (Third Revision)
IRC:	16	-1989	Specification for Priming of Base Course with Bituminous Primers (First Revision)
IRC:	18	-2000	Design Criteria for Pre-stressed Concrete Road Bridges (Post-

			Tensioned Concrete) (Third Revision)
IRC:	20	-1966	Recommended Practice for Bituminous Penetration Macadam (Full Grout)
IRC:	21	-2000	Standard Specifications and Code of Practice for Road Bridges. Section-Ill Cement Concrete (Plain and reinforced)(Third revision)
IRC:	22	-1986	Standard Specifications and Code of Practice for Road Bridges. Section-VI Composite Construction (First Revision).
IRC:	24	-2001	Standard Specifications and Code of Practice for Road Bridges. Section-V Steel Road Bridges (First Revision)
IRC:	26	-1967	Type Design for 200-Metre Stones
IRC:	30	-1968	Standard Letters and Numerals of Different Heights for Use on Highway Signs
IRC:	32	-1969	Standard for Vertical and Horizontal Clearances of Overhead Electric Power and Telecommunication Lines as Related to Roads
IRC:	33	-1969	Standard procedure for evaluation and condition surveys of stabilised soil roads.
IRC:	34	-1970	Recommendations for road construction in waterlogged area.
IRC:	35	-1997	Code of Practice for Road Markings (with Paints) (First Revision)
IRC:	36	-1970	Recommended Practice for Construction of Earth Embankments for Road Works
IRC:		37	-2001 Guidelines for the Design of Flexible Pavements (Second Revision)
IRC:	38	-1988	Guidelines for Design of Horizontal Curves for Highways and Design Tables (First Revision)
IRC:	40	-2002	Standard Specifications and Code of Practice for Road Bridges, Section IV-Brick, Stone and Block Masonry (Second Revision)
IRC:		41	-1997 Type designs for check barriers (First Revision)
IRC:	42	-1972	Performa for record of test values of locally available pavement construction materials.
IRC:		45	-1972 Recommendations for Estimating the Resistance of Soil below the Maximum Scour Level in the Design of Well Foundations of Bridges
IRC:		52	-2001 Recommendation about the alignment survey and geometric design of hill roads. (Second Revision)
IRC:		54	-1974 Vertical Clearances at Underpasses for Vehicular Traffic.
IRC:	56	-1974	Recommended Practice for Treatment of Embankment Slopes for Erosion Control
IRC:		57	-1974 Recommended Practice for Sealing of Joints in Concrete Pavements
IRC:	58	-2002	Guidelines for the design of plain jointed Rigid pavements for highways (Second Revision)
IRC:	59	-1976	Tentative Guidelines for the design of gap graded cement concrete mixes for road pavements.
IRC:		61	-1976 Tentative Guidelines for the construction of Cement Concrete Pavements in Hot Weather

IRC:	65	-1976	Recommended practice for traffic rotaries.
IRC:	67	-2001	Code of Practice for Road Signs (First Revision)
IRC:	69	-1977	Space Standards for Roads in Urban Areas
IRC:	70	-1977	Guidelines on regulations and control of mixed traffic in urban areas.
IRC:	71	-1977	Recommended practice for preparation of notations.
IRC:	73	-1980	Geometric Design Standards for Rural (Non-Urban) Highways
IRC:	75	-1979	Guidelines for the Design of High Embankments
IRC:	78	-2000	Standard Specifications and Code of Practice for Road Bridges. Section-VII Foundations & Sub-structure (Second Revision).
IRC:		79 -1981	Recommended Practice for Road Delineators
IRC:		80 -1981	Type Designs for Pick-up Bus Stops on Rural (i.e., Non-Urban) Highways
IRC:		81 -1997	Tentative Guidelines for Strengthening of Flexible Road Pavement Using Benkelman Beam Deflection Technique (First Revision)
IRC:	83	-1999	Standard Specifications and Code of Practice for Road Bridges. Section-IX Bearings, Part-I: Metallic Bearings.
IRC:	83	-1987	Standard Specifications and Code of Practice for Road Bridges, (Part-II) Section-IX Bearings, Part-II: Electrometric Bearings
IRC:	83	-2002	Standard Specifications and Code of Practice for Road Bridges, (Part-II) Section-IX Bearings, Part-IH: POT POT-CUM-PTFE, PIN AND~ METALLIC GUIDE BEARINGS
IRC:		84 -1983	Code of Practice for Curing of Cement Concrete Pavement
IRC:	85	-1983	Recommended practice for accelerated strength testing and evaluation of concrete for Road and Airfield Constructions.
IRC:		86 -1983	Geometric Design Standards for Urban Roads in Plains
IRC:		87 -1984	Guidelines for the design and erection of false work for road bridges.
IRC:	88	-1984	Recommended practice for lime fly ash stabilised soil base/ sub base in pavement construction.
IRC:	89	-1997	Guidelines for Design & Construction of River Training & Control Works for Road Bridges (First Revision)
IRC:	91	-1985	Tentative guidelines for construction of cement concrete pavement in cold weather.
IRC:		92 -1985	Guidelines for the Design of Interchanges in Urban Areas
IRC:		93 -1985	Guidelines on Design and Installation of Road Traffic Signals
IRC:	98	-1997	Guidelines on Accommodation of Underground Utility Services Along and Across Roads in Urban Area (First Revision)
IRC:	101	-1988	Guidelines for design of continuously reinforced concrete pavement with elastic joints.

IRC: 102	-1988	Traffic studies for planning bypasses around towns.
IRC: 103	-1988	Guidelines for Pedestrian Facilities
IRC: 104	-1988	Guidelines for Environmental impact assessment of Highway projects.
IRC: SP: 11	-1988	Handbook of Quality Control for Construction of Roads and Runways (Second Revision)
IRC: SP: 13	-2004	Guidelines for the Design of Small Bridges and Culverts.
IRC: SP: 14	-1973	A Manual for the Application of the Critical Path Method to Highway Project in India
IRC: SP: 15	-1996	Ribbon Development along Highway and its prevention.
IRC: SP: 16	-2004	Guidelines for surface evenness of Highways Pavements (First Revision)
IRC: SP: 17	-1977	Recommendations about Overlays on Cement Concrete Pavements
IRC: SP: 18	-1978	Manual for Highway Bridge Maintenance Inspection.
IRC:SP: 19	-2001	Manual for Survey, Investigation and Preparation of Road Projects (First Revision)
IRC: SP: 21	-1979	Landscaping of Road
IRC:SP: 22	-1980	Recommendations for the Sizes for each Type of Road Making Machinery to Cater to the General Demand of Road Works
IRC: SP: 23	-1983	Vertical Curves for Highways
IRC: SP: 25	-1984	Gopi and his Road Roller-Guidelines on Maintenance of Road Roller
IRC: SP: 27	-1984	Report Containing Recommendations of IRC Regional Workshops on Highway Safety
IRC: SP: 32	-1988	Road Safety for Children (5-12 Years Old)
IRC:SP: 33	-1989	Guidelines on Supplemental Measures for Design, Detailing & Durability of Important Bridge Structures.
IRC:SP: 34	-1989	General Guidelines about the Equipment for
IRC:SP: 35	-1990	Inspection and Maintenance of Bridge.
IRC:SP: 37	-1991	Guidelines for Evaluation of Load Carrying Capacity of Bridges
IRC:SP: 39	-1992	Guidelines on Bulk Bitumen Transportation & Storage Equipment
IRC:SP: 40	-1993	Guidelines on techniques for strengthening and rehabilitation of bridges.
IRC:SP: 41	-1994	Guidelines on Design of At-Grade Intersections in Rural & Urban Areas
IRC:SP: 42	-1994	Guidelines on Road Drainage
IRC:SP: 44	-1994	Highway Safety Code
IRC:SP: 46	-1997	Steel Fibre Reinforced Concrete For Pavements
IRC: SP: 47	-1998	Guidelines on Quality System for Road Bridges (Plain, Reinforced, Pre-stressed and Composite Concrete).
IRC:SP: 48	-1998	Hill Road Manual

IRC:SP: 50	-1999	Guidelines on Urban Drainage
IRC:SP: 51	-1999	Guidelines for Load Testing of Bridges
IRC:SP: 52	-1999	Bridge Inspector's Reference Manual
IRC: SP:	53 -2002	Guidelines on Use of Polymer and rubber Modified Bitumen in Road Construction (first Revision)
IRC: SP:	54 -1999	Project Preparation Manual for Bridges.
IRC:SP: 55	-2001	Guidelines for Safety in Construction Zones
IRC:SP: 56	-2000	Guidelines for Steel Pedestrian Bridges
IRC:SP: 57	-2001	Guidelines for Quality Systems for Road Construction
IRC:SP: 58	-2001	Guidelines for Use of Fly ash in Road Embankments
IRC:SP: 59	-2002	Guidelines for Use of Geo-textiles in Road Pavements and Associated Works
IRC:SP: 60	-2002	an Approach Document for Assessment of Remaining Life of Concrete Bridges

Ministry of Surface Transport Publications

MORT&H Pocketbook for Bridge Engineers, 2000 (First Revision)

MORT&H Pocketbook for Highway Engineers, 2002 (Second Revision)

MORT&H Specifications for Road and Bridge Works, 2001 (Fourth Revision)

MOST Standard Plans for 3.0 m Span Reinforced Cement Concrete Solid Slab Superstructure with and without Footpaths for Highways, 1991

MOST Standard Plans for Highways Bridges R.C.C. T-Beam & Slab Superstructure - Span from 10 m to 24 m with 12 m width, 1991

MOST Standard Plans for Highway Bridges PSC Girder and RC Slab Composite Superstructure for 30 m Span with and without Footpaths, 35 m Span with Footpaths and 40 m Span without Footpaths, 1991

MOST Standard Drawings for Road Bridges - R.C.C. Solid Slab Superstructure (15* & 30* SKEW Span 4.0 m to 10.0 m (with and without Footpaths), 1992

MOST Type Designs for Intersections on National Highways, 1992

MOST Computer Aided Design System for High Embankment Problems, 1993

MOST Addendum to Ministry's Technical Circulars and Directives on National Highways and Centrally Sponsored Road & Bridge Projects (Aug. 88 to Dec. 92), 1993

MOST Standard Drawing for Road Bridges R.C.C. Solid Slab Superstructure (22.5* SKEW) R.E. Span 4M to 10M (with and without Footpath), 1996

MOST Addendum to Ministry's Technical Circulars and Directives on National Highways and Centrally Sponsored Road & Bridge Projects (Jan. 93 to Dec. 94). 1996

Standard Plan for Highway Bridges - Prestressed Concrete Beam & RCC Slab Type Superstructure -Volume-II

MOST Addendum to Technical Circulars & Directives on National Highways & Centrally Sponsored Road &Bridge Works Projects (Jan. 1995 to Dec. 1997)

MOST Standard Plans for Single, Double and Triple Cell Box Culverts with and without Earth Cushion Manual for Safety in Road Design

MORT&H Manual for Construction and Supervision of Bituminous Works, 2001

BIS PUBLICATIONS

IS: 1944 Parts - 1 and 2 in one II) 1970		Code of Practice for lighting of Public thoroughfare: Parts Land 2 For Main and secondary (Part-I & roads (Group-A and B) (First revision) (Amendments No. 1 and 2) volume) (Amendments-2).
IS: 1944		Code of Practice for Lighting of Public Thoroughfares: Parts 5 Lighting for

(Part-V) 1981		Grade separated junctions, Bridges and Elevated roads (Group - D).
IS: 1944(Part-VI) 1981		Code of Practice for lighting of Public thoroughfare: Part-6 Lighting for Towns and city centres and areas of civic Importance (Group-E).
IS/ISO: 9000		Standards for quality management systems.
IS: 10748 - 1995		Hot rolled steel for welded tubes and pipes (First Revision)
NBC		National Building Code
Part-Ill, NBC:		Development Control rules and general building requirements.
Part-IV, NBC:		Fire Protection
Part-VI, NBC:		Structural Design
Part-VIII, NBC:		Building Services
Part-IX, NBC:		Plumbing Services

AppendixD-I

TECHNICAL SPECIFICATIONS FOR ROAD TUNNELS - CIVIL WORKS

Enclosed

AppendixD-II

ROAD TUNNELS – E &M, LIGHTING AND OTHER FIXED OPERATING EQUIPMENT(FOE)

Enclosed