

- (xxii) Summary of daily journal for incident lane closure, time and duration and length
- (xxiii) Traffic detour/diversion for construction - time and duration and number of available lanes
- (xxiv) Notes of meetings between the Concessionaire, the Independent Engineer and NHAJ highlighting critical decisions taken or agreements reached.

5.2 Prior to making the request for the issue of Completion Certificate, the Concessionaire shall submit to NHAJ the following documents, free of costs:

- (i) Three hardcopies and two copies in electronic form (two Compact Discs) of the "As Built" drawings of the Project Highway - detailed, accurately scaled and sequentially numbered, covering all relevant engineering features, which in relation to structures shall also include cross sections in each drawing;
- (ii) copies of all geo-technical and bore hole reports obtained by the Concessionaire, if any;
- (iii) Three hardcopies and two copies in electronic form (two Compact Discs) of the Operations and Maintenance Manual.

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SCHEDULE - I

OPERATION AND MAINTENANCE (O & M) REQUIREMENTS.

1.0 General

- a. The Concessionaire shall comply with the O&M Requirements set out in this Schedule. In doing so, the Concessionaire shall ensure that the Project Facilities are maintained to the standards and specifications as set out in the Design Requirements and DPR and shall also meet the other requirements, if any, set out in the Agreement.
- b. During the Implementation Period, the Concessionaire shall take appropriate measures to operate and maintain the existing 2 lane highway and ensure that the same remains open for uninterrupted, smooth and safe traffic flow at all times.
- c. In the design, planning and implementation of all works and functions associated with the operation and maintenance of the Project Facilities, the Concessionaire shall take all such actions and do all such things (including without limitation, organising itself, adopting measures and standards, executing procedures including inspection procedures, highway patrols, and engaging contractors, if any, agents and employees) in such manner, as will :
 - (i) Ensure the safety of personnel deployed on and users of the Project Facilities or part thereof;
 - (ii) Keep the Project Facilities from undue deterioration and wear;
 - (iii) Permit unimpaired performance of statutory duties and functions of any party in relation to the Project;
- d. During the Concession Period, the Concessionaire shall ensure that :
 - (i) The Project Facilities are kept free from undue deterioration and undue wear;
 - (ii) applicable and adequate safety measures are taken;
 - (iii) minimum delay is caused to users of the Project Facilities;
 - (iv) adverse effects on the environment and to the owners and occupiers of property and/or land in the vicinity of the Project Facilities, due to any of its actions, is minimised;
 - (v) Any situation which has arisen or likely to arise on account of any accident or other emergency is responded to as quickly as possible and its adverse effects controlled/minimised;

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- (vi) disturbance or damage or destruction to operations of the Project Facilities is control
- (vii) Members of the public are treated with due by its employees/ agents;
- (viii) Users are provided with adequate informati event or any other matter affecting the Project to control/minimise any adverse consequence by such event or matter,
- (ix) A complaint register to record grievances of any member of the public in relation to the operations and maintenance of the Project/Project Facilities is duly maintained;
- (x) Traffic data and data relating to the operation and maintenance of the Project Facilities are collected;
- (xi) All materials used in the maintenance, repair and replacement of any of the Project Facilities shall meet the Design Requirements/ standards prescribed in the DPR.
- (xii) The personnel assigned by the Concessionaire have the requisite qualifications and experience and are given the training necessary to enable the Concessionaire meet the O & M Requirements.

2.0 Operation and Maintenance Manual and O & M Plans

- a. Prior to the commencement of any construction activity, the Concessionaire, in consultation with the independent Engineer, shall finalise the O&M Plan - Implementation Period.
- b. As provided in Schedule H, prior to making application for the Completion certificate for the Project the Concessionaire shall finalise in consultation with the Independent Engineer:
 - (i) the O&M Manual
 - (ii) the O&M Plan for the first year of operations.
- c. Six weeks prior to the anniversary of COD each year, the Concessionaire shall submit an annual O&M Plan for the next year of operations.

3.0 Maintenance Requirements

3.1 Road Works

A. Maintenance Standards

- a. During Implementation Period, the Concessionaire shall maintain the existing 2 lane highway in traffic worthy conditions as per the Intervention levels 1 and 2 provided in Table I -1;

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Table I - 1
Intervention Levels
(Existing 2 lane highway during Implementation Period)

Sl.	Service Factor	Level 1 (Desirable)	Level 2 (Acceptable)
1.	Potholes / km (max) i) upto 75 mm deep ii) more than 75 mm deep	Nil Nil	5 nos. of size < 5 sq.m Nil
2.	Percent Cracking	Nil	No Unsealed cracks > 6mm wide on 95% Project Highway.
3.	Rut Depth not exceeding 10mm	Length not more than 10% of the Project Highway	Length upto 20% of Project Highway
4.	User Information	All road signs, Km post and road marking in good condition.	All road signs, Km post and road marking in good condition.
5.	Percentage Defective bridge Deck area and bump at approach	Nil	Nil
6.	Drainage (including shoulders)	No visible water pool within the ROW	No visible water pool within the ROW.
7.	Characteristic Deflection as per IRC: 81-1997	Upto 0.50 mm	Upto 0.80 mm

- b. During Operations Period, all the road works and pavements contained in the Project Facilities (including those in the ancillary facilities) shall be maintained in traffic-worthy condition as per the intervention levels 1 & 2 as provided in the Table I - 2 through the various maintenance activities set out later.

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**Table I - 2
Intervention Levels
Operations Period**

Sl.	Service Factor	Level 1 (Desirable)	Level 2 (Acceptable)
1.	Roughness by Bump Integrator (max. permissibility)	2000 mm/Km (Allowable Tolerance: +5%)	3000 mm/Km
2.	Potholes / km (max) i) Less than 75 mm deep ii) more than 75 mm deep	 Nil Nil	 2 nos. of size < 5 sq.m Nil
3.	Percent Cracking	Nil	No Unsealed cracks > 6mm wide on 95% Project Highway.
4.	Rut Depth not exceeding 10mm	Length not more than 5% of Project Highway	Up to 10% of length of Project Highway
5.	User Information	All road signs, Km post and road marking in good condition in 3 language formula.	All road signs, Km post and road marking in good condition in 3 language formula
6.	Percentage Defective bridge Deck area and bump at approach	Nil	Nil
7.	Camber i) Mainline ii) Service Road	(+ or -) 0.05% variation from the Camber as per Design Requirements (+ or -) 0.10% variation from the Camber as per Design Requirements	(+ or -) 0.15% variation from the Camber as per Design Requirements (+ or -) 0.20% variation from the Camber as per Design Requirements
8.	Drainage (including shoulders)	No visible water pool within the Project Highway	No visible water pool within the Project Highway
9.	Characteristic Deflection as per IRC: 81-1997	Upto 0.50 mm	Upto 0.80 mm



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c. The road roughness value shall be measured at least twice in a year by a properly calibrated Bump Integrator device before the monsoon and soon after the monsoon i.e in the months of June and November of every year. It shall be measured longitudinally or transversely along the line picking up worst surface characteristics, which include the rut areas and depressions etc. The Concessionaire shall ensure that at no point during the Operations Period the roughness in the road surface shall fall below than the prescribed acceptable roughness values given in Table I - 2.

d. The structural condition of the flexible pavement of the Project Highway shall be assessed every year by taking Benkelman Beam Deflections and working out characteristic deflections of homogeneous sections of the Project Highway as per IRC-81-1997. In the case of cement concrete pavement, joints shall be thoroughly inspected every year and the loss of sealing compounds made good.

e. Bridges and Other Structures: The Concessionaire shall maintain and carry out required repairs of the various elements of the structures in accordance with IRC-SP-35: 1990.

B. Maintenance Activities

1. Routine Maintenance

a. In order to ensure smooth and uninterrupted flow of traffic during normal operating conditions for all 24 hours of a day, routine maintenance of the Project Facilities shall include but not be limited to:

- (i) prompt repairs of potholes, electrical items, concrete joints, drains, line marking, lighting and signage; patching, re-grading of granular shoulders to designed standard, making good the deficiency of material on the shoulder, drain cleaning, repairing of signs, road marking, carrying out repairs to pavement crack by sealing;
- (ii) replacement of equipment/consumables, horticultural maintenance and repairs to equipment, pavements, bridges, structures and other civil works which are part of the Project/Project Facilities;
- (iii) the drainage system is at best when it is maintained properly as designed. For this purpose it is necessary that the drains keep their shape & scope in the designed manner during the lifetime. It is also necessary that drains retain their full cross-section, particularly during monsoon. These maintenance within the Project Site in accordance with Good Industry Practice;
- (iv) keeping the Project Site/Project Facilities in a clean, tidy and orderly condition free of litter and debris and taking all practical measures to prevent damage to the Project Facilities or any other property on or near the Project Site. Removing and disposing of in accordance with all Applicable Laws and Applicable Permits, all rubbish, debris, etc. including any and all equipment, supplies, materials and wastes

brought or produced by the Concessionaire/Contractor on the Project Site;

- (v) undertaking maintenance works in accordance with the O & M Plan and O&M Manual;
- (vi) preventing, with the assistance of concerned law enforcement agencies where necessary, any unauthorised entry to and exit from and any encroachments including any encroachments on the ROW /Project Site;
- (vii) taking all reasonable measures for the safety of all the workmen, material, supplies and equipment brought to the Project Site. Explosives, if any, shall be stored, transported and disposed of by the Concessionaire in accordance with Applicable Laws/Applicable Permits.

- b. For routine maintenance works, the Concessionaire shall generally follow the operational and performance criteria specified in the respective IRC/MoST standards and specifications for each of the performance indicators covered under pavement condition survey, roughness and BBD deflections. Where such criteria are not specified in the standards, the Concessionaire, for the purpose of routine maintenance shall set forth such criteria as to conform to good international standards and Good Industry Practice for sound pavement maintenance practices in consultation with the Independent Engineer.
- c. The Concessionaire shall regularly carry out the necessary preventive maintenance activities for the Project Facilities to ensure adherence to the Design Requirements/ specifications set out in the DPR throughout the Concession Period.
- d. Asset Management Deliverables And Tolerance Criteria: The Concessionaire shall strictly follow and adhere to the Asset Management Project Deliverables and Tolerance Criteria as given in Appendix: I-1.

2. Periodic Maintenance

- a. This activity shall be carried out at the end of 5th year, 10 year and 15th year from COD. Roadmarking as specified and other road side features shall be restored to meet the relevant standards to the satisfaction of the Independent Engineer.
- b. The periodic maintenance activities shall also include profile corrective course overlaid with periodic renewal of the wearing course of the road pavement with minimum 40 mm thick Asphaltic Concrete (AC).
- c. The paved shoulders shall also be treated in similar manner as applicable to the Mainline traffic lanes.
- d. The periodic renewal shall result in improvement of the riding quality, meeting road roughness value as at the time of COD.

- e. The granular hard shoulders shall be restored to the design cross section as per the DPR. This will involve application of additional material of same characteristics to bring it back to the required cross section.
- f. The rip-rap (stone pitching) shall be repaired wherever required.
- g. Road marking as specified and other road side features wherever required shall be restored to meet the relevant standard specified.

3. Emergency Maintenance

- a. The Emergency Response Protocol ("ERP") shall be developed by the Concessionaire in consultation with the local police, hospital/ambulance services, fire departments and other authorities/support personnel and the Independent Engineer. This shall be a part of the O&M Manual developed by the Concessionaire.
- b. The ERP shall set out steps to be taken and measures to be adopted by the Concessionaire in responding to dealing with Emergency including those situations related to vehicle accidents involving personal injuries or fatalities, property damage and force majeure as follows :
 - (i) In the event of an Emergency, the Concessionaire shall immediately carry out an inspection of the area affected by the Emergency. Where Emergency has necessitated closure of the Project Facilities or part thereof, the Concessionaire shall promptly carry out any repair works necessary to restore the Project Facilities to safe condition and in any event shall carry out such works before the affected area of the Project Facilities is re-opened to traffic.
 - (ii) The Concessionaire shall ensure that sufficient staff, plant, equipment and materials, including without limitation medical assistance are available to respond to Emergency within reasonable period at all times during the Concession Period.
 - (iii) The Concessionaire shall employ appropriate personnel as 'Duty Officers' and shall ensure that a Duty Officer is on duty at all times to respond to Emergency. A schedule of the telephone numbers of the Duty Officers shall be provided to NHA1, GoWB, Independent Engineer and the police so that contact can be made with a Duty Officer at any time. The Concessionaire shall ensure that Duty Officers are empowered to mobilise the necessary staff, plant, equipment and materials in response to information or instruction from NHA1, Independent Engineer, police or other emergency services in the event of Emergency. Procedures for liaison between Duty Officers and the police and other emergency services shall be developed as part of the Emergency Response Protocol.
- c. In case of Emergency, the Concessionaire shall
 - (i) carry out such emergency maintenance and repairs as may be required to repair the damages, if any, in consultation with the Independent

Engineer and where required under the supervision of the police in order to ensure that the Project Facilities are returned to normal operating standards as quickly as possible.

- (ii) follow the relevant operating procedure specified in the O&M Manual including the setting up of temporary traffic cones and lights as well as the removal of obstruction and debris expeditiously.
- (iii) Take all necessary measures to minimise pollution in accordance with the procedure specified in the O&M Plan/ Environmental Management Plan where liquid or soluble material spillage is involved.

4. Other Maintenance Works

a. **Illumination:** The Concessionaire shall maintain all illumination installations and related hardware in accordance with relevant clauses of IS: 1944 (Part I-V) 1981. The maintenance will normally involve cleaning of luminaries, replacement of burnt out luminaries, damaged illumination poles or brackets and repairs to transformers. Detailed maintenance procedure for the same shall be prepared in consultation with the Independent Engineer. In case of any breakdown, illumination shall be restored within 24 hours. The following standards shall broadly apply:

- (i) Illumination shall be maintained at the designed level throughout the Concession Period.
- (ii) All faults shall be repaired instantly and lighting restored and missing and damaged items shall be replaced instantly.
- (iii) Cleaning shall be done at regular intervals as specified in the O&M Manual to ensure that lighting is not below the specified standard.
- (iv) All installations shall be safeguarded against weathering and ageing effect by repainting and other preventive measures.
- (v) The servicing of stand-by power generation units shall be carried out in accordance with the manufacturer's instructions.
- (vi) All electricity charges shall be borne by the Concessionaire.

b. Highway Signs and Road Markings

- (i) All traffic signs and markings shall always be kept clean, visible and in correct alignment and position.
- (ii) Any damage to traffic signs which reduces or threatens to reduce full and clear visibility shall be rectified within twenty four (24) hours of its occurrence. If they are used as base for posters, the posters shall be removed and the signs shall be cleaned within 24 hours. Signs shall be washed using detergent solution followed by clean water to maintain their visibility and reflectivity unimpaired due to dust etc.

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- (iii) Any part of traffic signs damaged due to weathering, corrosion, vandalism or any other cause shall be replaced by the Concessionaire within seven days.
- (iv) Any mandatory sign including those for traffic safety, damaged beyond repair shall be replaced within 2 days and all other signs replaced within 3 days.
- (v) Appropriate devices for measuring the luminosity and reflectivity shall be used to check visibility and reflectivity of signs, delineators and markings. These shall be replaced by similar material if the reduction in the level of these two requirements falls below 50% of the original level.
- (vi) Line marking with thermo-plastic paint shall be carried out soon after any overlay/renewal coat is provided.

c. Landscaping

- (i) Maintenance of highway landscape shall include attending to repairs to elements of the landscape connected services as and when necessary, and replacement of irreparable items of work.
- (ii) Trees shall be maintained as per the guidelines in IRC : SP : 21 – 1979 and no indiscriminate felling of trees shall be resorted. The felling of trees shall be undertaken in consultation with the Independent Engineer and after obtaining due permission of the Forest Department, as applicable.
- (iii) While borrowing earth from roadside land for maintenance it shall be ensured that no earth is removed from around the roots of trees. All borrowing operation shall be as per IRC:10-1961.
- (iv) Maintenance operations include numbering and maintaining a register of all road side trees within the Right of way (ROW).
- (v) The routine maintenance such as trimming and shaping shall also cover those hedges and trees within the ROW, which affect the performance of the Project Highway.
 - ◆ Cutting or clearance to safeguard visibility at intersections, road bends, accesses and signs shall be carried out in such a way as to avoid permanent damage to hedges and trees. Hedges and trees overhanging carriageways shall be trimmed to provide a minimum headroom of 5.5 metres at all times;
 - ◆ Turning within the ROW shall be mown as to achieve a visual pattern in harmony with adjacent areas. Mowing shall be done when the height of cut reaches 150 mm.
 - ◆ The O&M Manual shall include a maintenance and management plan for trees, shrubs, turfing and hedges to sustain their development in a manner pleasing in appearance.

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d. Safety Barriers and Pedestrian Guard Rail

- (i) The Concrete Barrier (New Jersey Type) should require minimum maintenance except in case of damage due to impact.
- (ii) Concrete Posts and Steel Beam Guardrails will require repairs or replacement from low to medium impact damage caused by vehicles. Periodic painting will also be required.

e. PIU Complex, Maintenance Yard

- i. The Concessionaire shall carry out regular and periodic inspection and maintenance of the PIU Complex and Wayside Amenity. This shall include cleaning, repairs and maintenance of various parts of the building, services and facilities in a wholesome and hygienic condition at all time. This will involve replacement of irreparable items of work, cleaning & disinfecting of the water supply systems, inspection and maintenance of drainage/sanitation systems and illumination and electrical installations, landscaping, painting and shall be as per relevant clauses of NBC. Maintenance of pavement of parking lot with road markings shall also be carried out.
- ii. Maintenance of all furniture, furnishing items and equipment shall include periodic servicing, checking, replacement attending to all necessary repairs, replenishment of the consumables and other incidentals. Laboratory shall be maintained and operated efficiently to carry out requisite Tests till end of the concession period.

f. Truck Lay-Bys and Bus Bays

Maintenance of Truck Lay-Bys and Bus Bays shall include attending to repairs to the pavement, illumination, road signs and road marking, landscaping etc and also to various parts of the passenger shelter and other facilities like drinking water, toilets, litter bins etc as and when necessary. Replacement of irreparable items shall be done within 2 days.

g. Road Furniture

- i. Maintenance of road furniture like KM post, Hectometer stones, ROW pillar etc and attending to repairs to various parts of the road furniture and connected services as and when necessary, and replacement of irreparable items of work in reasonable period.
- ii. At the end of the Concession Period, all road furniture shall be handed over to NHA in useable and in working order.

h. Maintenance of Wayside amenity

Maintenance of Wayside amenity shall include attending to repairs to the pavement, kerb, channel, illumination, pavement/Lane markings, road signs, Landscaping etc. and other facilities like water supply, drainage, waste disposal

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system, CD structures, litter bins, toilets, etc. as and when necessary. Replacement of irreparable items shall be done in 2 days.

4.0 Safety and Traffic Management Operations

4.1 Safety

- a. The Concessionaire shall implement a Safety Management Programme in line with relevant MoST and IRC guidelines. This shall form a part of the O&M Manual.
- b. The Concessionaire shall nominate a traffic safety and control officer (Traffic Safety Officer) who shall be responsible for all arrangements necessary for traffic safety and control including the provision and operation of recovery vehicles for breakdown. The Traffic Safety Officer shall be available on call on a 24 hours' basis.
- c. In case of Emergency, the Concessionaire shall take prompt and effective steps to minimise the adverse effects to road users and shall act as requested or as directed by the Police and take all such safety precautions and measures to minimise the risk of personal injury.

4.2 Traffic Management

A. General

Traffic Management shall be undertaken during scheduled and unscheduled construction work and maintenance activities and also during any Emergency. Traffic Management during Emergency shall be undertaken in consultation with the Independent Engineer. The extent of the traffic management shall be assessed as per the site conditions.

B. Traffic Management Plan

- a. Before the commencement of construction activity, an overall traffic management plan and programme for a planned scheduled construction and/or operations and maintenance activity of the existing highway shall be prepared in consultation with the Independent Engineer. The plan shall be based on the following operational parameters:
 - (i) The existing two lane carriageway shall be utilised to the maximum extent possible;
 - (ii) At major intersections all traffic turning movements will be allowed at all times;
 - (iii) Lane closure adopted for diverting the main traffic during Construction Works shall be governed by the approved programme of construction.
 - (iv) Existing 2 lane traffic may be reduced to a one lane one-way operation for a short duration of a maximum of 4 hours in 24 hours provided it is adequately controlled by signing and flag men;

- (v) The activity of renewal or strengthening shall not be carried out in a continuous length of more than 2 km in rural section and 1.0 km in urban section and shall not be closer than 2 km and 1 km in between respectively;
- (vi) Lane closure in short lengths less than or equal to 500 metres for carrying out routine maintenance activities shall not be more than for a continuous period of 12 hours.
- (vii) Traffic speed through the construction zone shall be reduced to 40 km/hr by designed speed bumps and warning signs.
- (viii) For the safety of construction workers as well as the traffic, a physical separation of 1.5 m between work area and the highway traffic shall be maintained by installing orange coloured drums; (Painted rocks/stones are not permitted).
- (ix) All construction traffic shall enter and exit the construction site at designated and manually controlled entrances;
- (x) All short (4 months and less and during dry season) and long (more than 4 months and during monsoon season) term temporary road detours (diversions) shall be designed and submitted for approval by the Independent Engineer prior to construction;
- (xi) Adequate advance warning and information signs shall be incorporated in the traffic management plan in accordance with IRC/MoST standards and specifications. ✓

- b. The Concessionaire shall provide, erect, maintain, reposition, cover, uncover and remove traffic signs as required in respect of works on the Project Site (including without limitation any diversions). Adequate safety during night time shall be ensured by providing mobile emergency lighting units with illuminated warning signs at important locations finalised in consultation with the Independent Engineer. ✓

C. Corridor Control Plan

- a. Regular 24 hours patrol/surveillance of the ROW in respect of the Project/Project Facilities shall be required to monitor, report and take actions against activities, such as, encroachments, unauthorised construction of road or entrance connections, structures, interference with drainage system etc, within 150 m of the highway corridor. ✓
- b. Surveillance shall also include traffic operation and management of accidents/ other incidents.
- c. The Corridor Control Plan shall be developed in consultation with local administrative authorities and the Independent Engineer and shall form a part of the O & M Manual.

5.0 Inspections & Frequency

The Concessionaire shall plan inspection programme for the Project Facilities for its smooth operations as follows:

5.1 Visual Inspection

Visual Inspections are broad general inspections carried out frequently by highway/ bridge maintenance engineers having adequate knowledge of road structures. The purpose of visual inspection is to report the obstacles to traffic and fairly obvious deficiencies, which could lead to accidents or maintenance problems. Such inspections should be frequent. The visual inspection may be carried out by visual assessment with careful observation of the specific object/item of the Project Facilities for identification and for quantification of the deficiencies or damages of the Project Facilities.

5.2 Close Inspection

Close inspections may be visual and/or by standard instrumental aids for assessment of defects / deficiencies of Project Highway with careful observation of specific element(s). The close inspection may be daily / periodic but it is more intensive and would require detailed examination of element of the Project Highway. It should cover all the aspects of the specific element of Project Highway against a checklist. The frequency of close inspections would depend upon the nature of structure of Project Highway. This inspection is to be carried out by the Highway/Bridge Engineer having good knowledge of road structures with theoretical background to analysis the nature, and extent of defects/deficiencies, suggest suitable remedial measures to rectify/remedy them and quantify repair work.

5.3 Thorough Inspection

A thorough inspection is comprehensive and detailed for assessment of defects/deficiencies of the Project Highway by visual inspection or with aid of standard equipment and non-destructive testing where necessary. Such an inspection is to be carried out on the basis of comprehensive checklist of items related to the materials, condition and situation of the structure etc. The checklist is to be prepared meticulously well in advance of inspection. The thorough inspection should be undertaken during the most critical weather condition, which is generally rainy season in India. During rainy season the Road /bridge structures are under severe condition thereby the damage and deficiencies of the Project Highway are more pronounced. The inspection carried out during the said period offer the most critical evaluation of the performance of the structure. The thorough inspections would be of critical importance for bridges, culverts and drainage structures, as well as road pavements during adverse weather condition of monsoon period.

5.4 Frequency of Inspections

The type of inspection and related frequency of various items of Project Highway and its facilities have been indicated in the Table I- 3 below. The frequency of inspection can be suitably revised in consultation with the

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Independent Engineer if the situation so warrants. The objective and minimum frequency of inspections under normal circumstances shall be as under. If the exigencies arise, the interval of inspection shall be reduced.

Table I-3
Objective and Frequency of Inspection

Object	Item	Daily	Monthly	Quarterly	Before and after rainy season
Riding Surface	Pavement	+	7		●
	Expansion joints	+	7		●
Median	Kerb	+	7		●
Side Slopes	Shape	+		7	●
	Turfing		+		●
	Pitching & masonry		+		●
	Retaining wall		7		●
Drainage	Side/Toe drain	◇	7		
	Gullies and catch pits	◇	7		
Bridges	Superstructure			7	●
	Substructure			7	●
	Head wing walls and aprons			7	●
	Painting				●
	Hand rail		7	●	
Culverts/ Underpasses					●
Safety Barrier		+		7	●
Traffic operation facilities	Signs		●	7	
	Marking	+	7	●	
	Delineator	+	7	●	
	Lighting	+		7	
Other facilities	Vegetation landscaping	+	7	●	
	Truck layby	+	7		
	Way side amenities	+	7		
Traffic Conditions		+	●	7	
Encroachments		+	●		

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 - ◇
- Visual inspection
Close inspection
Thorough inspection
Visual inspection during rainy season only

6. Reporting Requirements

The reporting and information that generally need to be provided by the Concessionaire are given below. The Requirements given below are indicative of the type of information to be provided. The format of such reports, recording requirements, software standards and number of copies required would be finalised in consultation with the Independent Engineer. All reports and records shall be in the English language.

6.1 Inspection Reports and Remedial Measures

The periodicity of inspections for maintenance activities by the Concessionaire shall be set out in the O&M Manual and regular reports on the same shall be sent to the Independent Engineer. Where required, the Concessionaire shall carry out any maintenance, repair or rehabilitation works found necessary as a result of such inspections.

6.2 Monthly O & M Report

During the Concession Period, within 5 days of the end of each calendar month or part thereof, the Concessionaire shall provide to the Independent Engineer/ NHA1 a monthly report (Monthly O&M Report) which shall contain the following minimum information:

- (i) Inspections undertaken by the Concessionaire during the month and action taken/ proposed thereafter;
- (ii) Details of all reports submitted to the Independent Engineer during the month
- (iii) O & M inspection compliance report
- (iv) Maintenance activities undertaken during the month ended,
- (v) Details of any Emergency and action taken

The format of the O&M Report would be finalised in consultation with the Independent Engineer.

7.0 O & M Manual

- a. The O&M Manual prepared by the Concessionaire in consultation with the Independent Engineer shall set out the operations and maintenance standards and details of the operations and maintenance activities to be undertaken during the Concession Period, so that the Project Facilities shall at all times conform to the Design Requirements/ specifications set out in the DPR.
- b. The O&M Manual should have separate sections for operations and maintenance.
- c. The Manual should include without limitation the following aspects:
 - (i) Organisation structure with responsibilities of key personnel;
 - (ii) Traffic Management Plan including the Corridor Control Plan;
 - (iii) Safety Management Programme including the Emergency Response Protocol;

- (iv) Inspection Procedures;
- (v) Maintenance Intervention Levels;
- (vi) Asset Management Project Deliverables and Tolerance Criteria;
- (vii) Environment Management Plan;
- (viii) Maintenance Programme;
- (ix) Management information system;
- (x) Report Formats.

8.0 Miscellaneous

a. Inventory

- (i) The Concessionaire shall maintain an inventory of all items comprised in the Project Facilities (the "Inventory"), in a format to be developed in consultation with the Independent Engineer.
- (ii) Throughout the Concession Period the Concessionaire shall keep the Inventory updated to take account of works carried out on and other changes made to the Project Facilities.
- (iii) A copy of the Inventory shall be submitted by the Concessionaire to the Independent Engineer within thirty (30) days of receipt of a request for the same.

b. Abnormal Indivisible Load Routing (Oversize and Overweight)

- (i) The Concessionaire shall take all reasonable steps to facilitate the transit of Abnormal Indivisible Loads along the Project Facilities.
- (ii) The Concessionaire shall develop a procedure for handling Abnormal Indivisible Loads in consultation with local authorities and the Independent Engineer.

c. Equipment belonging to third parties

The Concessionaire shall be responsible for the installation, operation, maintenance and removal of any equipment belonging to third parties.



Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
1. Pavement including Shoulders and Slopes Paved Lanes and Paved Shoulders (Bituminous)	Smooth Safe Adequate skid Resistance Durable	95 Roughness Under 3000 mm/km	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> • no ruts > 10 mm • no unsealed cracks larger than 6 mm on 95% of road length • no potholes > 5.00 sq.cm area and 2.5 cm deep • no shoving > 7 spot per km • bleeding, raveling < 3% of total area of pavement • no edge deformation > 10 mm/km • no shallow depressions > 5 sqcm/km • patching - even, and < 12 mm higher or lower • roughness not greater than 3300 mm/km • no false ditch (shoulder build up causes water to drain back onto the pavement) <p>Timeliness Requirement :</p> <ul style="list-style-type: none"> • potholes causing a threat to safety will be responded to immediately, others within 2 days of notification • bleeding surface to be treated immediately within 1 day • renewals improving roughness within one month of notification
Unpaved shoulders	Safe Smooth (no standing of water) Adequate width	90	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> • < 10% drop off > 25 mm (linear measure) • No false ditch (shoulder build up cause water to drain back into the pavement) • no scouring or deformation. <p>Timeliness Requirement :</p> <ul style="list-style-type: none"> • Shall be corrected within two days, if shoulder are deformed or scoured and lower than 25 mm from the adjacent carriageway.

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NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Asset Criteria	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
2. Roadside			
Grass / Turf	Neat Attractive Sight distance Present	90	<ul style="list-style-type: none"> Tolerance's Criteria : <ul style="list-style-type: none"> grass height 12" or less sight distance is clear in intersections, passing zones, curves etc. neat around crash barrier, headwalls, paved ditches adequate cover Timeliness Requirement : <ul style="list-style-type: none"> respond immediately upon notification roadkill promptly and properly disposed off within 4 hours Tolerance's Criteria : <ul style="list-style-type: none"> roadside appears neat and clean Tolerance's Criteria : <ul style="list-style-type: none"> overall appearance is nearly maintained Tolerance's Criteria : <ul style="list-style-type: none"> minimal erosion, and no erosion showing a pattern that will endanger the stability of the slope Tolerance's Criteria : <ul style="list-style-type: none"> the slope of pitching surface should be as per design slope, slight variation shall be repaired within two days Tolerance's Criteria : <ul style="list-style-type: none"> inform traffic police and remove blockage, if required construct temporary diversion
Debris, Trees and Roadkill	Roadway free of obstruction	100	
Litter/Malba	Neat Attractive	90	
Landscaping	Neat Attractive	80	
Slopes	Stable No erosion	100	
Slope Pitching	No disturbed pitching	95	
Road blockade	No blockade	100	

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NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the independent Engineer.

Asset Management Project Deliverables and Tolerance

Appendix I-1

Asset Criteria	Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
3. Drainage	Cross Pipes	Structural sound Open Drains Joints intact Adequate capacity No erosion	95	Tolerance/s Criteria : <ul style="list-style-type: none"> ▪ <10% deteriorated barrel ▪ >90% diameter open ▪ drains properly ▪ joints intact ▪ no evidence of flooding ▪ minimal erosion at ends ▪ end protection intact ▪ no dip in road over pipe indicating structural problems
	Box Culverts/ Slab Culverts	Structurally sound Open Drains Joints intact Adequate capacity No erosion	95	Tolerance/s Criteria : <ul style="list-style-type: none"> ▪ <10% deteriorated barrel ▪ >90% diameter open ▪ drains ▪ joints intact ▪ no evidence of flooding ▪ minimal erosion at ends ▪ end protection intact ▪ no dip in road over pipe indicating structural problems
	Ditches, Paved/ lined drains	Aligned Structurally sound Clean	90	Tolerance/s Criteria : <ul style="list-style-type: none"> ▪ no undermining or undercut requiring action ▪ <25% spalled ▪ no obstruction to flow of water that requires action

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NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Appendix I-1

Asset Management Project Deliverables and Tolerance Criteria

Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
Ditches Unpaved/Unlined drains	Drain Functional	90	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> • grade drains • minimal erosion • outfalls functional • no obstruction to flow of water that requires action • no siltation
Storm Drains Drop Inlets	Open No flooding No settlement	90	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> • >90% open • no evidence of flooding
Kerb and Gutter	In line Clean/drain Sound No undermining	95	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> • minimal obstruction • no unsealed cracks >6 mm • no spalling > 1/4" deep • <25% of surface spalled
Erosion or Scour in upstream/downstream	No Erosion due to scour	100	<p>Erosion not to be allowed to continue</p>
Timeliness :	For all the above cases repair or reconstruction shall be attended and completed within a week or as instructed by Independent Engineer		

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NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Asset Management Project Deliverables and Tolerance

Appendix I-1

Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
4. Bridges/Culverts			
Overall Bridge	Smooth ride Strong Aesthetic Wide enough Available at legal limit	% scour critical - 0 % posted - 0	<ul style="list-style-type: none"> Tolerance's Criteria : no graffiti on structures Timeliness Required : structurally critical conditions must be notified immediately and repaired within a time frame as decided by Independent Engineer
Traffic Safety Features (Railings, Parapet, Walls drainage spouts etc.)	Present Functional		<ul style="list-style-type: none"> Tolerance's Criteria : functional Timeliness Required : repair or replace badly damaged traffic safety features within 1-2 days damaged but functional traffic safety features will be replaced within a week
Deck	Smooth Strong Wide enough Drains properly		<ul style="list-style-type: none"> Tolerance's Criteria : minimal spalls, cracks or scaling clean deck drains/scuppers are clean and functional
Super-structure	Strong Clearance Aesthetic		<ul style="list-style-type: none"> Tolerance's Criteria : no loss of section or cracks paint in good shape no spalling proper vertical clearance proper opening

B. S. I.

NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
Substructure	Strong Looks good Safe from scour Stable from settlement All components functional		Tolerances Criteria : • no spalls, cracks, scaling • bearing assemblies functional • abutment seats clean and sound • pier seats clean and sound • bearings clean, sound and lubricated periodically
Joints	Smooth does not leak		Tolerances Criteria : • joints no loose • joint are sealed
Structural Culverts			Tolerances Criteria : • < 10% deteriorated barrel • > 90% diameter open • minimal erosion at ends • correct grade • joints intact • no evidence of flooding • end protection intact • no dip in road over pipe indicating structural problems
Retaining Walls	Stable strong		Tolerances Criteria : • no spalling or cracks • weep holes open • no indication of settlement or rotation

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NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Appendix I-1

Asset Management Project Deliverables and Tolerance

Asset Criteria	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
5. Road Signs and Road Furniture			
Signs (includes overhead signs)	Good reflectivity Visible Undamaged Placed according to standards	100 - regulatory 90 - other	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> 100% clear of obstruction 95% surface free of damage placement works for motorist at posted speed <p>Timeliness Required :</p> <ul style="list-style-type: none"> replace warning and regulatory signs within 24 hours of notification
Pavement Markings	Bright visible	95	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> 100% clear of debris <5% of surface damaged placement meets industry standards
Object markers and Delineators	Reflective Present in right location	90	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> 90% reflective properly mounted

NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
6. Other Facilities Street Lighting	Functional Wiring Undamaged Painting	98	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> ▪ 98% lights functional ▪ 100% clear obstruction <p>Timeliness Required :</p> <p>Remedy the reason of non-functional of lights so that lighting is restored within 8 hours</p> <p>Replace any damaged poles, switch box or transformer within 24 hours or reasonable time decided by Independent Engineer</p>
Truck Layby	Functional Building Toilet Water Supply Drainage Pavement Lighting Landscaping	95	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> ▪ Water supply, Drainage & Lighting always shall be functional. ▪ 95% lights functional in the building or outside the building ▪ 95% of total time the water supply and drainage functional ▪ 98% of total paved area are crack free/pothole free. ▪ 98% of herbs and channel are in perfect condition. ▪ Building to be repainted every year. <p>Timeliness :</p> <p>Any rectification or replacement or repair shall be done within one day or as decided by Independent Engineer</p>

NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
Project Implementation Unit Office (PIU) including Laboratory Building Toilet Water Supply Drainage Lighting Pavement Equipment Furniture Furnishing Item Testing equipment and Apparatus Airconditioning and heating Emergency Generator	Functional Clean Hygienic Structures Efficient Dry Comfortable	95	<p>Tolerances Criteria :</p> <ul style="list-style-type: none"> • 100% functional of PIU Office and Laboratory • 98% functional of Laboratory testing equipment and apparatus • 100% testing facility of any type of tests • 98% lights functional, water supply and drainage functional • 98% time equipment (like A.C., Water Cooler, Heater) functional • 100% furnishing item to be refinished once in every two years. • 100% furniture functional • Total buildings to be painted every year. <p>Timeliness : Repair/replace/refinish within 24 hours of notification of independent Engineer</p>

NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the independent Engineer.

SCHEDULE J

Sl. No.	Annuity Payment Date	Annuity Amount (Rs. Million)
1	9-May-05	294.81
2	9-Nov-05	294.81
3	9-May-06	294.81
4	9-Nov-06	294.81
5	9-May-07	294.81
6	9-Nov-07	294.81
7	9-May-08	294.81
8	9-Nov-08	294.81
9	9-May-09	294.81
10	9-Nov-09	294.81
11	9-May-10	294.81
12	9-Nov-10	294.81
13	9-May-11	294.81
14	9-Nov-11	294.81
15	9-May-12	294.81
16	9-Nov-12	294.81
17	9-May-13	294.81
18	9-Nov-13	294.81
19	9-May-14	294.81
20	9-Nov-14	294.81
21	9-May-15	294.81
22	9-Nov-15	294.81
23	9-May-16	294.81
24	9-Nov-16	294.81
25	9-May-17	294.81
26	9-Nov-17	294.81
27	9-May-18	294.81
28	9-Nov-18	294.81
29	9-May-19	294.81
30	9-Nov-19	294.81

B.S.H.



Appendix 1-1

Asset Management Project Deliverables and Tolerance Criteria

Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
Drainage			Tolerance/s Criteria : <ul style="list-style-type: none"> • vegetation clean • protection present and functional • no embankment erosion • no channel drift

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NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

SCHEDULE K

Cashflow Projections


1. **"Initial Investment"** means an amount of Rs.4385 million, and is considered as a cash outflow as on the DID.
2. **"Annuity Amount"** means Rs. 294.81 million.
3. **"Internal Rate of Return"** means the annualised pre-tax internal rate of return of the Projected Net Cashflows.
4. **"Discounted Value of Future Net Cashflows"** on any date means an amount, the payment of which, on that date would result in the Concessionaire attaining the Internal Rate of Return.



Cashflow Projections	DID					
	1 9-Aug-03	2 9-May-05	3 9-May-06	4 9-Nov-06	5 9-May-07	6 9-Nov-07
end of semi-annual period from SPCD						
end of month						
Initial Investment (1)	4,385					
Annuity Amount (2)	294.81	294.81	294.81	294.81	294.81	294.81
Less:						
Projected Routine Maintenance Cost (3)	10.89	11.21	11.55	11.90	12.25	12.62
Projected Cost of Periodic Maintenance (4)						
Projected Total O&M Expenses (5) = (3)+(4)	10.89	11.21	11.55	11.90	12.25	12.62
Projected Net Cashflows (6) = (2)-(1)-(5)	(4,385)	283.92	283.26	282.91	282.56	282.19
Internal Rate of Return = IRR of (6)	7.20%					

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Cashflow Projections		7	8	9	10	11	12	13	14
end of semi-annual period from SPCD		9-May-08	9-Nov-08	9-May-09	9-Nov-09	9-May-10	9-Nov-10	9-May-11	9-Nov-11
end of month									
Initial Investment (1)		294.81	294.81	294.81	294.81	294.81	294.81	294.81	294.81
Annuity Amount (2)									
Less:									
Projected Routine Maintenance Cost (3)		13.00	13.39	13.79	14.20	14.63	15.07	15.52	15.99
Projected Cost of Periodic Maintenance (4)		-	-	-	159.54	-	-	-	-
Projected Total O&M Expenses (5) = (3)+(4)		13.00	13.39	13.79	173.75	14.63	15.07	15.52	15.99
Projected Net Cashflows (6) = (2)-(1)-(5)		281.81	281.42	281.02	121.06	280.18	279.74	279.29	278.82
Internal Rate of Return = IRR of (6)									



 ABS

Cashflow Projections

end of semi-annual period from SPCD
end of month

	15 9-May-12	16 9-Nov-12	17 9-May-13	18 9-Nov-13	19 9-May-14	20 9-Nov-14	21 9-May-15	22 9-Nov-15
Initial Investment (1)	294.81	294.81	294.81	294.81	294.81	294.81	294.81	294.81
Annuity Amount (2)								
Less:								
Projected Routine Maintenance Cost (3)	16.47	16.96	17.47	17.99	18.53	19.09	19.66	20.25
Projected Cost of Periodic Maintenance (4)						213.54		
Projected Total O&M Expenses (5) = (3)+(4)	16.47	16.96	17.47	17.99	18.53	232.63	19.66	20.25
Projected Net Cashflows (6) = (2)-(1)-(5)	278.34	277.85	277.34	276.82	276.28	62.18	275.15	274.56

Internal Rate of Return = IRR of (6)

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15/12

Appendix I-1

Asset Management Project Deliverables and Tolerance Criteria

Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
Kilometre stone/5 km stone	Present Painted in 3 language formula	100	<p>Tolerance/s Criteria :</p> <ul style="list-style-type: none"> 100% clear of any obstruction <5% of surface damaged placement meets IRC standards
Hectameter stone	Present Painted	95	<p>Tolerance/s Criteria :</p> <ul style="list-style-type: none"> properly secured <10% of surface damaged placement meets IRC standards
Bench marks reference pillars	Present Referenced Painted	100	<p>Tolerance/s Criteria :</p> <ul style="list-style-type: none"> 100% clear of any obstruction As per industry standards 100% accessible
Regulatory and Informatory Sign Board	Present Referenced Painted	100	<p>Tolerance/s Criteria :</p> <ul style="list-style-type: none"> 100% clear of any obstruction As per industry standards 10% damaged
Painting & Printing letters on road signs km stone, 200 m stones and 5 km stone	Painted to match with existing	100	<p>Tolerance/s Criteria :</p> <ul style="list-style-type: none"> 100% clear of any obstruction to match with the existing

NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

- (iv) Condition Survey of the existing 2 lane road, bridges and other structures and rehabilitation measures to be adopted for the same.

2.2 Implementation Period - Construction

- a. The Independent Engineer would monitor, in accordance with Good Industry Practice, the progress in implementation and ensure compliance with the Construction Requirements. For this purpose the Independent Engineer shall undertake, inter alia, the following activities and where appropriate make suitable suggestions:
 - (i) monitor the progress in implementation of the Project based on the Implementation Plan submitted by the Concessionaire;
 - (ii) review and approve the material testing and mix designs results and recommend special tests, where required, for materials and/or completed works, require removal/substitution of unsuitable materials and /or works and report deficiencies in respect of the same to NHAI;
 - (iii) review and monitor the quality assurance and quality control procedures followed by the Concessionaire;
 - (iv) review the manpower and equipment deployed by the Concessionaire;
 - (v) monitor the Construction Works for conformity with the DPR/ Project Requirements (including rehabilitation of the existing road and bridge structures);
 - (vi) verify the 'As Built' drawings for each component of the works prepared by the Concessionaire and require removal of deficiencies found therein;
 - (vii) review the safety and traffic management measures implemented;
 - (viii) review and ascertain the cost variation arising as a result of Change in Law and/ or Change in Scope and determine the Additional Cost;
 - (ix) require, monitor and review the results of Tests to be carried out by the Concessionaire in accordance with the Construction Requirements and/ or O&M Requirements;
 - (x) require suspension of whole or any part of the Construction Works if in its reasonable opinion the same does not conform to the Construction Requirements;
 - (xi) issue Provisional Certificate and/ or Completion Certificate in accordance with the applicable provisions of the Agreement; and
 - (xii) review and assist in finalisation of the O&M Manual and first annual O&M Plan prepared by the Concessionaire.

Appendix 1-1
Asset Management Project Deliverables and Tolerance Criteria

Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
1. Pavement including Shoulders and Slopes			
Paved Lanes and Paved Shoulders (Bituminous)	Smooth Safe Adequate skid Resistance Durable	95 Roughness Under 3000 mm/km	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> no ruts > 10 mm no unsealed cracks larger than 6 mm on 55% of road length no potholes > 5.00 sq.cm area and 2.5 cm deep no shoving > 7 spot per km bleeding, raveling < 3% of total area of pavement no edge deformation > 10 mm/km no shallow depressions > 5 sqcm/km patching - even, and < 12 mm higher or lower roughness not greater than 3300 mm/km no false ditch (shoulder build up causes water to drain back onto the pavement) <p>Timeliness Requirement :</p> <ul style="list-style-type: none"> potholes causing a threat to safety will be responded to immediately, others within 2 days of notification bleeding surface to be treated immediately within 1 day renewals improving roughness within one months of notification
Unpaved shoulders	Safe Smooth (no standing of water) Adequate width	90	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> < 10% drop off > 25 mm (linear measure) No false ditch (shoulder build up cause water to drain back into the pavement) no scouring or deformation. <p>Timeliness Requirement :</p> <p>Shall be corrected within two days, if shoulder are deformed or scoured and lower than 25 mm from the adjacent carriageway.</p>

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NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Cashflow Projections		23	24	25	26	27	28	29	30
end of semi-annual period from SPCD		9-May-16	9-Nov-16	9-May-17	9-Nov-17	9-May-18	9-Nov-18	9-May-19	9-Nov-19
end of month									
Initial Investment (1)		294.81	294.81	294.81	294.81	294.81	294.81	294.81	294.81
Annuity Amount (2)									
Less:									
Projected Routine Maintenance Cost (3)		20.86	21.49	22.13	22.79	23.48	24.18	24.91	25.65
Projected Cost of Periodic Maintenance (4)		-	-	-	-	-	-	-	285.81
Projected Total O&M Expenses (5) = (3)+(4)		20.86	21.49	22.13	22.79	23.48	24.18	24.91	311.46
Projected Net Cashflows (6) = (2)-(1)-(5)		273.95	273.32	272.68	272.02	271.33	270.63	269.90	(16.65)
Internal Rate of Return = IRR of (6)									




Asset Criteria	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
2. Roadside			
Grass / Turf	Neat Attractive Sight distance Present	90	<ul style="list-style-type: none"> Tolerance's Criteria : <ul style="list-style-type: none"> grass height 12" or less sight distance is clear in intersections, passing zones, curves etc. neat around crash barrier, headwalls, paved ditches adequate cover Timeliness Requirement : <ul style="list-style-type: none"> respond immediately upon notification roadkill promptly and properly disposed off within 4 hours Tolerance's Criteria : <ul style="list-style-type: none"> roadside appears neat and clean Tolerance's Criteria : <ul style="list-style-type: none"> overall appearance is nearly maintained Tolerance's Criteria : <ul style="list-style-type: none"> minimal erosion, and no erosion showing a pattern that will endanger the stability of the slope Tolerance's Criteria : <ul style="list-style-type: none"> the slope of pitching surface should be as per design slope, slight variation shall be repaired within two days. Tolerance's Criteria : <ul style="list-style-type: none"> inform traffic police and remove blockage, if required construct temporary diversion
Debris, Trees and Roadkill	Roadway free of obstruction	100	
Litter/Malba	Neat Attractive	90	
Landscaping	Neat Attractive	80	
Slopes	Stable No erosion	100	
Slope Pitching	No disturbed pitching	95	
Road blockade	No blockade	100	

BSZ

BSZ

NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
3. Drainage			
Cross Pipes	Structural sound Open Drains Joints intact Adequate capacity No erosion	95	<p>Tolerance/s Criteria :</p> <ul style="list-style-type: none"> <10% deteriorated barrel >90% diameter open drains properly joints intact no evidence of flooding minimal erosion at ends end protection intact no dip in road over pipe indicating structural problems
Box Culverts/ Slab Culverts	Structurally sound Open Drains Joints intact Adequate capacity No erosion	95	<p>Tolerance/s Criteria :</p> <ul style="list-style-type: none"> <10% deteriorated barrel >90% diameter open drains joints intact no evidence of flooding minimal erosion at ends end protection intact no dip in road over pipe indicating structural problems
Ditches, Paved/ lined drains	Aligned Structurally sound Clean	90	<p>Tolerance/s Criteria :</p> <ul style="list-style-type: none"> no undermining or undercut requiring action <25% spalled no obstruction to flow of water that requires action

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NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Appendix 1-1

Asset Management Project Deliverables and Tolerance Criteria

Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
Ditches Unpaved/unlined drains	Drain Functional	90	<p>Tolerances Criteria :</p> <ul style="list-style-type: none"> • grade drains • minimal erosion • outfalls functional • no obstruction to flow of water that requires action • no siltation
Storm Drains Drop Inlets	Open No flooding No settlement	90	<p>Tolerances Criteria :</p> <ul style="list-style-type: none"> • >90% open • no evidence of flooding
Kerb and Gutter	In line Clean/drain Sound No undermining	95	<p>Tolerances Criteria :</p> <ul style="list-style-type: none"> • minimal obstruction • no unsealed cracks >6 mm • no spalling > 1/4" deep • <25% of surface spalled
Erosion or Scour in upstream/downstream	No Erosion due to scour	100	<p>Erosion not to be allowed to continue</p>
Timeliness :	For all the above cases repair or reconstruction shall be attended and completed within a week or as instructed by Independent Engineer		

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NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Asset Management Project Deliverables and Tolerance Criteria

Appendix I-1

Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
4. Bridges/Culverts			
Overall Bridge	Smooth ride Strong Aesthetic Wide enough Available at legal limit	% scour critical - 0 % posted - 0	<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> no graffiti on structures <p>Timeliness Required :</p> <ul style="list-style-type: none"> structurally critical conditions must be notified immediately and repaired within a time frame as decided by Independent Engineer
Traffic Safety Features (Railings, Parapet, Walls drainage spouts etc.)	Present Functional		<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> functional <p>Timeliness Required :</p> <ul style="list-style-type: none"> repair or replace badly damaged traffic safety features within 1-2 days damaged but functional traffic safety features will be replaced within a week
Deck	Smooth Strong Wide enough Drains properly		<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> minimal spalls, cracks or scaling clean deck drains/scuppers are clean and functional
Super-structure	Strong Clearance Aesthetic		<p>Tolerance's Criteria :</p> <ul style="list-style-type: none"> no loss of section or cracks paint in good shape no spalling proper vertical clearance proper opening

B.S.P.

NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Asset Management Project Deliverables and Tolerance Criteria

Asset	Outcome	Performance Target : % of asset that shall be in the outcome described condition	Condition Assessment Acceptance, Tolerances Criteria and Service Delivery
Substructure	Strong Looks good Safe from scour Stable from settlement All components functional		Tolerances Criteria : • no spalls, cracks, scaling • bearing assemblies functional • abutment seats clean and sound • pier seats clean and sound • bearings clean, sound and lubricated periodically
Joints	Smooth does not leak		Tolerances Criteria : • joints no loose • joint are sealed
Structural Culverts			Tolerances Criteria : • < 10% deteriorated barrel • > 90% diameter open • minimal erosion at ends • correct grade • joints intact • no evidence of flooding • end protection intact • no dip in road over pipe indicating structural problems
Retaining Walls	Stable strong		Tolerances Criteria : • no spalling or cracks • weep holes open • no indication of settlement or rotation

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NOTE : Timeliness requirement wherever not mentioned shall be within reasonable period as decided in consultation with the Independent Engineer.

Geometric Parameters and Standards

Sl. No.	Particulars	Unit	Value	Remarks
A. Road Works				
1	Design Speed	Km/hr	100	
2	Width of Carriageway	m	7.0 m (each direction)	
a.	Shoulder			
	- Paved	m	1.5	
	- Earthen	m	1.5	
	- Rounding	m	0.5	
b.	Curb Shyness	mm	250	
c.	Median	m	5.0	Rural and where land is available
		m	1.2	Urban Area/where land availability is restricted
d.	Service Road			
	- For all service road, carriageway	m	5.5	To be provided as per requirement in built-up area.
e.	Footpath	m	1.5	To be provided over drain in market area of built up/ urban area
3	Embankment Slope	Ratio	2H:1V	
4	Crossfall			
a.	Carriageway	%	2.5	
b.	Paved Shoulder	%	2.5	
c.	Earthen Shoulder	%	3.0	
d.	Service Road	%	2.5	
5	Super Elevation	%	5.0 to 7.0	The relation will be about median edge
6	Horizontal Curves			
a.	Minimum Radius	m	400	Ruling
		m	360	Absolute
7	Vertical Curves			
a.	Minimum Length for 100 kmph	m	60	Vertical curves to be designed for safe stopping sight distance
b.	Minimum Length for 80 kmph	m	50	
B Interchanges				
8	Interchange Ramp			
a.	Design Speed	km/hr	65	
b.	Carriageway Width			
	i) Single Lane	m	4.75	
	ii) Double Lane	m	7	
c.	Shoulder Paved			
	i) Inner(Single Lane/Double Lane)	m	1.0/1.5	
	ii) Outer	m	0.5/1.5	
d.	Minimum Radius	m	125	
e.	Maximum Superelevation	%	5	
f.	Longitudinal gradient	Percentage	1 in 30 (max.)	

Sl. No.	Particulars	Unit	Value	Remarks
9	Interchange Loop Ramp			
a.	Design Speed	Km/hr	30	
b.	Carriageway Width			
	i) Single Lane	m	4.75	
	ii) Double Lane	m	7	
c.	Shoulder Paved			
	i) Inner	m	1	
	ii) Outer	m	0.5	
d.	Minimum Radius	m	50	
b.	Longitudinal gradient		1 in 30 (max.)	
C	Bridge Works			
1	Clear Width of Culverts for new 3-lane			
a.	Without service road	m	11.0	
b.	With service road on both side	m	18.0	
2	Outer to Outer Width of Bridges for each 3-Lane	m	12.1	without footpath
		m	13.9	with footpath (one side)
3	Outer to Outer width of Bridges for New 6-Lane	m	23.8	without footpath
4	Width of Crash Barriers	mm	500	
5	Width of Footpath & Railing	mm	1500+200	
6	Median			
a.	Covered totally		same as approach section	
b.	Gap between two adjacent bridges		same as approach section with a gap of 2250 mm	
7	Approach Road			
a.	Embankment Slope	Ratio	2H : 1V	
b.	Transition between bridge and approach road		Maximum 4.0 m length RCC approach slab 300 mm thick for full width of carriageway	
c.	Longitudinal slope	Percentage	3% (max.)	
9	Construction Material			
a.	Reinforced concrete works	m	min. M 20	
b.	Pre-stressed concrete works	m	min. M 40	
c.	Wearing coarse	15mm thick maslic apshalt over 50 mm thick asphaltic concrete		
d.	Reinforcing steel	HYSD bars S 415 (Fe 415)		
e.	Pre-stressing steel	19 T 13		

SCHEDULE – H

CONSTRUCTION REQUIREMENTS

1.0 General

The Project Facilities shall be so constructed as to meet the requirements in respect thereof contained in the DPR and the Design Requirements. In addition, the Concessionaire shall observe and meet the following requirements:

2.0 Before Commencement of construction

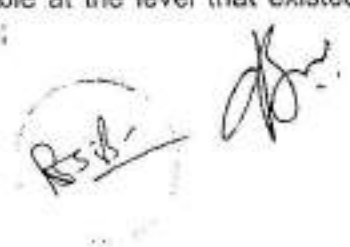
2.1 Prior to commencement of any construction activity, the Concessionaire shall finalise an implementation plan for the Project (Implementation Plan) in consultation with the Independent Engineer. The Implementation Plan shall, inter alia, include:

- (i) A detailed schedule of implementation for putting up and operationalising the Project Facilities, which shall specify at least 4 major milestones;
- (ii) The Critical Path Method (CPM)/ Programme Evaluation and Review Technique (PERT) charts or similar activity planning technique/ method for monitoring. This would cover all stages/ aspects of the Project implementation including design and engineering, procurement of materials and equipment, installation, construction and testing;
- (iii) Manpower deployment plan, including the designation of key personnel for the management and supervision of all Project activities. (This would include the designation of suitably qualified personnel for areas such as contract administration and supervision, construction management, traffic and safety, environmental management, plant and equipment maintenance, procurement, materials management and quality control); and
- (iv) A broad method statement for key items (Earth Works, GSB/WMM, Bituminous Layers, PQC, DLC Concrete Works and structural concrete work including Pre-stressing Concrete) setting out the methodology of construction, materials and construction equipment mobilisation/ utilisation plans, broad output calculations and details of the quality assurance and quality control procedures.
- (v) Format of the monthly report giving details of the physical progress in implementation of the Project and operations and maintenance activities undertaken (Monthly Progress Report).

2.2 Prior to commencement of any construction activity, the Concessionaire shall also finalise in consultation with the Independent Engineer an operations and maintenance plan for the Project during the Implementation Period (O&M Plan – Implementation Period) and which shall, inter alia, include the following :

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- (i) an Environmental Management Plan based on the environmental assessment report contained in the DPR or based on such other alternate assessment made by the Concessionaire;
 - (ii) Traffic Management Plan;
 - (iii) a safety management programme including an Emergency Response Protocol.
- 2.3 The Concessionaire shall, in consultation with the Independent Engineer workout an appropriate schedule for submission of documents set out in 2.1 and 2.2 above to the Independent Engineer for review.
- 2.4 Prior to commencement of construction of any of the Project Facilities, the Concessionaire shall have:
- (i) Obtained all such Applicable Permits as are necessary to commence construction of such Project Facilities;
 - (ii) Finalised such Drawings as are necessary and the Implementation Schedule in consultation with the Independent Engineer;
 - (iii) Mobilised the requisite resources, personnel and organisation necessary for the same and designated and appointed suitable officers/representatives as it may deem appropriate with responsibility to supervise implementation of the Project and for exchange of information with the Independent Engineer and NHAI;
 - (iv) Finalised in consultation with the Independent Engineer a method statement setting out details of the actual methods that would be adopted by the Concessionaire for the construction of such Project Facilities including details of equipment and machinery that would be used, their locations, and arrangements for conveying and handling materials;
 - (v) Finalised in consultation with the Independent Engineer quality assurance and quality control procedures to cover all aspects of the work so as to ensure the desired quality. This would include establishment of a well-equipped functional laboratory.
- 3.0 During Construction**
- 3.1 The Concessionaire shall:
- (i) Ensure that the construction/ rehabilitation of the Project Facilities is undertaken with minimal inconvenience to the traffic using the existing highway and provide detours wherever required;
 - (ii) Ensure that the standard of service on the existing highway is maintained to the extent possible at the level that existed prior to the commencement of construction;

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- (iii) Take the necessary precautions to minimise accidents and respond to Emergency as quickly as possible;
 - (iv) Take precautions to avoid inconvenience to, damage to, destruction of or disturbance to any third party rights and properties;
 - (v) provide a safe, clear and informative system of road signs;
 - (vi) ensure adequate safety of road users and the personnel deployed at the Project Site which would include measures for the safety of traffic such as the provision and maintenance of barricades, traffic signs and illumination during night in consultation with the Independent Engineer;
 - (vii) be in compliance with the Applicable Laws and Applicable Permits obtained for the Project including the clearances obtained by NHA;
 - ✓ (viii) Adhere to the Implementation Plan and Implementation Period O&M Plan-Implementation Period;
 - (ix) deploy adequate number of qualified and competent personnel having relevant experience and skills for implementation of the Project and interaction with the Independent Engineer/ NHA.
- 3.2 In flexible pavement type, longitudinal cold joint shall not be allowed while laying DBM and BC wearing course. The bituminous layers shall be laid in full width including the paved shoulders in a single go.
- 3.3 In rigid pavement type, dowel and tie bars are provided at the locations which is specified in DPR and the construction of the different layers of concrete pavement is made as per the MOST Specification.
- 3.4 Positions and Levels
- (i) The Concessionaire shall be responsible for :
 - (a) the accurate setting-out in relation to original survey control points, lines and levels of reference provided by NHA;
 - (b) the correctness of the positions, levels, dimensions and alignment of all parts of the works;
 - (c) the provision of all necessary instruments, appliances and labour in connection with the foregoing responsibilities;
 - (ii) If, at any time during execution of the works, any error is noticed in the position, levels, dimensions or alignment of any part of the Construction Works, the Concessionaire, on being asked to do so by the Independent Engineer, shall at his own cost, rectify such errors to the satisfaction of the Independent Engineer.
 - (iii) The checking of any setting-out or of any line or level by the Independent Engineer shall not in any way relieve the Concessionaire



of his responsibility for the accuracy thereof and the Concessionaire shall carefully protect and preserve all benchmarks, sight rails, pegs and other materials used in setting-out the works.

3.5 Tests

- (i) Various quality control tests would be undertaken for the Project as per the standards prescribed by MoST and Bureau of Indian Standards. Where no testing methods are specified by the said standards, details of the tests to be carried out and specifications to be achieved for the respective Project Facilities/ Construction Works or part thereof shall be agreed upon with the Independent Engineer prior to construction;
- (ii) Where material properties vary from or comply only marginally with the specifications contained in the Design Requirements/ DPR, the Independent Engineer shall increase the frequency of testing as appropriate at the cost of the Concessionaire.
- (iii) Workmanship
 - (a) The finished bituminous layers (DBM and BC) and concrete layer (PQC) shall be tested for workmanship (immediately before allowing traffic) by measuring roughness, longitudinally separately for each lane with the Calibrated Towed Fifth Wheel Bump Integrator. Calibration of Bump Integrator device shall be carried out using the procedure recommended in the World Bank Technical Publication No. 46. The measured roughness shall not exceed a value of 2000 mm/km for finished Bituminous layer (DBM & BC) and Concrete Layer (PQC) layers. In case DBM is laid in two separate lifts, the roughness shall be measured on the final DBM layer. The allowable tolerance is upto 5% of the specified roughness value.
 - (b) Any completed layer (DBM and BC) having roughness in excess of the value 2000mm/km beyond the admissible tolerance shall not be accepted. For cement concrete pavement the same roughness level shall be applicable.
- (iv) The tests would be carried out at a location (place of manufacture, fabrication or preparation, at site or any specialised testing laboratory) that the Independent Engineer may reasonably require, at the cost and expense of the Concessionaire.
- (v) The Concessionaire shall provide such assistance, labour, electricity, fuels, stores, apparatus and instruments as are normally required for examining, measuring and testing any materials or plant and shall supply samples of materials, as required by the Independent Engineer to undertake Tests.

- 3.6 No part of the Construction Works shall be covered up or put out of view before the same has been examined by the Independent Engineer.

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3.7 The Independent Engineer may from time to time require:

- (i) removal from the Project Site, within such time as may be specified in its instructions, any material, equipment, machinery or plant which, in its opinion, do not meet the standards specified in the Design Requirements/ DPR.
- (ii) Substitution/ replacement of such improper material, equipment, machinery or plant;
- (iii) Re-execution, of any or part of the Construction Works which in the opinion of the Independent Engineer do not meet the standards set out in the DPR/ Design Requirements;
- (iv) the Concessionaire to make boreholes or to carry out exploratory excavation for the Project.

3.8 The Concessionaire shall ensure minimum interference to the flow of traffic during widening stage of the existing 2-lane pavement. The additional carriageway shall be constructed first and the traffic diverted to it before improvements to the existing carriageway are commenced.

3.9 The Concessionaire shall mobilise adequate numbers of equipment, plants and machinery to ensure adherence to the Implementation Plan. The Concessionaire shall ensure that:

- (i) the Hot Mix Plant is of Batch type with minimum 150 TPH capacity.
- (ii) drum mix type Hot Mix Plant is not used on the Project Site under any circumstances.
- (iii) no old inefficient plant, machinery or equipment is used and generally should not be more than 3 years old.
- (iv) full width Paver finisher with Electronic Sensor Device is mobilised with such adjustable floating screed width so that no cold longitudinal joints are formed while laying DBM or BC layer including the paved shoulder's width.
- (v) proportioning of materials shall be done in the batching plant by weight, each type of material being weighed separately. The capacity of batching and mixing plant shall be at least 25% higher than the proposed capacity of the laying/paving equipment.
- (vi) the concrete shall be placed with an approved fixed form or slip form paver with independent units designed to (a) spread (b) consolidate, screed and float finish, (c) texture and cure the freshly placed concrete in one complete pass of the machine. The paver shall be equipped with electronic controls to control / sensor line and grade from either or both sides of the machine.

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- (vii) There should be adequate number of concrete saws with sufficient number of diamond-edge saw blades.

3.10 The Concessionaire shall arrange for the quarrying, where required, of all the material requirements for the Project and disposal of all material wastes. The Applicable Permits in this regard would have to be obtained by the Concessionaire. All quarrying operations shall be carried out by the Concessionaire with minimum degrading of the environment. All excessive and unsuitable excavated materials shall be stacked at appropriate dumping places or otherwise disposed of by the Concessionaire in consultation with the Independent Engineer.

3.11 Prior to making the request for the issue of Completion Certificate, the Concessionaire shall submit to the Independent Engineer/ NHAJ the following, duly finalised in consultation with the Independent Engineer:

- (i) the Operation and Maintenance Manual for the Project (O&M Manual) setting out in detail the standards, schedules, procedures, type, periodicity and other details of the operation and maintenance activities to be carried out for the Project during the Operations Period so as to meet the O&M Requirements as well as details of the management information system to be incorporated, reports to be submitted and procedure for reviews.
- (ii) The Operations & Maintenance Plan (O&M Plan) for the first year of operations.

4.0 After Completion of Construction

Upon completion of construction (including road marking work) but prior to issue of the Completion Certificate, the Project Site shall be cleared of all construction equipment, surplus materials, debris and temporary installations and shall be left in tidy and an aesthetically pleasing appearance to the satisfaction of the Independent Engineer.

All structural work related to the up-gradation work of the stretches shall be in conformity to the specification mentioned in Volume V : Specification of Detailed Project Report.

5.0 Reporting Requirements and Documents to be provided

5.1 During the Implementation Period, the Concessionaire shall submit to the Independent Engineer/ NHAJ Monthly Progress Report (for each calendar month or part thereof) within 5 working days of the last day of the month. The report shall review the progress made, identify slippages if any, and project the future activities to be undertaken (including rectifications), operations and maintenance activities undertaken and would, inter alia, include the following:

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- (i) Listing of working drawings/sketches submitted
- (ii) Comments of Independent Engineer, if any on the working drawings/sketches submitted
- (iii) Concessionaire's response to the comments on the Drawings/sketches
- (iv) Listing of the "As Built" drawings submitted
- (v) Progress of pre-construction activities - mobilization of plant and equipment, personnel, site office, utility relocation etc.
- (vi) Concessionaire's compliance inspection report, if any required
- (vii) Constraints in construction
- (viii) Progress data with "S" curves, if applicable
- (ix) Project data with contract detail and sectional completion details
- (x) Tests carried out, if any, and results thereof
- (xi) Remedial measures taken by the Concessionaire following such tests, where required
- (xii) Traffic management steps taken by the Concessionaire
- (xiii) Review of milestones and reasons for delay, if any
- (xiv) Suspension of construction, if any, its reasons, duration and the steps undertaken to resume construction
- (xv) Change of Scope Notice issued by NHA, if any, and status thereof
- (xvi) All actual or potential deviations from the Implementation Plan
- (xvii) Disagreements/ Disputes , if any and proposed measures to be taken
- (xviii) Maintenance activities carried out by the Concessionaire on the existing carriageway
- (xix) Monthly weather report giving daily temperature maximum and minimum value, rainfall and any other significant event
- (xx) Injury to any construction personnel during construction, its severity, cause and remedial measure(s) taken to avoid recurrence
- (xxi) Brief report of any accident / incident within the Project Site, injury/fatality, property damage, cause of accident and actions taken to avoid recurrence

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