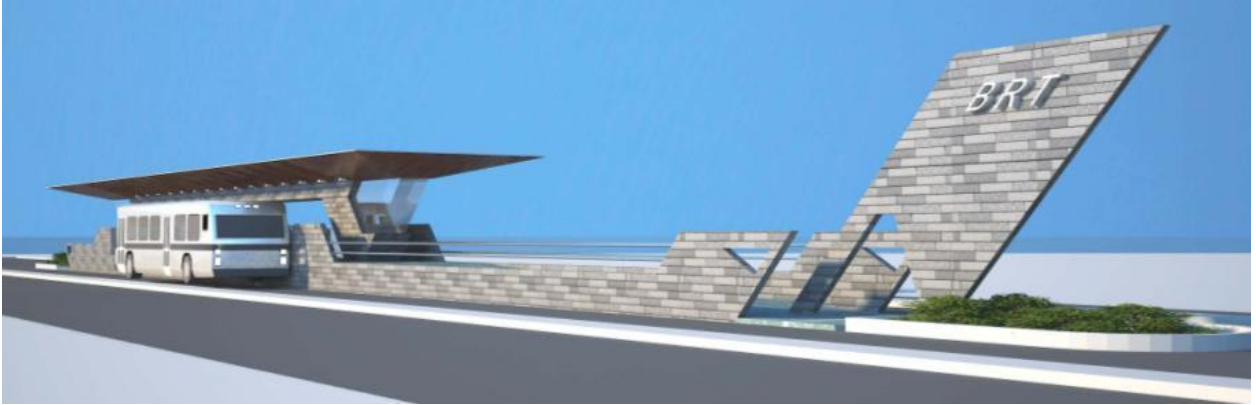


Directorate of Urban Land Transport

**IMPLEMENTATION OF BUS RAPID TRANSIT SYSTEM (BRTS)  
IN HUBLI – DHARWAD**

ENVIRONMENT IMPACT ASSESSMENT REPORT (Addendum-1)



**HUBLI-DHARWAD BRTS COMPANY LIMITED**

**November 2015**

## TABLE OF CONTENTS

|    |  |    |
|----|--|----|
| 1. | Introduction .....   | 4  |
| 2. | Description of proposed BRTS bus only flyover .....                              | 4  |
|    | 2.1 Unkal Cross .....  | 5  |
|    | 2.2 Unkal Lake .....   | 6  |
|    | 2.3 Navanagar .....  | 6  |
|    | 2.4 Environmental and Safety Impacts .....                                       | 7  |
|    | 2.5 Non Motorised Transport (NMT) .....  | 7  |
|    | 2.5.1 Dharwad (From Old SP office to Shivaji Circle-2.0 Km) .....                | 7  |
|    | 2.5.2 Navanagar (Cancer Hospital to PU College Navanagar )– 1.5 km .....         | 7  |
|    | 2.6 Change in pavement design, from Km 4+200 to Km 15+900 .....                  | 7  |
|    | 2.7 Requirement of Bus –only flyover.....  | 8  |
|    | 2.8 Analysis of Alternative .....  | 8  |
| 3. | Baseline Environmental Condition.....  | 9  |
| 4. | Assessment of Impacts due to changes in Scope of Work, Mitigation Measures ..... | 9  |
| 5. | Assessment of Ecological Impacts .....   | 18 |
|    | 5.1 Additional Impact and Mitigation Plan.....                                   | 18 |
|    | 5.2 Compensatory Plantation .....  | 19 |
| 6. | Institutional Arrangement.....   | 20 |
|    | 6.1 Role and Responsibility .....  | 20 |
|    | 6.1.1 Hubli-Dharwad Bus Rapid Transit System Co. ....                            | 20 |
|    | 6.1.2 Project Management Consultant – PMC LASA .....                             | 21 |
|    | 6.1.3 Karnataka Road Development Corporation Limited .....                       | 22 |
|    | 6.2 Environmental Audit .....  | 22 |
|    | 6.3 Landscape .....  | 23 |
|    | 6.4 Green BRTS Committee.....  | 23 |
| 7. | Environmental Management Measures for Bus Only Flyover .....                     | 24 |
| 8. | Environmental Management Measures on NMT Corridor.....                           | 34 |
|    | 8.1 Appointment of Safety Expert .....   | 47 |
| 9. | Revised Environmental Management Plan (EMP) Budget .....                         | 48 |

**TABLE**

---

|  |    |
|--|----|
| Table 1-1: Extent of Land to be Acquired (Area In Acr-Gunta) ..... | 4  |
| Table 2-1: Bus – Only Flyovers .....                               | 5  |
| Table 2-2: Proposed BRT Lane & MTL .....                           | 7  |
| Table 2-3: Alternative Analysis.....                               | 8  |
| Table 4-1: Aspects , Impacts And Mitigation .....                  | 10 |
| Table 5-1: Number of Trees to be cut, Village-Wise.....            | 18 |
| Table 5-2: Plantation Additional Impact.....                       | 18 |
| Table 5-3: Revised Impacts And Mitigation Measures .....           | 19 |
| Table 5-4: Phase Wise Action Plan.....                             | 19 |
| Table 6-1: Audit Report - Time Line with Deliverables .....        | 22 |
| Table 6-2: Landscape Work .....                                    | 23 |
| Table 7-1: Environmental Management Plan - Bus Only Flyover .....  | 22 |
| Table 8-1: Environmental Management Measures for Non .....         | 35 |
| Table 9-1: Revised EMP Budget.....                                 | 48 |

**ANNEXURE**

---

ANNEXURE -1 : STRIP PLAN OF CHANGE IN EMP

ANNEXURE -2 : PLANTATION DETAILS PHASE-1 (2013-2014)

ANNEXURE -3 : PLANTATION DETAILS PHASE-2 (2014-2015)

ANNEXURE -4 : ACTION PLAN OF GREEN BRTS

ANNEXURE -5 : EMP GOOD PRACTICES AND PHOTOGRAPGS OF GREEN BRTS PLANTATION

## 1. Introduction

This report is an addendum to the approved Environmental Impact assessment report –December 2013 prepared for the Hubli-Dharwad BRTS Project. The EIA report had been prepared for assessment of impacts due to construction of Bus Rapid Transport project between the twin cities of Hubli and Dharwad. Accordingly, EMP had been prepared for the road and the road components separately. The approved BRTS project has also other components like NMT. Additional works like bus-only flyovers and ROB are proposed to be taken up with the State Government funding (not included in the BRTS project). This addendum is prepared with a purpose to address changes resulting from the completion of the Joint measurement certificate survey as well as to assess and describe impacts and mitigation measures proposed, if any as a result of other components which may or may not be a part of the approved BRTS project but are nevertheless, crucial for the project. The addendum describes the above components; impact to environment, if any; analysis of alternatives and Environmental Management Plan and finally, changes in environmental budget for mitigation of impacts.

M/s. Hubli – Dharwad BRTS Company Ltd. has completed the Joint Measurement Survey Certificate of all lands to be acquired/ transferred. The total land to be acquired is 72.29 acres. The village wise details to be acquired / transferred are given in table below.

**Table 1-1: Extent of Land to be Acquired (Area In Acr-Gunta)**

| Village/ City                 | Extent as per notification 15(1) | Extent as per JMC-(Agri/ NA) | Govt Land/ Dept | HDMC (land relinquished for road margin) | Extent to be acquired |
|-------------------------------|----------------------------------|------------------------------|-----------------|--|-----------------------|
| <b>Hubli City</b><br>Zone 4&5 | 08-34                            | 8.04                         | 1-36            | 0-39                                     | 5-09                  |
| <b>Unakal (Revenue)</b>       | 02-27                            | 1.23                         | 0-25            | 0-11                                     | 0.27                  |
| <b>Bairidevarakoppa</b>       | 09-05                            | 8.37                         | 3-19            | 0-36                                     | 4.22                  |
| <b>Amargol</b>                | 11-31                            | 11.30                        | 6-01            | 2-11                                     | 3.18                  |
| <b>Rayapur</b>                | 10-39                            | 11.11                        | 6-01            | 3-17                                     | 2.02                  |
| <b>Sattur</b>                 | 04-06                            | 7.16                         | 2-22            | 4-14                                     | 0.30                  |
| <b>Navlur</b>                 | 05-20                            | 8.39                         | 3-35            | 1-12                                     | 3-32                  |
| <b>Lakkamanahalli</b>         | 06-21                            | 8.17                         | 4-03            | 3-01                                     | 2.13                  |
| <b>Dharwad City</b>           | 06-12                            | 6.12                         | 0-38            | 0-35                                     | 4.19                  |
| <b>Total</b>                  | <b>66-39</b>                     | <b>72.29</b>                 | <b>28-17</b>    | <b>17-17</b>                             | <b>26.35</b>          |

## 2. Description of proposed BRTS bus only flyover

Three bus-only flyovers have been proposed on the corridor. These works are being carried out outside the scope of the approved BRTS project. The details are shown in STRIP PLAN under the Annexure –1. The bus-only flyovers have been proposed based on the traffic at crucial junctions so as to facilitate accelerated and un-obstructed movement of BRT buses as well as conflict-free and smooth movement for other categories of vehicles, pedestrians etc.

The considerations for choosing the option of BRTS Bus-only flyovers are summarized below:

- *The BRT bus movement should be accelerated as interference from other traffic would be eliminated at the junctions. The operation of BRT would be smooth and efficient.*
- *Land acquisition is kept to the barest minimum.*
- *The construction should be least disruptive to the users and the public.*
- *Facilities created in the widening to 8-lanes/ 7-lane in design should be utilized to the maximum extent.*

- Constraints of site should be resolved by proven technological solutions.

Within the given constraints, the solution of BRTS bus-only flyovers proposed at Unkal Cross, Unkal lake and Navanagar is sound, economical, constructible and manageable.

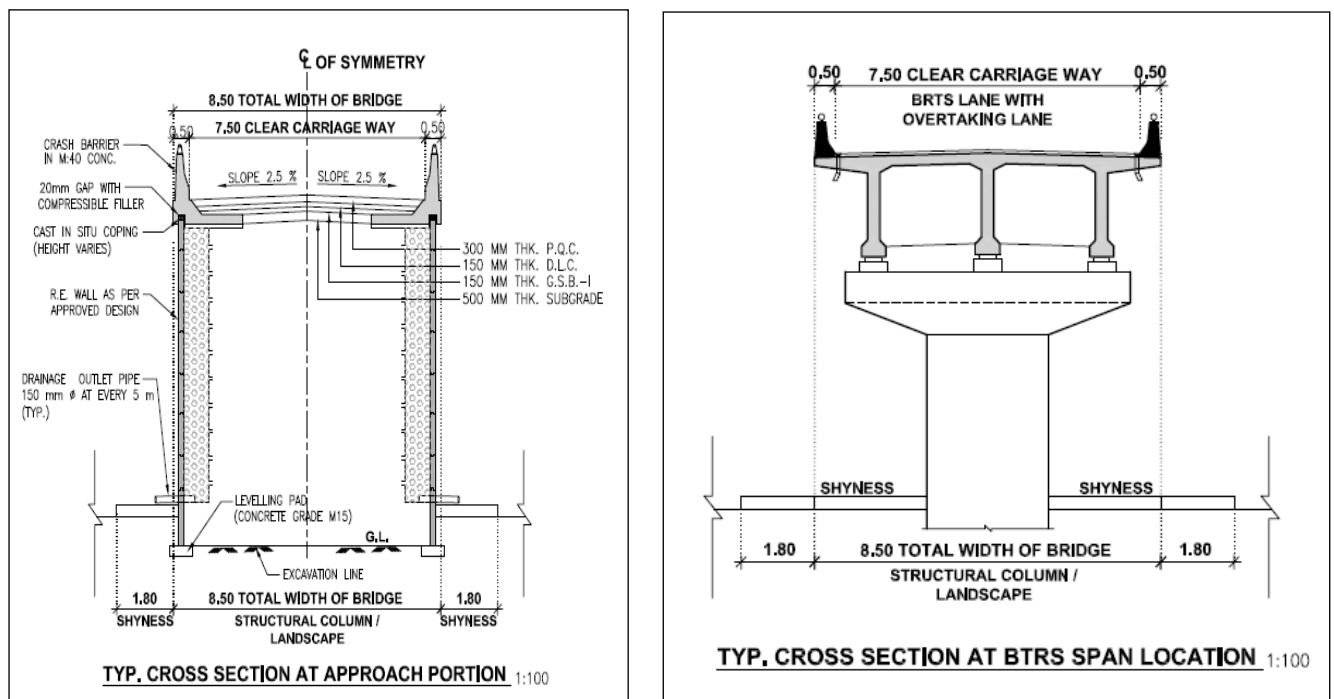
**Table 2-1: Bus – Only Flyovers**

| Sl. No. | Location    | Chainage (Km) |       | Width of bus only flyover (m) | Total Cross Section Width (m) | Length of bus only flyover Km |
|---------|-------------|---------------|-------|-------------------------------|-------------------------------|-------------------------------|
|         |             | From          | To    |                               |                               |                               |
| 1       | Unkal Cross | 2.325         | 2.950 | 8.50                          | 35                            | 0.625                         |
| 2       | Unkal Lake  | 3.100         | 3.575 | 8.50                          | 35                            | 0.475                         |
| 3       | Navanagar   | 6.656         | 7.510 | 11.50                         | 44                            | 0.854                         |

### 2.1 Unkal Cross

The BRTS bus-only flyover at this location is proposed from km 2.325 to 2.950. It has a total length of 0.625 Km.

The detailed plan and cross-section of Bus only flyover at Unkal Cross is given below:



**FIGURE. – 2.1: Typ. Cross Section of Unkal Cross Bus Only Flyover**

### 2.2 Unkal Lake

The BRTS Bus-only flyover at Unkal lake is proposed from km 3.100 to 3.575. It has total length of 0.475 km. The detailed plan and cross-section of Bus only flyover at Unkal lake are given below:

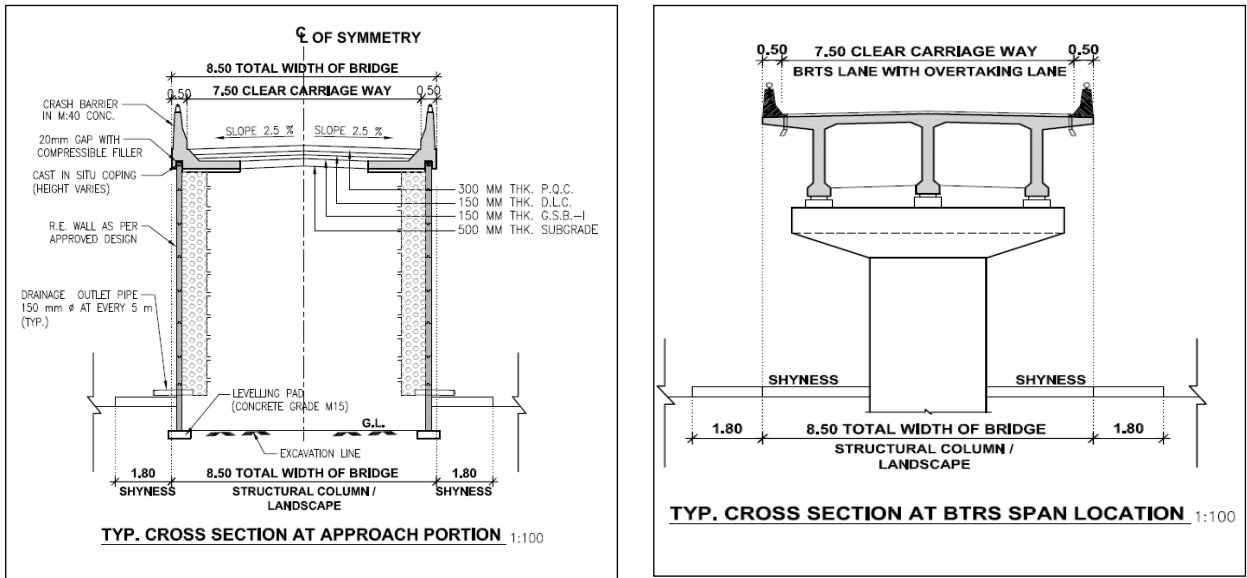


FIGURE - 2.2: TYP. CROSS SECTION OF UNKAL LAKE BUS ONLY FLYOVER

### 2.3 Navanagar

The BRTS bus-only flyover at this location is proposed from km 6.656 to 7.510. It has a total length of 0.854 km. The detailed plan & cross-section at Navanagar are given below:

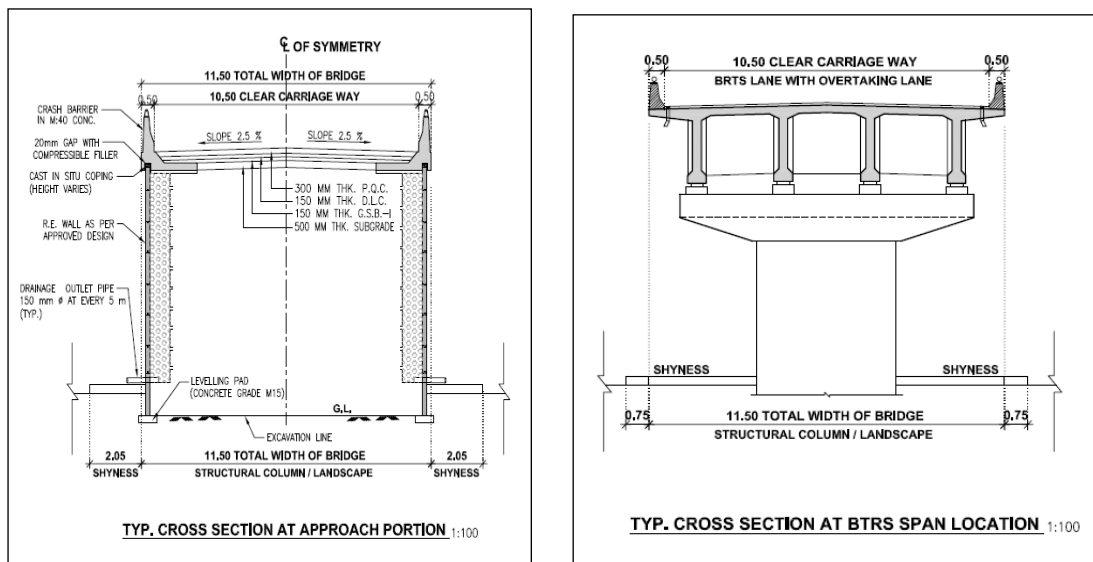


FIGURE - 2.3: TYP. CROSS SECTION OF BUS ONLY FLYOVER - NAVANAGAR

## 2.4 Environmental and Safety Impacts

The main impacts foreseen are dust and noise during construction and traffic management. Diversion roads are proposed to ensure smooth traffic flows during construction.

## 2.5 Non Motorised Transport (NMT)

NMT network is proposed on roads where pedestrian activity is high to facilitate improved access to the BRTS corridor at Navanagar and Dharwad.

After careful assessment and changes in design provisions, 33 trees of almost 2m to 3m girth size have been saved in the NMT corridor from tree-felling.

### 2.5.1 Dharwad (From Old SP office to Shivaji Circle-2.0 Km)

Footpaths and drains are proposed from Old SP office Dharwad to Shivaji Circle Dharwad for a total length of 2.0 Km. Further, after careful assessment, 29 trees are saved at this location from tree-felling.

### 2.5.2 Navanagar (Cancer Hospital to PU College Navanagar )– 1.5 km

Footpath and drains are proposed from the cancer Hospital Navanagar to Navanagar PU College. It has total length 1.5 Km. After careful assessment and changes in design provisions, 33 numbers of well grown trees of almost 2m to 3m girth size are saved.

## 2.6 Change in pavement design, from Km 4+200 to Km 15+900

The scope of change is limited to Mixed Traffic Lanes. The MTL of BRT lane has been proposed with flexible pavement due to ease of construction; future impacts due to increase in built-up area along the corridor etc.

**Table 2-2: Proposed BRT Lane & MTL**

| Section | Chainage (KM)    | Locations                            | Right of Way (m) | Length of Section (KM) | Proposed Pavement Type |                  |          | Changes                   |
|---------|------------------|--------------------------------------|------------------|------------------------|------------------------|------------------|----------|---------------------------|
|         |                  |                                      |                  |                        | BRTS                   |                  | Bus Stop |                           |
|         |                  |                                      |                  |                        | BRT                    | MTL              |          | Mixed Carriage way (MTL)  |
| I       | 00.00 to 2.5     | Hubli CBT to Hosur Circle            | 18/24/27m        | 2.5                    | Flexible/Overlay       | Flexible/Overlay | Rigid    | No Changes                |
| II      | 0.000 to 4.200   | (Hubli Hosur circle to Naveen Hotel) | 35m              | 4.200                  | Flexible/Overlay       | Flexible/Overlay | Rigid    | No Changes                |
| III     | 4.200 to 15.900  | (Naveen Hotel to Gandhi Nagar)       | 44m              | 11.7                   | Rigid                  | Flexible         | Rigid    | <b>Change to Flexible</b> |
| IV      | 15.900 to 18.840 | (Gandhi Nagar to Jubilee circle)     | 35m              | 2.94                   | Flexible               | Flexible         | Rigid    | No Changes                |
| V       | 00.00 – 00.500   | Jubilee Circle to Dharwad C.B.T      | 24m              | 0.5                    | Flexible               | Flexible         | Rigid    | No Changes                |

**2.7 Requirement of Bus –only flyover**

| Sl. No | Description<br>(Change of Scope of Work)                                   | Remarks   |
|--------|--|---|
| 1.     | BRTS Bus-only flyover at Unkal Crossing from Chainage km 2+325 to km 2+950 | The grade separation has been provided upon demand of local people and considering the safety of the road users and non-availability of space for junction improvement. |
| 2.     | BRTS Bus-only flyover at Unkal Lake from Chainage km 3+100 to km 3+575     | The grade separation has been provided upon demand of local people and considering the safety of the road users and non-availability of space for junction improvement. |
| 3.     | BRTS Bus-only flyover at Navanager from Chainage 6+656 to 7.510 km         | The grade separation has been provided upon demand of local people and considering the safety of the road users non-availability of space for junction improvement.     |
| 4.     | Navanagar(Cancer Hospital to PU college Navanager – 1.5 km                 | Footpath of 1.53 km length to provide last mile connectivity..  |
| 5.     | NMT at Dharwad(From Old SP office to Shivaji Circle-2.0 Km)                | Footpath of 2.0 km length to provide last mile connectivity..   |
| 6      | Change in pavement design from chainage km 4+200 to km 15+900              | For reasons mentioned in the above paras.   |

**2.8 Analysis of Alternative**

On the basis of requests from the project affected persons, H-DBRTSCo had reviewed the options for BRTS corridor from TollNnaka to Jubilee Circle in Dharwad. The process followed to arrive at the final option has been detailed out in the Resettlement Action Plan. The RAP document is available in the HDBRTS Co office and on the internet [www.hdbrts.co.in](http://www.hdbrts.co.in).

**2.8.1 Construction of BRT corridor in Dharwad**

Analysis of alternative has been studied for ‘BRT at Grade’ and elevated BRT in term of potential impacts. The details are given in *Table -2.3*.

**Table 2-3: Alternative Analysis**

| Sl. No. | Factors                               | BRT- lane With At grade Impacts   | 4 lane BRT Elevated Corridor  |
|---------|---------------------------------------|---|---|
| 1.      | <b>Construction Time Impact</b>       | Since construction of road at grade takes lesser time than construction of structure so impact and disturbance to local people is less. | Since construction time of structures is more than construction of at grade road junction, so the impact duration is more compared to the at grade road construction. |
| 2.      | <b>Damage and disruption of flora</b> | Impact on flora is same for grade separator and at grade construction since the Right of Way remains the same.                          | Impact on flora is same for grade separator and at grade construction since the Right of Way remains the same.  |



| Sl. No. | Factors   | BRT- lane With At grade Impacts   | 4 lane BRT Elevated Corridor  |
|---------|---|---|---|
| 3.      | <b>Interference with traffic at cross roads and others links routes</b> | Interference with traffic at cross-roads may reduce the speed of BRTS.  | The speed of BRTS may improve but the ease of accessibility of Public to the BRTS stations will be affected.  |
| 4.      | <b>Loss of Property and livelihood.</b>                                 | Loss of Property and livelihood.  | Loss of Property and livelihood   |
| 5.      | <b>Environmental quality during Construction</b>                        | Dust and noise during construction may affect air-quality.  | Dust and noise during construction may affect air-quality. Noise pollution may continue to be significant on adjacent properties even after completion of construction. |
| 6.      | <b>Road Safety/ Accident</b>  | Reduced accidental risks due to separate lanes for other traffic and BRT buses, pedestrian facilities and safe crossings. | Reduced accidental risks due to buses due to elevated corridor. Limited RoW for mixed traffic may cause accidents.  |
| 7.      | <b>Cost</b>   | The land acquisition costs are higher. However, overall costs are comparable for both the options.                        | Cost of construction is higher. However, overall costs are comparable for both the options.   |

#### Result of Alternative Analysis:

On comparison of various aspects like commuter convenience, aesthetics of the city, cost involved etc, the at-grade option has been found to be appropriate.

### 3. Baseline Environmental Condition

The environmental baseline condition viz Air, Water, Noise etc. within the project area remain unchanged and for details, kindly refer to the EIA of the project, which is also available on website [www.hdbtrts.co.in](http://www.hdbtrts.co.in)

Trees along Road: During the preparation of EIA, it was assessed that 1750 trees are likely to be felled in the section of BRT corridor.

The assessment for impact on trees has been carried out for Mixed Traffic Lane (MTL) and infrastructure sites and the number of trees to be felled has been revised upwards by 2244 trees.

### 4. Assessment of Impacts due to Changes in Scope of Work, Mitigation Measures

The environmental impact assessment has been conducted for the changes in the scope of work. The impacts in addition to the impacts identified in the EIA approved are given in table below.

**Table 4-1: Aspects , Impacts And Mitigation**

| Sl, No          | Description Of Change Of Scope Of Work   | Aspects  | Environmental Impacts   | Mitigation Measures  |
|-----------------|--|--|---|--|
| 1.              | <b>(Bus- only flyover)</b><br><br>1. Unkal Crossing (km 2+325 to km 2+950)<br>2. Unkal Lake (km 3+100 to km 3+575)<br>3. Navanagar (Km 6.657 to 7.510) | <b>Construction Stage (Bus- only flyover)</b>  |   |  |
|                 |  | Debris Disposal  | Land contamination , deterioration of water quality , visual intrusions and pollution problems to environment | The Contractor shall prepare Comprehensive Solid Waste Management Plan in consultation with Environmental Engineer and after approval of plan by Environmental Engineer debris shall be disposed off accordingly.<br><br>No dismantling shall be carried out without identification & approval of site by Environmental Engineer.  |
|                 |  | Handling & storing of materials  | Pollution to environment, incidental & accidental risks,  | The Contractor shall prepare a plan for storage of material shall submit for the approval to Engineer, Area of storage of material near the work site shall be earmarked in consultation with Environmental Engineer.<br><br>The ground for storage of materials should be leveled. All construction materials should be stored properly on platforms and other supports in line with IS: 7293 & IS: 7969. |
| Safety Measures | Pollution to environments on vehicles incidents/ accidents , health hazards, death Hazards   | The Contractor shall prepare plan of safety arrangements and submit it to the Environmental Engineer for approval, five days prior to the commencement of works.<br><br><b>Road Safety :</b><br><br>Arrangement for road safety should be made in line with IRC: SP -55. |   |  |

| Sl, No | Description Of Change Of Scope Of Work | Aspects | Environmental Impacts | Mitigation Measures   |
|--------|--|---------|-----------------------|---|
|        |  |         |                       | <p><b>Personal Safety :</b></p> <p>Tool Box Talk should be conducted at the first hrs. It should be conducted at assembly points to raise awareness followed by information of hazardous risks, near miss, and injuries.</p> <p>The Contractor shall provide:</p> <ul style="list-style-type: none"> <li>✓ Safety Shoes, Gum boots, Goggles and Safety Jackets to all workers employed on cement mortars, brick work, concreting, and painting</li> <li>✓ Welders should have protective eye shields when engaged in welding works.</li> <li>✓ Earplugs should be provided to workers who exposed to loud noise, working with jack hammer, joint cutting machines, vibrators.</li> <li>✓ Adequate safety measures for workers during handling of materials.</li> <li>✓ The Contractor shall comply with all regulations for safe working zone at excavations and trenches.</li> <li>✓ At every workplace, drinking water shall be made available to avoid waterborne diseases.</li> <li>✓ The Contractor at his own expenses shall put up necessary shuttering and planking or cut slopes to a safer angle or both with due regard to the safety of personnel and workers and to the satisfaction of the Engineer.</li> </ul> <p><b>First Aid :</b></p> |

| Sl, No | Description Of Change Of Scope Of Work | Aspects                           | Environmental Impacts                     | Mitigation Measures   |
|--------|--|-----------------------------------|---|---|
|        |  |                                   |   | <p>A readily available first- aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules, should be kept at Construction site.</p> <p>The first-aid box should contain antibiotics, pain killers, anti-diarrhoeal medicines, sterilized dressing material, antiseptics, bandage and other necessary appliances be available as per the factory rules.</p>   |
|        |  | Labour Camps / Construction Camps | Health Hazards, Pollution to environment. | <p>The Contractor shall make necessary arrangement for basic facilities at labour camps e.g. toilets, drinking water, light etc. The lay –out plant of Labours camps should approved by the Environmental Engineer.</p> <p>Medical Facilities – (Construction camps/ Labour camps)</p> <p><b>Sanitation Facilities:</b></p> <p>The Construction camps shall be provided with sanitary latrines &amp; urinals. Closed drainage systems and the proper treatment systems according to the local conditions should be constructed for the proper flow and effective drainage.</p> <p><b>Shelter at work place:</b></p> <p>At such work places where the duration of the works will prevail for more than one month some form of shelters will be provided for meals, resting, change of clothes and for keeping the tools of the work and personal protective equipment. The height of shelter</p> |

| Sl, No | Description Of Change Of Scope Of Work | Aspects             | Environmental Impacts  | Mitigation Measures   |
|--------|--|---------------------|--|---|
|        |  |                     |  | <p>shall not less than 3m from floor level to lowest part of the roof.</p> <p><b>Health care Facilities:</b></p> <p>The Contractor should be provided basic health care facilities at the construction camps.</p> <p>The health centre will have at least a doctor (part time), nurses, duty staff, medicines and minimum medical facilities to tackle first-aid requirements for minor accidental cases. The arrangements will be made with the nearest hospital to refer patients of major illnesses or critical cases.</p> |
|        |  | Construction Wastes | <p>1. Water Pollution</p>  | <p>All waste arising from the construction activity is to be disposed off at municipal landfill site and as per approval of the Engineer. The wastes must be collected and stored at the wastes storage yards.</p> <p>The Environmental Engineer shall certify that all wastes generated at grade separator are disposed off ensuring no deterioration of water quality and pollution to environment.</p>   |
|        |  |                     | <p>2. Blockage of drainage &amp; surface runoff impede the flow of water from channel.</p> | <p>The Contractor shall take all measures as directed by the Environmental Engineer to prevent temporary or permanent flooding at the site or any adjacent area.</p>  |
|        |  | Borrow Materials    | <p>Alteration of topography, disruption to flora &amp; fauna</p>                           | <p>No borrow materials should be taken from river beds, irrigation canals and any other water course.</p> <p>Environmental requirements should be made as per Clause:</p>   |

| Sl, No | Description Of Change Of Scope Of Work | Aspects  | Environmental Impacts              | Mitigation Measures  |
|--------|--|--|------------------------------------|--|
|        |  | Dust generation due to transporting of materials & Construction activities | Air Pollution, health hazards      | <p>305.2.2.2 of MoRTH Specification.</p> <p>The Contractor shall take all measures to suppress dust fumes. Water Tankers should be placed, for sprinkling of water to control dust</p> <p><b>Monitoring of Air Quality</b></p> <p>The Contractor shall monitor Air Quality at Grade Separator at peak hrs of construction, quarterly except the monsoon.</p>   |
|        |  | Construction Machineries   | Noise pollution                    | <p>The excavation should be made using good engineering practices so that noise levels are kept at acceptable levels.</p> <p>Ear muff should be provided to the workers.</p> <p>Job rotation should be made to reduce the noise expose to the workers.</p> <p><b>Monitoring of Noise Level :</b></p> <p>The Contractor shall monitor Noise Quality at Grade Separator at peak hrs of construction, four times in years or as directed by Engineer.</p> |
|        |  | Handling of Chemicals  | Health hazards to workers & staffs | <p>Any skin contacts with epoxy materials, solvents and epoxy strippers should be avoided.</p> <p>The resin and hardener should not be allowed to come into direct contact with skin. The most effective protection is achieved by wearing polythene gloves, rubber gloves, with a cloth liner, and</p>  |

| Sl, No  | Description Of Change Of Scope Of Work | Aspects  | Environmental Impacts                    | Mitigation Measures  |
|---|--|--|--|--|
|   |  |  |  | <p>protective clothing.</p> <p>If materials are sprayed, a respirator shall be used. All discarded buckets and containers shall be removed from site. These shall be stored in waste disposal site.</p>  |
| <b>The Contractor 's Demobilization (Grade Separator)</b> |  |  |  |  |
| 1   |  | Cleanup Operations, Restoration and Rehabilitation | Environmental Pollution, Health Hazards. | <p>The Contractor shall prepare site restoration plans, which shall be approved by the <b>Engineer of HDBRTS</b>. The clean-up and restoration operations are to be implemented by the Contractor prior to demobilization.</p> <p>All excavated sites which are not used for construction works shall be re-filled and the entire site left clean and tidy at the Contractor 's expense, to the satisfaction to the Engineer</p> <p>The Contractor shall clear all temporary structures, residual spoils, other wastes laying in and around the project site as per Comprehensive Waste Management Plan.</p> |

## 5. Assessment of Ecological Impacts

Joint verification was conducted at site with the competent authority and the land owners. During this verification and changes in the scope of work an additional 2244 trees are required to be cut. These are spread over entire stretch of BRTS corridor of length 18.92 km and given in the below table.

**Table 5-1: Number of Trees to be cut, Village-Wise**

| Sl No | Village                        | Total       |
|-------|--------------------------------|-------------|
| 01    | Hubli City                     | 201         |
| 02    | Unkal                          | 102         |
| 03    | Bhairidevrakoppa               | 107         |
| 04    | Amargol                        | 220         |
| 05    | Rayapur                        | 180         |
| 06    | Sattur                         | 402         |
| 07    | Navalur                        | 40          |
| 08    | Lakkamanhalli                  | 178         |
| 09    | Dharwad City                   | 250         |
| 10    | Hosur Interchange, Package -10 | 400         |
| 11    | Dharwad Depot, Package -8      | 164         |
|       | <b>Total</b>                   | <b>2244</b> |

Compensatory plantation of 1:2 ratio meaning planting of 2 trees for felling of 1 tree will be done.

### 5.1 Additional Impact and Mitigation Plan

The revised number of tree plantation as additional mitigation measures is indicated in the table below.

**Table 5-2: Plantation Additional Impact**

| Sl. No | Infrastructure Sites           | Assessment for felling of Trees | Trees to be Planted (Compensation Measures) |
|--------|--------------------------------|---------------------------------|---|
| 1      | Hosur Interchange, Package -10 | 400                             | 800   |
| 2      | Dharwad Depot, Package -8      | 164                             | 328   |
| 3      | Mixed Traffic Lane             | 1680                            | 3360  |
|        | <b>Sub- total</b>              | <b>2244</b>                     | <b>4488</b>                                 |
| 4      | 10% casualty                   |                                 | 450   |
| 5      | <b>Total</b>                   |                                 | <b>4938 (~ 4950 trees)</b>                  |



**Table 5-3: Revised Impacts And Mitigation Measures**

| Sl. No | Particulars   | Trees to be Planted (Compensation Measures) |
|--------|---|---|
| 1      | Additional Impacts (including 10% casualty rate).As per Table No, 7 as indicated above. | <b>4950</b>                                 |
| 2      | Compensatory planting towards 2013-14 casualty rates (Green BRTS activities).           | <b>3760</b>                                 |
| 3      | Compensatory planting towards 2014-15 casualty rates (Green BRTS activities).           | <b>800</b>                                  |
| 4      | <b>Total</b>  | <b>9510</b>                                 |

## 5.2 Compensatory Plantation

1750 trees were estimated to be cut during early stage of the project. Now after changes in scope of work and joint verification an additional 1680 trees are required to be felled for the mixed traffic lane (MTL). As mentioned in Table -5.2 and 5.3, the total 9510 trees are to be planted as part of compensatory plantation in addition to the planned 18000. The phase wise action plan for planting is at Annexure 4.

**Table 5-4: Phase Wise Action Plan**

| Phases                        | Plantation  | Survival   | Action Plan  |
|-------------------------------|---|--|--|
| Phase I<br>2013-14            | 8000 trees in 2013 Monsoon  | 4240   | Replacement planting will be taken up either in the same or new locations.                     |
| Phase II<br>2014-15           | 4000 in 2014 Monsoon  | Survival will be known after Monsoon 2015                        | Replacement planting will be taken up either in the same or new locations.                     |
| Phase III<br>2015-16          | Plantation of 4000 trees in 2015  | Survival will be known in Monsoon of 2016                        | Planned for plantation of 4000 saplings in 2015  |
| Phase IV<br>2016-17           | Plantation of 2000 trees in 2015 and replacement planting                                   | Survival rates will be assessed after one year of the plantation | Planned for plantation of 2000 saplings in 2015 and replacement planting compensating casualty |
| Phase V<br>2016-17<br>2017-18 | Plantation of 9510 trees against felling of 2244 trees and Casualty of Phase -1 & Phase-II. | Survival rates will be assessed after one year of the plantation | In the year 2016 monsoon, when Infrastructure sites are ready                                  |

(Note : List of Plant Species : Mahagani , Badam, Aala, Basavanpad, Arali , Halasu , AkashMallige, Hulgal , Sankeshwar, Nelli, Tapsi, Hunase, Bevu, Nerale, Sampige, Ashoka, Cherry; Spatodia)

Also an innovative programme “NAMMA THOTA @ Green BRTS has been launched in the educational institutions and Government office premises of the twin cities of Hubli and Dharwad. The plantation detail under the Phase - 1 and Phase-2 are shown in Annexure -2 and Annexure -3 respectively.

## 6. Institutional Arrangement

For effective implementation of EMP, Green BRTS activities and co-ordinating with the KRDC officials, the institution has deployed Environmental specialist from PMC. In addition the company has established the Green-BRTS committee. Institutional arrangement has been strengthened by addition of environmental auditor and Landscape architect.

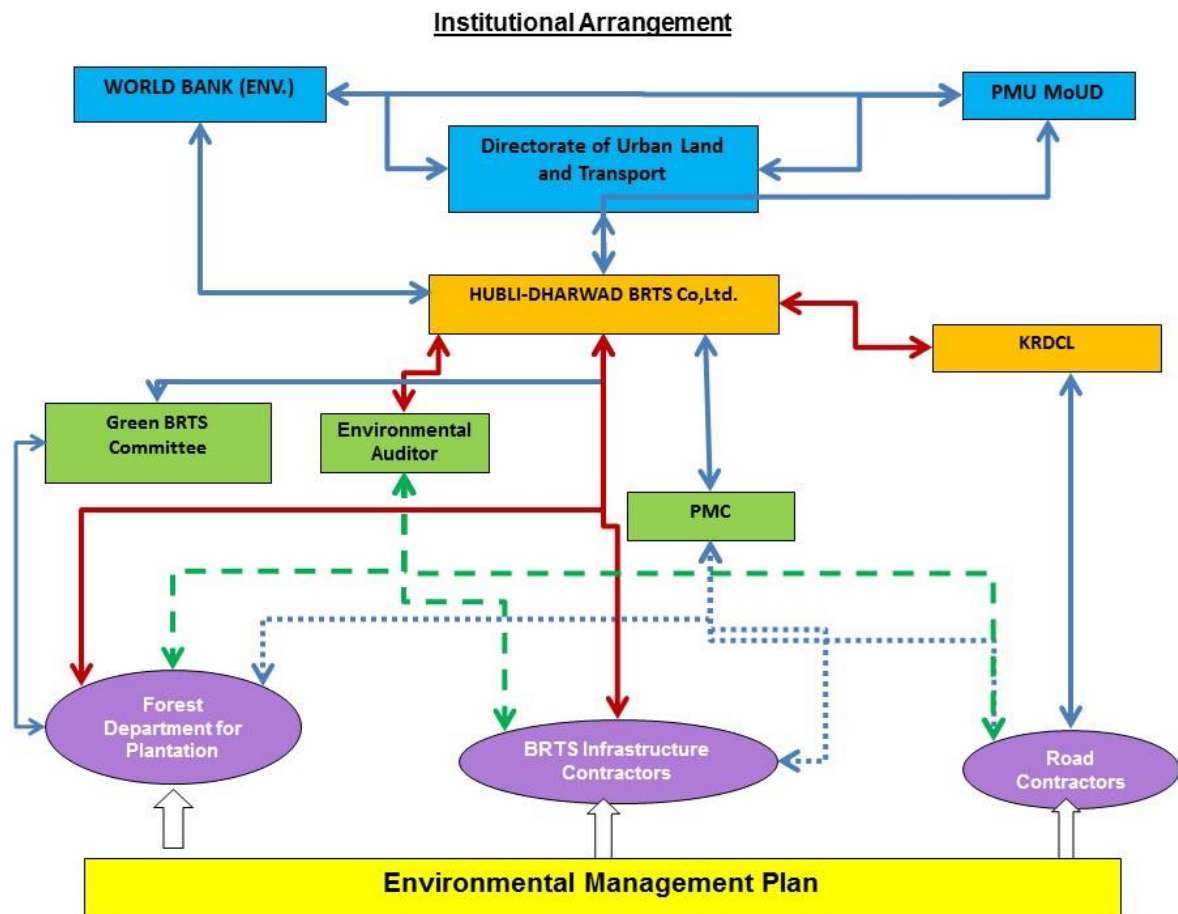


Figure 6-1: Institutional Arrangement

### 6.1 Role and Responsibility

#### 6.1.1 Hubli-Dharwad Bus Rapid Transit System Co.

##### A. Responsibility of Managing Director

1. To ensure all execution works are being carried –out with sound construction management practices for minimal loss & damage to ecosystem and environment.
2. Ensure welfare facilities at labour camps and the health & safety for workers while they are at site.
3. To ensure work at infrastructure site are safe and free from risks,
4. To provide information, instruction, training and supervision are necessary to ensure health & safety of ailing workers at work site.

5. Provision, maintenance or monitoring of working environment at infrastructure project that is safe, free from risks to health and adequate arrangements are made at work site.

#### **B. Responsibility of DGM (Infra)**

1. To ensure effective implementation of Environmental Management Plan as per suggestion and advice of project management consultant.
2. To ensure all legal requirements are furnished by an agency and all the works are being executed without contravention of laws of Gov of India.
3. To ensure the entire project site are free from risks & hazards, and instruct the contractor to attend lapses as per PMC advice.
4. To ensure work at the infrastructure site are safe and free from risks;
5. To provide all assistance for training and monitoring for EMP implementation.
6. Provision, maintenance or monitoring of working environment at infrastructure project that is safe, free from risks to health and adequate arrangements are made at work site.
7. To ensure effective implementation of environmental management plan at all project site.
8. Take actions on environmental non-compliances.
9. To provide all resources for attending environmental issues, afforestation programme etc.

#### **C. Responsibility of Environmental Manager (Civil & Env)**

1. Attend all issues pertaining to environment, health and safety.
2. Monitor of all legal compliances related to project.
3. Periodical monitoring of infrastructure site to ensure entire sections are free from all risks and hazards.
4. To ensure welfare facility at worksite, general site requirements, health and hygiene for workers & staffs.
5. Supervising construction activities to ensure environmental & safety requirement are met-with and based on best industry practices.
6. To conduct environmental meeting on monthly basis for resolving issues.
7. To conduct Green BRTS programme, afforestation, checking of landscape drawing.
8. To monitor felling of trees, liaising with forest departments for trees felling and afforestation.
9. Ensuring that corrective measures are taken, if necessary.
10. Ensure compliance of Environmental Management Plan implementation.
11. Preparation of CAPA (*Corrective Actions and Preventive Actions*) for incidence and accident, Prepare a training modules on various aspects of Environment and safety.
12. To ensure conducting of Environmental Monitoring Programme for Air, Water, Noise and Soil quality to be conducted on quarterly basis.

#### **6.1.2 Project Management Consultant – PMC LASA**

1. To assist the client on all environmental related matters.
2. To assist training program on environmental aspects as per site specific requirement under guideline of HSEMS.
3. To report compliances of environmental management plan.
4. To assist to client, HDBRTS on all environmental related matters.
5. Prepare Environmental Monitoring Report and timely submission on monthly basis.
6. To assist client in liaison with concern authority e.g. Forest Department, Irrigation department etc.
7. To assist in felling of trees, forest clearance, EMP addendum (if any) etc.
8. To maintain & update documentation system.
9. Assist to conduct periodical environmental monitoring for effective implementation of EMP.

10. Tracking of legal status on environmental matters required for this project.
11. Assist the client for Air, Water, Noise and Soil quality monitoring on quarterly basis.
12. Assist the client for checking landscape drawing, executing agency etc.
13. Assist the client to ensure entire construction activities are free from risks & hazards.

### 6.1.3 Karnataka Road Development Corporation Limited

1. To ensure work at MTL are safe and free from risks, and effective implementation of Environmental Management Plan as per suggestion & advice of PMC.
2. To ensure all legal requirements are furnished by the agency.
3. To ensure the entire project site are free from risks and hazards, and instruct the Contractor to attend lapses as per PMC advice.
4. Ensure monitoring of air, water and noise quality during construction.
5. Take actions on environmental non-compliances.
6. To provide all resources for attending environmental issues, afforestation programme etc.
7. Ensure all execution works are being carried – out with sound construction management practices for minimal loss & damage to ecosystem & environment.
8. Ensure welfare facilities at labour camps and the health & safety for workers while they are at site.

## 6.2 Environmental Audit

HDBRTSCO has appointed a consultant for annual Independent Environmental Audit to assess the status of implementation of Environmental management plans, identify constraints, if any during implementation, document best practices, if any and suggest measures for effective implementation and monitoring for sound construction management practices as to have minimal impacts to environment. The monitoring and evaluation of effectiveness of environmental Management plan will cover all the sites under Hubli- Dharwad BRTS Project. The scope of work of the consultant for annual independent environmental audit including the deliverables and timelines for deliverables are given in table 6.1.

**Table 6-1: Audit Report - Time Line with Deliverables**

| Sl No | Report   | Deliverables                                    | Time frame  |
|-------|--|---|---|
| 1.    | Pre- auditing Planning                         | Submission of Inception Report                  | Within 1.5 weeks from the date of start of issue of work order/signing of agreement |
| 2.    | Site –Audit Activities of 1 <sup>st</sup> Year | Submission of 1 <sup>st</sup> year Audit Report | Within 3 weeks of completion of 1 <sup>st</sup> Year Audit,                         |
| 3.    | Site –Audit Activities of 2 <sup>nd</sup> Year | Submission of 2 <sup>nd</sup> year Audit Report | Within 3 weeks of completion of 2 <sup>st</sup> Year Audit,                         |
| 4.    | Site –Audit Activities of 3 <sup>rd</sup> Year | Submission of 3 <sup>rd</sup> year Audit Report | Within 3 weeks of completion of 3 <sup>st</sup> Year Audit,                         |
| 5.    | Final Report                                   | Submission of final Report                      | Within 3 weeks after submission of 3 <sup>rd</sup> year audit report.               |

### 6.3 Landscape

The Hubli-Dharwad BRTS Company has engaged the services of landscape architects for developing a landscape plan for avenue and transit infrastructure. The brief scope of the assignment includes preparation of preliminary landscape design for the BRTS corridor, transit infrastructure etc for approval of the Company after carrying out detailed survey of the existing site and facilities.

Broader Scope of Consultancy services include the following:

1. Conducting the detailed survey of the required parameters in the proposed sites where the landscaping is to be undertaken.
2. Consultants will be required to provide a wide range of services, including but not limited to the preparation of:
  - *Concept plans.*
  - *Detailed landscape plans for each site which would also contain vegetation assessment and planting plans and Furniture details and signage.*
  - *Landscape construction documentation.*
  - *Bid documents and cost estimates.*
3. Assist the client in evaluation of bids and selection of landscape developers.
4. Monitoring/Supervision during landscaping till the stage of successful completion of project.

The scope of work of the consultant for preparation of landscape design for the Hubli-Dharwad BRTS Project including the deliverables and timelines for deliverables are at table 6.2.

**Table 6-2: Landscape Work**

| Sl. No. | Deliverable   | Due Date  |
|---------|---|---|
| 1.      | Submission of Inception Report  | End of first month from the date of signing of Contract |
| 2       | Submission of and approved of brief report, design type, and conceptual plans, broad plant lists and presentation.                        | End of Second month                                     |
| 3       | Submission of and approved of planting plan, planting lists and planting specifications.  | End of Forth Month.                                     |
| 4       | Detail estimate and BOQ and Bid documents for calling tenders.  | End of Fifth Month                                      |
| 5       | Assisting client and evaluation of tenders and preparation of draft contract agreement for executing of the work by Landscape developers. | End of Sixth Month.                                     |

### 6.4 Green BRTS Committee

A Green BRTS Committee has been constituted under the Chairmanship of Managing Director, M/s. Hubli – Dharwad BRTS Company Ltd. The committee reviews various activities planned for implementation as per the plantation action plan. The committee shall meet once in two months and the proceedings of the meeting of the committee shall be submitted to Commissioner, DULT, Deputy Commissioner, Dharwad and Managing Director, KRDCCL for information. The arrangement of Green – BRTS committee is as follows,

| SI No | Name of the Department/Organization  | Designation of the Member    |
|-------|--|------------------------------|
| 1     | Forest Department, Dharwad   | Deputy Conservator of Forest |
| 2     | Karnataka Pollution Control Board, Dharwad                                       | Environmental Officer        |
| 3     | Karnataka Road Development Corporation Limited.<br>Hubballi.                     | Executive Engineer           |
| 4     | University of Agricultural Science, Dharwad                                      | Environmental Expert         |
| 6     | Hubli-Dharwad Nagarik Parisar Samiti,<br>Dharwad.(Non-Governmental Organisation) | President                    |
| 6     | Scope, Dharwad (Non-Governmental Organisation)                                   | President                    |
| 7     | Rashtrrothan Sankalp Trust,Bangalore<br><br>(Non-Governmental Organisation)      | President                    |
| 8     | Nirat Seva Samste, Dharwad (Non-Governmental<br>Organisation)                    | President                    |
| 9     | Hubli-Dharwad BRTS Company Ltd.  | Member Convenor              |
| 10    | Hubli-Dharwad BRTS Company Ltd.  | Green BRTS Co-ordinator      |

## 7. Environmental Management Measures for Bus Only Flyover

Environmental management measures deal with the management measures recommended avoiding, minimizing and mitigating foreseen environmental impacts of the project. At the location of a) Unkal Cross (km 2+325 to km 2+950); b) Unkal Lake (km 3+100 to km 8+575); c) Navanagar (Km 6.656 to 7.510) Bus Only Flyover is proposed. In order to avoid traffic conflicts, accessibility, defragmentation of community either side of roads, risks free sites. The following are the Environmental Management Plan for recommended measures for mitigation of impacts that will be followed by the Contractor during construction of bus only flyover. The detail measures required to be implemented during the construction stage are presented in Table : 7.1

**Table 7-1: Environmental Management Plan - Bus Only Flyover**

| Sl, No | Description of change of Scope of Work   | Aspects                         | Environmental Impacts   | Mitigation Measures   | Reference and timeframe  | Responsibility |                                |
|--------|--|---------------------------------|---|---|--|----------------|--------------------------------|
|        |  |                                 |   |   |  | Implementation | Supervision                    |
| 1.     | <b>Construction Stage</b>  |                                 |   |   |  |                |                                |
|        | <b>BUS ONLY FLYOVER</b><br><br>1. Unkal Cross (km 2+325 to km 2+950)<br>2. Unkal Lake (km 3+100 to km 8+575)<br>3. Navanagar (Km 6.656 to 7.510) | Debris Disposal                 | Land contamination , deterioration of water quality , visual intrusions and pollution problems to environment | The Contractor shall prepare Comprehensive Solid Waste Management Plan in consultation with Environmental Engineer and after approval of plan by Environmental Engineer debris shall be disposed off accordingly.<br><br>No dismantling shall be carried out without identification & approval of site by Environmental Engineer. | The debris disposal is in accordance with the EMP prepared for the Road portion                  | Contractor     | KRDCL assisted by PMC of KRDCL |
|        |  | Handling & storing of materials | Pollution to environment, incidental & accidental risks,  | The Contractor shall prepare a plan for storage of material shall submit for the approval to Engineer; Area of storage of material near the work site shall be earmarked in consultation with Environmental   | The handling and storing of material is in accordance with the EMP prepared for the Road portion | Contractor     | KRDCL assisted by PMC of KRDCL |

| Sl, No | Description of change of Scope of Work | Aspects         | Environmental Impacts  | Mitigation Measures   | Reference and timeframe   | Responsibility |                                       |
|--------|--|-----------------|--|---|---|----------------|---------------------------------------|
|        |  |                 |  |   |   | Implementation | Supervision                           |
|        |  |                 |  | <p>Engineer.</p> <p>The ground for storage of materials should be leveled. All construction materials should be stored properly on platforms and other supports in line with IS: 7293 &amp; IS: 7969.</p>   |   |                |                                       |
|        |  | Safety Measures | <p>Pollution to environments on vehicles incidents/ accidents, health hazards, death Hazards</p> | <p>The Contractor shall prepare plan of safety arrangements and submit it to the Environmental Engineer for approval, five days prior to the commencement of works.</p> <p><b>Road Safety :</b></p> <p>Arrangement for road safety should be made in line with IRC: SP -55.</p> <p><b>Personal Safety :</b></p> <p>Tool Box Talk should be conducted at the first hrs. It should be conducted at assembly points to raise awareness followed by</p> | <p>Safety measures in accordance with the EMP prepared for the Road portion</p> | Contractor     | <p>KRDCL assisted by PMC of KRDCL</p> |



| Sl, No | Description of change of Scope of Work | Aspects | Environmental Impacts | Mitigation Measures   | Reference and timeframe | Responsibility |             |
|--------|--|---------|-----------------------|---|-------------------------|----------------|-------------|
|        |  |         |                       |   |                         | Implementation | Supervision |
|        |  |         |                       | <p>information of hazardous risks, near miss, and injuries.</p> <p>The Contractor shall provide:</p> <ul style="list-style-type: none"> <li>✓ Safety Shoes, Gum boots, Goggles and Safety Jackets to all workers employed on cement mortars, brick work, concreting, and painting</li> <li>✓ Welders should have protective eye shields when engaged in welding works.</li> <li>✓ Earplugs should be provided to workers who exposed to loud noise, working with jack hammer, joint cutting machines, vibrators.</li> <li>✓ Adequate safety measures for workers during handling of materials.</li> <li>✓ The Contractor shall comply with all</li> </ul> |                         |                |             |

| Sl, No | Description of change of Scope of Work | Aspects | Environmental Impacts | Mitigation Measures  | Reference and timeframe | Responsibility |             |
|--------|--|---------|-----------------------|--|-------------------------|----------------|-------------|
|        |  |         |                       |  |                         | Implementation | Supervision |
|        |  |         |                       | <p>regulations for safe working zone at excavations and trenches.</p> <p>✓ At every workplace, drinking water shall be made available to avoid waterborne diseases.</p> <p>✓ The Contractor at his own expenses shall put up necessary shuttering and planking or cut slopes to a safer angle or both with due regard to the safety of personnel and workers and to the satisfaction of the Engineer.</p> <p><b>First Aid :</b></p> <p>A readily available first- aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules, should be kept at Construction site.</p> <p>The first-aid box should</p> |                         |                |             |

| Sl, No | Description of change of Scope of Work | Aspects                           | Environmental Impacts                     | Mitigation Measures  | Reference and timeframe | Responsibility |                                |
|--------|--|-----------------------------------|---|--|-------------------------|----------------|--------------------------------|
|        |  |                                   |   |  |                         | Implementation | Supervision                    |
|        |  |                                   |   | contain antibiotics, pain killers, anti-diarrhoeal medicines, sterilized dressing material, antiseptics, bandage and other necessary appliances be available as per the factory rules.   |                         |                |                                |
|        |  | Labour Camps / Construction Camps | Health Hazards, Pollution to environment. | <p>The Contractor shall make necessary arrangement for basic facilities at labour camps eg toilets, drinking water, light etc. The lay –out plant of Labours camps should approved by the Environmental Engineer.</p> <p>Medical Facilities – (Construction camps/ Labour camps)</p> <p><b>Sanitation Facilities:</b></p> <p>The Construction camps shall be provided with sanitary latrines &amp; urinals. Closed drainage systems and the proper treatment systems according to the local conditions should be</p> |                         | Contractor     | KRDCL assisted by PMC of KRDCL |

| Sl, No | Description of change of Scope of Work | Aspects | Environmental Impacts | Mitigation Measures  | Reference and timeframe | Responsibility |             |
|--------|--|---------|-----------------------|--|-------------------------|----------------|-------------|
|        |  |         |                       |  |                         | Implementation | Supervision |
|        |  |         |                       | <p>constructed for the proper flow and effective drainage.</p> <p><b>Shelter at work place:</b></p> <p>At such work places where the duration of the works will prevail for more than one month some form of shelters will be provided for meals, resting, change of clothes and for keeping the tools of the work and personal protective equipment. The height of shelter shall not less than 3m from floor level to lowest part of the roof.</p> <p><b>Health care Facilities:</b></p> <p>The Contractor should be provided basic health care facilities at the construction camps.</p> <p>The health centre will have at least a doctor (part time), nurses, duty staff, medicines and minimum medical</p> |                         |                |             |

| Sl, No | Description of change of Scope of Work | Aspects | Environmental Impacts  | Mitigation Measures   | Reference and timeframe  | Responsibility |                                |
|--------|--|---------|--|---|--|----------------|--------------------------------|
|        |  |         |  |   |  | Implementation | Supervision                    |
|        |  |         |  | facilities to tackle first-aid requirements for minor accidental cases. The arrangements will be made with the nearest hospital to refer patients of major illnesses or critical cases.   |  |                |                                |
|        | Construction Wastes                    |         | 1. Water Pollution   | <p>All waste arising from the construction activity is to be disposed off at municipal landfill site and as per approval of the Engineer. The wastes must be collected and stored at the wastes storage yards.</p> <p>The Environmental Engineer shall certify that all wastes generated at grade separator are disposed off ensuring no deterioration of water quality and pollution to environment.</p> | The water pollution prevention and management will be in accordance with the EMP prepared for the Road portion           | Contractor     | KRDCL assisted by PMC of KRDCL |
|        |  |         | 2. Blockage of drainage & surface runoff, impede the flow of water from channel. | The Contractor shall take all measures as directed by the Environmental Engineer to prevent temporary or permanent flooding at the site or any adjacent area.   | Blockage of drainage & surface runoff, impede the flow of water in accordance with the EMP prepared for the Road portion |                |                                |

| Sl, No | Description of change of Scope of Work | Aspects  | Environmental Impacts                                 | Mitigation Measures   | Reference and timeframe   | Responsibility |                                |
|--------|--|--|---|---|---|----------------|--------------------------------|
|        |  |  |   |   |   | Implementation | Supervision                    |
|        |  | Borrow Materials   | Alteration of topography, disruption to flora & fauna | No borrow materials should be taken from river beds, irrigation canals and any other water course.<br><br>Environmental requirements should be made as per Clause: 305.2.2.2 of MoRTH Specification.  |   | Contractor     | KRDCL assisted by PMC of KRDCL |
|        |  | Dust generation due to transporting of materials & Construction activities | Air Pollution, health hazards                         | The Contractor shall take all measures to suppress dust fumes. Water Tankers should be placed, for sprinkling of water to control dust.<br><br><b>Monitoring of Air Quality</b><br><br>The Contractor shall monitor Air Quality at Grade Separator at peak hrs of construction, quarterly except the monsoon. | Air pollution prevention and health hazard management will be accordance with the EMP prepared for the Road portion | Contractor     | KRDCL assisted by PMC of KRDCL |
|        |  | Construction Machineries   | Noise pollution                                       | The excavation should be made using good engineering practices so that noise levels are kept at acceptable levels.  | Measures to prevent Noise Pollution will be in accordance with the EMP prepared for the Road portion                | Contractor     | KRDCL assisted by PMC of KRDCL |

| Sl, No | Description of change of Scope of Work | Aspects               | Environmental Impacts              | Mitigation Measures  | Reference and timeframe   | Responsibility |                                |
|--------|--|-----------------------|------------------------------------|--|---|----------------|--------------------------------|
|        |  |                       |                                    |  |   | Implementation | Supervision                    |
|        |  |                       |                                    | <p>Ear muff should be provided to the workers.</p> <p>Job rotation should be made to reduce the noise expose to the workers.</p> <p><b>Monitoring of Noise Level :</b></p> <p>The Contractor shall monitor Noise Quality at Grade Separator at peak hrs of construction, four times in years or as directed by Engineer.</p> |   |                |                                |
|        |  | Handling of Chemicals | Health hazards to workers & staffs | <p>Any skin contacts with epoxy materials, solvents and epoxy strippers should be avoided.</p> <p>The resin and hardener should not be allowed to come into direct contact with skin. The most effective protection is achieved by wearing polythene gloves, rubber gloves, with a cloth liner,</p>                          | Health and safety of workers will be in accordance with the EMP prepared for the Road portion | Contractor     | KRDCL assisted by PMC of KRDCL |

| Sl, No  | Description of change of Scope of Work | Aspects  | Environmental Impacts                    | Mitigation Measures  | Reference and timeframe   | Responsibility |                                |
|---|--|--|--|--|---|----------------|--------------------------------|
|   |  |  |  |  |   | Implementation | Supervision                    |
|   |  |  |  | and protective clothing.<br><br>If materials are sprayed, a respirator shall be used. All discarded buckets and containers shall be removed from site. These shall be stored in waste disposal site.   |   |                |                                |
| <b>The Contractor 's Demobilization (Grade Separator)</b> |  |  |  |  |   |                |                                |
| 1   |  | Cleanup Operations, Restoration and Rehabilitation | Environmental Pollution, Health Hazards. | The Contractor shall prepare site restoration plans, which shall be approved by the <b>Engineer of HDBRTS</b> . The clean-up and restoration operations are to be implemented by the Contractor prior to demobilization.<br><br>All excavated sites which are not used for construction works shall be re-filled and the entire site left clean and tidy at the Contractor 's expense, to the satisfaction to the Engineer<br><br>The Contractor shall clear all temporary structures, residual spoils, other wastes | The Cleanup Operations, Restoration and Rehabilitation will be in accordance with the EMP prepared for the Road portion | Contactora     | KRDCL assisted by PMC of KRDCL |



| Sl, No | Description of change of Scope of Work | Aspects | Environmental Impacts | Mitigation Measures   | Reference and timeframe | Responsibility |             |
|--------|--|---------|-----------------------|---|-------------------------|----------------|-------------|
|        |  |         |                       |   |                         | Implementation | Supervision |
|        |  |         |                       | laying in and around the project site as per Comprehensive Waste Management Plan. |                         |                |             |

## **8. Environmental Management Measures on NMT Corridor**

Environmental Management Measures deals with the management measures recommended to avoid, minimize and mitigate foreseen environmental impacts of the project. At the location of Nava Nagar and Dharwad, the Non Motorized Transport, (NMT Infrastructure) has been proposed in order to precede easy access to BRTS corridor for the commuter. Therefore, impact assessment is warranted to reduce impacts during the construction of NMT infrastructure.

The following are the aspects of Environmental Management and recommended mitigation measures that will be followed by the Contractor during the construction of NMT project at both the location at Navanagar and Dharwad NMT project and the detailed measures required to be implemented during the construction stage are presented in *Table : 8.1*.

**Table 8-1: Environmental Management Measures for Non**

| Sl. No.      | Environmental Aspects     | Management Measures   | Location  | Responsibility |                                     |
|--------------|---------------------------|---|---|----------------|-------------------------------------|
|              |                           |   |   | Implementation | Supervision                         |
| <b>NMT 1</b> | <b>CONSTRUCTION STAGE</b> |   |   |                |                                     |
| NMT 1.1      | Debris Disposal           | <p>The Contractor shall identify disposal sites and shall report the same to the Environmental Engineer. These locations shall be checked on site and accordingly approved by Environmental Engineer prior to any disposal of waste materials.</p> <p>The Contractor shall prepare Comprehensive Solid Waste Management Plan in consultation with Environmental Engineer and after approval of plan by Environmental Engineer debris shall be disposed off accordingly.</p> <p>No dismantling shall be carried out without identification and approval of site by Environmental Engineer.</p> | Along the corridor  | Contractor     | HDBRTSCO with assistance of PMC     |
| NMT 1.2      | Safety Arrangement        | <p>The Contractor shall prepare plan of safety arrangements and submit it to the Environmental Engineer for approval, five days prior to the commencement of works of NMT site.</p> <p>The cautionary sign boards should be placed, 50 m ahead the construction zone with retro reflective tapes. The signs boards, lights,</p>   | At the construction site, labour camp and construction camp | Contractor     | HDBRTSCO with the assistance of PMC |

| Sl. No. | Environmental Aspects  | Management Measures  | Location                                | Responsibility |                                     |
|---------|--|--|---|----------------|-------------------------------------|
|         |  |  |   | Implementation | Supervision                         |
|         |  | barriers, safety cones shall be maintained in a satisfactory manner as directed by the Engineer.   |   |                |                                     |
| NMT 1.3 | Handling and storing of materials                                      | <p>The Contractor shall prepare a plan for storage of material at NMT site and shall submit for the approval to Engineer,</p> <p>Area of storage of material near the work site shall be earmarked in consultation with Environmental Engineer.</p> <p>The ground for storage of materials should be leveled. All construction materials should be stored properly on platforms and other supports in line with IS: 7293 &amp; IS: 7969.</p> | Material storage area and handling area | Contractor     | HDBRTSCO with the assistance of PMC |
| NMT 1.4 | Damage and Disruption of Utilities Services, existing green vegetation | <p>The Contractor shall not obstruct any utilities services and existing vegetation during the construction of NMT infrastructure.</p> <p>The Contractor shall carry out excavation carefully for foundation work during the NMT construction without damage to existing water pipeline, telephone line, electrical poles and transformers.</p>  | Along the construction site.            | Contractor     | HDBRTSCO with the assistance of PMC |
| NMT 1.5 | Flora  | The Contractor must take measures to protect all existing trees during the construction of NMT.  | Tree along the alignment.               | Contractor     | HDBRTSCO with the assistance of PMC |
| NMT 1.6 | Labour   | The Contractor shall make necessary arrangement for toilets and Drinking Water requirement at site.  | At construction site and labour camp.   | Contractor     | HDBRTSCO with the assistance of     |

| Sl. No.          | Environmental Aspects                    | Management Measures   | Location              | Responsibility |                                     |
|------------------|--|---|-----------------------|----------------|-------------------------------------|
|                  |  |   |                       | Implementation | Supervision                         |
|                  |  |   |                       |                | PMC                                 |
| <b>Pollution</b> |  |   |                       |                |                                     |
|                  | <b>Water Pollution</b>                   |   |                       |                |                                     |
| NMT 1.7          | Water Pollution from Construction Wastes | All waste arising from the NMT construction activity is to be disposed off at municipal landfill site and as per approval of the Engineer. The wastes must be collected and stored at the wastes storage yards and should be disposal at approved disposal sites. The Environmental Engineer shall certify that all wastes generated at NMT site have been disposed off as to have no pollution to any water body and to the environment.   | At construction site. | Contractor     | HDBRTSCO with the assistance of PMC |
| NMT 1.8          | Drainage and runoff                      | The Contractor shall ensure that no construction of materials like earth, stone or any other construction material shall be left inside the storm water channel to which impede the flow of water. All vents should be cleared and clean from the extraneous wastes in order to free intake of surface run off in the storm water drain of NMT infrastructure.<br><br>The Contractor shall take all measures as directed by the Environmental Engineer to prevent temporary or permanent flooding at the site or any adjacent area. | At construction site. | Contractor     | HDBRTSCO with the assistance of PMC |
| NMT 1.9          | Borrow Materials                         | No borrow materials should be taken from river beds, irrigation canals and any other water course.  |                       | Contractor     | HDBRTSCO with the assistance of PMC |
|                  | <b>Air Pollution</b>                     |   |                       |                |                                     |

| Sl. No.  | Environmental Aspects      | Management Measures  | Location              | Responsibility |                                     |
|----------|----------------------------|--|-----------------------|----------------|-------------------------------------|
|          |                            |  |                       | Implementation | Supervision                         |
| NMT 1.10 | Dust Pollution             | The Contractor shall take all measures to suppress dust fumes. Water Tankers should be placed, for sprinkling of water to control dust.  | At construction site. | Contractor     | HDBRTSCO with the assistance of PMC |
|          | <b>Noise Pollution</b>     |  |                       |                |                                     |
|          | Noise Control              | The excavation should be made using good engineering practices so that noise levels are kept at acceptable levels.<br><br>Ear muff should be provided to the workers.<br><br>Job rotation should be made to reduce the noise expose to the workers.  | At construction site. | Contractor     | HDBRTSCO with the assistance of PMC |
| NMT 1.11 | <b>Safety</b>              |  |                       |                |                                     |
|          | Tool Box Talk              | Tool Box Talk should be held at the first hrs.<br><br>Toolbox is the routine exercise for the workers to alert on accidental risks and to ensure personal safety, hazards at work place and preventing measures.<br><br>The Tool Box Talks should be made at designed place fixed for assembly points to raise awareness followed by information of hazardous risks, near miss, and injuries.<br><br>Toolbox meeting improve workplace safety, health environment by deciding what action needs to be taken to reduce the risks. | At construction site. | Contractor     | HDBRTSCO with the assistance of PMC |
| NMT 1.12 | Personal Safety for Labour | The Contractor shall provide:  | At construction site. | Contractor     | HDBRTSCO with the                   |

| Sl. No. | Environmental Aspects | Management Measures  | Location | Responsibility |                      |
|---------|-----------------------|--|----------|----------------|----------------------|
|         |                       |  |          | Implementation | Supervision          |
|         |                       | <ul style="list-style-type: none"> <li>✓ Safety Shoes, Gum boots, Goggles and Safety Jackets to all workers employed on cement mortars, brick work, concreting, and painting</li> <li>✓ Welders should have protective eye shields when engaged in welding works.</li> <li>✓ Earplugs should be provided to workers who exposed to loud noise, working with jack hammer, joint cutting machines, vibrators.</li> <li>✓ Adequate safety measures for workers during handling of materials.</li> <li>✓ The Contractor shall comply with all regulations for safe working zone at excavations and trenches.</li> <li>✓ At every workplace, drinking water shall be made available to avoid waterborne diseases.</li> <li>✓ The Contractor at his own expenses shall put up necessary shuttering and planking or cut slopes to a safer angle or both with due regard to the safety of personnel and workers and to the satisfaction of the Engineer.</li> </ul> <p>The Contractor shall comply with all the precautions as required for ensuring safety of</p> |          |                | assistance of<br>PMC |

| Sl. No. | Environmental Aspects | Management Measures   | Location | Responsibility |             |
|---------|-----------------------|---|----------|----------------|-------------|
|         |                       |   |          | Implementation | Supervision |
|         |                       | <p>the works as per the International Labour Organization (ILO) Convention No. 62 as far as those are applicable to this Agreement.</p> <p>The Contractor shall make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 are adhered to.</p> <p>The Contractor shall not employ any person below the age of 14 years for any work and no woman shall be employed on the work of painting with products containing lead in any form.</p> <p>The Contractor shall also ensure that no paint containing lead or lead products is used to except in the form of paste or readymade paint. The Contractor shall provide facemasks for use to the workers when paint is applied in the form of spray.</p> <p>The Contractor shall develop a Construction Safety Plan and the same be submitted for the approval of Engineer. The Contact numbers of Police, Fire Brigade, Ambulance, Police Station, Environmental Engineer, and HDBRTS should be displayed at each NMT Site.</p> |          |                |             |



| Sl. No.  | Environmental Aspects | Management Measures  | Location              | Responsibility |                                     |
|----------|-----------------------|--|-----------------------|----------------|-------------------------------------|
|          |                       |  |                       | Implementation | Supervision                         |
| NMT 1.13 | Handling of Chemicals | <p>Any skin contacts with epoxy materials, solvents and epoxy strippers should be avoided.</p> <p>The resin and hardener should not be allowed to come into direct contact with skin. The most effective protection is achieved by wearing polythene gloves, rubber gloves, with a cloth liner, and protective clothing.</p> <p>If materials are sprayed, a respirator shall be used.</p> <p>All discarded buckets and containers shall be removed from site. These shall be stored in waste disposal site.</p>  | At construction site. | Contractor     | HDBRTSCO with the assistance of PMC |
| NMT 1.14 | Management of Safety  | <p>The Contractor shall submit the pedestrian safety management plan for safe working zone and the same should be approved by Environmental Engineer. Delineator post should be provided at the interval of 20 meter along the entire NMT construction site.</p> <p>The Contractor shall take all necessary measures for the safety of local communities during the construction of NMT. The Contractor shall provide, erect and maintain the bamboo barricades including the signs boards, markings, red flags, warning sign boards.</p> <p>The Contractor shall ensure that all signs,</p> | At construction site. | Contractor     | HDBRTSCO with the assistance of PMC |

| Sl. No.       | Environmental Aspects                           | Management Measures   | Location              | Responsibility |                                     |
|---------------|---|---|-----------------------|----------------|-------------------------------------|
|               |   |   |                       | Implementation | Supervision                         |
|               |   | barricades markings are provided as per the standards & specifications.   |                       |                |                                     |
| NMT 1.15      | Informatory Safety Sign Boards                  | The Contractor shall provide, erect and maintain informatory/safety signs written in English and Hindi, Kannada wherever required or as suggested by the Environmental Engineer.  | At construction site. | Contractor     | HDBRTSCO with the assistance of PMC |
| NMT 1.16      | Pollution Monitoring                            | The Contractor shall monitor Air Quality at NMT site at peak hrs of construction, quarterly except the monsoon.   | At construction site. | Contractor     | HDBRTSCO with the assistance of PMC |
| <b>H.1</b>    | <b>HEALTH</b>                                   |   |                       |                |                                     |
| NMT-<br>H 1.1 | Medical Facilities at Construction camps/ sites | <p><b>Sanitation Facilities:</b></p> <p>The Construction camps shall be provided with sanitary latrines and urinals. Closed drainage systems and the proper treatment systems according to the local conditions should be constructed for the proper flow and effective drainage.</p> <p><b>Shelter at work place:</b></p> <p>At such work places where the duration of the works will prevail for more than one month some form of shelters will be provided for meals, resting, change of clothes and for keeping the tools of the work and personal protective equipment. The height of shelter shall not less than 3m from floor level to lowest part</p> | At construction site. | Contractor     | HDBRTSCO with the assistance of PMC |

| Sl. No.        | Environmental Aspects | Management Measures  | Location                              | Responsibility |                                     |
|----------------|-----------------------|--|---------------------------------------|----------------|-------------------------------------|
|                |                       |  |                                       | Implementation | Supervision                         |
|                |                       | <p>of the roof.</p> <p><b>Health care Facilities:</b></p> <p>The Contractor should be provided basic health care facilities at the construction camps.</p> <p>The health centre will have at least a doctor (part time), nurses, duty staff, medicines and minimum medical facilities to tackle first-aid requirements for minor accidental cases. The arrangements will be made with the nearest hospital to refer patients of major illnesses or critical cases.</p> <p><b>Day crèche facilities</b></p> <p>At construction sites where women with very young children are employed, provision of a day crèche shall be provided. At construction sites where 20 or more women are ordinarily employed, a hut for children under the age of 6 years shall be provided.</p> |                                       |                |                                     |
| NMT –<br>H 1.2 | First Aid             | <p>A readily available first- aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules, should be kept at NMT Construction site.</p> <p>The first-aid box should contain antibiotics, pain killers, anti-diarrhoeal medicines, sterilized</p>  | At construction site and labour camp. | Contractor     | HDBRTSCO with the assistance of PMC |

| Sl. No.          | Environmental Aspects                              | Management Measures  | Location              | Responsibility |                                     |
|------------------|--|--|-----------------------|----------------|-------------------------------------|
|                  |  |  |                       | Implementation | Supervision                         |
|                  |  | dressing material, antiseptics, bandage and other necessary appliances be available as per the factory rules.  |                       |                |                                     |
| <b>NMT D 1</b>   | <b>The Contractor 's Demobilization</b>            |  |                       |                |                                     |
| <b>NMT D 1.1</b> | Cleanup Operations, Restoration and Rehabilitation | <p>The Contractor shall prepare site restoration plans, which shall be approved by the Engineer of HDBRTS. The clean-up and restoration operations are to be implemented by the Contractor prior to demobilization.</p> <p>All excavated sites which are not used for construction works shall be re-filled and the entire site left clean and tidy at the Contractor 's expense, to the satisfaction to the Engineer</p> <p>The Contractor shall clear all the temporary structures, residual spoils, other wastes lying in and around the project site as per Comprehensive Waste Management Plan.</p> | At construction site. | Contractor     | HDBRTSCO with the assistance of PMC |

## 8.1 Appointment of Safety Expert

For carrying out environmental, health and safety management measures during the NMT construction, the Contractor will mobilize a qualified Safety Engineer as per the stipulated contract conditions for the day to day co-ordination. The Safety Expert shall be responsible for the implementation of all the aspects of environmental, health and safety management measures. The safety Engineer should be a graduate in Civil Engineering and shall have 7 years experience in similar fields dealing with EHS aspects.

The responsibility of Safety Expert shall be as follows:

- Co-ordinate with HSE Manager for resolving the Health, Safety Environment and prepare report for remedial measures;
- Prepare the HSE Training program as per the site specific requirement under guideline of HSEMS;
- Review, monthly safety committee minutes, prepare summary report;
- Follow-up with the Project in charge / Liaising in-charge for monthly HSE Report. Site HSE report should reach before 7 days of every month;
- To insure Environmental and Safety Issues and its timely closer;
- Maintaining and updating centralise documentation system;
- Prepare HSE Internal Audit Schedule for project sites & inform site in-charge in advance;
- Carry- out HIRA (Hazard identification and risk assessment) & EAI (Environmental Aspects and its Impacts) and prepare mitigation measures and approve it form Head-HSE;
- Tool Box Talk at assembly point, every day by 9.00hrs to ensure the personal safety for the workers before sending them to Construction sites;
- In depth monitoring of project links on daily basis;
- Attend road safety arrangement and PPEs;
- Training to workers for improvement of HSE objectives;
- Ensure First-Aid kits at the construction sites;
- Assist in mock drills for Safety. Health & Environmental awareness programme;
- daily Safety Observation Tour, Work place Monitoring, Safety Findings to be recorded & Informed to site HSE Expert;
- Assist in emergency prepadness plan and its effectiveness report (i.e. Mock-drill Report) on half yearly/yearly basis;
- Reporting of accidents (if any) immediately to the EE under consultation to SHE Manager;
- To ensure Environmental Monitoring programme for Air, Water, Noise and Soil quality to be conducted on quarterly basis; and
- Follow-up HSE Audit & prepare report according to compliances.

## 9. Revised Environmental Management Plan (EMP) Budget

Revised Environmental Management budget for environmental mitigation measures in addition to initial mitigation costs are given in *Table – 9.1*.

**Table 9-1: Revised EMP Budget**

| S. No.     | Item  | Unit   | Rate (in INR) | Quantity                   | Cost (in INR)         |
|------------|---|--------|---------------|----------------------------|-----------------------|
| <b>I</b>   | Initial budgetary provisions for Environmental management measures for road component included under good engineering practices 10% contingency   |        |               |                            | 60,67,600.00          |
| <b>II</b>  | Initial budgetary provisions for Environmental management measures for BRTS component included under good engineering practices 10% contingency   |        |               |                            | 19,55,800.00          |
|            |   |        |               | <b>Total</b>               | <b>80,23,400.00</b>   |
| <b>A</b>   | <b>CONSTRUCTION PHASE</b>   |        |               |                            |                       |
| <b>1.0</b> | <b>Green BRTS Programme (Tree Plantation and Protection)</b>  |        |               |                            |                       |
| 1.1        | 1 <sup>st</sup> Phase – 2013-2014; by BRTS; Watch & Care under responsibility of school/ College.   | Number | 55.00         | 8000                       | 4,40,000.00           |
| 1.2        | 2 <sup>nd</sup> Phase - 2014-2015; watch & care by Forest Department.   | Number | 214.00        | 4000                       | 8,56,000.00           |
| 1.3        | 3 <sup>rd</sup> Phase - 2015-2016 by Forest Department  | Number | 315.00        | 4000                       | 12,60,000.00          |
| 1.4        | 4 <sup>th</sup> Phase -2016-2017 by Forest Department   | Number | 320.00        | 2000                       | 6,40,000.00           |
| 1.5        | 5 <sup>th</sup> Phase-2017-2018 by Forest Department. (Plantation of 9510 saplings against additional felling of tree for MTL, infrastructure sites and causality towards above said four phases. | Number | 340.00        | 9510                       | 32,33,400.00          |
| <b>2.0</b> | Consultancy charges for conducting annual independent Environmental Audit   |        |               |                            | 13,17,375.00          |
| <b>3.0</b> | Consultancy charges for preparation of Landscape plan for Hubli-Dharwad BRTS Project  |        |               |                            | 77,71,500.00          |
|            |   |        |               | <b>Total Amounts (INR)</b> | <b>1,55,18,275.00</b> |
|            |   |        |               | <b>10% contingency</b>     | <b>15,51,828.00</b>   |
|            | <b>Grand Total INR.</b> (Environmental Budget Under Good Engineering Practices, for additional Impacts with 10% contingency)  |        |               |                            | <b>1,70,70,103.00</b> |

### Revised EMP Budget

For mitigation measures of additional impacts, EMP budget is INR Rs. 1,70,70,103 (One crore seventy lakhs seventy thousand one hundred and three only).