ANNEXURE-5

TREE PLANTATION STRATEGY

The sustainable economic development depends on the rational use of environmental resources and minimizing, to the extent possible, adverse environmental impacts through improved project selection and more responsible project planning and design. Under this strategy the development must be environmentally sound in the broadest sense. In highway development, environmental planning is concerned with good blending of improvements of physical, social, and economic parameters. It involves not only the environmental (land, water, and air) but is also concerned with integration to local, regional and national socio-economic development.

Road development can have wide ranging environmental impacts. This is because roads extend over long distance and by promoting rapid communication they can catalyze dramatic changes in land use patterns. Soil degradation, loss of top soil and reduction of the productive capacity of the soil covered by the road, which is significantly reduced further as a result of compaction with heavy machinery during construction, is one of the most immediate effects. Landscape and aesthetic distortions due to road development leads to modifications in the regional landscape and changes in the natural relief and morphology of the, vegetation, inclusive of avenue trees and recreational areas. But these impacts can often be significantly reduced through environmentally-sound construction and operation management practices. Careful consideration and assessment of the surrounding environment in road construction and improvement will reduce disruption costs and harmful effects while increasing usage and benefits. Therefore a proper landscape plan should be made which will protect the road from soil erosion, sinking and also to maintain the aesthetic beauty. It will also reduce land, water, air and noise pollutions as well.

Aim and Objective of Tree Plantation:-

- To create green belt and avenues for meeting aesthetic recreational needs to the people.
- To beautify the areas for scenic beauty.
- To reduce the surface run-off discharge and checking soil erosion along the embankments.
- To reduce the encroachment of road reserve areas.
- To reduce temperature and increase humidity.
- To reduce noise pollution to the neighboring household population.
- To reduce the impacts of air pollution and dust as trees and shrubs are known to be natural sink for air pollutants.
- To provide much needed shade on glaring hot roads during summer.
- Moderating the effect of wind and incoming radiation.
- To define the ROW especially highlight sharp horizontal curves during night.
- To promote road development as eco friendly activity.

Tree Plantation Strategy

Plantation is one of the most important constituents of soft landscaping. Trees, shrubs and climbers have been used to enhance the soft natural ambience against harsh elements in most of the enhancement schemes. The planting species are decided based on the physical growth characteristics of trees, like form and shape, foliage pattern, growth rate, branching pattern, soil characteristics etc. While selecting the species of trees for landscaping a great care should be taken

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to choose the species, which already exist on the project corridor. The tree plantation will be carried out in accordance with the IRC: SP: 21:2009 guidelines and specifications.

Plantation Pattern

Depending on the availability of the ROW, plantation pattern is worked out as follows:-

1. The first row along the highway to be planted with small to medium sized ornamental trees.
2. Subsequent rows depending on the availability of land will comprise of ornamental or shade bearing species of more height than those in the first row. Since the proposed Highway section is passing through the rural sections, the last row will always be of shade bearing tall trees. Five rows of trees are proposed to be planted on either side.
3. Planting of shrubs in the median.
4. Planting of herbaceous species as ground cover in the median, special landscapes on embankment slopes.
5. Turfing with grasses in the median and embankment slopes.
6. The last row to be planted with tall shade bearing trees for better road safety and for enhancing aesthetics.

Tree Plantation along the Highway Section

1st Row

The first row of plantation along the highway section should be worked out by ornamental species. Since the proposed highway section is passing through the rural areas, the following species are recommended for the 1st row of avenue plantation.

Table 1.0 Species recommended for 1st row plantation

S. No.	Botanical Name	Local Name
1	*Cassia fistula*	Amaltas
2	*Terminalia arjuna*	Arjun
3	*Delonix regia*	Gulmohar
4	*Bauhinia sps*	Kachnar
5	*Cassia nodusa*	Cassia

2nd Row

The 2nd row of plantation along the Project stretch should be worked out by ornamental species of more height i.e. medium height trees, than the first row. The following species are recommended:-

Table 2.0: Species recommended for subsequent row plantation

S. No.	Botanical Name	Local Name
1	*Melia azadiracta*	Bakain
2	*Pongamia pinnata*	Kanji
3	*Gravillea robusta*	Silver Oak
4	*Albizzia lebbek*	Kala siris
5	*Dalbergia sissoo*	Shisham

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Subsequent Rows

The subsequent rows of plantation along the Highway section have been worked out. The tall shade trees like Peepal, Neem, Mango, Shisham etc have high crown and secure better visibility. They have a long gestation period and has rapid growth and capacity to resist disease and pests attack are therefore ideal. These shaded trees should be planted at a spacing of 12m C/C.

The tree species recommended as shade plants for roadside avenues are given the following table:-

Table 3.0: Species recommended for Subsequent rows

S. No.	Botanical Name	Local Name
1	*Ficus religiosa*	Peepal
2	*Ficus infectoria*	Paker
3	*Madhuca indica*	Mahua
4	*Dalbergia Sissoo*	Shisham
5	*Azadirachta indica*	Neem
6	*Mangifera indica*	Mango
7	*Tamarindus indica*	Imli
8	*Syzynium cuminij*	Jamun

Shrub plantation for Median

The species to be planted in median would be of low or medium height with ornamental value to enhance the visual experience of the road corridor. It will also act as a screen to prevent glare from the incoming vehicles. Depending on the width of the median, which is 6.0 m, two rows of flowering shrubs will be provided. Some herbaceous species may also be planted as a ground cover on the median.

Table 4.0: Species recommended for Median

S. No.	Botanical Name	Local Name
1	*Thaventia nerifolia*	Kaner
2	*Bouganvillea sps.*	Bouganvillea
3	*Ipomia*	

Plantation along the Embankments

On the embankment slopes, some herbaceous species followed by grasses turf will be provided. The species proposed for the purpose of turfing are Cynodon dactylon, Cythocline perpurea, Solanum Nigrum, Alternanthera, Chlorophytum, Eupatorium, Wedelia, Duranta, Portulacca, Ipomea, Pelia Cadrii, Asparagus, Opheopogon grass etc.

Technical specifications for planting along the Highway section are as follows:

1. Ornamental plants except last row

- Distance from embankment : 1.0m away from the toe of the embankment
- Spacing between plant to plant : 3m
- Spacing between rows : 3m
- Size of the pits : 60x60x60 cms
- For alkaline soils : By auger
- Water logged areas : mounds with height varying depending on the water level
- Species recommended : Listed in **Table 1.0** and **Table 2.0.**
- No of plants per Km : 333
- Height of plant : 1.5 to 2m

2. Shaded plants (Last row)

- Distance from the preceding row : 3.0m
- Spacing between plant to plant : 12m
- Size of the pits
- Normal size : 60x60x60 cms

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- For alkaline soils : By auger
- Water logged areas : mounds
- Species recommended : Listed in **Table 3.0**
- No of plants per Km : 84
- Height of plant : more than 2m

In localities where a really bad patch of USAR occurs recommendations are to be strictly followed for better survival of plants. Deep pits to be dug and soil amender Gypsum 1 Kg to 3 kg with 2 kg compost and sand are to be filled before planting the plants.

For multiple row plantations, five strand barbed wire fencing, with cross strands, stretched on angle iron poles fixed at a distance of 4 meters from one another are to be provided as per recommendations. Live fencing/ bamboo fencing/ thorn fencing may also be used where protection can be ensured through these.

3. Shrubs (For Median/ Embankment)

The surface is to be prepared adequately for shrubs planting or grass sowing. The grasses and shrub planting is done to provide a strong surface cover but needs a well-prepared surface. All masses of loose debris will be removed.

- Size of the pits for planting shrubs : 45x45x45 cms
- Species recommended : Listed in **Table 4.0**
- No of plants per Km : 666 (For two rows in the median)
- Use of compost and manure : 1/3 of volume of pit mixed with soil and refilled

The contractor will be required to water the area in case of insufficient rains after planting.

Plantation at Road Junctions/ Intersection and Traffic Islands

Road intersections are main nodal spaces and are of vital importance in terms of road aesthetics. Proper landscaping of the traffic islands and the surrounding areas shall integrate these features with surrounding landscape. The layout of traffic intersections shall be fixed by the traffic needs of the junction.

Plantation at the Sensitive noise receptors

All along the project corridor were sensitive receptors for noise such as educational institutions, hospitals, religious structure of community importance situated, the trees known for behaving as "noise barrier" will be proposed like- Neem (*Azadirachta indica*), Shisham (*Dalbergia sisso*), Imli (*Tamarindus indica*). Some flowering trees like Amaltas, Gulmohar, Kachnar, Asoka etc. can also done. Tall trees with thick canopies create a wind screen through which the air can be filtered and noise levels be considerably reduced. Some such trees are *Acacia auriculiformis* and *Greavillea Robusta*. At the sensitive noise receptors, tall shrubs of 1.5 – 3 m height like *Cassia biflora, Hamelia Patens* etc. can also be provided for maximum possible screening.

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