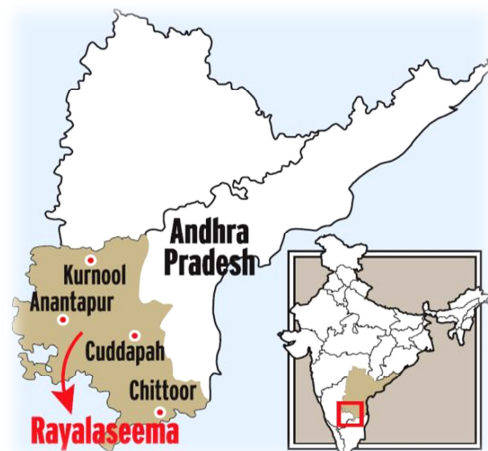


## EXECUTIVE SUMMARY

### E.1 INTRODUCTION

Good transportation systems are lifeline to the area they serve. Roads bring about all-round development in the region. A good road network helps in the success of all development activities, be it in the sphere of movement of people and goods, agriculture, commerce, education, health, and social welfare, or even maintenance of law and order and security.

Post bifurcation, the Rayalaseema region, comprising four districts of Kurnool, Kadapa, Anantapur and Chittoor finds itself at crossroads. 40% of the land in the new state is in the Rayalseema region, which is a huge tract of land quite inhospitable for agriculture. Keeping this view in mind, the Govt. of Andhra Pradesh plans to develop the region by providing better infrastructure facilities and thus make this region a major potential hub for industrial development. In this regard, an access-controlled expressway is planned, in pursuance of connecting the new capital city of Amaravathi, to solve the development issues of Rayalaseema.



As part of this endeavor, the Roads and Buildings (R&B) Department of Andhra Pradesh, has been entrusted the ambitious work of **Preparation of Detailed Project Report for 4/6 Lane Access Controlled Green Field Expressway Connecting New Capital City Amaravathi to Ananthapuramu in the State of Andhra Pradesh through BOT/ EPC Basis** by the Govt. of Andhra Pradesh. R&B (NH&CRF), Govt. of AP (*herein after referred to as the "Client"*), has appointed M/s. Aarvee Associates Architects Engineers & Consultants Pvt. Ltd. (*herein after referred to as the "Consultant"*) to provide consultancy services for preparation of Detailed Project Report for the proposed expressway. The Agreement for consultancy services was signed on 04/04/2018. The current draft feasibility report has been prepared based on analysis of data derived from the surveys, observations made during site visits and in accordance with contractual stipulations.

### E.2 SCOPE OF SERVICES

As per Terms of Reference (ToR), the project study consists of preparation of the following:

- Initial traffic surveys and demand assessment
- Initial social impact assessment and assessment of land to be acquired
- Initial Environmental impact assessment

- Preparation of general arrangement drawings for Structures
- Preparation of Plan & Profile of the proposed road & pavement design
- Preparation of indicative BOQ and rough cost estimates
- Economic and Financial analysis of the project

### E.3 PROJECT STRETCH

The proposed expressway connects the new capital city of Andhra Pradesh, Amaravathi with Ananthapuramu. The spinal corridor takes off from NH-44 near Maruru in Ananthapuramu district and ends at Pedaparimi near Sakhamuru, thereby crossing the Vijayawada IRR near Tadikonda and ORR near Velavarthipadu. Few fragments of proposed expressway pass through Nallamala Forest area. The expressway traverses across the districts of Ananthapuramu, Kurnool, Kadapa, Prakasam and Guntur. 6-lane road starts from Yadavalli which forms a single straight stretch to the state capital. The expressway is proposed to be designed as high-speed corridor by making it completely access-controlled.

**Table-E.1: Details of Project Corridor**

| S.No.                               | Stretch                               | Length | Major Settlements Nearby                                                                                              | District(s)                      |
|-------------------------------------|---------------------------------------|--------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 1                                   | Ananthapuramu - Yadavalli<br>(4 lane) | 173 km | Narapala, Kadavakallu, Tadipatri, Allagadda, Giddalur, Yadavalli                                                      | Ananthapuramu, Kurnool, Prakasam |
| 2                                   | Yadavalli - Amaravathi<br>(6 lane)    | 211 km | Guddimetta, Cumbum, Dekanakonda, Nuzendla, Kommalapadu, Chilakaluripet, Nadendla, 113 Talluru, Medikonduru, Tadikonda | Prakasam, Guntur                 |
| Total Length of Expressway = 384 km |                                       |        |                                                                                                                       |                                  |

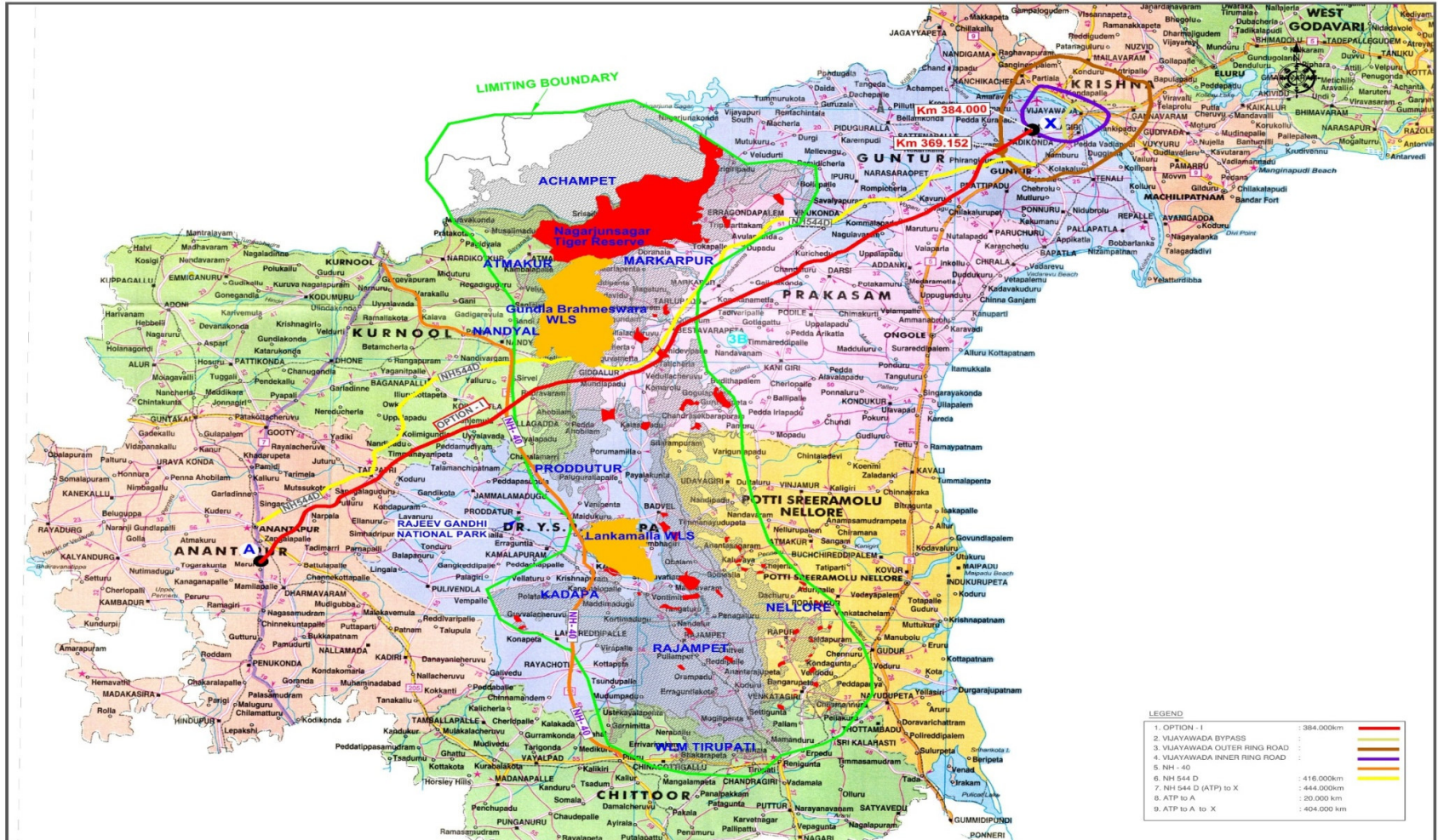


Figure E-1: Index Map of the Project Stretch

#### E.4 SALIENT FEATURES

The proposed Right of Way (RoW) for the project corridor is as shown in *Table-E.2*.

**Table-E.2: Right of Way**

| S.No. | Alignment                                                  | Section                                    | RoW   |
|-------|------------------------------------------------------------|--------------------------------------------|-------|
| 1     | Maruru (Km 0.000) to Yadavalli (Km 184.270) (4 lane)       | Ananthapuramu – Amaravathi Spinal Corridor | 100 m |
| 2     | Yadavalli (Km 184.270) to Pedaparimi (Km 395.290) (6 lane) |                                            | 100 m |

**Terrain:** The project corridor predominantly passes through plain terrain followed by hilly terrain and rolling terrain.

**Landuse:** The predominant land-use along the project corridor is agricultural followed by barren lands, forest area, Built-up area and others.

**Settlements:** 140 villages/ towns are found along the Ananthapuramu - Amaravati corridor

**Forest/ Wild Life Sanctuaries:** As already stated, section of the proposed expressway traverses for 33.10 km (Ananthapuramu – Amaravati section) in the forest area. Total length of road passing through forest land is approximately 33.10 km.

#### E.5 SURVEYS AND INVESTIGATIONS

The studies and investigations carried out during the feasibility study comprised mainly of the following:

- Topographic surveys using photogrammetry by Unmanned Aerial Vehicle (UAV)
- Traffic surveys viz., Classified Traffic Volume Count, Axle Load, Origin Destination and Commodity Movement including collection of secondary data for traffic projections
- Collection and laboratory testing of soil samples from pits adjacent to the existing road
- Identification of borrow areas for different types of pavement and bridge construction material, collection of samples and their analysis
- Environmental baseline studies and Public Consultations

#### E.6 TRAFFIC STUDIES

Based on reconnaissance studies, the locations for conducting various traffic surveys were finalised. The traffic surveys viz., Classified Traffic Volume Count, Axle Load, Origin Destination and Commodity Movement etc. including collection of secondary data for traffic projections were carried out in the month of May-2018. Secondary data was collected for the purpose of determining the Seasonal Variation Factors and Growth Rates at various count



stations for different vehicle categories. The identified locations for traffic surveys are given below:

- **Location 1:** NH-44 near Maruru between Anantapur & Bengaluru
- **Location 2:** NH-544D near Rotary Puram between Anantapur & Tadipatri
- **Location 3:** NH-67 near Ankireddy palli between Proddatur & Gooty
- **Location 4:** SH-57 near Atmakur between Kurnool & Doranala
- **Location 5:** NH-40 near Dupadu between Markapur & Macherla
- **Location 6:** NH-544D near Chilakaluripet between Guntur & Ongole
- **Location 7:** NH-544D near Phirangipuram between Narasaraopet & Guntur
- **Location 8:** NH-565 near Sattenapalle between Guntur & Piduguralla
- **Location 9:** NH-16 near Motu Junction between Porumamilla & Cumbum
- **Location 10:** NH-544D near Onipenta between Mydukur & Porumamilla
- **Location 11:** NH-40 near Ayalurmitta between Kadapa & Kurnool
- **Location 12:** NH-340C near Kanigiri between Markapur & Pamuru
- **Location 13:** NH-544D near Allur between Koilkuntla & Pulivendula
- **Location 14:** NH-40 near Vontimitta between Kadapa & Rajampet
- **Location 15:** SH-34 near Kaza between Vijayawada & Guntur

#### E.6.1 Annual Average Daily Traffic (AADT)

The Average Daily Traffic volumes of different types of vehicles were assessed from Origin - Destination survey and the AADT figures were calculated after applying seasonal correction factors for different types of vehicles (diesel / petrol) for the month of May. AADT values for different sections are given in **Table E.3**.

#### E.6.2 Vehicle Damage Factor

The VDF values observed for the diverted traffic for different types of vehicles are given in **Table E.4**.

#### E.6.3 Traffic Growth Rates

Traffic growth rates are an important parameter for projecting the traffic for the design life of pavement. The projected traffic, in turn, will form the basis for capacity assessment, pavement design, and economic and financial viability analysis. Growth rates adopted for different types of vehicles are given in **Table E.5**.

Table E.3: Average Annual Daily Traffic

| Survey Location |                  | 1                     | 2                     | 3                 | 4                  | 5                   | 6               | 7                     | 8                    | 9                    | 10                    | 11               | 12                | 13                       | 14                | 15                  |
|-----------------|------------------|-----------------------|-----------------------|-------------------|--------------------|---------------------|-----------------|-----------------------|----------------------|----------------------|-----------------------|------------------|-------------------|--------------------------|-------------------|---------------------|
| Stretch         |                  | Anantapur - Bengaluru | Anantapur - Tadipatri | Proddatur - Gooty | Kurnool - Doranala | Markapur - Macherla | Guntur - Ongole | Narasaraopet - Guntur | Guntur - Piduguralla | Porumamilla - Cumbum | Mydukur - Porumamilla | Kadapa - Kurnool | Markapur - Pamuru | Koilkuntla - Pulivendula | Kadapa - Rajampet | Vijayawada - Guntur |
| Volume          | Total Traffic    | 12530                 | 9012                  | 6899              | 4895               | 8928                | 23756           | 18314                 | 18396                | 4249                 | 6830                  | 12842            | 7376              | 2860                     | 10290             | 55077               |
|                 | Tollable Traffic | 8251                  | 3056                  | 2821              | 1583               | 3989                | 13476           | 6055                  | 6552                 | 1445                 | 1977                  | 6713             | 1896              | 941                      | 6649              | 25932               |
| PCU             | Total Traffic    | 17982                 | 10165                 | 12038             | 5272               | 11721               | 34051           | 17972                 | 19281                | 4979                 | 7731                  | 18679            | 8060              | 3522                     | 17676             | 63477               |
|                 | Tollable Traffic | 15242                 | 5819                  | 7200              | 2766               | 8497                | 27670           | 10537                 | 11938                | 3266                 | 3993                  | 14429            | 3345              | 2005                     | 14027             | 46593               |

Table E.4: Vehicle Damage Factors

| Survey Location | 1                 |                   | 2                 |                   | 3                 |               | 4               |                  | 7                    |                | 9                   |                | 10              |                     | 11             |                 |
|-----------------|-------------------|-------------------|-------------------|-------------------|-------------------|---------------|-----------------|------------------|----------------------|----------------|---------------------|----------------|-----------------|---------------------|----------------|-----------------|
| Vehicle Type    | Towards Anantapur | Towards Bengaluru | Towards Anantapur | Towards Tadipatri | Towards Proddatur | Towards Gooty | Towards Kurnool | Towards Doranala | Towards Narasaraopet | Towards Guntur | Towards Porumamilla | Towards Cumbum | Towards Mydukur | Towards Porumamilla | Towards Kadapa | Towards Kurnool |
| LCV             | 1.141             | 0.810             | 0.29              | 0.48              | 0.33              | 0.28          | 1.419           | 0.194            | 0.122                | 0.793          | 0.229               | 0.682          | 1.076           | 0.366               | 1.221          | 1.587           |
| 2 Axle          | 2.030             | 1.875             | 2.59              | 1.14              | 3.02              | 2.42          | 2.008           | 2.755            | 1.853                | 2.383          | 4.214               | 1.860          | 3.280           | 2.891               | 1.746          | 2.158           |
| 3 Axle          | 3.795             | 3.326             | 5.79              | 2.18              | 5.67              | 6.20          | 3.779           | 6.920            | 4.643                | 5.778          | 5.852               | 3.904          | 4.597           | 3.048               | 4.053          | 3.519           |
| MAV             | 7.184             | 6.349             | 6.99              | 2.73              | 7.53              | 7.35          | 7.297           | 7.384            | 5.621                | 4.233          | 7.280               | 6.513          | 6.680           | 4.407               | 7.145          | 7.228           |

Table E.5: Recommended Traffic Growth Rates

| S.No. | Period    | Car (W) | Car (Y) | Truck (2A) | Truck (3A, MAV) | Bus   | Mini Bus |
|-------|-----------|---------|---------|------------|-----------------|-------|----------|
| 1     | 2018-2020 | 5.00%   | 5.00%   | 5.00%      | 5.00%           | 5.00% | 5.00%    |
| 2     | 2021-2025 | 5.00%   | 5.00%   | 5.00%      | 5.00%           | 5.00% | 5.00%    |
| 3     | 2026-2030 | 5.00%   | 5.00%   | 5.00%      | 5.00%           | 5.00% | 5.00%    |
| 4     | 2031-2035 | 5.00%   | 5.00%   | 5.00%      | 5.00%           | 5.00% | 5.00%    |
| 5     | 2036-2040 | 5.00%   | 5.00%   | 5.00%      | 5.00%           | 5.00% | 5.00%    |
| 6     | 2040-2045 | 5.00%   | 5.00%   | 5.00%      | 5.00%           | 5.00% | 5.00%    |
| 7     | 2045-2050 | 5.00%   | 5.00%   | 5.00%      | 5.00%           | 5.00% | 5.00%    |
| 8     | 2050-2052 | 5.00%   | 5.00%   | 5.00%      | 5.00%           | 5.00% | 5.00%    |

#### E.6.4 Traffic Assignment on Project Corridor

The proposed expressway is assumed to come into operation in the year 2022. It is expected that due to construction of access controlled expressway, traffic on existing roads will completely utilize the facility. The entire project stretch has been divided into 21 homogenous traffic sections based on entry and exit points in the form of interchanges proposed. The entry/ exit points along the project stretch have been chosen at such locations where possible diversion of existing traffic is expected on to the proposed expressway from National/ State Highways/ MDRs.

- **Leg 1:** Stretch from Maruru to Kandakur (Anantapur Dist.)
- **Leg 2:** Stretch from Kandakur to Chamaluru (Anantapur Dist.)
- **Leg 3:** Stretch from Chamaluru to Hussainpuram (Anantapur Dist.)
- **Leg 4:** Stretch from Hussainpuram to Boyala Tadipatri (Anantapur & Kurnool Dist.)
- **Leg 5:** Stretch from Boyala Tadipatri to Allur (Kurnool Dist.)
- **Leg 6:** Stretch from Allur to Nallagatla (Kurnool Dist.)
- **Leg 7:** Stretch from Nallagatla to Chinna Kambaloor (Kurnool & Prakasam Dist.)
- **Leg 8:** Stretch from Chinna Kambaloor to Yadavalli (Prakasam Dist.)
- **Leg 9:** Stretch from Yadavalli to Nekunambadu (Prakasam Dist.)
- **Leg 10:** Stretch from Nekunambadu to Kethagudipi (Prakasam Dist.)
- **Leg 11:** Stretch from Kethagudipi to Gudipadu (Prakasam Dist.)
- **Leg 12:** Stretch from Gudipadu to Kunduru (West) (Prakasam Dist.)
- **Leg 13:** Stretch from Kunduru (West) to Komalapadu (Prakasam Dist.)
- **Leg 14:** Stretch from Komalapadu to Kavuru (Prakasam & Guntur Dist.)
- **Leg 15:** Stretch from Kavuru to Medikonduru (Guntur Dist.)
- **Leg 16:** Stretch from Medikonduru to Velavarthipadu (Guntur Dist.)

- **Leg 17:** Stretch from Velavarthipadu to Tadikonda (Guntur Dist.)
- **Leg 18:** Stretch from Tadikonda to Pedaparimi (Guntur Dist.)



Figure E-2: Section (leg) wise break up of Project Stretch

Table-E.6: Potential Divertible Traffic on Proposed Expressway in the year 2018  
(Legs 1 to 11)

| Vehicle Mode | Leg 1 | Leg 2 | Leg 3 | Leg 4 | Leg 5 | Leg 6 | Leg 7 | Leg 8 | Leg 9 | Leg 10 | Leg 11 |
|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|
| Car          | 2463  | 2469  | 2576  | 1515  | 1513  | 1513  | 1317  | 1512  | 2605  | 2579   | 3230   |
| Bus          | 278   | 278   | 278   | 512   | 512   | 512   | 377   | 447   | 753   | 767    | 785    |
| Mini Bus     | 13    | 13    | 16    | 27    | 27    | 27    | 11    | 5     | 15    | 16     | 19     |
| Tata Magic   | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 1     | 1     | 1      | 2      |
| LCV          | 451   | 485   | 492   | 425   | 428   | 427   | 415   | 408   | 669   | 677    | 702    |
| 2 Axle       | 420   | 420   | 427   | 378   | 377   | 374   | 343   | 382   | 549   | 549    | 562    |
| 3 Axle       | 716   | 717   | 743   | 944   | 1000  | 1002  | 876   | 686   | 961   | 955    | 1028   |
| Multi Axle   | 1491  | 1503  | 1490  | 1455  | 1513  | 1492  | 1325  | 1380  | 1900  | 1845   | 1944   |



| Vehicle Mode            | Leg 1        | Leg 2        | Leg 3        | Leg 4        | Leg 5        | Leg 6        | Leg 7        | Leg 8        | Leg 9        | Leg 10       | Leg 11       |
|-------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Mini LCV                | 302          | 286          | 300          | 390          | 415          | 415          | 381          | 381          | 608          | 605          | 663          |
| <b>Total (Vehicles)</b> | <b>6134</b>  | <b>6171</b>  | <b>6322</b>  | <b>5646</b>  | <b>5785</b>  | <b>5762</b>  | <b>5045</b>  | <b>5202</b>  | <b>8061</b>  | <b>7994</b>  | <b>8935</b>  |
| <b>Total (PCU)</b>      | <b>14414</b> | <b>14512</b> | <b>14688</b> | <b>14634</b> | <b>15088</b> | <b>14989</b> | <b>13089</b> | <b>13270</b> | <b>19581</b> | <b>19341</b> | <b>20852</b> |

**Table-E.7: Potential Divertible Traffic on Proposed Expressway in the year 2018  
(Legs 12 to 21)**

| Vehicle Mode            | Leg 12       | Leg 13       | Leg 14       | Leg 15       | Leg 16       | Leg 17       | Leg 18      |
|-------------------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|
| Car                     | 3238         | 3171         | 3246         | 3205         | 3055         | 1868         | 1736        |
| Bus                     | 949          | 978          | 974          | 958          | 862          | 569          | 524         |
| Mini Bus                | 20           | 20           | 20           | 20           | 19           | 12           | 8           |
| Tata Magic              | 2            | 2            | 2            | 2            | 2            | 2            | 2           |
| LCV                     | 733          | 749          | 775          | 959          | 796          | 689          | 604         |
| 2 Axle                  | 615          | 647          | 656          | 755          | 599          | 270          | 240         |
| 3 Axle                  | 1041         | 1039         | 1054         | 1094         | 933          | 445          | 313         |
| Multi Axle              | 1972         | 1902         | 1907         | 1908         | 1700         | 730          | 592         |
| Mini LCV                | 719          | 693          | 684          | 685          | 621          | 305          | 254         |
| <b>Total (Vehicles)</b> | <b>9289</b>  | <b>9201</b>  | <b>9318</b>  | <b>9586</b>  | <b>8587</b>  | <b>4890</b>  | <b>4273</b> |
| <b>Total (PCU)</b>      | <b>21779</b> | <b>21572</b> | <b>21759</b> | <b>22368</b> | <b>19734</b> | <b>10366</b> | <b>8807</b> |

### E.6.5 Projected Traffic Volumes

The anticipated and projected traffic volumes on the project road (including developmental traffic) are given in **Tables E.8** and **E.9** considering the growth rates shown in **Table E.5**.

**Table-E.8: Projected Traffic on Project Corridor (Legs 1 to 10)**

| Traffic Volume (No.) |        |        |        |        |        |        |        |        |        |        |
|----------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Year                 | Leg 1  | Leg 2  | Leg 3  | Leg 4  | Leg 5  | Leg 6  | Leg 7  | Leg 8  | Leg 9  | Leg 10 |
| 2018                 | 6134   | 6171   | 6322   | 5646   | 5785   | 5762   | 5045   | 5202   | 8061   | 7994   |
| 2020                 | 6763   | 6804   | 6970   | 6225   | 6378   | 6353   | 5562   | 5735   | 8887   | 8813   |
| 2025                 | 11854  | 11907  | 12120  | 10987  | 11363  | 11330  | 10323  | 10545  | 15334  | 15239  |
| 2030                 | 17460  | 17527  | 17799  | 16221  | 16834  | 16791  | 15505  | 15789  | 22456  | 22334  |
| 2035                 | 24804  | 24888  | 25237  | 23323  | 24003  | 23949  | 22307  | 22670  | 31775  | 31620  |
| 2040                 | 28688  | 28797  | 29241  | 26899  | 27668  | 27598  | 25503  | 25966  | 36881  | 36685  |
| 2045                 | 33648  | 33786  | 34352  | 31465  | 32345  | 32256  | 29582  | 30173  | 43399  | 43147  |
| 2050                 | 39977  | 40154  | 40876  | 37289  | 38315  | 38201  | 34788  | 35543  | 51717  | 51395  |
| 2052                 | 42973  | 43169  | 43965  | 40048  | 41141  | 41016  | 37253  | 38085  | 55655  | 55301  |
| PCUs                 |        |        |        |        |        |        |        |        |        |        |
| Year                 | Leg 1  | Leg 2  | Leg 3  | Leg 4  | Leg 5  | Leg 6  | Leg 7  | Leg 8  | Leg 9  | Leg 10 |
| 2018                 | 14413  | 14511  | 14687  | 14633  | 15086  | 14987  | 13088  | 13269  | 19579  | 19340  |
| 2020                 | 15890  | 15998  | 16192  | 16132  | 16632  | 16523  | 14429  | 14629  | 21586  | 21322  |
| 2025                 | 34776  | 34915  | 35166  | 34274  | 35725  | 35586  | 32915  | 33170  | 45498  | 45162  |
| 2030                 | 54873  | 55049  | 55367  | 53637  | 56086  | 55904  | 52493  | 52822  | 71051  | 70618  |
| 2035                 | 81372  | 81593  | 82005  | 80245  | 82916  | 82685  | 78332  | 78751  | 104700 | 104151 |
| 2040                 | 90500  | 90786  | 91306  | 89516  | 92471  | 92178  | 86622  | 87157  | 117102 | 116403 |
| 2045                 | 102152 | 102517 | 103179 | 101346 | 104669 | 104294 | 97203  | 97888  | 132932 | 132037 |
| 2050                 | 117023 | 117487 | 118334 | 116439 | 120237 | 119757 | 110708 | 111578 | 153134 | 151991 |
| 2052                 | 124062 | 124576 | 125511 | 123590 | 127608 | 127075 | 117101 | 118062 | 162700 | 161439 |

**Table-E.9: Projected Traffic on Project Corridor (Legs 11 to 21)**

| Traffic Volume (No.) |        |        |        |        |        |        |        |        |
|----------------------|--------|--------|--------|--------|--------|--------|--------|--------|
| Year                 | Leg 11 | Leg 12 | Leg 13 | Leg 14 | Leg 15 | Leg 16 | Leg 17 | Leg 18 |
| 2018                 | 8935   | 9289   | 9201   | 9318   | 9586   | 8587   | 4890   | 2537   |
| 2020                 | 9851   | 10241  | 10144  | 10273  | 10569  | 9467   | 5391   | 2797   |
| 2025                 | 16561  | 17061  | 16937  | 17103  | 17479  | 16072  | 6885   | 3574   |
| 2030                 | 24022  | 24659  | 24501  | 24712  | 25193  | 23396  | 8786   | 4561   |



|             |               |               |               |               |               |               |               |               |
|-------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 2035        | 33774         | 34548         | 34346         | 34615         | 35230         | 32937         | 11214         | 5820          |
| 2040        | 39433         | 40431         | 40175         | 40519         | 41302         | 38375         | 14312         | 7428          |
| 2045        | 46656         | 47941         | 47613         | 48052         | 49051         | 45316         | 18266         | 9481          |
| 2050        | 55873         | 57525         | 57105         | 57667         | 58942         | 54175         | 23311         | 12100         |
| 2052        | 60238         | 62063         | 61601         | 62220         | 63625         | 58369         | 25701         | 13340         |
| <b>PCUs</b> |               |               |               |               |               |               |               |               |
| <b>Year</b> | <b>Leg 11</b> | <b>Leg 12</b> | <b>Leg 13</b> | <b>Leg 14</b> | <b>Leg 15</b> | <b>Leg 16</b> | <b>Leg 17</b> | <b>Leg 18</b> |
| 2018        | 20850         | 21778         | 21571         | 21758         | 22368         | 19733         | 10364         | 7069          |
| 2020        | 22987         | 24010         | 23781         | 23988         | 24660         | 21755         | 11426         | 7794          |
| 2025        | 47282         | 48589         | 48299         | 48566         | 49421         | 45711         | 14593         | 9958          |
| 2030        | 73327         | 74995         | 74622         | 74963         | 76057         | 71316         | 18619         | 12707         |
| 2035        | 107606        | 109557        | 109083        | 109516        | 110915        | 104866        | 23767         | 16214         |
| 2040        | 120811        | 123351        | 122745        | 123301        | 125083        | 117360        | 30331         | 20694         |
| 2045        | 137664        | 140957        | 140185        | 140890        | 143165        | 133310        | 38711         | 26413         |
| 2050        | 159176        | 163425        | 162436        | 163340        | 166243        | 153668        | 49404         | 33707         |
| 2052        | 169359        | 174064        | 172974        | 173973        | 177171        | 163305        | 54466         | 37161         |

### E.6.6 Capacity Standards

The leg-wise projected traffic volume on the project stretch is compared against respective capacities and the year during which the projected volume reaches its capacity is given in **Table E.10**. The Project Highway needs to be designed for a level of service 'B' as per the capacity manual IRC:64.

**Table-E.10: Capacity Calculations (including developmental traffic)**

| S.No. | Section/<br>Leg | Traffic in<br>Year 2018<br>(PCU) | Year attaining 4 lane<br>capacity |       | Year attaining 6<br>lane capacity |       | Year attaining 8 lane<br>capacity |        |
|-------|-----------------|----------------------------------|-----------------------------------|-------|-----------------------------------|-------|-----------------------------------|--------|
|       |                 |                                  | Year                              | PCU   | Year                              | PCU   | Year                              | PCU    |
| 1     | Leg 1           | 14413                            | 2034                              | 60452 | 2043                              | 97150 | 2053                              | 127851 |
| 2     | Leg 2           | 14511                            | 2034                              | 60664 | 2043                              | 97477 | 2053                              | 128389 |
| 3     | Leg 3           | 14687                            | 2034                              | 61054 | 2043                              | 98080 | -                                 | -      |
| 4     | Leg 4           | 14633                            | 2034                              | 59306 | 2044                              | 98742 | -                                 | -      |
| 5     | Leg 5           | 15086                            | 2034                              | 61924 | 2042                              | 96998 | 2052                              | 127608 |
| 6     | Leg 6           | 14987                            | 2034                              | 61703 | 2042                              | 96671 | 2052                              | 127075 |
| 7     | Leg 7           | 13088                            | 2034                              | 57560 | 2045                              | 97203 | -                                 | -      |
| 8     | Leg 8           | 13269                            | 2034                              | 57959 | 2045                              | 97888 | -                                 | -      |
| 9     | Leg 9           | 19579                            | 2029                              | 51436 | 2034                              | 78629 | 2044                              | 129449 |
| 10    | Leg 10          | 19350                            | 2029                              | 51025 | 2034                              | 78105 | 2044                              | 128598 |
| 11    | Leg 11          | 20850                            | 2029                              | 53603 | 2034                              | 81395 | 2043                              | 130428 |
| 12    | Leg 12          | 21778                            | 2029                              | 55195 | 2034                              | 83425 | 2042                              | 129881 |
| 13    | Leg 13          | 21571                            | 2029                              | 54843 | 2034                              | 82971 | 2042                              | 129216 |
| 14    | Leg 14          | 21758                            | 2029                              | 55164 | 2034                              | 83386 | 2042                              | 129827 |
| 15    | Leg 15          | 22368                            | 2029                              | 56208 | 2034                              | 84715 | 2041                              | 128355 |
| 16    | Leg 16          | 19733                            | 2029                              | 51693 | 2034                              | 78954 | 2044                              | 129802 |
| 17    | Leg 17          | 10364                            | -                                 | -     | -                                 | -     | -                                 | -      |
| 18    | Leg 18          | 7069                             | -                                 | -     | -                                 | -     | -                                 | -      |

It can be observed from the above table that most sections attain 4 lane and 6 lane capacities in longer runs once the expressway comes into operation.



## E.7 TYPICAL CROSS SECTION

Based on traffic considerations, geometric standards and existing site condition, the following parameters for cross sections have been proposed for different sections of the project road.

- i. **TCS – 01:** Undivided 4 – Lane with paved shoulder in Plain and Rolling Terrain
  - Main Carriageway = 2x7.50 m
  - Depressed Median including edge strip = 22.50 m
  - Paved Shoulder = 2x3.0 m
  - Earthen Shoulder on outer edges = 2x2.0 m
  - Drain = 2x2.50 m
  - Utility Corridor = 2x2.0 m
- ii. **TCS – 02:** Undivided 4 – Lane with paved shoulder in Cut Section
  - Main Carriageway = 2x7.50 m
  - Depressed Median including edge strip = 22.50 m
  - Paved Shoulder = 2x3.0 m
  - Earthen Shoulder on outer edges = 2x2.0 m
  - Drain = 2x2.50 m
  - Utility Corridor = 2x2.0 m
- iii. **TCS – 03:** Undivided 6 – Lane with paved shoulder in Plain and Rolling Terrain
  - Main Carriageway = 2x11.25 m
  - Depressed Median including edge strip = 15.00 m
  - Paved Shoulder = 2x3.0 m
  - Earthen Shoulder on outer edges = 2x2.0 m
  - Drain = 2x2.50 m
  - Utility Corridor = 2x2.0 m
- iv. **TCS – 04:** Undivided Tunnel Cross Section (Twin Tube)
  - Main Carriageway = 2x11.25 m
  - Shyness = 2x0.75 m
  - Spacing between Tunnel Tubes = 35.00 m
  - Paved Shoulder = 2x3.0 m
  - Delineator Railing = 2x0.5 m
  - Footway cum Drain = 2x1.20 m
  - Walkway cum Utility Duct including railing = 2x1.00 m
- v. **TCS – 05:** Undivided 6 – Lane with paved shoulder in Forest Cut Section
  - Main Carriageway = 2x11.25 m
  - Depressed Median including edge strip = 38.50 m
  - Paved Shoulder = 2x3.0 m

- Earthen Shoulder on outer edges = 2x2.0 m
  - Drain = 2x2.50 m
  - Prefabricated Sheets = 2 No. of 3.0m Height
- vi. **TCS – 06:** Undivided 6 – Lane with paved shoulder in Forest Section
- Main Carriageway = 2x11.25 m
  - Depressed Median including edge strip = 38.50 m
  - Paved Shoulder = 2x3.0 m
  - Earthen Shoulder on outer edges = 2x2.0 m
  - Drain = 2x2.50 m
- vii. **TCS – 07:** Divided 4 – Lane with paved shoulder
- Main Carriageway = 2x7.0 m
  - Raised Median including Shyness = 5.0 m
  - Paved Shoulder = 2x1.50 m
  - Earthen Shoulder = 2x2.0 m
  - Utility Corridor = 2x3.0 m
- viii. **TCS – 08:** 2 – Lane with paved shoulder for Ramps
- Main Carriageway = 7.50 m
  - Paved Shoulder = 2x1.00 m
  - Earthen Shoulder = 2x1.0 m

## E.8 DESIGN OF STRUCTURES

The summary of proposed structures is given in **Table E.11**.

**Table-E.11: Proposed Structures**

| S.No. | Type                     | Ananthapuramu - Amaravati Spinal Corridor |
|-------|--------------------------|-------------------------------------------|
| 1     | Box Culverts (No.)       | 623                                       |
| 2     | Major Bridges (No.)      | 35                                        |
| 3     | Minor Bridges (No.)      | 220                                       |
| 4     | VOPs / VUPs/ LVUPs (No.) | 111                                       |
| 5     | ROBs (No.)               | 5                                         |
| 6     | Tunnels Length (km)      | 8.38                                      |
| 7     | Viaduct Length (km)      | 7.33                                      |
| 8     | Interchange (No.)        | 18                                        |

At all major NH/SH crossings along the project stretch, Interchanges are proposed to permit traffic from crossing roads to pass through the junction without directly interfering with the traffic stream of Expressway.

**Table-E.12: Proposed Interchanges**

| S.No. | Design Chainage (Km) | Type of Structure  | Type of crossing road | Corridor  |
|-------|----------------------|--------------------|-----------------------|-----------|
| 1     | 0.505                | Trumpet            | NH-44                 | Main Line |
| 2     | 8.340                | Partial Cloverleaf | NH-42                 | Main Line |
| 3     | 32.327               | Partial Cloverleaf | SH-128                | Main Line |
| 4     | 63.615               | Partial Cloverleaf | NH-67                 | Main Line |
| 5     | 84.637               | Partial Cloverleaf | SH-57                 | Main Line |
| 6     | 106.231              | Partial Cloverleaf | SH-28                 | Main Line |
| 7     | 125.024              | Partial Cloverleaf | NH-18                 | Main Line |
| 8     | 184.250              | Partial Cloverleaf | NH-544D               | Main Line |
| 9     | 207.800              | Partial Cloverleaf | SH-53                 | Main Line |
| 10    | 234.850              | Partial Cloverleaf | NH-565                | Main Line |
| 11    | 257.500              | Partial Cloverleaf | SH-54                 | Main Line |
| 12    | 286.500              | Partial Cloverleaf | SH-51                 | Main Line |
| 13    | 312.840              | Partial Cloverleaf | SH-2                  | Main Line |
| 14    | 336.000              | Partial Cloverleaf | SH-45                 | Main Line |
| 15    | 355.560              | Partial Cloverleaf | SH-50                 | Main Line |
| 16    | 365.300              | Partial Cloverleaf | SH-2                  | Main Line |
| 17    | 369.150              | Partial Cloverleaf | ORR                   | Main Line |
| 18    | 389.100              | Partial Cloverleaf | IRR                   | Main Line |

## E.9 PAVEMENT DESIGN

The Preliminary Pavement design is done for both flexible and rigid options. The flexible pavement is designed as per IRC: 37-2012. The rigid pavement is designed using IRC:58-2015 and CMA methods. The Sub grade CBR for the new carriage way is considered 10%. Sub grade thickness of 500 mm is considered for both flexible and rigid pavement options.

### E.9.1 Flexible Pavement Design

**Table-E.13: Flexible Pavement Design (20 years design period)**

| Stretch                        | MSA | BC (mm) | DBM (mm) | Granular Base (mm) | Granular Subbase (mm) | Sub Grade (mm) | Total (mm) |
|--------------------------------|-----|---------|----------|--------------------|-----------------------|----------------|------------|
| Main Line<br>(Leg 1 to Leg 7)  | 111 | 50      | 115      | 250                | 200                   | 500            | 1115       |
| Main Line<br>(Leg 8 to Leg 18) | 138 | 50      | 125      | 250                | 200                   | 500            | 1125       |

### E.9.2 Rigid Pavement Design

**Table-E.14: Rigid Pavement Design**

| S. No. | Item                             | Rigid Pavement design with Tied Concrete shoulders |
|--------|----------------------------------|----------------------------------------------------|
| 1      | PQC of M40 grade, mm             | 320                                                |
| 2      | DLC of M15 grade, mm             | 150                                                |
| 3      | GSB, mm                          | 200                                                |
| 4      | Dia. of Dowel bar, mm            | 38                                                 |
| 5      | Length of Dowel bar, mm          | 500                                                |
| 6      | Spacing of Dowel bar, mm         | 300                                                |
| 7      | Dia. of Tie bar, mm (Plain bars) | 12                                                 |
| 8      | Length of tie bar, mm            | 640                                                |
| 9      | Spacing of tie bar, mm           | 560                                                |

### E.10 TOLL BOOTHS

As closed tolling is proposed to be adopted, toll booths are proposed at all entry/ exit points of loops and ramps of interchanges. The proposed locations of toll booths are given below.

**Table-E.15: List of Toll Booths**

| S.No. | Design Chainage (Km) | Location     | Corridor  | Remarks                       |
|-------|----------------------|--------------|-----------|-------------------------------|
| 1     | 0.505                | Maruru       | Main Line | Toll Booths on Loop and Ramps |
| 2     | 8.340                | Kandukuru    | Main Line |                               |
| 3     | 32.327               | Chamalaru    | Main Line |                               |
| 4     | 63.615               | Hussenapuram | Main Line |                               |
| 5     | 84.637               | Nandipadu    | Main Line | Toll Booths on Loop           |

| S.No. | Design Chainage (Km) | Location       | Corridor  | Remarks                       |
|-------|----------------------|----------------|-----------|-------------------------------|
| 6     | 106.231              | Allur          | Main Line | and Ramps                     |
| 7     | 125.024              | Nallagatla     | Main Line |                               |
| 8     | 184.250              | Daddavada      | Main Line |                               |
| 9     | 207.800              | Nekunambad     | Main Line | Toll Booths on Loop and Ramps |
| 10    | 234.850              | Kethagudipi    | Main Line |                               |
| 11    | 257.500              | Gudipadu       | Main Line |                               |
| 12    | 286.500              | Nuzendla       | Main Line |                               |
| 13    | 312.840              | Komalapadu     | Main Line | Toll Booths on Loop and Ramps |
| 14    | 336.000              | Kavuru         | Main Line |                               |
| 15    | 355.560              | Vemavaram      | Main Line |                               |
| 16    | 365.300              | Medikonduru    | Main Line |                               |
| 17    | 369.150              | Velavarthipadu | Main Line | Toll Booths on Loop and Ramps |
| 18    | 389.100              | Tadikonda      | Main Line |                               |

### E.11 Road Cum Air Strip

In accordance with the recent guidelines proposed by the Ministry, Road-cum-Air strip is proposed which would be used both as a runway as well as a highway. The road would be closed for traffic at the time of landing and take-off of aero planes.

**Table-E.16: Airstrip Details**

| S.No | Description               | Details                         |
|------|---------------------------|---------------------------------|
| 1    | Location of Runway        | Km 127.000 to Km 130.000        |
| 2    | Location                  | Chilakaloor (Rudravaram Mandal) |
| 3    | Basic Runway Length       | 3000m                           |
| 4    | Runway Width              | 60m                             |
| 5    | Stabilised Shoulder       | 7.5m on either side of runway   |
| 6    | Clear Zone length         | 150m                            |
| 7    | Effective Runway Gradient | 0.3%                            |



## E.12 INITIAL ENVIRONMENTAL IMPACT ASSESSMENT

The Environmental Impact Assessment (EIA) is aimed at determining the environmental impacts due to the construction and operation of the project road. The major environmental disciplines in the EIA study include topography and land use, soil and agriculture, geology and seismicity, water quality, climate and meteorology, air quality, noise level, terrestrial and aquatic ecology. The initial environmental impact assessment is presented in detail in Chapter 10 of Main Report.

## E.13 INITIAL SOCIAL IMPACT ASSESSMENT

The main objective of conducting social screening is to provide inputs of social concerns to be detailed in project design and to avoid or minimize the adverse social impacts with the best possible engineering solutions at minimum cost in close coordination between engineering, environmental and social experts during the entire design process. The social screening exercise is intended to assess the negative impacts (direct, indirect or cumulative) and to suggest mitigating measures to avoid or at least minimize the adverse impacts on nearby communities and natural environment, peoples and properties falling on the direct path of road development, people indirectly affected by the way of disruption of livelihood, breakage in community linkages, impacts arising from land acquisition and resettlement etc. The initial social impact assessment is presented in detail in Chapter 11 of Main Report.

## E.14 COST ESTIMATE

The cost estimation for the project is extremely important as the viability and implementation of a project depends on the project cost. Therefore, cost estimates have been carried out with due care. Estimation of preliminary cost, a primary pre-requisite for economic and financial evaluation, has been carried out for construction of new bridges, cross drainage structures, road furniture, bus bays, rest areas, toll plazas etc.

Based on the improvement options considered, the quantities are worked out for the adopted Flexible pavement design based on the traffic data and other design criteria. The analysis of rates was carried out as per the Standard Data Book of MORT&H. The rates of materials were obtained from the SSR of Andhra Pradesh (2018-19). Market rates were adopted for items for which the rates were not available in SSR.

The quantities of earthwork in cut and fill are calculated based on the highway design. The pavement quantities like sub-grade, GSB, WMM, DBM and BC are computed using the pavement design and the typical cross sections adopted. Adequate provision is made for road side furniture including safety devices and miscellaneous items. Estimated cost for construction of proposed expressway for the roadway network configuration of four/ six lane is **Rs. 21888.36 Cr.**

**Table E-17: Abstract of Cost Estimate**

| Total Cost (Rs.)                                       |                        |                       |                      |
|--------------------------------------------------------|------------------------|-----------------------|----------------------|
| Item Description                                       | Main Line              | Kadapa Spur           | Kurnool Spur         |
| BILL NO: 1 - SITE CLEARANCE                            | 129,251,226            | 25,782,656            | 7,204,066            |
| BILL NO: 2 - EARTHWORKS                                | 61,799,123,259         | 6,632,378,563         | 1,255,525,415        |
| BILL NO: 3 - SUB-BASE AND BASE COURSES                 | 15,513,271,787         | 2,028,806,547         | 799,087,685          |
| BILL NO: 4 - BITUMINOUS WORKS                          | 18,047,005,901         | 2,236,347,026         | 666,091,036          |
| BILL NO: 5 - CULVERTS                                  | 5,172,183,877          | 739,986,621           | 193,372,841          |
| BILL NO: 6 - BRIDGES                                   | 19,925,817,494         | 3,188,882,030         | 1,211,897,334        |
| BILL NO: 6A - TUNNEL                                   | 20,250,000,000         | 14,875,000,000        | -                    |
| BILL NO: 6B - VIADUCTS                                 | 15,551,250,000         | 10,333,125,000        | -                    |
| BILL NO: 7 - DRAINAGE AND PROTECTION WORKS             | 12,133,359,169         | 1,989,485,785         | 1,071,887,657        |
| BILL NO: 8 - ROAD JUNCTIONS                            | -                      | -                     | -                    |
| BILL NO: 9 - TRAFFIC SIGNS, MARKINGS AND APPURTENANCES | 267,850,780            | 61,808,547            | 17,055,720           |
| BILL NO: 10 - MISCELLANEOUS                            | 2,237,487,175          | 413,725,760           | 109,562,026          |
| <b>Total Construction Cost</b>                         | <b>171,026,600,668</b> | <b>42,525,328,535</b> | <b>5,331,683,780</b> |
| <b>Length of the proposed road (Kms)</b>               | <b>395.29</b>          | <b>88.62</b>          | <b>21.15</b>         |
| <b>Construction Cost in Crores per Km</b>              | <b>43.27</b>           | <b>47.99</b>          | <b>25.21</b>         |