

**DESIGN & ANALYSIS OF DIFFERENT ELEMENTS OF DELHI –
AMRITSAR – KATRA GREENFIELD EXPRESSWAY**

**A Dissertation Submitted in Fulfillment of the Requirement for the
Award of the Degree of**

Master of Engineering
In Infrastructure Engineering

Submitted by

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THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

**DEPARTMENT OF CIVIL ENGINEERING
THAPAR INSTITUTE OF ENGINEERING AND TECHNOLOGY
(A DEEMEND TO BE UNIVERSITY), PATIALA, PUNJAB
(2022)**

Declaration by the Candidate

I hereby declare that the Project report entitled “**Design & Analysis OF Different Elements of Delhi – Amritsar – Katra Greenfield Expressway**” submitted by me to Thapar Institute of Engineering and Technology, Patiala in partial fulfillment of the requirement for the award of the degree of M.E. in CIVIL ENGINEERING DEPARTMENT is a record of bonafide dissertation work carried out by me under the guidance of Dr. Tanuj Chopra (Assistant Professor, Department of Civil Engineering) and **Mr. Prashant Mahajan** (Manager Tech, NHAI.)

I further declare that the work reported in this dissertation has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

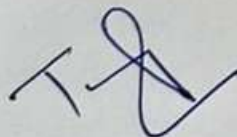


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This is to certify that the above declaration made by the student concerned is correct according to the best of our knowledge and belief



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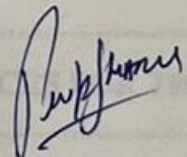
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The vision of working in a team with a high level of responsibility fostered a character of teamwork and created a feeling of oneness which thus, extended our range of vision, encouraged us to perform to the best our ability and create a report of the highest quality.



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Abstract

The Project road Delhi – Amritsar – Katra Greenfield Expressway has an approximate length of 600 Km including spurs and the project road is named NE5. And Phase 1 of the Project road is all Greenfield Expressway (To promote development in undeveloped areas, lower the cost of acquiring land, and speed up construction, Greenfield Expressways are planned to avoid populated areas and follow new alignments.) and Phase -2 of the project road is a combination of Greenfield And Brownfield Expressway.

On the Delhi-Amritsar-Katra Greenfield Expressway, a new type of pavement has been introduced called Perpetual Pavement, which has a design life of more than 30 years. The design of Perpetual Pavement has been as per the guidelines of IRC 37 (Equations like MSA calculation, Fatigue model, Rutting model etc). IITPAVE has been used to check the actual strains developed on the road and compare them with the allowable strains, which is 80 microns for Horizontal Tensile Strain and 200 microns for Vertical Compressive Strain. If the actual strain were to be less than the allowable strain, then only the proposed thickness would be adopted for the construction.

For the design of the geometry of the road, MXROAD is used. The Specifications of the IRC: SP:99-2013 are used for the geometric design of the road (Design Speed, Minimum Length of Transition Curve, Safe Sight Distance, Gradient, Minimum Length of Vertical Curve).

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

The National Highways Authority of India (NHAI) has been constituted through an Act of Parliament for faster, economical and quality Road Construction work throughout India. NHAI aims to provision and maintain the national highway network to meet user expectations in the most time-bound and cost-effective manner within the strategic policy framework. The National Highways Authority of India (NHAI) is the nodal agency of The Ministry of Road Transport and Highways (MORT&H), Government of India, and has been entrusted with the Development of the Delhi - Amritsar – Katra Expressway having an approximate length of 600 Km including spurs through BOT & EPC basis.

The Project Highway starts from Kundli Manesar Palwal Expressway (KMP) in National Capital Region (NCR) and ends at Katra in Jammu & Kashmir. As stage I development, Delhi to Gurdaspur (397.7 km) has been considered the entire Greenfield Alignment passes through the following Districts namely Jhajjar, Rohtak, Jind, Kaithal of Haryana, Patiala, Sangrur, Ludhiana, Kapurthala, Jalandhar and Gurdaspur of Punjab The Project Highway starts at Ch. 0.000 and ends at Ch. 397.700, the total length of the Project Highway is 397.700 Kms. In Addition to Phase 1 and 2, Connectivity to Amritsar is established from the Delhi Katra Expressway alignment from Nakodar at the intersection of Expressway with NH 703 (old NH 71) (Expressway Ch. 306) and ends on Amritsar-Ajnala Road NH 354 (near Canal). The entire Greenfield Alignment passes through Jalandhar, Kapurthala, Tarn Taran, and the Amritsar district of Punjab State. The Project Highway starts at Ch. 0.000 and ends at Ch. 99.033, the total length of the Project Highway is 99.033 Kms. The proposed connectivity has been referred to as the Project Highway in this Report. From Km 0.000 to Km 24.000 Amritsar connectivity is added to phase 1 as part of Package 10.

Presently Delhi – Ludhiana – Amritsar – Katra is connected by two different routes:

- ✚ Delhi to Katra via Panipat-Jalandhar-Pathankot-Jammu (NH44)
- ✚ Delhi to Katra via Jind - Sangrur - Amritsar - Pathankot – Jammu (NH-352 & 52)
- ✚ Most of these roads / NHs are existing 4 lanes or are being widened to six-lane configurations under various schemes of the Government of India. The constraint being felt in doing so is

the cost of land abutting the highway, and difficulty in acquisition due to large-scale ribbon development along the corridor thereby requiring several bypasses only utilizing part of the existing asset. There is also a requirement of realignments at sections and provision of grade-separated structure to have at least partial access control along the routes so as to have a safe high-speed Corridor.

Assuming a constant growth in economic activities along these developed corridors the existing facility would not be able to cater to the demands thus posed by the enhanced traffic and the level of service of the NHs would deteriorate as traffic would be much higher than the lane capacity. To have a long-term solution and have future planning in mind, the Government of India entrusted NHAI to propose an alternative solution traversing through the hinterland. The proposed alignment would act as a catalyst in enhancing the engine of growth in these backward regions of the states of Haryana, Punjab, and Jammu & Kashmir.

1.2 PROJECT ROAD

The Project Highway starts from Kundli Manesar Palwal Expressway (KMP) in National Capital Region (NCR) and ends at Domel near Katra in Jammu & Kashmir. Phase 1 of the project starts from Kundli Manesar Palwal Expressway (KMP) in National Capital Region and ends near Gurdaspur. The entire Greenfield Alignment of Phase 1 passes through the following Districts namely Jhajjar, Jind, Kaithal, Karnal, Rohtak, Sonapat, Sangrur, Patiala, Ludhiana, Kapurthala, Jalandhar, and Gurdaspur. The Project Highway starts at Ch. 0+000 and ends at Ch. 397+700 and also includes a section of Amritsar Connectivity from Junction with Jalandhar-Moga road (NH-703) near Kang Sahibu village to Junction with Kapurthala-Sultanpur Lodhi road (NH-703A) near Isharwal village (Km 0+000 to km 24+000). The total length of the Project Highway including a section of Amritsar connectivity in Phase 1 is 421.700 Kms. The key plan of the project highway is shown in the figure below:

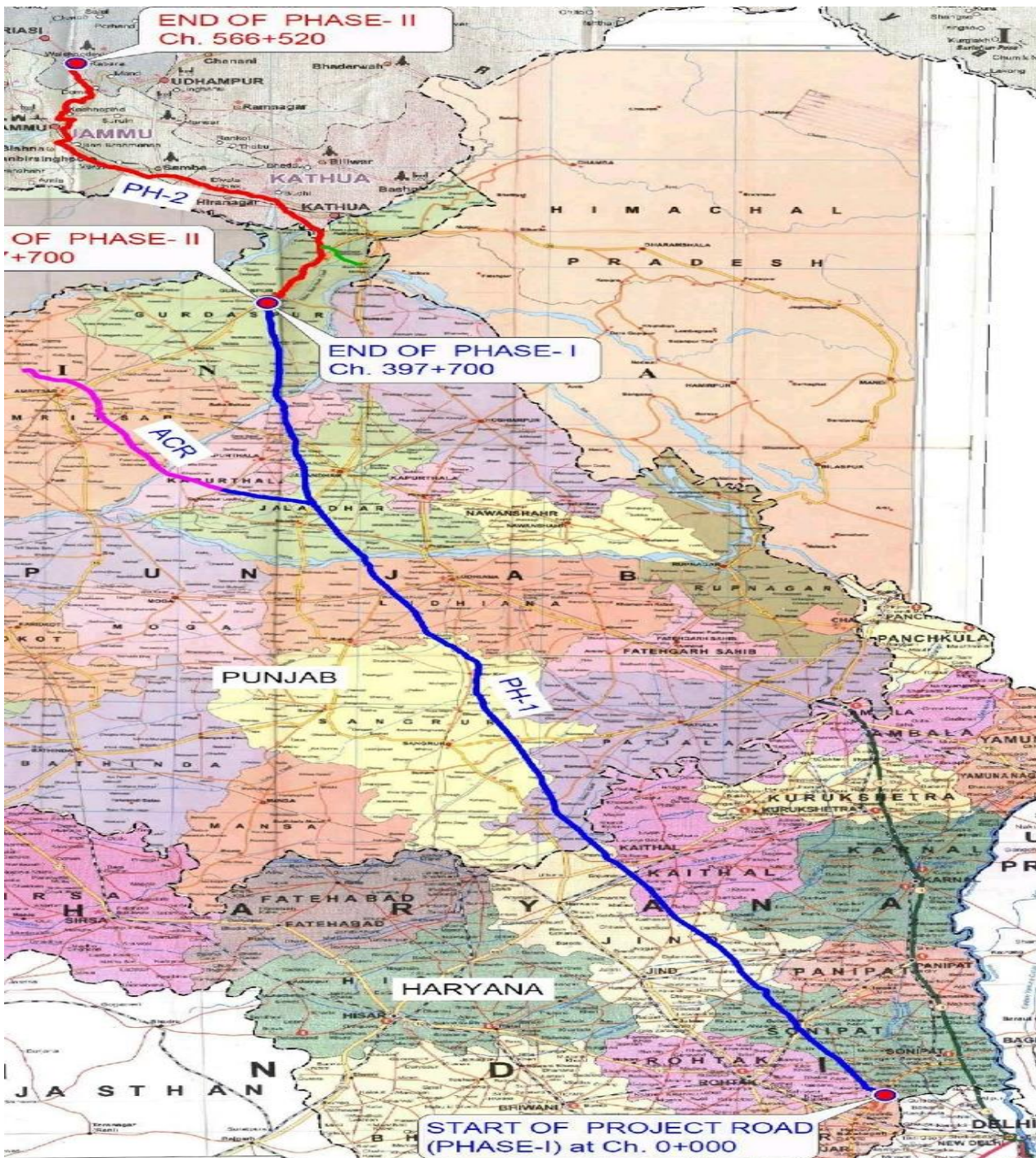


Figure 1.1 Project Road

District and Tehsils (Sub-Districts) Traversed by the Proposed Alignment

Phase 1 of the project Highway passes through 6 districts of Haryana, namely Jhajjar, Jind, Kaithal, Karnal, Rohtak, and Sonapat, and 6 districts of Punjab, namely Sangrur, Patiala, Ludhiana, Kapurthala, Jalandhar, and Gurdaspur. It passes through 29 Tehsils i.e. Bahadurgarh, Safidon, Pilukhera, Alewa, Narwana, Rajaund, Kaithal, Kalayat, Asandh, Sampla, Rohtak, Kharkhoda, Gohana, Dhuri, Malerkotla, Sangrur, Sunam, Patran, Jagraon, Ludhiana East,

Ludhiana West, Kapurthala, Bholath, Jalandhar, Jalandhar West, Nakodar, Phillaur, Gurdaspur and Batala. A total of 407 villages are falling along the project alignment and the summary is given in the table below:

Table 1. 1 Summary of Villages along the Alignment

S. No.	District	Tehsil	No. of Villages
1	Jhajjar	Bahadurgarh	3
2	Rohtak	Sampla	3
		Rohtak	10
3	Sonipat	Kharkhoda	2
		Gohana	20
4	Jind	Safidon	1
		Alewa	6
		Pilukhera	14
		Narwana	3
5	Karnal	Assandh	1
6	Kaithal	Kaithal	2
		Kalayath	13
		Rajond	3
7	Ludhiana	Jagraon	5
		Ludhiana East	2
		Ludhiana West	29
8	Jalandhar II	Jalandhar west	2
		Nakodar	10
		Jalandhar 2	42
		Phillaur	22
9	Kapurthala	Kapurthala	26
		Bholath	8
10	Gurdaspur	Gurdaspur	43
		Batala	23
11	Patiala	Patran	21

S. No.	District	Tehsil	No. of Villages
12	Sangrur	Sunaam	11
		Sangrur	18
		Dhuri	17
		Maler Kotla	30
Amritsar Connectivity km 0+000 to km 24+000			
1	Jalandhar II	Nakodar	10
2	Kapurthala	Kapurthala	7
Total			407

1.3 CONSTRUCTION PACKAGES

The entire project road is divided into Twelve construction packages including 24km of Amritsar connectivity given in Table 1.2.

Table 1. 2 Construction Packages

Sr. No.	Packages	Design Chainage (Km)		Package Start Point		Package End Point		Length of the Stretch (km)
		Start	End	Latitude	Longitude	Latitude	Longitude	
1	Package I	0+000	34+000	28°47'44.0 0" N	76°52'51.4 7" E	29°02'48.50 " N	76°41'27.0 5" E	34.000
2	Package II	34+000	60+800	29°02'48.5 0" N	76°41'27.0 5" E	29°15'11.41 " N	76°34'07.0 1" E	26.800
3	Package III	60+800	91+400	29°15'11.4 1" N	76°34'07.0 1" E	29°29'23.88 " N	76°24'45.1 9" E	30.600
4	Package IV	91+400	120+250	29°29'23.8 8" N	76°24'45.1 9" E	29°42'53.87 " N	76°15'55.8 3" E	28.850
5	Package V	120+250	157+920	29°42'53.8 7" N	76°15'55.8 3" E	30°00'32.94 " N	76°05'16.7 5" E	37.670
6	Package VI	157+920	188+830	30°00'32.9 4" N	76°05'16.7 5" E	30°16'19.76 " N	75°59'01.1 2" E	30.910
7	Package VII	188+830	225+770	30°16'19.7 6" N	75°59'01.1 2" E	30°34'50.24 " N	75°53'13.8 7" E	36.940

8	Package VIII	225+770	260+860	30°34'50.2 4" N	75°53'13.8 7" E	30°50'38.6 7"N	75°42'15.5 3"E	35.090
9	Package IX	260+860	303+900	30°50'38.6 7"N	75°42'15.5 3"E	31°11'30.2 8"N	75°31'06.4 8"E	43.040
10	Package X	303+900	319+400	31°11'30.2 8"N	75°31'06.4 8"E	31°19'37.5 7"N	75°29'26.3 4"E	15.500
		0+000	24+000	31°12'08.5 3"N	75°30'20.7 3"E	31°16'13.3 1"N	75°16'07.0 0"E	24.000
11	Package XI	319+400	362+420	31°19'37.5 7"N	75°29'26.3 4"E	31°42'10.8 5"N	75°25'37.6 9"E	43.020
12	Package XII	362+420	397+700	31°42'10.8 5"N	75°25'37.6 9"E	32° 01'03.62"N	75°24'05.4 1"E	35.280
Total Length (Km)								421.700

1.4 LAND USE PATTERN

The land use for the Greenfield alignment passes through Agricultural and Barren Land.

1.5 DESIGN SPEED

A design speed of 120 km per hour has been considered for the entire highway.

1.6 RIGHT OF WAY

The recommended minimum Right of Way is given in the table below:

Table 1. 3 Recommended Minimum Right of Way

Section	Right of Way (ROW) in m
Rural Section	90
Rural sections passing through semi-urban areas	90
Forest Area	90

At some sections of the project highway, 100m Right of Way is proposed to accommodate for future Ludhiana Ring road and Jalandhar Ring Road as presented below table as per construction packages. It also includes 24km of Amritsar connectivity. To accommodate the 100m ROW the

centreline has been shifted towards Katra bound carriageway side by 7.5m in two sections from Km 251+630 to Km 272+600 and from Km 306+900 to Km 333+450.

Table 1. 4 Details of Proposed Right of Way

PKG. No.	Stretches		Length	ROW Width	Remarks
	From (Km)	To (Km)	(in Km)	(in m)	
Main Expressway					
PKG-1	0	34+000	34.000	90m	--
PKG-2	34+000	60+800	26.800	90m	--
PKG-3	60+800	91+400	30.600	90m	--
PKG-4	91+400	120+250	28.850	90m	--
PKG-5	120+250	157+920	37.670	90m	--
PKG-6	157+920	188+830	30.910	90m	--
PKG-7	188+830	225+770	36.940	90m	--
PKG-8	225+770	251+630	25.860	90m	--
	251+630	260+860	9.230	100m	--
PKG-9	260+860	272+600	11.740	100m	--
	272+600	303+900	31.300	90m	--
PKG-10	303+900	306+400	2.500	90m	--
	306+400	319+400	13.000	100m	--
	0+000	24+000	24.000	90m	Amritsar Connectivity
PKG-11	319+400	333+450	14.050	100m	--
	333+450	362+420	28.970	90m	--
PKG-12	362+420	397+700	35.280	90m	--

1.7 LANE WIDTH OF CARRIAGEWAY

. At the time of Final Feasibility, a median width of 27m was considered for future widening inside the median. Later NHAI instructed to reduce the median width from 27m to 22m.

1.8 MEDIAN

The median shall be depressed and recommended width of the median including shyness is 22m.

Other specifications for the median are mentioned below:

- The depressed median has suitably designed and provisions of rainwater harvesting system at suitable intervals for effective drainage of surface runoff from the median.
- An edge strip of 0.75m width of depressed median adjacent to carriageway in either direction shall be paved with the same specifications as of the adjacent carriageway.
- As far as possible, the median shall be of uniform width for the Project road. However, where changes are unavoidable, a transition of 1 in 50 is to be provided.
- Median is to be well planted to cut off the glare coming from the vehicle traveling in opposite directions.
- In Median longitudinal gradient is designed in such a way that the water flows away from SVUP, LVUP VUP median. Median drains shall be terminated well before these structures with an effective drainage arrangement.
- At VUP, SVUP, LVUP, and Bridge location, the median wall is eliminated and a slope of 1:6 is provided; in place of the median wall pitching and toe wall are to be provided.

1.9 SHOULDERS

The shoulders on the outer side (left side of a carriageway) shall be 3 m wide paved plus 2 m wide earthen as per Section 2, Clause 2.6 of IRC: SP: 99-2013. The shoulder composition shall be as below:

- The composition and specification of the paved shoulder shall be the same as that of the main carriageway.
- The earthen shoulder shall be provided with a 200 mm thick layer of non-erodible/granular material for protection against erosion.

1.10 OBJECTIVE OF STUDY

- To get the idea about how Government acquires the land before the construction of the road and the procedure of the Land Acquisition
- To get to know about the design of perpetual pavement, design life of the perpetual pavement, and how perpetual pavement is different from conventional flexible pavement
- Design of Perpetual Pavement

- Valuate different types of structures which are falling in the proposed alignment
- Get to know about the Common Schedule Rates of the building materials
- Perform Geometric Design of the Greenfield Expressway

CHAPTER 2

LAND ACQUISITION

2.1 PROJECT ALIGNMENT AND HINDRANCES/ ENCUMBRANCES FOR THE RIGHT OF WAY (ROW)

- The fundamental condition for effective implementation of a National Highway project is the delineation and identification of the most advantageous alignment of a National Highway artery. Based on this, the suggestions for land acquisition are made. Therefore, the alignments must be decided upon or completed following exercising diligence.
- However, it might still be preferable to build an NH with a two-lane arrangement including a paved shoulder (10 meters wide roadway), which can be done in a row of 16 to 20 meters. This can accommodate a traffic density of around 15000 PCUs per day without sacrificing the service level. A road qualifies to be 4-laned with a divided carriageway if it already has a traffic density of greater than 15,000 PCUs/Day. It would be logical to plan for a fresh, green-field alignment in many situations.
- The maximum RoW on an existing 2-lane road typically ranges from 12 meters to 24 meters. We need a minimum RoW of 60 meters by the NH standards for a 4/6/8 lane highway. (90 metres are the smetersd for an expressway). When we consider the associated costs and time required for utility shifting, tree-felling, and additional compensation for the demolition of structures coming in the expanded RoW, it has been discovered that it is eminently feasible to acquire a RoW of 60 to 70 metres for the gmeterseld at the same cost as involved in expanding an existing road

2.2 PROCESS OF LAND ACQUISITION

➤ 3A. POWER TO ACQUIRE LAND, ETC

(THE NATIONAL HIGHWAYS ACT, 1956)

- Where the Central Government is satisfied that for a public purpose any land is required for the building, maintenance, management or operation of a national highway or part thereof, it may, by notification in the Official Gazette, declare its intention to acquire such land.
- Every notification under sub-section shall give a brief description of the land.
- The competent authority shall cause the substance of the notification to be published in two local newspapers, one of which will be in a vernacular language.

➤ 3C. HEARING OF OBJECTIONS.

- Any person interested in the land may, within twenty-one days from the date of publication of the notification under sub-section of section 3A, object to the use of the land for the purpose or purposes mentioned in that sub-section.
- Every objection under sub-section shall be made to the competent authority in writing and shall set out the grounds thereof and the competent authority shall give the objector an opportunity of being heard, either in person or by a legal practitioner, and may, after hearing all such objections and after making such further enquiry, it any, as the competent authority thinks necessary, by order, either allow or disallow the objections.

➤ 3D. DECLARATION OF ACQUISITION.

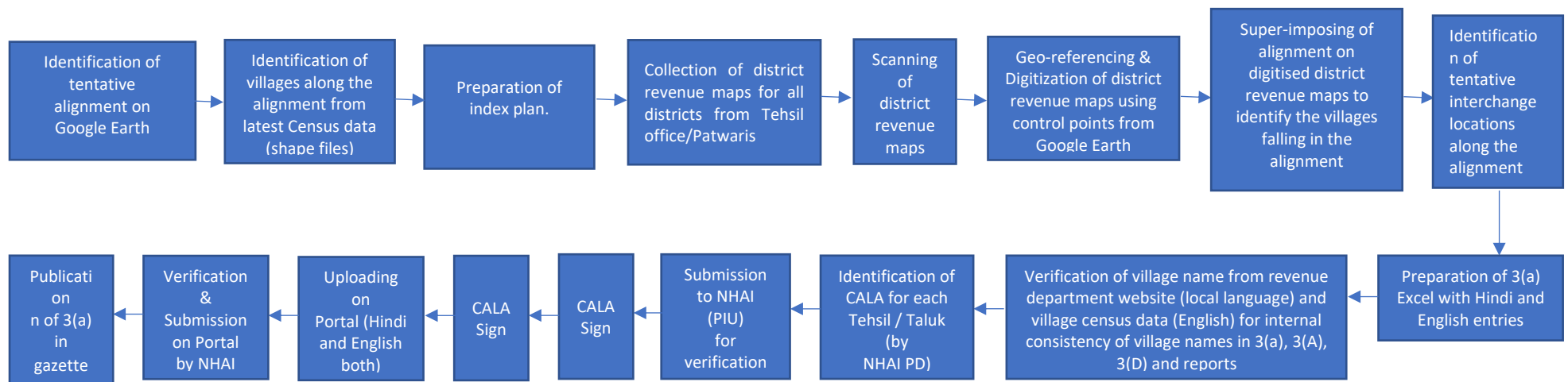
- Where no objection under sub-section of section 3C has been made to the competent authority within the period specified therein or where the competent authority has disallowed the objection under sub-section of that section, the competent authority shall, as soon as may be, submit a report accordingly to the Central Government and on receipt of such report, the Central Government shall declare, by notification in the Official Gazette, that the land should be acquired for the purpose or purposes mentioned in sub-section of section 3A.

➤ 3G. DETERMINATION OF AMOUNT PAYABLE AS COMPENSATION.

- Where any land is acquired under this Act, there shall be paid an amount which shall be determined by an order of the competent authority.

2.3 FLOW CHART OF LAND ACQUISITION

One Way - 3(a)



One Way - 3(A)



3(A) Notification format (English & Hindi)

SCHEDULE

Brief description of the land to be acquired with or without structure falling within the stretch of land from Km. to Km. (..... section) of the National Highway No..... in the State of

Serial number	Name of the district	Name of the taluk	Name of the village	Survey number	Type	Nature	Area in hactares / Square metres
1	2	3	4	5	6	7	8

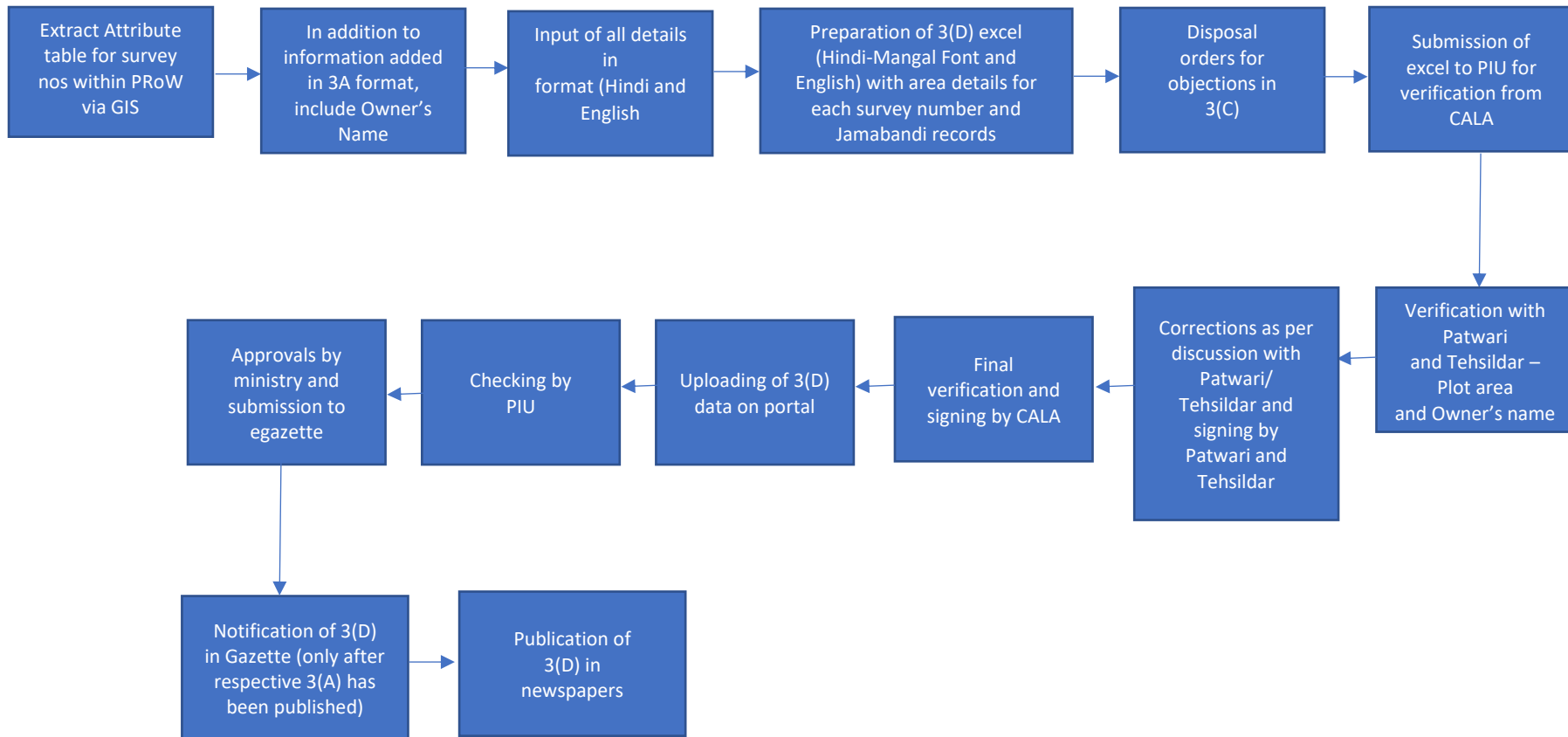
अनुसूची

.....राज्य केजिले में राष्ट्रीय राजमार्ग संख्याके.....कि.मी.सेकि.मी. तक (.....खंड) के लिए अर्जन की जाने वाली संरचना रहित अथवा संरचना सहित भूमि का संक्षिप्त विवरण

क्रम संख्या	जिला का नाम	तालुक का नाम	गाँव का नाम	सर्वेक्षण संख्या	भूमि का प्रकार	भूमि की प्रकृति	भूमि का क्षेत्रफल (हेक्टेयर में/ वर्ग मी० में)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Figure 2.2 Submission Format for 3A

One Way - 3(D)



3A Gazette Master Sheet Format and Additional 3A Sheet Format

Data Source	NHAI / Portal
	CONSULTANCY
	Mapping Team
	Attributes Team
	Field Team
	Gazette - CALA Signed Copy
	Manual Input / Formula

3A - Gazette Master Sheet Format

S.No.	Concat (Village, Survey No.)	District	Tehsil / Taluk	Village	Survey No.	Type of Land	Nature of Land	3A Gazetted Area (in ha)	3A Status
	=CONCAT(Village, Survey No.)								3A-1
									3A-2

To be extracted from CALA Signed Copy of 3A Notification

Figure 2.3 - 3(A) Gazette Master Sheet

3(D) Notification format (English & Hindi)

SCHEDULE

Brief description of the land to be acquired, with or without structure, falling within the stretch of land from Km..... to Km..... (..... Section) on the National Highway No..... in the State of

Serial number	Name of the district	Name of the taluk	Name of the village	Survey number	Type of land	Nature of land	Area in hactares / Square metres	Name of the land owner/ Interested persons
1	2	3	4	5	6	7	8	9

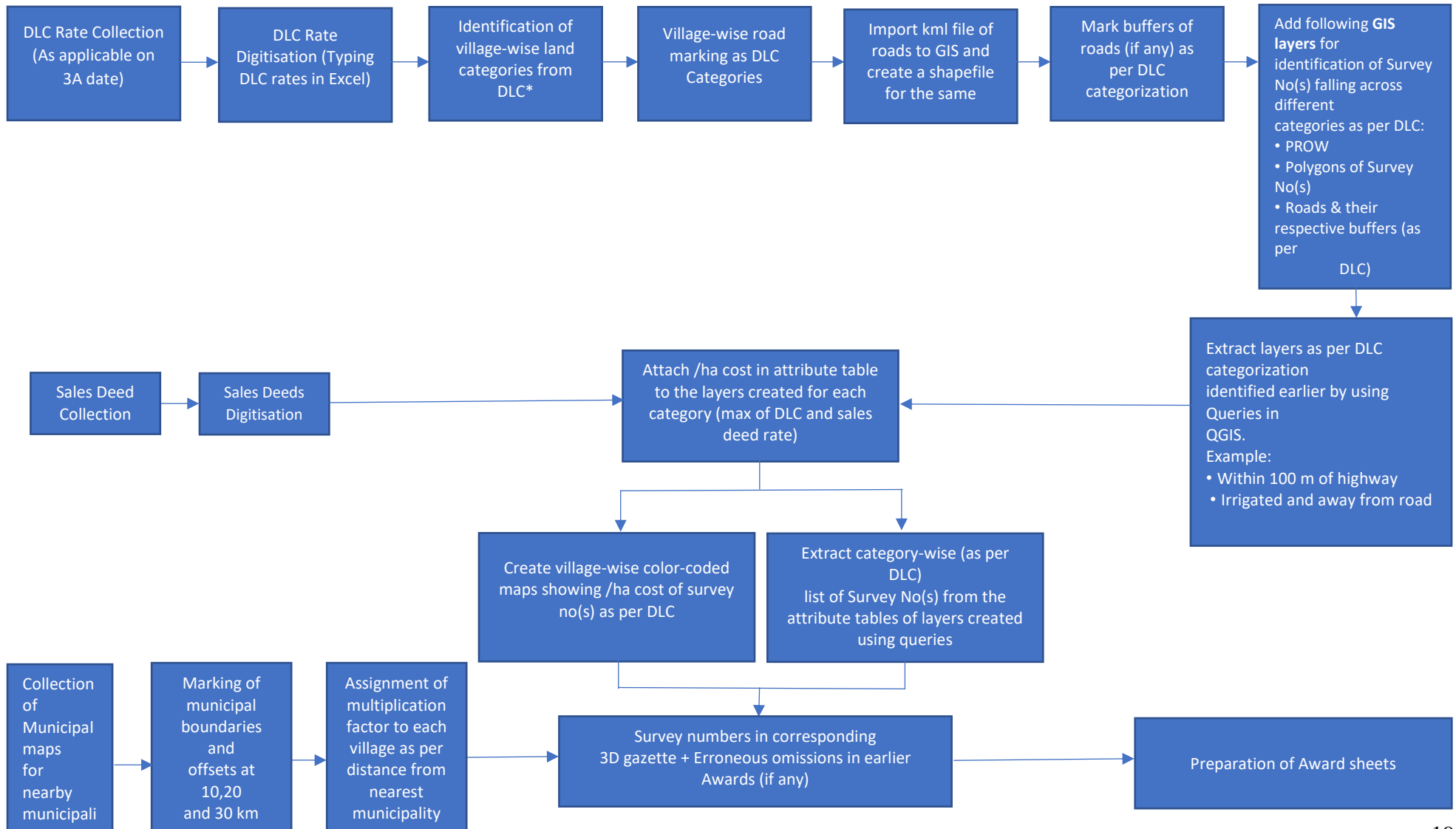
अनुसूची

.....राज्य केजिले में राष्ट्रीय राजमार्ग संख्याके.....कि.मी. सेकि.मी. तक (.....सेक्शन) के लिए अर्जन की जाने वाली संरचना रहित अथवा संरचना सहित भूमि का संक्षिप्त विवरण

क्रम संख्या	जिला का नाम	तालुक का नाम	गाँव का नाम	सर्वेक्षण संख्या	भूमि का प्रकार	भूमि की प्रकृति	भूमि का क्षेत्रफल (हेक्टेयर में/वर्ग मी० में)	भूस्वामियों/हितबद्ध व्यक्तियों के नाम
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Figure 2.4 -3(D) notification format

One Way - 3(G) Market Valuation



CHAPTER 3

ANALYSIS AND DESIGN OF PERPETUAL PAVEMENT

3.1 LONG-LIFE PAVEMENT

A pavement having a life of fifty years or longer is generally termed as a long-life pavement or perpetual pavement. In the Indian context, pavements with design traffic of 300 msa or more may be designed as long-life pavements. As per Asphalt Institute, MS-4, 7th edition, if the tensile strain caused by the traffic in the bituminous layer is less than 70 micro strain (considered to be the endurance limit of the material), the bituminous layer will never crack. Similarly, if the vertical subgrade strain is less than 200 micro strain, there will be practically very little rutting in the subgrade(IRC: 37, 2018). For the climatic conditions prevailing in the plains of India, where the Average Annual Pavement Temperature may be close to 35deg C, the corresponding limiting strains may be taken as 80 and 200 micro strains respectively. Thus, long-life pavement design involves selecting a suitable pavement layer combination which can keep the horizontal tensile strain and vertical compressive strain limited to the afore-mentioned limiting strain values corresponding to endurance condition. Different layers of the long-life pavement have to be designed and constructed in such a way that that only the surface course would need replacement from time to time.

The basic concept of perpetual pavement was to design the bituminous pavement having higher modulus with resistance towards fatigue cracking, rutting and moisture damage(Newcomb et al., 2010). The Pavement structures having thick layer helps in preventing structural rutting in the subgrade by limiting them to the surface layers only (Brown et al., 2002). The probability of failure due to bottom-up fatigue cracking in the bituminous pavements can be reduced by increasing the thickness of the bituminous layers as this can limit the maximum strain at the bottom of bituminous layers(Martin et al., 2001).

3.2 DESIGN INPUT

To decide the best pavement alternative for a particular project, a pavement type selection process called pavement option study has been undertaken. This process helps to determine the most cost-effective pavement type capable of supporting anticipated traffic under existing environmental conditions and providing safety and driving comfort to the traveling public.

The following options have been considered for the new pavement design.

Option – 1: Flexible pavement with granular base and sub-bases,

Option – 2: Flexible pavement with Cement Treated Sub-base (CTSB)

Option – 3: Flexible Pavement with Cement Treated Base (CTB) & Cement Treated Sub-Base Layers (CTSB)

Option – 4: Flexible Pavement with Cement Treated Base (CTB) & Granular Sub-base Layers (GSB)

Option – 5: Perpetual Pavement with Cement Treated Sub-base (CTSB)

Option – 6: Perpetual Pavement With granular base and sub-bases

Option – 7: Perpetual Pavement with Cement Treated Base (CTB) & Cement Treated Sub-Base Layers (CTSB)

Option – 8: Perpetual Pavement with Cement Treated Base (CTB) & Granular Sub-base Layers (GSB)

Option – 9: Rigid Pavement

CODE USED

IRC: 37 – 2018, “Tentative Guidelines for the Design of Flexible Pavements”

3.3 DESIGN LIFE

The flexible pavement design has been carried out by IRC: 37-2018. As per clause 4.3.1 of IRC: 37-2018, a design life of 30 years has been considered for flexible pavement design options (the option I to IV). Design life for perpetual pavement (Option-V to VIII) considered is minimum of 50 years (minimum) and similarly, design life for rigid pavement design (Option-IX) considered as 30 years

NOTE: - In this design, I considered option – 6 (Perpetual Pavement With granular base and sub-bases) for the design of pavement.

3.4 TRAFFIC PROJECTIONS (AADT)

The design traffic has been assessed by carrying out traffic surveys on alternate/parallel roads along the proposed alignment. The entire proposed project highway is a greenfield and hence, diverted traffic has been calculated and projected for the design period. For pavement design, commercial vehicles with laden weight more than 3 tonnes have been considered. Such vehicles consisted of Buses, LCVs, 2-Axle Trucks, 3-Axle Trucks, and Multi-Axle Trucks. The summary of the Base year (2018) traffic of commercial vehicles is given in the table below and

graphically shown in the figure below; detailed Traffic Projections for the design period are given in **Annexure 1**.

Table 3. 1 Summary of Base Year Commercial Vehicles (2018)

HOMOGENEOUS SECTIONS	MINI BUS	BUS	LMV	LCV	2 AXLES	3 AXLES	MAV	TOTAL No.
1	19	148	978	349	264	337	451	2546
2	23	164	1217	429	306	398	508	3045
3	23	164	1220	429	306	399	508	3049
4	10	30	1258	380	197	312	290	2477
5	10	28	1253	376	195	309	288	2459

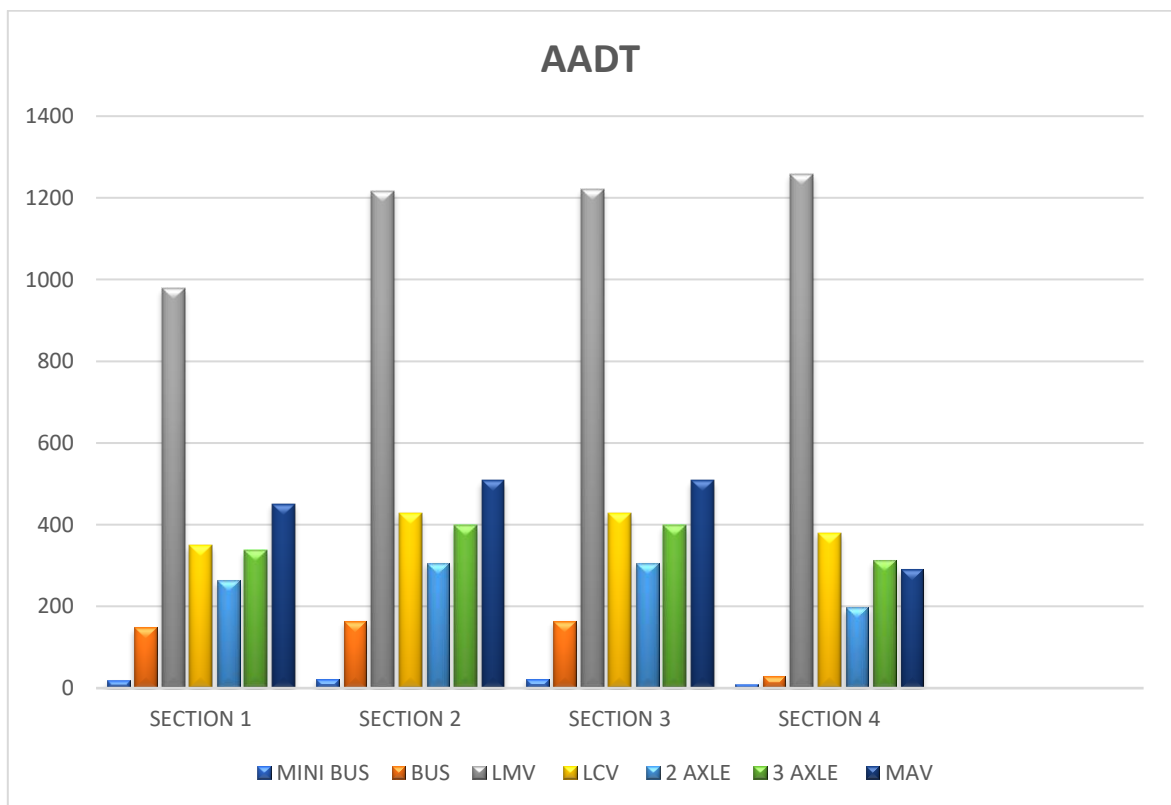


Figure 3.1 AADT Graph

3.5 VEHICLE DAMAGE FACTORS (VDFS)

To calculate the number of repetitions of a typical axle load, the vehicle damage factor (VDF) multiplies the number of commercial vehicles with different axle loads and axle configurations. This word refers to a commercial vehicle having an identical number of standard axles. The commonly accepted standard axle load is 8,160 kg(IRC: 37, 2018). The ESAL is calculated using the relationships proposed in IRC: 37-2018, "Tentative suggestions for the design of Flexible Pavements," of which an excerpt is shown below.

(IRC – 37 – 2018 clause 4.4.3)

$$\text{Single axle with single wheel on either side} = \left(\frac{\text{Axle load in KN}}{64} \right)^4 \dots\dots\dots (4.1)$$

$$\text{Single axle with dual wheel on either side} = \left(\frac{\text{Axle load in KN}}{80} \right)^4 \dots\dots\dots (4.2)$$

$$\text{Tandem axle with dual wheel on either side} = \left(\frac{\text{Axle load in KN}}{148} \right)^4 \dots\dots\dots (4.3)$$

$$\text{Tridem axle with dual wheel on either side} = \left(\frac{\text{Axle load in KN}}{224} \right)^4 \dots\dots\dots (4.4)$$

The relationship is referred to as the ‘Fourth Power Rule’, which states that the damaging effect of an axle load increases as the fourth power of the weight of an axle. To convert axle loads from survey data into ESAL, each axle of each category of vehicle is multiplied by equivalency factor of that type of axle. The output is the ‘damage’ caused by that particular axle on the pavement. Damages by all axles are then added to find the cumulative damage by that type of vehicle. The VDF is calculated by using the following equation:

$$\text{VDF} = \frac{\text{CUMULATIVE DAMAGE}}{\text{SAMPLE SIZE}}$$

Eight points along the proposed alignment's parallel roads have undergone axle load surveys. According to the axle load study, overloading is present everywhere but two places. The transportation of materials like marble, granite, and aggregates is mostly to blame for this. Once this project roadway is operational, overloading will be prevented by implementing weigh-in-motion (WIM) systems that will penalize overloading trucks. To avoid penalties, overloading must be gradually reduced. As a result, the measured axle loads are limited to the permitted maximums plus an additional 20% overload.

The VDFs are calculated for the following three options:

Option -I: Actual VDF as per axle load survey.

Option-II: VDF with restricted axle loads at Legal Limits (Legal Limits considered as per MoRTH Circular (Circular No. RT11028/11/2017-MVL))

Option-III: VDF with a restricted axle load of 20% overloading over Legal Limits

Detailed VDF calculations are given as **Annexure 2**. The summary of Calculated VDFs is given in the table below.

Table 3. 2 SUMMARY OF VDF

TYPE OF VEHICLE	DIRECTION	BUS	LCV-4	LCV -6	2 AXLE	3 AXLE	MAV
ACTUAL VDF	UP	0.67	0.17	0.56	2.6	4.02	6.75
	DOWN	0.71	0.99	0.77	2.38	4.14	15.75
VDF WITH LEGAL LIMIT	UP	0.67	0.17	0.56	2.23	2.14	3.63
	DOWN	0.71	0.56	0.32	2.19	2.24	6.34
VDF WITH A 20 % LEGAL LIMIT	UP	0.56	0.17	0.56	2.65	3.16	6.56
	DOWN	0.71	0.8	0.5	2.56	3.26	11.01

Table 3. 3 SUMMARY OF ADOPTED VEHICLE DAMAGE FACTOR

VEHICLE TYPE	BUS	LCV 4	LCV 6	2 AXLE	3 AXLE	MAV
SECTION: AMRITSAR CONNECTIVITY (MAX VDF)						
ACTUAL VDF	0.71	0.99	0.77	2.38	4.14	15.75
VDF WITH LEGAL LIMIT	0.71	0.56	0.32	2.19	2.24	6.34
VDF WITH A 20 % LEGAL LIMIT	0.71	0.8	0.56	2.65	3.26	11.01

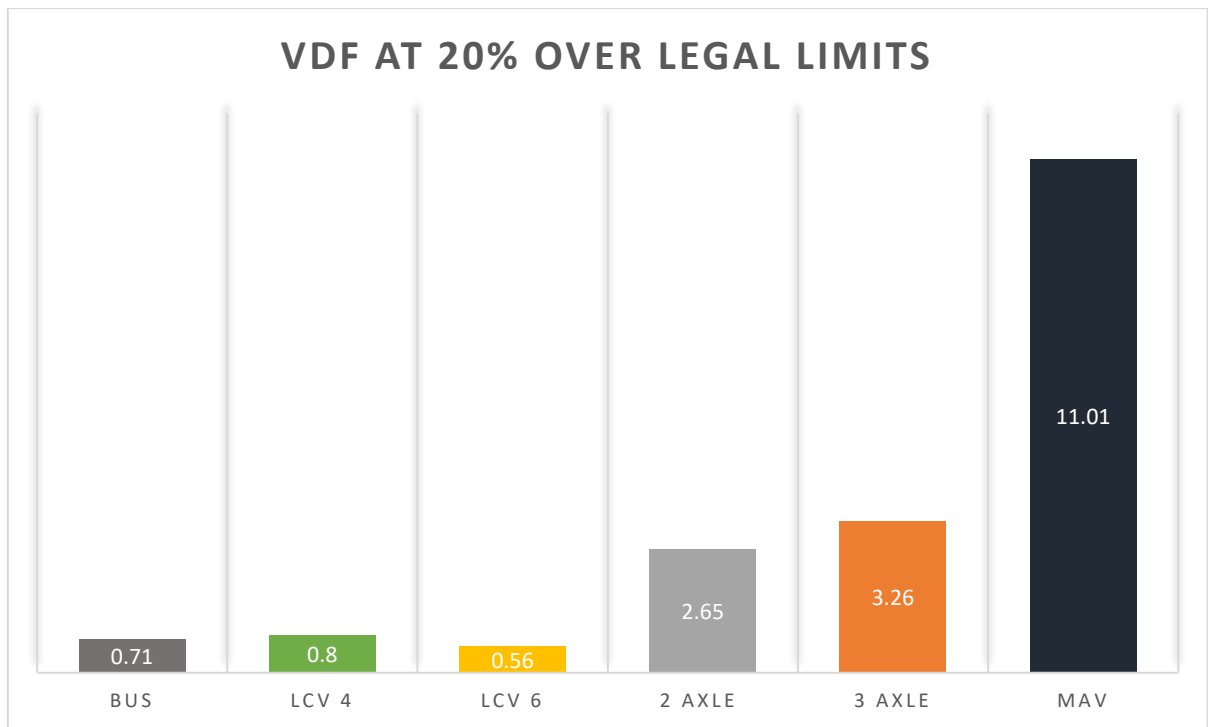


Figure 3.2 VDF at 20% over legal limit

3.6 LANE DISTRIBUTION FACTORS

Lane distribution factors have been considered as per clause 4.5.1 (iv) of IRC: 37- 2018 and the same are given in the table below:

Table 3.4 LDF

SL. NO	DESCRIPTION	DESIGN PERIOD		LDF CONSIDERED
		FROM (YEAR)	TO (YEAR)	
1	4 - LANE DIVIDED CARRIAGEWAY	2023	2053	75%

3.7 TRAFFIC LOADING (MSA)

The total number of standard axles that will be transported throughout the proposed highway's design life is how the design traffic is calculated. This can be calculated using the equation below:

$$\frac{365 \times [(1 + r)^n - 1] \times A \times D \times F}{r}$$

[IRC – 37 – 2018 clause 4.6 equation no. (4.5)]

Where,

N – Cumulative number of standard axles to be catered for in the design in terms of MSA

A – Initial traffic in the years of completion of construction in terms of the number of commercial vehicles per day

F – Vehicle Damage Factor

n – Design life in years

r – Annual growth rate of commercial vehicles

The traffic in the year of completion is estimated by using the following formula:

$$A = P (1r/100)^x$$

Where,

P – Number of commercial vehicles as per count

x – Number of years between the count and the year of completion of construction. Completion of construction.

Table 3. 5 The summary of obtained and adopted MSA

SECTION	FROM	TO	LENGTH (KM)	ACTUAL	LEGAL LIMIT	20% OVER LEGAL LIMIT	FINAL MSA (20% OVER LEGAL LIMITS)	ADOPTED MSA
				30 YEARS	30 YEARS	30 YEARS	30 YEARS	
1	67.8	70.3	2.5	113	51	83	114	115
2	70.3	76.1 2	5.816	155	70	114		
3	76.12	79.6 5	3.534	155	70	114		
4	79.65	87.4 3	7.78	90	43	67		
5	87.43	99.0 2	11.583	85	40	64		

The detailed MSA calculations are given in Annexure 3.

3.8 DESIGN CBR

Based on Laboratory test results of identified borrow area soil, the available CBR varies between 6.9% and 12%.

The borrow area's soil having CBR greater than 12% is considered for the sub-grade. The effective sub-grade design CBR considered for pavement design is 12%. Contractor is required to identify the borrow area locations for the sub-grade soil having CBR greater than 12% to get the effective sub-grade design CBR of 12%.

3.9 PAVEMENT DESIGN FOR MAIN CARRIAGEWAY

3.9.1 PAVEMENT MODEL

A multilayer, elastic structure is used to represent flexible pavement. An elastic model with linear layers is used to calculate stresses and strains at important places. For calculating stresses and strains in flexible pavements, the stress analysis programme IITPAVE has been employed. In order to prevent cracking and rutting in the bituminous layers and non-bituminous layers, respectively, pavement designers typically consider tensile strain, or t , at the bottom of the bituminous layer and vertical sub-grade strain, or v , at the top of the sub-grade as key factors. Figure below illustrates various stresses and strains that can occur in a flexible pavement.

The IRC approach for pavement design is based on reducing the vertical compressive strain above the subgrade, which causes permanent deformation of the pavement, and the horizontal tensile strain at the base of the bituminous layer, which causes pavement cracking. The equations regulating the two aforementioned pavement failure criteria are as follows:

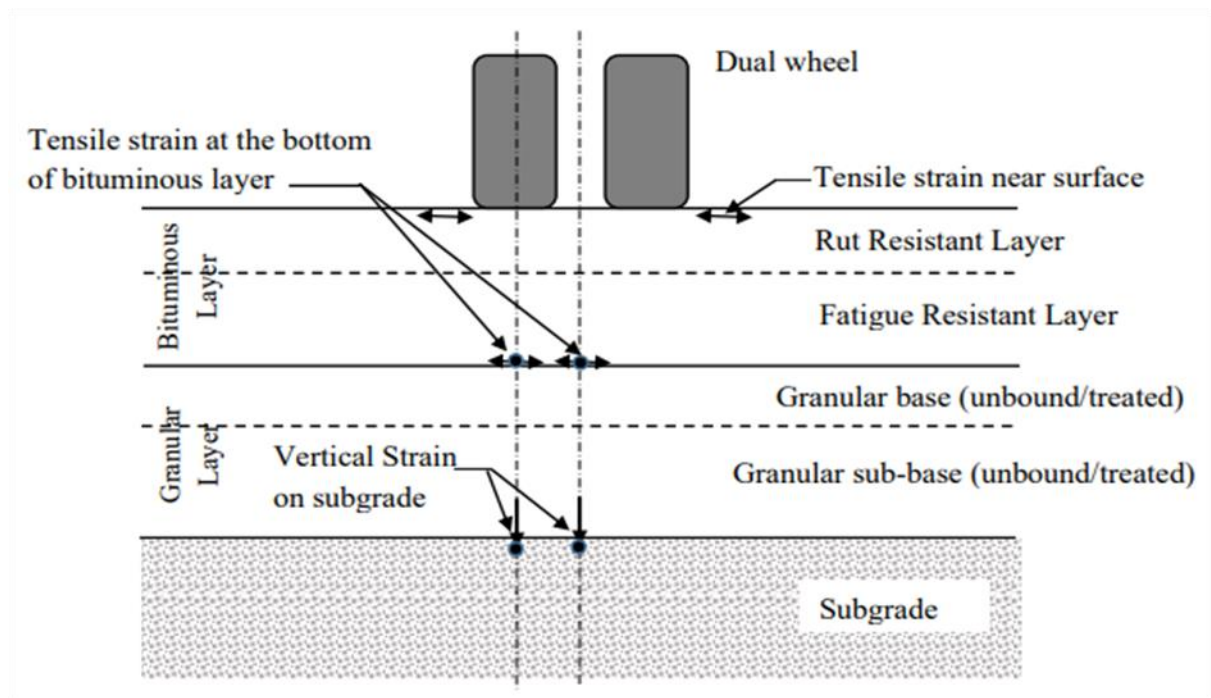


Figure 3.3 STRESS AND STRAIN IN A FLEXIBLE PAVEMENT

3.9.2 FATIGUE MODEL

The bituminous layer's bottom experiences tensile strain with each load repetition, which causes microcracks to form. As the load repetitions increase in size, the microcracks eventually spread to the surface over an area that is unacceptable from the perspective of the pavement's long-term serviceability. The condition is known as bituminous layer fatigue, and the pavement's fatigue life is determined by the quantity of load repetitions that generate fatigue using conventional axles. The two designed equations for standard bituminous mixes are listed below:

$$N_f = 1.6064 * C * 10^{-4} (1/\epsilon_t)^{3.89} * (1/MR)^{0.854} \text{ (80\% Reliability)} \quad (\text{EQ 3.3})$$

$$N_f = 0.5161 * C * 10^{-4} (1/\epsilon_t)^{3.89} * (1/MR)^{0.854} \text{ (90\% Reliability)} \quad (\text{EQ 3.4})$$

(IRC – 37 – 2018 clause 3.6.2)

Where,

N_f = Fatigue life in number of standard axles

ε_t = Maximum tensile strain at the bottom of the bituminous layer,

MR = Resilient modulus of the bituminous layer

C = 10^M , and $M = 4.84(V_b / (V_a + V_b) - 0.69)$

Corresponding to the values of V_a and V_b as stated above the above equation for 80% reliability is as given; $V_a = 4.5\%$ and $V_b = 10.5\%$ and 90% reliability is given $V_a = 3.5\%$ and $V_b = 11.5\%$ has been considered for Pavement Design as per Clause 12.3 IRC 37-2018.

3.9.3 RUTTING MODEL

The model considers the vertical strain in sub-grade as the only variable for rutting, which is a measure of bearing capacity of the sub-grade. The two-rutting equation for 80% and 90% reliability levels are given below

$$N = 4.1656 \times 10^{-8} (1/\epsilon_v)^{4.5337} \text{ - (80\% Reliability Level)}$$

$$N = 1.4100 \times 10^{-8} (1/\epsilon_v)^{4.5337} \text{ - (90\% Reliability Level)}$$

(IRC – 37 – 2018 clause 3.6.1)

Where,

N - Number of cumulative standard axles, and

ϵ_v - Vertical strain in the sub-grade

3.9.4 RESILIENT MODULUS OF THE SUBGRADE

Resilient modulus is regarded as the appropriate input for the linear elastic theory chosen in these guidelines for the analysis of flexible pavements because it is measured in a repeated load test while only accounting for the elastic (or resilient) component of the specimen's deformation (or strain). By performing the repeated tri-axial test in accordance with the instructions provided in AASHTO T307-99 [19], it is possible to measure the resilient modulus of soils in a laboratory setting. The following formulas may be used to estimate the resilient modulus of subgrade soil (MRS) from its CBR value because this equipment is typically pricey [20, 21].

$$MRS = 10.0 * CBR \text{ for } CBR \leq 5 \% \quad (6.1)$$

$$MRS = 17.6 * (CBR)^{0.64} \text{ for } CBR > 5 \% \quad (6.2)$$

(IRC – 37 – 2018 clause 6.3)

Where,

MRS = Resilient modulus of subgrade soil (in MPa).

CBR = California bearing ratio of subgrade soil (%)

3.9.5 RESILIENT MODULUS OF GSB LAYER

The foundational or supporting layer's resilient modulus value and the granular layer's thickness both influence the elastic/resilient modulus value of the layer. Because larger deflections caused by loads result in de-compaction in the lower part of the granular layer, a weaker support does not allow for higher modulus of the upper granular layer. The modulus of the granular can be estimated using Equation 7.1 based on its thickness and the modulus value of the supporting layer.

$$\mathbf{MRGRAN} = \mathbf{0.2(h)^{0.45} \times MRSUPPORT} \quad (7.1)$$

(IRC – 37 – 2018 clause 7.2.3)

Where,

h = thickness of granular layer in mm

MRGRAN = resilient modulus of the granular layer (MPa)

MRSUPPORT = (effective) resilient modulus of the supporting layer (MPa)

3.9.6 PERPETUAL PAVEMENT DESIGN

Decreasing natural resources and increasing construction and maintenance cost of highway projects, the time has come to think beyond the conventional method of designs. Therefore, the full depth bituminous pavement is considered as sustainable perpetual pavement for heavy traffic and interest of socio-economic perspective.

Perpetual pavement is having thick bituminous layers, which do not undergo structural damage for high traffic flows over the longer periods. Perpetual pavements are made up with multiple layers of durable bitumen. The main aspect is to provide rut-resistant, impermeable, wear-resistant and durable intermediate layers and fatigue resistant and durable base layers.

The bottom layer is designed to be strong but flexible to resist strains that could cause cracks to form from the bottom up. Generally, this pavement type shall be designed for high traffic volume and for longer design period i.e., greater than 50 years.

With this perpetual pavement, the traditional fatigue cracking is reduced, and pavement distress is typically confined to the upper layer of the pavement structure. Therefore, whenever surface distress reaches a critical level, an economical rehabilitation is required to remove the distressed surface and resurfacing with an asphalt overlay or milling and relaying of existing surface course.

The pavement structural layers proposed are Non-Bituminous Base and Sub-base, Bituminous Surfacing comprising Dense Bituminous Macadam (DBM) & Stone Matrix Asphalt (SMA).

IITPAVE software is used for strain calculations for this design. The allowable strains in the pavement layers have been calculated in terms of two primary pavement failure modes: fatigue cracking and rutting. The actual strains arising in the pavement layers due to traffic loading have been calculated, assuming suitable thickness values for different pavement layers. The assumed pavement crust is deemed to be safe for the design loads if obtained strains are lesser than the allowable strains.

PROPOSED CRUST COMPOSITION

Table 3. 6 PROPOSED CRUST COMPOSITION

RESILIENT MODULUS OF		3000
GRADE OF BITUMEN		PMB - 40 (SMA)
		VG - 40 (DBM)
PROPOSED CRUST COMPOSITION (mm)	SMA	50
	DBM	250
	WMM	150
	GSB	200
	TOTAL	650
Allowable Tensile Strain below the Bituminous Layers (ϵ_t)		80×10^{-6}
Actual Tensile Strain below the Bituminous Layers (ϵ_t)		73.85×10^{-6}
Allowable Vertical Strain at the top of Sub-grade (ϵ_v)		200×10^{-6}
Actual Vertical Strain at the top of Sub-grade (ϵ_v)		172.27×10^{-6}

As the value of Allowable Tensile Strain & Allowable Vertical Strain is greater than Actual Tensile Strain & Actual Vertical Strain respectively which I get from the IITpave software.

Hence the Crust thickness is passed

CHAPTER 4

STRUCTURE VALUATION

4.1 INTRODUCTION

The process of determining a building's current marketable cost is called the valuation of a building or property. The value of a building is determined by the type of building, the construction, the longevity, the location, size, shape, road width, frontage, types, and quality of building materials used, and the cost of these items.

Whenever we have to construct a new greenfield expressway or a highway the first thing, we have to do is the acquisition of the land on the proposed alignment. While acquiring the land some structures are coming under the proposed alignment for which NHAI has to pay the current marketable cost and compensation value to the owner of that particular structure or building.

4.2 FACTORS AFFECTING VALUATION OF STRUCTURE

The valuation also depends on.

- a) Hight of the plinth
- b) Hight of the building
- c) Thickness of its walls
- d) Nature of structure (such as load bearing or framed structure)
- e) Type of flooring
- f) Type Roofing
- g) Type Doors
- h) Type Windows etc.

The location of a building is crucial in determining the value of that building. For instance, a building situated in a market district would be more valuable and sturdier than a similar structure situated in a residential region. Additionally, the value of buildings situated near adequate municipal water, sewer, and electrical systems has soared. In comparison to a building located on leasehold ground, a building on freehold land generates a larger valuation amount.

The demand for a particular structure, which changes periodically, also affects its value. The value of the building increases as demand increases.

The building's age influences its value; thus, it should be known from records, inquiries, or visual inspection, and it should also be determined how long the structure will last in the future.

By determining the building's current cost and accounting for a reasonable depreciation, the valuation of the structure is determined. And in this project valuation of structures is done by PLINTH AREA RATE & PUNJAB COMMOM SCHEDULE OF RATE 2020

Plinth area method of calculating the cost of a building is less difficult than the point by point estimation strategy which is difficult and long. In this strategy, the plinth range of the building is measured and calculated and plinth-area rate of a comparable building within the territory is gotten by enquiry and fetched is calculated.

The plinth area method may not be precise if the building is not thoroughly examined and compared with the reference building of the locality. To fix this problem, different parts of the building such as foundation, structure, floor, roof, doors, windows, finishing etc. should be thoroughly examined. If the plinth area method is judiciously used, then the cost calculation will be precise and sufficient to suit practical purposes.



Figure 4.1 VALUATION of structure 1a



Figure 4.2 VALUATION of structure 1b



Figure 4.3 VALUATION of structure 1c



Figure 4.4 VALUATION of structure 1d

ELECTRICAL INSTALATION 3%	14421.13
SANITARY INSTALATION	0
GRAND TOTAL	495125.5
DEPRECIATION $P(1-RD/100)^N$	0.8855
AMOUNT AFTER DEPRECIATION	445001.6
SAY	445002



Figure 4.5 VALUATION of structure 2a



Figure 4.6 VALUATION of structure 2b

CHAPTER 5

GEOMETRIC DESIGN

5.1 OVERVIEW

The dimensions and arrangement of the highway's observable features are handled with by the geometric design of the roadway. The focus of the geometric design is on the needs of the driver and the vehicle, such as safety, comfort, and efficiency.

The features which are considered during geometric design of road are

1. Cross section elements
2. Sight distance consideration
3. Horizontal curvature
4. Gradients
5. Intersection

The psychology and behaviour of the driver, the qualities of the vehicle, and the characteristics of the traffic, such as speed and volume, all have a significant impact on the design of these elements. Accidents and their severity can be reduced with proper geometric design. As a result, the goal of geometric design is to give the best possible traffic operating efficiency and maximum safety at an affordable price.

5.2 FACTORS AFFECTING GEOMETRIC DESIGN

There are two factors which affect the geometric design of a road

- a. Design speed
- b. Topography

5.2.1 DESIGN SPEED

The geometric design is most significantly impacted by design speed. The sight distance, horizontal curve, and vertical curve length are all directly impacted. A design speed is used for all geometric designs because the speed of vehicles varies depending on the driver, the terrain, etc.

The fastest continuous speed that a single vehicle may go on a highway safely in good weather is referred to as design speed. The legal speed limit, which is enforced to prevent drivers from exceeding an established safe speed, is distinct from the design speed. The desired speed, which is the top speed at which a vehicle would go in the absence of traffic and local geometry, is distinct from the design speed as well.

The design speeds given in Table 5.1 shall be adopted for various terrain classifications. (Terrain is classified by the general slope of the ground across the Expressway alignment).

5.2.2 TOPOGRAPHY

The topography is the next crucial element that has an impact on geometric design. For a plain terrain, roads that meet the necessary criteria are simpler. However, the cost of building multiplies with the grade and the terrain at a certain design speed. To keep the cost and duration of construction under control, different terrains have varying geometric design criteria. Sharper curves and steeper gradients are features of this.

5.3 TYPES OF CURVES

1. Horizontal Curves
2. Vertical Curves

5.3.1 HORIZONTAL CURVE

To alter a road's alignment or direction, horizontal bends are provided. Circular arcs or circular curves are horizontal curves. As the radius is reduced, a curve becomes sharper, which makes it unsafe and dangerous.

The alignment must be seamless and match the topography. The horizontal curves must be created with the highest practicable radius and must have circular portions at both ends, flanked by spiral transitions.

There are some different types of Horizontal Curves

1. Simple Curve
2. Compound Curve
3. Reverse Curve
4. Transition or Spiral Curve

5.3.2 VERTICAL CURVE

Vertical curves are the curves in a vertical alignment that are created when two different gradients collide. It is offered to provide safety, visibility, and appearance. The employment of parabolic curves in summit curves has been the most typical method. This is as a result of how simple it is to set up on the field and how smoothly the gradients change. Furthermore, excellent riding comfort is provided by the utilisation of parabolic curves. Since it comes the closest to meeting the ideal transition conditions, cubic parabola is favoured when dealing with valley curves.

There are two types of Vertical curves

1. Sag Curve
2. Crest Curve

5.4 DESIGN OF HORIZONTAL AND VERTICAL CURVES (FROM CHAINAGE 164+000 TO 188+830)

The design of Horizontal and Vertical curves has been done by the software called MXROAD.

Requirements for the design of Horizontal and Vertical Curves (IRC:SP:99, 2013)

Table 5. 1 Design Speed

Nature of Terrain	Cross Slope of the Ground	Design Speed (km/hr)
Plain	Less than 10 percent	120
Rolling	Between 10 and 25 percent	100

Table 5. 2 Table Right of Way in Plain/Rolling Terrain

Section	Right of Way Width (ROW)
Rural Section	90 m - 120 m
Rural Sections passing through semi- urban areas	120 m

Table 5. 3 Width of Median

Type of Median	Design Speed (km/hr)	
	Minimum	Desirable
Depressed	12	15
Flush	4.5	4.5
Flush (to accommodate structure/pier on median)	8	8

Table 5. 4 Minimum Length of Transition Curves

Design Speed (km/h)	Minimum Length of Transition Curve (m)
120	100
100	85
80	70

Table 5. 5 Safe Sight Distance

Design Speed (km/hr)	Safe Stopping Sight Distance (m)	Desirable Minimum Sight Distance (m) (Intermediate Sight Distance)
120	250	500
100	180	360
80	120	240

Table 5. 6 Decision Sight Distance

Design Speed (km/h)	Decision Sight Distance (m)
120	360
100	315
80	230

Table 5. 7 Gradient

Terrain	Ruling Gradient	Limiting Gradient
Plain	2.5 percent	3 percent
Rolling	3 percent	4 percent

Table 5. 8 Minimum Length of Vertical Curve

Design Speed (km/hr)	Minimum Grade Change Requiring Vertical Curve	Minimum Length of Vertical Curve (m)
120	0.5 percent	100
100	0.5 percent	85
80	0.6 percent	70

(All these requirements are as per IRC: SP:99-2013)

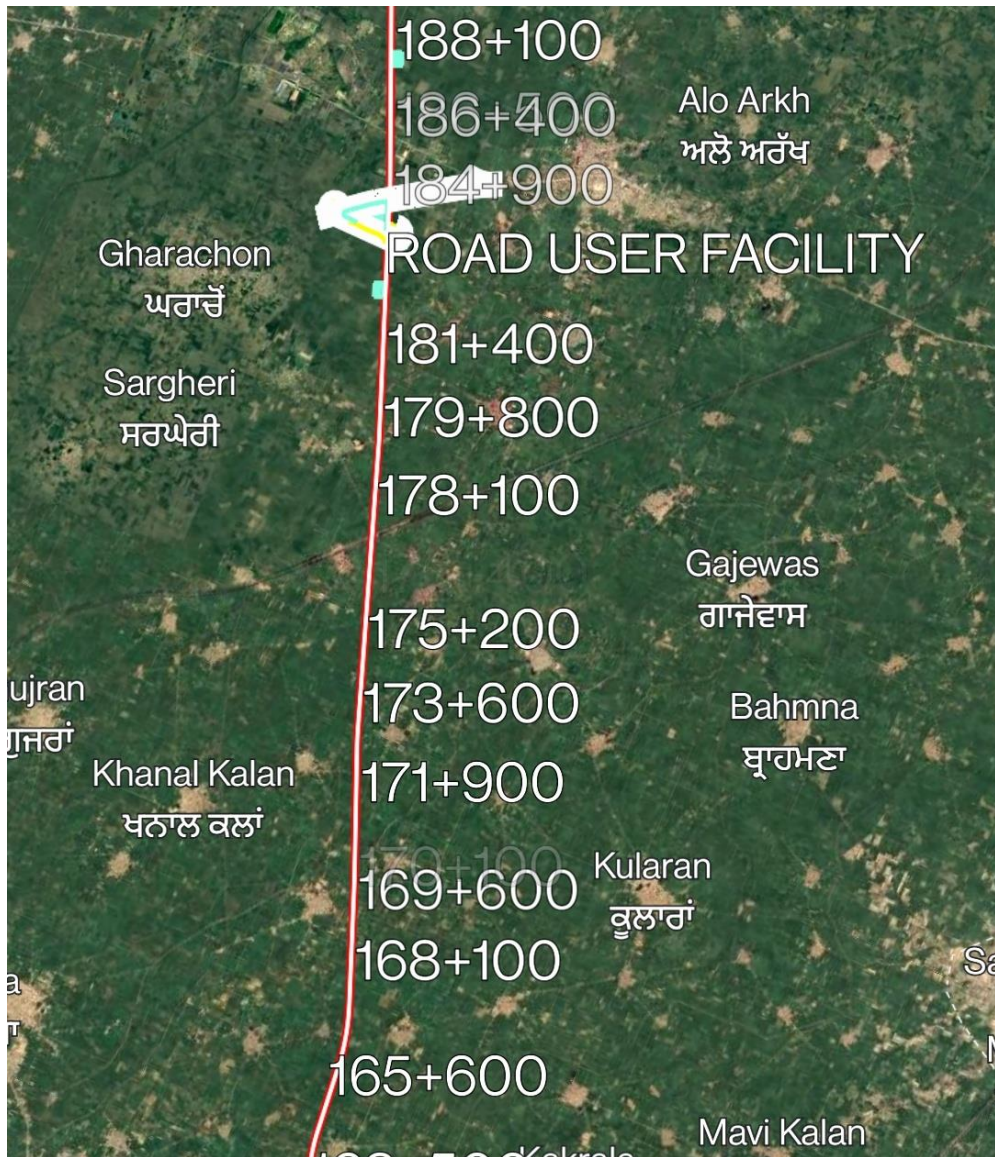


Figure 5.1 ALLIGNMENT (164+000 TO 188+830)

5.4.1 HORIZONTAL CURVE DESIGN REPORT

HORIZONTAL ALIGNMENT DESIGN REPORT																			
Sr. No.	HP Chainage	Easting	Northing	Arc Start Chainage	Arc End Chainage	Radius	Hand of Arc (Right/Left)	Length of Arc (m)	Start Of Transition			End Of Transition			Design Speed (kmph)	Superelevat ion (%)	Deflection Angle		
									Transition Start Chainage	Transition End Chainage	Transition Length (m)	Transition Start Chainage	Transition End Chainage	Transition Length (m)					
1	164+787.142	602796.846	3326826.018	164+365.953	165+205.239	4000	Right	839.286							120	NC	12	1	18.805
2	167+300.983	602528.179	3329328.570	166+613.205	167+980.182	5000	Left	1366.977							120	NC	15	39	51.864
3	170+690.446	601266.693	3332483.779	170+504.246	170+876.636	20000	Left	372.391							120	NC	1	4	0.555
4	173+647.275	600118.071	3335208.402	173+432.418	173+862.029	8000	Right	429.611							120	NC	3	4	36.694
5	176+365.822	599197.964	3337766.616	176+238.882	176+492.760	35000	Left	253.877							120	NC	0	24	56.170
6	177+790.953	598705.924	3339104.114	177+624.721	177+957.181	25000	Right	332.460							120	NC	0	45	42.996
7	179+873.763	598012.871	3341068.240	179+194.561	180+552.794	35000	Left	1358.233							120	NC	2	13	24.450
8	182+891.243	596899.104	3343872.833	182+810.540	182+971.946	50000	Left	161.406							120	NC	0	11	5.848
9	183+526.885	596662.593	3344462.836	183+369.185	183+684.584	40000	Right	315.399							120	NC	0	27	6.394
10	185+725.177	595860.762	3346509.678	185+442.614	186+007.663	14000	Left	565.049							120	NC	2	18	44.987

5.4.2 VERTICAL CURVE DESIGN REPORT

VERTICAL CURVE TABLE													
Sr. No.	VIP Chainage	VIP LEVELS	LENGTH OF CURVE	TYPE OF CURVE	Grade IN %	Grade OUT %	Algebraic Difference	CHAINAGE START OF CURVE	CHAINAGE END OF CURVE	LEVEL START OF CURVE	LEVEL END OF CURVE	K VALUE	Design Speed (kmph)
1	164+172.576	235.451	140	Hog	0.800	0.300	-0.500	164+102.576	164+242.576	234.9	235.661	279.897	120
2	164+575.646	236.66	100	Sag	0.300	1.150	0.850	164+525.646	164+625.646	236.5	237.235	117.639	120
3	165+013.031	241.69	483	Hog	1.150	-0.675	-1.825	165+771.531	165+254.531	238.9	240.060	264.658	120
4	165+403.931	239.051	120	Sag	-0.675	0.700	1.375	165+343.931	165+463.931	239.5	239.471	87.273	120
5	165+634.461	240.665	285	Hog	0.700	-0.380	-1.080	165+491.961	165+776.961	239.7	240.124	263.889	120
6	166+072.099	239.002	150	Hog	-0.380	-0.850	-0.470	165+997.099	166+147.099	239.3	238.365	319.149	120
7	166+253.391	237.461	125	Sag	-0.850	0.800	1.650	166+190.891	166+315.891	238	237.961	75.758	120
8	166+566.979	239.97	355	Hog	0.800	-0.550	-1.350	166+389.479	166+744.479	238.6	238.993	262.963	120
9	166+867.260	238.318	125	Sag	-0.550	1.100	1.650	166+804.760	166+929.760	238.7	239.006	75.758	120
10	167+207.324	242.059	420	Hog	1.100	-0.500	-1.600	166+997.324	167+417.324	239.7	241.009	262.500	120
11	168+156.128	237.315	250	Sag	-0.500	0.300	0.800	168+031.128	168+281.128	237.9	237.690	312.500	120
12	168+622.069	238.713	100	Sag	0.300	0.700	0.400	168+572.069	168+672.069	238.6	239.063	250.000	120
13	169+087.808	241.973	100	Hog	0.700	0.300	-0.400	169+037.808	169+137.808	241.6	242.123	250.035	120
14	169+500.771	243.212	535	Hog	0.300	-0.600	-0.900	169+233.271	169+768.271	242.4	241.607	594.383	120
15	170+113.243	239.537	135	Sag	-0.600	1.000	1.600	170+045.743	170+180.743	239.9	240.212	84.373	120
16	170+440.949	242.814	150	Hog	1.000	0.000	-1.000	170+365.949	170+515.949	242.1	242.814	150.000	120
17	170+667.342	242.814	135	Hog	0.000	-0.900	-0.900	170+599.842	170+734.842	242.8	242.206	150.000	120
18	171+005.210	239.773	125	Sag	-0.900	0.725	1.625	170+942.710	171+067.710	240.3	240.226	76.923	120
19	171+350.977	242.28	375	Hog	0.725	-0.700	-1.425	171+163.477	171+538.477	240.9	240.968	263.158	120
20	171+680.057	239.976	100	Sag	-0.700	0.300	1.000	171+630.057	171+730.057	240.3	240.126	100.005	120
21	171+999.636	240.935	345	Hog	0.300	-1.000	-1.300	171+827.136	172+172.136	240.4	239.210	265.410	120
22	172+235.159	238.58	115	Sag	-1.000	0.550	1.550	172+177.659	172+292.659	239.2	238.896	74.197	120
23	172+520.625	240.15	250	Hog	0.550	-0.400	-0.950	172+395.625	172+645.625	239.5	239.650	263.129	120
24	172+944.514	238.454	135	Sag	-0.400	1.450	1.850	172+877.014	173+012.014	238.7	239.433	72.965	120
25	173+428.690	245.475	380	Hog	1.450	0.000	-1.450	173+238.690	173+618.690	242.7	245.475	262.052	120
26	173+806.565	245.475	330	Hog	0.000	-1.250	-1.250	173+641.565	173+971.565	245.5	243.413	264.000	120
27	174+222.838	240.272	150	Sag	-1.250	0.950	2.200	174+147.838	174+297.838	241.2	240.984	68.182	120
28	174+601.195	243.866	406	Hog	0.950	-0.600	-1.550	174+398.195	174+804.195	241.9	242.648	261.935	120
29	175+079.713	240.995	100	Sag	-0.600	-0.450	0.150	175+029.713	175+129.713	241.3	240.770	667.477	120
30	175+343.959	239.805	150	Sag	-0.450	0.300	0.750	175+268.959	175+418.959	240.1	240.030	199.951	120
31	175+926.049	241.552	100	Sag	0.300	1.000	0.700	175+876.049	175+976.049	241.4	242.052	142.857	120
32	176+167.383	243.965	340	Hog	1.000	-0.300	-1.300	175+997.383	176+337.383	242.3	243.455	261.538	120
33	176+395.732	243.28	100	Sag	-0.300	0.500	0.800	176+345.732	176+445.732	243.4	243.530	125.000	120
34	176+730.421	244.953	262	Hog	0.500	-0.500	-1.000	176+599.421	176+861.421	244.3	244.298	262.000	120
35	177+060.550	243.303	100	Sag	-0.500	0.300	0.800	177+010.550	177+110.550	243.6	243.453	125.000	120
36	177+282.986	243.97	158	Hog	0.300	-0.300	-0.600	177+203.986	177+361.986	243.7	243.733	263.333	120
37	177+522.966	243.25	125	Sag	-0.300	1.150	1.450	177+460.466	177+585.466	243.4	243.969	86.207	120
38	178+044.704	249.25	605	Hog	1.150	-1.150	-2.300	177+742.204	178+347.204	245.8	245.771	263.043	120
39	178+516.563	243.824	125	Sag	-1.150	0.500	1.650	178+454.063	178+579.063	244.5	244.136	75.762	120
40	178+876.927	245.625	395	Hog	0.500	-1.000	-1.500	178+679.427	179+074.427	244.6	243.650	263.354	120
41	179+238.486	242.01	150	Sag	-1.000	0.900	1.900	179+163.486	179+313.486	242.8	242.685	78.948	120
42	179+559.638	244.9	370	Hog	0.900	-0.500	-1.400	179+374.638	179+744.638	243.2	243.975	264.286	120
43	179+818.867	243.604	125	Sag	-0.500	0.600	1.100	179+756.367	179+881.367	243.9	243.979	113.636	120
44	180+189.549	245.828	420	Hog	0.600	-1.000	-1.600	179+979.549	180+399.549	244.6	243.728	262.500	120
45	180+495.606	242.767	135	Sag	-1.000	0.750	1.750	180+428.106	180+563.106	243.4	243.274	77.143	120
46	180+816.983	245.178	275	Hog	0.750	-0.300	-1.050	180+679.483	180+954.483	244.1	244.765	261.905	120
47	181+066.549	244.429	100	Sag	-0.300	0.800	1.100	181+016.549	181+116.549	244.6	244.829	90.909	120
48	181+299.474	246.292	340	Hog	0.800	-0.500	-1.300	181+129.474	181+469.474	244.9	245.442	261.538	120
49	181+576.956	244.905	100	Sag	-0.500	0.500	1.000	181+526.956	181+626.956	245.2	245.155	100.000	120
50	182+025.868	247.15	395	Hog	0.500	-1.000	-1.500	181+828.368	182+223.368	246.2	245.175	263.333	120

51	182+541.080	241.997	150	Sag	-1.000	0.900	1.900	182+466.080	182+616.080	242.7	242.672	78.947	120
52	183+018.848	246.297	500	Hog	0.900	-1.000	-1.900	182+768.848	183+268.848	244	243.797	263.158	120
53	183+489.472	241.591	180	Sag	-1.000	1.000	2.000	183+399.472	183+579.472	242.5	242.491	90.000	120
54	183+829.478	244.991	340	Hog	1.000	-0.300	-1.300	183+659.478	183+999.478	243.3	244.481	261.538	120
55	184+222.324	243.813	100	Sag	-0.300	0.900	1.200	184+172.324	184+272.324	244	244.263	83.333	120
56	184+590.216	247.124	498	Hog	0.900	-1.000	-1.900	184+341.216	184+839.216	244.9	244.633	262.095	120
57	184+948.510	243.54	160	Sag	-1.000	1.150	2.150	184+868.510	185+028.510	244.3	244.460	74.416	120
58	185+418.905	248.95	605	Hog	1.150	-1.150	-2.300	185+116.405	185+721.405	245.5	245.471	263.043	120
59	186+005.272	242.207	130	Sag	-1.150	0.600	1.750	185+940.272	186+070.272	243	242.597	74.286	120
60	186+266.938	243.777	100	Hog	0.600	0.300	-0.300	186+216.938	186+316.938	243.5	243.927	333.333	120
61	186+461.123	244.359	100	Sag	0.300	1.000	0.700	186+411.123	186+511.123	244.2	244.859	142.857	120
62	186+867.605	248.424	525	Hog	1.000	-1.000	-2.000	186+605.105	187+130.105	245.8	245.799	262.500	120
63	187+331.805	243.782	150	Sag	-1.000	1.000	2.000	187+256.805	187+406.805	244.5	244.532	75.000	120
64	187+818.691	248.651	700	Hog	1.000	-1.650	-2.650	187+468.691	188+168.691	245.2	242.876	264.151	120
65	188+342.068	240.015	150	Sag	-1.650	0.350	2.000	188+267.068	188+417.068	241.3	240.278	75.000	120
66	188+742.456	241.417	150	Hog	0.350	-0.300	-0.650	188+667.456	188+817.456	241.2	241.192	230.769	120

ANNEXURE. 1 TRAFFI PROJECTIONS

GREENFIELD BYPASS			
SECTION	FROM	TO	LENGTH (KM)
4	67.8	70.3	2.5
5	70.3	76.116	5.816
6	76.116	79.65	3.534
7	79.65	87.43	7.78
8	87.43	99.02	11.583
TOTAL LENGTH			31.213

TRAFFIC SUMMARY (2019-20)					
VEH TYPE	SECTION 1	SECTION 2	SECTION 3	SECTION 4	SECTION 5
CARS	4235	5390	5395	5355	5300
TAXI	0	0	0	0	0
MINI BUS	19	23	23	10	10
STD. BUS	148	164	164	30	28
MINI LCV	978	1217	1220	1258	1253
LCV	349	429	429	380	376
2 AXLE	264	306	306	197	195
3 AXLE	337	398	399	312	309
MAV	451	508	508	290	288
TOTAL VEH	6781	8435	8444	7832	7759
TOTAL PCUs	10042	12173	12185	10120	10023

TRAFFIC PROJECTION - MOTSLIKELY SCENARIO

SECTION - 1

YEAR	CAR	TAXI	MINI BUS	GOVT BUS	PVT BUS	LMV	LCV	2 AXLE	3 AXLE	MAV (4 - 6A)	TOTAL VEHICLES	TOTAL PCU
2019 - 20	4235	0	19	0	148	978	349	264	337	451	6781	10070
2020 - 21	4526	0	20	0	156	1027	366	270	345	474	7184	10606
2021 - 22	4836	0	21	0	164	1078	385	276	353	497	7610	11171
2022 - 23	5426	0	23	0	182	1132	404	282	362	522	8333	12060
2023 - 24	5798	0	24	0	192	1189	424	288	371	548	8834	12714
2024 - 25	6121	0	25	0	201	1248	445	294	379	576	9290	13327
2025 - 26	6461	0	26	0	210	1311	468	301	389	604	9769	13969
2026 - 27	6820	0	28	0	219	1376	491	307	398	635	10274	14645
2027 - 28	7199	0	29	0	229	1445	516	314	407	666	10806	15355
2028 - 29	7600	0	30	0	239	1517	541	321	417	700	11366	16100
2029 - 30	7942	0	31	0	247	1593	568	328	427	735	11872	16794
2030 - 31	8299	0	32	0	256	1673	597	335	437	771	12401	17521
2031 - 32	8673	0	33	0	266	1756	627	343	448	810	12956	18283
2032 - 33	9063	0	35	0	275	1844	658	350	459	850	13535	19078
2033 - 34	9471	0	36	0	285	1936	691	358	470	893	14140	19908
2034 - 35	9815	0	37	0	293	2033	726	366	481	938	14688	20686
2035 - 36	10173	0	38	0	302	2135	762	374	493	984	15261	21500
2036 - 37	10543	0	39	0	311	2242	800	382	504	1034	15855	22346
2037 - 38	10927	0	40	0	320	2354	840	391	516	1085	16473	23226
2038 - 39	11324	0	41	0	329	2471	882	399	529	1140	17115	24141
2039 - 40	11659	0	42	0	337	2595	926	408	542	1197	17705	25013
2040 - 41	12002	0	43	0	345	2725	972	417	555	1256	18315	25918
2041 - 42	12357	0	44	0	353	2861	1021	426	568	1319	18949	26859
2042 - 43	12721	0	45	0	362	3004	1072	435	581	1385	19606	27838
2043 - 44	13096	0	46	0	370	3154	1126	445	595	1455	20287	28853
2044 - 45	13409	0	47	0	377	3312	1182	455	610	1527	20919	29832
2045 - 46	13730	0	48	0	385	3477	1241	465	624	1604	21574	30852
2046 - 47	14058	0	49	0	392	3651	1303	475	639	1684	22252	31907
2047 - 48	14394	0	50	0	399	3834	1368	486	655	1768	22953	33004
2048 - 49	14738	0	51	0	407	4026	1437	496	670	1856	23681	34146
2049 - 50	15090	0	52	0	415	4227	1508	507	686	1949	24435	35333
2050 - 51	15451	0	53	0	423	4438	1584	518	703	2047	25217	36567
2051 - 52	15820	0	54	0	431	4660	1663	530	720	2149	26027	37849
2052 - 53	16198	0	55	0	439	4893	1746	541	737	2256	26866	39182
2053 - 54	16585	0	56	0	448	5138	1833	553	755	2369	27738	40571
2054 - 55	16982	0	57	0	456	5395	1925	565	773	2488	28641	42013
2055 - 56	17388	0	58	0	465	5664	2021	578	791	2612	29578	43516
2056 - 57	17803	0	59	0	474	5948	2122	591	810	2743	30550	45079
2057 - 58	18229	0	61	0	483	6245	2229	604	830	2880	31560	46709
2058 - 59	18664	0	62	0	492	6557	2340	617	850	3024	32606	48401
2059 - 60	19111	0	63	0	502	6885	2457	630	870	3175	33694	50166

TRAFFIC PROJECTION - MOTSLIKELY SCENARIO

SECTION - 2

YEAR	CAR	TAXI	MINI BUS	GOVT BUS	VT BU	LMV	LCV	2 AXLE	3 AXLE	MAV (4 - 6A)	TOTAL VEHICLE S	TOTAL PCU
2019 - 20	5390	0	23	0	164	1217	429	306	398	508	8435	12210
2020 - 21	5660	0	24	0	172	1278	450	315	410	538	8848	12800
2021 - 22	5942	0	26	0	181	1342	473	325	422	571	9282	13423
2022 - 23	6240	0	28	0	190	1409	497	334	435	605	9737	14077
2023 - 24	6552	0	30	0	199	1479	521	344	448	641	10215	14764
2024 - 25	6879	0	31	0	209	1553	548	355	461	680	10716	15482
2025 - 26	7223	0	33	0	220	1631	575	365	475	721	11243	16239
2026 - 27	7584	0	34	0	231	1712	604	376	489	764	11795	17031
2027 - 28	7963	0	36	0	242	1798	634	388	504	810	12375	17866
2028 - 29	8362	0	37	0	254	1888	666	399	519	858	12983	18740
2029 - 30	8780	0	39	0	267	1982	699	411	535	910	13623	19661
2030 - 31	9219	0	40	0	280	2081	734	424	551	964	14293	20625
2031 - 32	9680	0	41	0	295	2186	770	436	567	1022	14997	21639
2032 - 33	10164	0	43	0	309	2295	809	449	584	1084	15737	22706
2033 - 34	10672	0	44	0	325	2410	849	463	602	1149	16513	23825
2034 - 35	11205	0	46	0	341	2530	892	477	620	1217	17329	25003
2035 - 36	11766	0	47	0	358	2657	936	491	639	1290	18184	26238
2036 - 37	12354	0	48	0	376	2789	983	506	658	1368	19082	27536
2037 - 38	12972	0	50	0	395	2929	1032	521	678	1450	20026	28904
2038 - 39	13620	0	51	0	414	3075	1084	537	698	1537	21017	30338
2039 - 40	14301	0	52	0	435	3229	1138	553	719	1629	22056	31845
2040 - 41	15016	0	54	0	457	3391	1195	569	740	1727	23150	33433
2041 - 42	15767	0	55	0	480	3560	1255	586	763	1831	24296	35098
2042 - 43	16556	0	56	0	504	3738	1318	604	785	1940	25501	36849
2043 - 44	17383	0	58	0	529	3925	1384	622	809	2057	26767	38693
2044 - 45	18252	0	59	0	555	4121	1453	641	833	2180	28095	40629
2045 - 46	19165	0	60	0	583	4327	1525	660	858	2311	29490	42664
2046 - 47	20123	0	61	0	612	4544	1602	680	884	2450	30955	44805
2047 - 48	21129	0	62	0	643	4771	1682	700	911	2597	32494	47055
2048 - 49	22186	0	63	0	675	5009	1766	721	938	2753	34111	49422
2049 - 50	23295	0	64	0	709	5260	1854	743	966	2918	35808	51911
2050 - 51	24460	0	66	0	744	5523	1947	765	995	3093	37593	54531
2051 - 52	25683	0	67	0	781	5799	2044	788	1025	3278	39466	57285
2052 - 53	26967	0	68	0	821	6089	2146	812	1056	3475	41433	60181
2053 - 54	28316	0	70	0	862	6393	2254	836	1087	3684	43501	63230
2054 - 55	29731	0	71	0	905	6713	2366	861	1120	3905	45672	66434
2055 - 56	31218	0	72	0	950	7049	2485	887	1154	4139	47952	69805
2056 - 57	32779	0	74	0	997	7401	2609	913	1188	4387	50349	73354
2057 - 58	34418	0	75	0	1047	7771	2739	941	1224	4650	52865	77085
2058 - 59	36139	0	76	0	1100	8160	2876	969	1260	4929	55509	81011
2059 - 60	37946	0	78	0	1155	8568	3020	998	1298	5225	58288	85144

TRAFFIC PROJECTION - MOTSLIKELY SCENARIO

SECTION - 3

YEAR	CAR	TAXI	MINI BUS	GOVT BUS	VT BU	LMV	LCV	2 AXLE	3 AXLE	MAV(4 6A)	TOTAL VEHICLES	TOTAL PCU
2019 - 20	5395	0	23	0	164	1220	429	306	398	508	8443	12218
2020 - 21	5719	0	24	0	172	1281	450	315	410	538	8910	12863
2021 - 22	6062	0	25	0	181	1345	473	325	422	571	9404	13544
2022 - 23	6426	0	27	0	190	1412	497	334	435	605	9925	14263
2023 - 24	6811	0	28	0	199	1483	521	344	448	641	10476	15021
2024 - 25	7220	0	29	0	209	1557	548	355	461	680	11059	15822
2025 - 26	7653	0	31	0	220	1635	575	365	475	721	11675	16667
2026 - 27	8112	0	32	0	231	1717	604	376	489	764	12325	17558
2027 - 28	8599	0	34	0	242	1802	634	388	504	810	13013	18500
2028 - 29	9115	0	36	0	254	1893	666	399	519	858	13740	19494
2029 - 30	9662	0	37	0	267	1987	699	411	535	910	14508	20543
2030 - 31	10241	0	39	0	280	2087	734	424	551	964	15320	21651
2031 - 32	10856	0	41	0	295	2191	770	436	567	1022	16179	22821
2032 - 33	11507	0	43	0	309	2300	809	449	584	1084	17087	24056
2033 - 34	12198	0	46	0	325	2416	849	463	602	1149	18046	25361
2034 - 35	12929	0	48	0	341	2536	892	477	620	1217	19061	26739
2035 - 36	13705	0	50	0	358	2663	936	491	639	1290	20133	28194
2036 - 37	14528	0	53	0	376	2796	983	506	658	1368	21267	29731
2037 - 38	15399	0	55	0	395	2936	1032	521	678	1450	22466	31355
2038 - 39	16323	0	58	0	414	3083	1084	537	698	1537	23734	33070
2039 - 40	17302	0	61	0	435	3237	1138	553	719	1629	25075	34881
2040 - 41	18341	0	64	0	457	3399	1195	569	740	1727	26492	36796
2041 - 42	19441	0	67	0	480	3569	1255	586	763	1831	27991	38818
2042 - 43	20608	0	71	0	504	3747	1318	604	785	1940	29577	40955
2043 - 44	21844	0	74	0	529	3935	1384	622	809	2057	31253	43212
2044 - 45	23155	0	78	0	555	4131	1453	641	833	2180	33026	45598
2045 - 46	24544	0	82	0	583	4338	1525	660	858	2311	34901	48119
2046 - 47	26017	0	86	0	612	4555	1602	680	884	2450	36885	50784
2047 - 48	27578	0	90	0	643	4783	1682	700	911	2597	38982	53599
2048 - 49	29232	0	95	0	675	5022	1766	721	938	2753	41201	56575
2049 - 50	30986	0	99	0	709	5273	1854	743	966	2918	43548	59721
2050 - 51	32845	0	104	0	744	5536	1947	765	995	3093	46030	63045
2051 - 52	34816	0	110	0	781	5813	2044	788	1025	3278	48656	66560
2052 - 53	36905	0	115	0	821	6104	2146	812	1056	3475	51433	70275
2053 - 54	39119	0	121	0	862	6409	2254	836	1087	3684	54371	74202
2054 - 55	41466	0	127	0	905	6730	2366	861	1120	3905	57479	78353
2055 - 56	43954	0	133	0	950	7066	2485	887	1154	4139	60767	82742
2056 - 57	46592	0	140	0	997	7419	2609	913	1188	4387	64246	87383
2057 - 58	49387	0	147	0	1047	7790	2739	941	1224	4650	67926	92289
2058 - 59	52350	0	154	0	1100	8180	2876	969	1260	4929	71819	97477
2059 - 60	55491	0	162	0	1155	8589	3020	998	1298	5225	75938	102962

TRAFFIC PROJECTION - MOTSLIKELY SCENARIO

SECTION - 4

YEAR	CAR	TAXI	MINI BUS	GOVT BUS	VT BU	LMV	LCV	2 AXLE	3 AXLE	MAV(4-6A)	TOTAL VEHICLES	TOTAL PCU
2019 - 20	5355	0	10	0	30	1258	380	197	312	290	7832	10135
2020 - 21	5676	0	11	0	32	1333	401	203	321	305	8282	10683
2021 - 22	6017	0	12	0	34	1413	423	209	331	320	8759	11261
2022 - 23	6378	0	13	0	36	1498	446	215	341	336	9263	11871
2023 - 24	6761	0	14	0	38	1588	471	222	351	352	9797	12515
2024 - 25	7166	0	14	0	40	1683	497	228	362	370	10361	13193
2025 - 26	7596	0	15	0	43	1784	524	235	373	389	10959	13911
2026 - 27	8052	0	15	0	45	1892	553	242	384	408	11590	14667
2027 - 28	8535	0	16	0	48	2005	583	250	395	428	12260	15469
2028 - 29	9047	0	17	0	51	2125	615	257	407	450	12969	16315
2029 - 30	9590	0	17	0	54	2253	649	265	419	472	13719	17207
2030 - 31	10165	0	18	0	57	2388	685	273	432	496	14514	18151
2031 - 32	10775	0	19	0	60	2531	722	281	445	521	15355	19149
2032 - 33	11422	0	19	0	64	2683	762	289	458	547	16245	20201
2033 - 34	12107	0	20	0	68	2844	804	298	472	574	17187	21315
2034 - 35	12834	0	21	0	72	3015	848	307	486	603	18186	22492
2035 - 36	13604	0	21	0	76	3196	895	316	501	633	19241	23733
2036 - 37	14420	0	22	0	81	3388	944	326	516	665	20360	25047
2037 - 38	15285	0	22	0	86	3591	996	335	531	698	21544	26433
2038 - 39	16202	0	23	0	91	3806	1051	345	547	733	22798	27901
2039 - 40	17174	0	24	0	96	4035	1109	356	564	769	24127	29453
2040 - 41	18205	0	24	0	102	4277	1170	366	580	808	25532	31090
2041 - 42	19297	0	25	0	108	4533	1234	377	598	848	27021	32824
2042 - 43	20455	0	25	0	115	4805	1302	389	616	891	28597	34654
2043 - 44	21682	0	26	0	121	5094	1374	400	634	935	30267	36591
2044 - 45	22983	0	27	0	129	5399	1449	412	653	982	32035	38639
2045 - 46	24362	0	27	0	136	5723	1529	425	673	1031	33906	40802
2046 - 47	25824	0	28	0	145	6067	1613	438	693	1083	35889	43092
2047 - 48	27373	0	28	0	153	6431	1702	451	714	1137	37988	45509
2048 - 49	29015	0	29	0	163	6816	1795	464	735	1194	40212	48069
2049 - 50	30756	0	29	0	172	7225	1894	478	757	1253	42566	50773
2050 - 51	32602	0	30	0	183	7659	1998	493	780	1316	45060	53635
2051 - 52	34558	0	30	0	194	8118	2108	507	803	1382	47700	56659
2052 - 53	36631	0	31	0	205	8605	2224	523	828	1451	50498	59861
2053 - 54	38829	0	31	0	218	9122	2346	538	852	1523	53460	63243
2054 - 55	41159	0	32	0	231	9669	2475	554	878	1600	56598	66824
2055 - 56	43629	0	33	0	244	10249	2611	571	904	1680	59921	70611
2056 - 57	46246	0	33	0	259	10864	2755	588	931	1764	63441	74614
2057 - 58	49021	0	34	0	275	11516	2907	606	959	1852	67169	78851
2058 - 59	51962	0	34	0	291	12207	3066	624	988	1944	71117	83330
2059 - 60	55080	0	35	0	309	12939	3235	643	1018	2042	75300	88071

TRAFFIC PROJECTION - MOTSLIKELY SCENARIO

SECTION - 5

YEAR	CAR	TAXI	MINI BUS	GOVT BUS	VT BU	LMV	LCV	2 AXLE	3 AXLE	MAV(4-6A)	TOTAL VEHICLES	TOTAL PCU
2019 - 20	5300	0	10	0	28	1253	376	195	309	288	7759	10039
2020 - 21	5618	0	11	0	30	1316	395	201	318	302	8191	10566
2021 - 22	5955	0	12	0	31	1381	415	207	328	318	8647	11122
2022 - 23	6312	0	13	0	33	1451	435	213	338	333	9129	11707
2023 - 24	6691	0	14	0	35	1523	457	219	348	350	9638	12325
2024 - 25	7093	0	14	0	37	1599	480	226	358	368	10175	12973
2025 - 26	7518	0	15	0	40	1679	504	233	369	386	10744	13659
2026 - 27	7969	0	15	0	42	1763	529	240	380	405	11344	14380
2027 - 28	8447	0	16	0	45	1851	556	247	391	426	11979	15144
2028 - 29	8954	0	17	0	47	1944	583	254	403	447	12650	15949
2029 - 30	9491	0	17	0	50	2041	612	262	415	469	13359	16796
2030 - 31	10061	0	18	0	53	2143	643	270	428	493	14109	17692
2031 - 32	10665	0	19	0	56	2250	675	278	441	517	14901	18637
2032 - 33	11305	0	19	0	60	2363	709	286	454	543	15738	19631
2033 - 34	11983	0	20	0	63	2481	744	295	467	570	16624	20683
2034 - 35	12702	0	21	0	67	2605	782	304	481	599	17560	21793
2035 - 36	13464	0	21	0	71	2735	821	313	496	629	18549	22962
2036 - 37	14272	0	22	0	75	2872	862	322	511	660	19596	24198
2037 - 38	15128	0	22	0	80	3015	905	332	526	693	20701	25500
2038 - 39	16036	0	23	0	85	3166	950	342	542	728	21871	26877
2039 - 40	16998	0	24	0	90	3325	998	352	558	764	23108	28330
2040 - 41	18018	0	24	0	95	3491	1048	363	575	802	24415	29861
2041 - 42	19099	0	25	0	101	3665	1100	374	592	842	25798	31480
2042 - 43	20245	0	25	0	107	3849	1155	385	610	885	27259	33186
2043 - 44	21459	0	26	0	113	4041	1213	396	628	929	28806	34991
2044 - 45	22747	0	27	0	120	4243	1273	408	647	975	30441	36896
2045 - 46	24112	0	27	0	127	4455	1337	421	666	1024	32169	38904
2046 - 47	25558	0	28	0	135	4678	1404	433	686	1075	33998	41028
2047 - 48	27092	0	28	0	143	4912	1474	446	707	1129	35931	43268
2048 - 49	28717	0	29	0	152	5158	1548	460	728	1185	37977	45636
2049 - 50	30441	0	29	0	161	5415	1625	473	750	1245	40139	48134
2050 - 51	32267	0	30	0	170	5686	1706	488	773	1307	42427	50775
2051 - 52	34203	0	30	0	181	5970	1792	502	796	1372	44846	53562
2052 - 53	36255	0	31	0	192	6269	1881	517	820	1441	47406	56508
2053 - 54	38430	0	31	0	203	6582	1975	533	844	1513	50112	59617
2054 - 55	40736	0	32	0	215	6912	2074	549	869	1589	52976	62904
2055 - 56	43180	0	33	0	228	7257	2178	565	896	1668	56005	66376
2056 - 57	45771	0	33	0	242	7620	2287	582	922	1751	59209	70041
2057 - 58	48518	0	34	0	256	8001	2401	600	950	1839	62599	73916
2058 - 59	51429	0	34	0	272	8401	2521	618	979	1931	66183	78006
2059 - 60	54514	0	35	0	288	8821	2647	636	1008	2028	69977	82331

ANNEXURE 2 VDF CALCULATION

VEHICLE DAMAGE FACTOR FOR LCV4																	
Direction - AMRITSAR TO JALANDHAR								FRONT AXLE LOAD(TON)			REAR AXLE LOAD(TON)			VDF			
VEHICLE TYPE	AXEL CONFIGURATION	<4.5m Y/N	ORIGIN	DESTINATION	COMMODITY	FRONT WHEEL LOAD(TON)	REAR WHEEL LOAD(TON)	FRONT AXLE LOAD(TON) (ACTUAL)	FRONT AXLE LOAD(TON) (WITH LEGAL LIMITS)	FRONT AXLE LOAD(TON) (WITH 20% OF LEG LIMITS)	REAR AXLE LOAD(TON) (ACTUAL)	REAR AXLE LOAD(TON) (WITH LEGAL LIMITS)	REAR AXLE LOAD(TON) (WITH 20% OF LEG LIMITS)	VDF ACTUAL	VDF WITH LEGAL LIMITS	VDF WITH 20% OF LEGAL LIMITS	
LCV 4	1.1	Y	AMRITSAR	LUDHIANA	ICE CREAM	1.10	1.5	3.8	3.8	2.2	3	3	3	0.15	0.15	0.05	
LCV 4	1.1	Y	AMRITSAR	LUDHIANA	THREAD	1.5	2.3	3.8	3.8	2	6.3	6.3	6.3	0.93	0.93	0.83	
LCV 4	1.1	Y	AMRITSAR	DELHI	FRUIT	0.8	1.2	3.2	3.2	1.6	3	3	3	0.10	0.10	0.05	
LCV 4	1.1	Y	AMRITSAR	JANJALA	EMPTY	1.2	0.86	5.32	5.32	1.8	6.78	6.78	6.78	1.51	1.51	1.10	
LCV 4	1.1	Y	AMRITSAR	LUDHIANA	ICE CREAM	1.1	1.5	5.4	5.4	2.2	10.4	3	9	6.51	0.48	3.42	
LCV 4	1.1	Y	AMRITSAR	CHANDHIGARH	VEGITABLE	2.1	2.15	2.2	2.2	4.2	4.3	4.3	4.3	0.19	0.19	0.34	
LCV 4	1.1	Y	AMRITSAR	JALANDHAL	PARCEL	2.3	2.6	3.12	4.3	4.3	5.8	5.8	5.8	0.64	0.76	0.76	
LCV 4	1.1	Y	AMRITSAR	LUDHIANA	EMPTY	1.08	0.8	3.8	2.16	2.16	1.6	1.6	1.6	0.11	0.01	0.01	
LCV 4	1.1	Y	AMRITSAR	LUDHIANA	PARCEL	1.24	1.46	4.3	2.48	2.48	2.92	2.92	2.92	0.22	0.06	0.06	
LCV 4	1.1	Y	AMRITSAR	LUDHIANA	ICE CREAM	1.10	1.5	2.2	2.2	2.2	2.6	2.6	2.6	0.04	0.04	0.04	
LCV 4	1.1	Y	AMRITSAR	LUDHIANA	THREAD	1.5	2.3	1.5	1.5	2	5.1	4.4	4.4	0.35	0.20	0.20	
LCV 4	1.1	Y	AMRITSAR	DELHI	FRUIT	0.8	1.2	1.6	1.6	1.6	2.4	2.4	2.4	0.02	0.02	0.02	
LCV 4	1.1	Y	AMRITSAR	JANJALA	EMPTY	1.2	0.86	1.8	1.8	1.8	1.72	1.72	1.72	0.01	0.01	0.01	
LCV 4	1.1	Y	AMRITSAR	LUDHIANA	ICE CREAM	1.1	1.5	2.2	2.2	2.2	3	3	3	0.05	0.05	0.05	
														VDF	0.77	0.32	0.50

VEHICLE DAMAGE FACTOR FOR LCV6																
Direction - AMRITSAR TO JALANDHAR								FRONT AXLE LOAD(TON)			REAR AXLE LOAD(TON)			VDF		
VEHICLE TYPE	AXEL CONFIGURATION	<4.5m Y/N	ORIGIN	DESTINATION	COMMODITY	FRONT WHEEL LOAD(TON)	REAR WHEEL LOAD(TON)	FRONT AXLE LOAD(TON) (ACTUAL)	FRONT AXLE LOAD(TON) (WITH LEGAL LIMITS)	FRONT AXLE LOAD(TON) (WITH 20% OF LEG LIMITS)	REAR AXLE LOAD(TON) (ACTUAL)	REAR AXLE LOAD(TON) (WITH LEGAL LIMITS)	REAR AXLE LOAD(TON) (WITH 20% OF LEG LIMITS)	VDF ACTUAL	VDF WITH LEGAL LIMITS	VDF WITH 20% OF LEGAL LIMITS
LCV 6	1.2	N	AMRITSAR	LUDHIANA	PARCHUNE	1.9	2.6	5.62	3.8	5.1	10.5	5.2	10.50	3.21	0.23	3.13
LCV 6	1.2	Y	AMRITSAR	LUDHIANA	KURKURE	1.3	2.1	4.8	2.6	6.3	8.2	4.2	10.3	1.23	0.09	3.13
LCV 6	1.2	N	AMRITSAR	SURANG	PARCHUNE	1.7	2.2	3.4	3.4	3.4	4.4	4.4	4.4	0.12	0.12	0.12
LCV 6	1.2	N	AMRITSAR	TOLL PLAZA	EMPTY	1.2	1.1	6.32	2.4	2.4	10.3	2.2	2.2	3.14	0.01	0.01
LCV 6	1.2	N	AMRITSAR	RAJASTHAN	BISCUIT	1.4	3.8	6.8	2.8	2.8	7.6	7.6	7.6	1.34	0.83	0.83
LCV 6	1.2	Y	AMRITSAR	DCA COLA FACTOR	COCA COLA	1.65	3.8	3.3	3.3	3.3	7.6	7.6	7.6	0.84	0.84	0.84
LCV 6	1.2	N	AMRITSAR	DELHI	PARCHUNE	1.45	2.8	2.9	2.9	2.9	5.6	5.6	5.6	0.26	0.26	0.26
LCV 6	1.2	Y	AMRITSAR	HARIDWAR	ATANJALI GOOD	1.7	3.4	3.4	3.4	3.4	6.8	6.8	6.8	0.55	0.55	0.55
LCV 6	1.2	Y	AMRITSAR	DELHI	DAK PARCEL	1.1	1.8	2.2	2.2	2.2	3.6	3.6	3.6	0.05	0.05	0.05
LCV 6	1.2	N	AMRITSAR	JALANDHAR	EMPTY	1.6	1.3	3.2	3.2	11.5	2.6	2.6	2.6	0.04	0.04	4.28
LCV 6	1.2	N	AMRITSAR	RAIYA	GHAR K ASAMAN	1.4	2.2	2.8	2.8	2.8	4.4	4.4	4.4	0.11	0.11	0.11
LCV 6	1.2	N	AMRITSAR	LUDHIANA	LOHA	1.54	3.54	3.08	3.08	3.08	7.08	7.08	7.08	0.64	0.64	0.64
LCV 6	1.2	N	AMRITSAR	JALANDHAR	ALOO	2.2	3.8	4.4	4.4	4.4	7.6	7.6	7.6	0.91	0.91	0.91
LCV 6	1.2	N	AMRITSAR	LUDHIANA	THREAD	1.5	2.8	5.3	3	3	5.6	5.6	5.6	0.43	0.26	0.26
LCV 6	1.2	N	AMRITSAR	DELHI	ARMY GOODS	2.4	4.1	4.8	4.8	4.8	8.2	8.2	8.2	1.23	1.23	1.23
LCV 6	1.2	N	AMRITSAR	DELHI	ARMY GOODS	2.5	4.2	5	5	5	8.4	8.4	8.4	1.37	1.37	1.37
LCV 6	1.2	N	AMRITSAR	MANDI	EMPTY	1.15	1.4	2.3	2.3	2.3	2.8	2.8	2.8	0.02	0.02	0.02
LCV 6	1.2	N	AMRITSAR	MUJAFFAR PUR	PARCHUNE	1.63	3.2	3.26	3.26	3.26	6.4	6.4	6.4	0.44	0.44	0.44
LCV 6	1.2	N	AMRITSAR	JALANDHAR	MEDICINE	1.45	3.4	2.9	2.9	2.9	6.8	6.8	6.8	0.54	0.54	0.54

LCV 6	1.2	N	AMRITSAR	JALANDHAR	ALOO	2.15	3.44	4.3	4.3	4.3	6.88	6.88	6.88	0.63	0.63	0.63
LCV 6	1.2	N	AMRITSAR	LUDHIANA	PAPER	2.58	5.3	5.16	5.16	5.16	10.6	10.6	10.6	3.26	3.26	3.26
LCV 6	1.2	N	AMRITSAR	MUNAR	PARCEL	1.55	1.8	3.1	3.1	3.1	3.6	3.6	3.6	0.06	0.06	0.06
LCV 6	1.2	Y	AMRITSAR	LUDHIANA	NAMAK	2.3	4.8	4.6	4.6	4.6	9.6	9.6	9.6	2.18	2.18	2.18
LCV 6	1.2	Y	AMRITSAR	GUDGAON	PARCEL	1.3	1.51	2.6	2.6	2.6	3.02	3.02	3.02	0.03	0.03	0.03
LCV 6	1.2	N	AMRITSAR	KENDWA	EMPTY	1.12	1.65	6.23	2.24	2.24	3.3	3.3	3.3	0.40	0.04	0.04
LCV 6	1.2	N	AMRITSAR	PANIPAT	THREAD	2.7		5.4	5.4	5.4	0	0	0	0.21	0.21	0.21
LCV 6	1.2	N	AMRITSAR	LUDHIANA	PARCEL	1.34	3.18	2.68	2.68	2.68	6.36	6.36	6.36	0.41	0.41	0.41
LCV 6	1.2	N	AMRITSAR	LUDHIANA	AC	1.68	1.86	3.36	3.36	3.36	3.72	3.72	3.72	0.08	0.08	0.08
LCV 6	1.2	Y	AMRITSAR	CHANDHIGARH	KURKURE	1.3	2.3	2.6	2.6	2.6	4.6	4.6	4.6	0.12	0.12	0.12
LCV 6	1.2	Y	AMRITSAR	LUDHIANA	PARCHUNE	2.1	3.2	4.2	4.2	4.2	6.4	6.4	6.4	0.49	0.49	0.49
LCV 6	1.2	N	AMRITSAR	LUDHIANA	BISCUIT	1	2.4	2	2	2	4.8	4.8	4.8	0.13	0.13	0.13
LCV 6	1.2	Y	AMRITSAR	JALANDHAR	COALDRINK	1.8	2.9	3.6	3.6	3.6	5.8	5.8	5.8	0.32	0.32	0.32
LCV 6	1.2	N	AMRITSAR	JALANDHAR	COALDRINK	1.7	3.2	7.3	3.4	3.4	12.5	6.4	6.4	6.65	0.44	0.44
LCV 6	1.2	N	AMRITSAR	JALANDHAR	PARCEL	1.3	3.4	2.6	2.6	2.6	6.8	6.8	6.8	0.53	0.53	0.53
LCV 6	1.2	Y	AMRITSAR	LUDHIANA	EMPTY	1.8	2.9	3.6	3.6	3.6	5.8	5.8	5.8	0.32	0.32	0.32
LCV 6	1.2	Y	AMRITSAR	LUDHIANA	EMPTY	1.1	0.9	5.32	2.2	2.2	10.5	1.8	1.8	3.16	0.01	0.01
LCV 6	1.2	Y	AMRITSAR	JALANDHAR	FREEZ	1.1	1.7	2.2	2.2	2.2	3.4	3.4	3.4	0.04	0.04	0.04
LCV 6	1.2	N	AMRITSAR	LUDHIANA	KURKURE	1.2	2.1	2.4	2.4	2.4	4.2	4.2	4.2	0.08	0.08	0.08
LCV 6	1.2	N	AMRITSAR	LUDHIANA	THREAD	1.9	4.2	3.8	3.8	3.8	8.4	8.4	8.4	1.27	1.27	1.27
LCV 6	1.2	N	AMRITSAR	CHANDHIGARH	EMPTY	1.2	0.9	2.4	2.4	2.4	1.8	1.8	1.8	0.01	0.01	0.01
LCV 6	1.2	Y	AMRITSAR	JALANDHAR	COALDRINK	1.9	5.5	3.8	3.8	3.8	11	11	11	3.63	3.63	3.63
													VDF	0.99	0.56	0.80

VEHICLE DAMAGE FACTOR FOR BUS																
Direction - AMRITSAR TO JALANDHAR								FRONT AXLE LOAD(TON)			REAR AXLE LOAD(TON)			VDF		
VEHICLE TYPE	AXEL CONFIGURATION	<4.5m Y/N	ORIGIN	DESTINATION	COMMODITY	FRONT WHEEL LOAD(TON)	REAR WHEEL LOAD(TON)	FRONT AXLE LOAD(TON) (ACTUAL)	FRONT AXLE LOAD(TON) (WITH LEGAL LIMITS)	FRONT AXLE LOAD(TON) (WITH 20% OF LEG LIMITS)	REAR AXLE LOAD(TON) (ACTUAL)	REAR AXLE LOAD(TON) (WITH LEGAL LIMITS)	REAR AXLE LOAD(TON) (WITH 20% OF LEG LIMITS)	VDF ACTUAL	VDF WITH LEGAL LIMITS	VDF WITH 20% OF LEGAL LIMITS
BUS	1.2	Y	AMRITSAR	LUDHIANA	PASSENGER	2.1	2.4	5.2	5.2	5.2	6.4	6.4	6.4	0.59	0.59	0.59
BUS	1.2	Y	AMRITSAR	JALANDHAR	PASSENGER	2.2	3.4	4.4	4.4	4.4	6.8	6.8	6.8	0.61	0.61	0.61
BUS	1.2	Y	AMRITSAR	JALANDHAR	PASSENGER	1.8	2.7	3.6	3.6	3.6	5.4	5.4	5.4	0.25	0.25	0.25
BUS	1.2	Y	AMRITSAR	MUNGALI	PASSENGER	2.4	3.8	4.8	4.8	4.8	7.6	7.6	7.6	0.94	0.94	0.94
BUS	1.2	Y	AMRITSAR	DELHI	PASSENGER	2.8	3.63	5.6	5.6	5.6	7.26	7.26	7.26	0.92	0.92	0.92
BUS	1.2	Y	AMRITSAR	HANDHIGARI	PASSENGER	2.3	3.1	4.6	4.6	4.6	6.2	6.2	6.2	0.47	0.47	0.47
BUS	1.2	Y	AMRITSAR	AMBALA	PASSENGER	2.9	3.8	5.8	5.8	5.8	7.6	7.6	7.6	1.09	1.09	1.09
BUS	1.2	Y	PATHANKOT	LUDHIANA	PASSENGER	2.11	3.56	4.22	4.22	4.22	7.12	7.12	7.12	0.70	0.70	0.70
BUS	1.2	Y	AMRITSAR	AGARA	PASSENGER	2.48	3.6	4.96	4.96	4.96	7.2	7.2	7.2	0.80	0.80	0.80
													VDF	0.71	0.71	0.71

VEHICLE DAMAGE FACTOR FOR 2AXLE																
Direction - AMRITSAR TO JALANDHAR								FRONT AXLE LOAD(TON)			REAR AXLE LOAD(TON)			VDF		
VEHICLE TYPE	AXEL CONFIGURATION	<4.5m Y/N	ORIGIN	DESTINATION	COMMODITY	FRONT WHEEL LOAD(TON)	REAR WHEEL LOAD(TON)	FRONT AXLE LOAD(TON) (ACTUAL)	FRONT AXLE LOAD(TON) (WITH LEGAL LIMITS)	FRONT AXLE LOAD(TON) (WITH 20% OF LEG LIMITS)	REAR AXLE LOAD(TON) (ACTUAL)	REAR AXLE LOAD(TON) (WITH LEGAL LIMITS)	REAR AXLE LOAD(TON) (WITH 20% OF LEG LIMITS)	VDF ACTUAL	VDF WITH LEGAL LIMITS	VDF WITH 20% OF LEGAL LIMITS
2A	1.2	N	LUDHIANA	AMRITSAR	PARCHUNE	2.6	3.8	3.8	3.8	3.8	3.4	3.4	3.4	0.1	0.1	0.1
2A	1.2	N	LUDHIANA	AMRITSAR	KURKURE	2.7	4.1	5.4	5.4	5.4	8.4	8.4	8.4	1.7	1.7	1.7
2A	1.2	Y	SURANG	AMRITSAR	PARCHUNE	2.3	4.2	4.6	4.6	4.6	8.4	8.4	8.4	1.5	1.5	1.5
2A	1.2	Y	TOLL PLAZA	AMRITSAR	EMPTY	2.49	4.28	3.1	4.98	4.98	4	8.56	8.56	0.1	1.7	1.7
2A	1.2	Y	RAJASTHAN	AMRITSAR	BISCUIT	2.1	1.9	4.2	4.2	4.2	3.8	3.8	3.8	0.2	0.2	0.2
2A	1.2	N	CA COLA FACTORY	AMRITSAR	COCA COLA	2.6	4.9	3.3	5.2	5.2	4.25	9.8	9.8	0.1	2.7	2.7
2A	1.2	N	DELHI	AMRITSAR	PARCHUNE	2.7	4.2	5.4	5.4	5.4	8.4	8.4	8.4	1.7	1.7	1.7
2A	1.2	N	HARIDWAR	AMRITSAR	ATANJALI GOOD	1.9	1.7	3.8	3.8	3.8	3.4	3.4	3.4	0.1	0.1	0.1
2A	1.2	N	DELHI	AMRITSAR	DAK PARCEL	2.8	5.4	5.6	5.6	5.6	10.8	10.8	10.8	3.9	3.9	3.9
2A	1.2	N	JALANDHAR	AMRITSAR	EMPTY	2.1	1.7	4.2	4.2	4.2	3.4	3.4	3.4	0.2	0.2	0.2
2A	1.2	N	RAIYA	AMRITSAR	GHAR K ASAMAN	2.6	4.2	5.2	5.2	5.2	8.4	8.4	8.4	1.6	1.6	1.6
2A	1.2	N	LUDHIANA	AMRITSAR	LOHA	2.6	4.1	5.2	5.2	5.2	8.2	8.2	8.2	1.5	1.5	1.5
2A	1.2	N	JALANDHAR	AMRITSAR	ALOO	2.2	2.1	4.4	4.4	4.4	4.2	4.2	4.2	0.3	0.3	0.3
2A	1.2	N	LUDHIANA	AMRITSAR	THREAD	2.6	5.1	5.2	5.2	5.2	10.2	10.2	10.2	3.1	3.1	3.1
2A	1.2	N	DELHI	AMRITSAR	ARMY GOODS	2.6	6.1	5.2	5.2	5.2	12.2	12.2	12.2	5.8	5.8	5.8
2A	1.2	N	DELHI	AMRITSAR	ARMY GOODS	2.8	5.4	5.6	5.6	5.6	10.8	10.8	10.8	3.9	3.9	3.9
2A	1.2	N	MANDI	AMRITSAR	EMPTY	1.9	1.6	3.8	3.8	3.8	3.2	3.2	3.2	0.1	0.1	0.1
2A	1.2	N	MUJAFFAR PUR	AMRITSAR	PARCHUNE	2.7	5.2	5.4	5.4	5.4	10.4	10.4	10.4	3.3	3.3	3.3
2A	1.2	N	JALANDHAR	AMRITSAR	MEDICINE	2.2	3.4	4.4	4.4	4.4	6.8	6.8	6.8	0.7	0.7	0.7
2A	1.2	N	JALANDHAR	AMRITSAR	ALOO	2.15	5.6	4.3	4.3	4.3	11.2	11.2	11.2	4.0	4.0	4.0
2A	1.2	Y	LUDHIANA	AMRITSAR	PAPER	2.39	5.2	4.78	4.78	4.78	10.4	10.4	10.4	3.1	3.1	3.1

2A	1.2	N	MUNAR	AMRITSAR	PARCEL	1.8	4.28	3.6	3.6	3.6	8.56	8.56	8.56	1.4	1.4	1.4
2A	1.2	N	LUDHIANA	AMRITSAR	NAMAK	2.79	2.6	5.58	3.4	5.58	5.2	4	5.2	0.7	0.1	0.7
2A	1.2	N	GUDGAON	AMRITSAR	PARCEL	2.45	4.2	4.9	4.9	4.9	8.4	8.4	8.4	1.5	1.5	1.5
2A	1.2	Y	KENDWA	AMRITSAR	PARCEL	3.8	7.7	3.54	3.54	3.54	5.6	5.6	5.6	0.3	0.3	0.3
2A	1.2	Y	PANIPAT	AMRITSAR	THREAD	2.702	7.1	5.4	5.4	5.4	11.5	11.5	11.5	4.7	4.7	4.7
2A	1.2	Y	LUDHIANA	AMRITSAR	PARCEL	2.62	6.8	5.8	5.8	5.8	11.5	11.5	11.5	4.9	4.9	4.9
2A	1.2	Y	LUDHIANA	AMRITSAR	AC	2.13	4.2	5.24	5.24	5.24	8	8	8	1.4	1.4	1.4
2A	1.2	Y	CHANDHIGARH	AMRITSAR	KURKURE	2.8	1.7	4.26	4.26	4.26	3.4	3.4	3.4	0.2	0.2	0.2
2A	1.2	N	LUDHIANA	AMRITSAR	PARCHUNE	2.1	6.4	5.6	5.6	5.6	11.5	11.5	11.5	4.8	4.8	4.8
2A	1.2	N	LUDHIANA	AMRITSAR	BISCUIT	2.65	1.96	4.2	4.2	4.2	3.92	3.92	3.92	0.2	0.2	0.2
2A	1.2	N	JALANDHAR	AMRITSAR	COALDRINK	2.78	4.2	5.3	5.3	5.3	8.4	8.4	8.4	1.7	1.7	1.7
2A	1.2	N	JALANDHAR	AMRITSAR	COALDRINK	2.65	5.6	5.56	5.56	5.56	11.2	11.2	11.2	4.4	4.4	4.4
2A	1.2	N	JALANDHAR	AMRITSAR	PARCEL	2.78	5.46	5.3	5.3	5.3	10.92	10.92	10.92	3.9	3.9	3.9
2A	1.2	Y	LUDHIANA	AMRITSAR	DAK PARCEL	2.65	6.7	5.4	5.4	5.4	13.4	11.5	13.8	8.3	4.7	9.3
2A	1.2	Y	LUDHIANA	AMRITSAR	COALDRINK	2.7	4.39	3.5	4.08	4.08	4.1	8.78	8.78	0.2	1.6	1.6
2A	1.2	Y	JALANDHAR	AMRITSAR	FREEZ	2.04	1.72	4.2	4.2	4.2	3.44	3.44	3.44	0.2	0.2	0.2
2A	1.2	N	LUDHIANA	AMRITSAR	KURKURE	2.1	6.9	6	6	6	13.8	11.5	13.8	9.6	5.0	9.6
2A	1.2	N	LUDHIANA	AMRITSAR	THREAD	3	4.7	5.2	5.2	5.2	9.4	9.4	9.4	2.3	2.3	2.3
2A	1.2	N	CHANDHIGARH	AMRITSAR	PARCHUNE	3.1	8.1	6	6	6	16.2	11.5	13.8	17.5	5.0	9.6
2A	1.2	Y	JALANDHAR	AMRITSAR	COALDRINK	3.4	5.3	6.2	6.2	6.2	10.6	10.6	10.6	3.9	3.9	3.9
2A	1.2	N	DELHI	AMRITSAR	DIESEL	2.7	7.9	6.8	6.8	6.8	15.8	11.5	13.8	16.4	5.5	10.1
2A	1.2	Y	LUDHIANA	AMRITSAR	COALDRINK	2	5.4	5.4	5.4	5.4	10.8	10.8	10.8	3.8	3.8	3.8
2A	1.2	N	JALANDHAR	AMRITSAR	PARCEL	2.9	5.6	4	4	4	11.2	11.2	11.2	4.0	4.0	4.0
2A	1.2	Y	CHANDHIGARH	AMRITSAR	THREAD	2.75	6.5	5.8	5.8	5.8	13	11.5	13.8	7.6	4.9	9.5
2A	1.2	Y	JALANDHAR	AMRITSAR	PARCHUNE	2.6	5.1	5.2	5.2	5.2	10.2	10.2	10.2	3.1	3.1	3.1

2A	1.2	Y	JALANDHAR	AMRITSAR	KURKURE	2.6	4.3	5.2	5.2	5.2	8.6	8.6	8.6	1.7	1.7	1.7
2A	1.2	N	DELHI	AMRITSAR	PARCHUNE	2.46	3.9	4.92	4.92	4.92	7.8	7.8	7.8	1.2	1.2	1.2
2A	1.2	Y	LUDHIANA	AMRITSAR	EMPTY	2.14	1.83	4.28	4.28	4.28	3.66	3.66	3.66	0.2	0.2	0.2
2A	1.2	N	CA COLA FACTO	AMRITSAR	COCA COLA	2.72	4.4	5.44	5.44	5.44	8.8	8.8	8.8	2.0	2.0	2.0
2A	1.2	Y	JALPAMGURU	AMRITSAR	PARCHUNE	1.86	1.73	3.72	3.72	3.72	3.46	3.46	3.46	0.1	0.1	0.1
2A	1.2	Y	JALANDHAR	AMRITSAR	ATANJALI GOOD	2.69	5.31	5.38	5.38	5.38	10.62	10.62	10.62	3.6	3.6	3.6
2A	1.2	Y	DAMAN ROAD	AMRITSAR	DAK PARCEL	2.15	1.72	4.3	4.3	4.3	3.44	3.44	3.44	0.2	0.2	0.2
2A	1.2	Y	SANGRUR	AMRITSAR	EMPTY	2.69	4.8	3	5.38	3.9	9.6	9.6	9.6	2.1	2.5	2.2
2A	1.2	Y	LUDHIANA	AMRITSAR	GHAR K ASAMAN	2.18	1.71	4.36	4.36	4.36	3.42	3.42	3.42	0.2	0.2	0.2
2A	1.2	Y	LUDHIANA	AMRITSAR	LOHA	2.08	1.76	4.16	4.16	4.16	3.52	3.52	3.52	0.2	0.2	0.2
2A	1.2	Y	DELHI	AMRITSAR	ALOO	2.62	5.2	5.24	5.24	5.24	10.4	10.4	10.4	3.3	3.3	3.3
2A	1.2	Y	INDORE	AMRITSAR	THREAD	2.46	3.9	4.92	4.92	4.92	7.8	7.8	7.8	1.2	1.2	1.2
2A	1.2	N	LUDHIANA	AMRITSAR	ARMY GOODS	2.59	4.6	5.18	5.18	5.18	9.2	9.2	9.2	2.2	2.2	2.2
2A	1.2	N	VYAS	AMRITSAR	ARMY GOODS	2.08	1.84	4.16	4.16	4.16	3.68	3.68	3.68	0.2	0.2	0.2
2A	1.2	Y	AMBALA	AMRITSAR	EMPTY	2.74	5.65	5.48	5.48	5.48	7.5	11.3	11.3	1.3	4.5	4.5
2A	1.2	N	PANIPAT	AMRITSAR	PARCHUNE	2.63	4.2	5.26	5.26	5.26	8.4	8.4	8.4	1.6	1.6	1.6
2A	1.2	N	SANGRUR	AMRITSAR	MEDICINE	2.69	4.8	5.38	5.38	5.38	9.6	9.6	9.6	2.5	2.5	2.5
2A	1.2	N	AMBALA	AMRITSAR	ALOO	2.31	3.8	4.62	4.62	4.62	7.6	7.6	7.6	1.1	1.1	1.1
2A	1.2	N	JALANDHAR	AMRITSAR	PAPER	2.59	5.28	3.1	5.18	5.18	5	10.56	10.56	0.2	3.4	3.4
2A	1.2	N	AMBALA	AMRITSAR	PARCEL	2.09	1.77	4.18	4.18	4.18	3.54	3.54	3.54	0.2	0.2	0.2
2A	1.2	Y	JALANDHAR	AMRITSAR	NAMAK	2.63	4.09	5.26	5.26	5.26	8.18	8.18	8.18	1.5	1.5	1.5
2A	1.2	Y	JALANDHAR	AMRITSAR	PARCEL	2.67	4.3	5.34	5.34	5.34	8.6	8.6	8.6	1.8	1.8	1.8
2A	1.2	Y	DELHI	AMRITSAR	PARCEL	2.31	2.9	4.62	4.62	4.62	5.8	5.8	5.8	0.5	0.5	0.5
2A	1.2	Y	PANIPAT	AMRITSAR	THREAD	2.86	5.39	5.72	5.72	5.72	3.2	10.78	10.78	0.6	3.9	3.9
2A	1.2	Y	CHANDHIGARH	AMRITSAR	PARCEL	2.69	4.3	5.38	5.38	5.38	8.6	8.6	8.6	1.8	1.8	1.8
2A	1.2	N	LOHALI	AMRITSAR	AC	2.6	4.19	5.2	5.2	5.2	3.38	3.38	3.38	0.4	0.4	0.4
2A	1.2	N	AMBALA	AMRITSAR	KURKURE	2.49	4.3	4.98	4.98	4.98	8.6	8.6	8.6	1.7	1.7	1.7
2A	1.2	N	JALANDHAR	AMRITSAR	PARCHUNE	2.14	1.81	4.28	4.28	4.28	3.62	3.62	3.62	0.2	0.2	0.2
2A	1.2	N	HIMACHAL	AMRITSAR	BISCUIT	2.76	6.3	3.5	5.52	5.52	3	11.5	13.8	0.1	4.8	9.4
													VDF	2.38	2.19	2.56

VEHICLE DAMAGE FACTOR FOR LCV																		
Direction - AMRITSAR TO JALANDHAR										FRONT AXLE LOAD(TON)			REAR AXLE LOAD(TON)			VDF		
VEHICLE TYPE	AXLE CONFIGURATION	<4.5m Y/N	ORIGIN	DESTINATION	COMMODITY	FRONT WHEEL LOAD(TON)	SECOND WHEEL LOAD (TON)	THIRD WHEEL LOAD (TON)	REAR WHEEL LOAD(TON)	FRONT AXLE LOAD(TON) (ACTUAL)	FRONT AXLE LOAD(TON) (WITH LEGAL LIMITS)	FRONT AXLE LOAD(TON) (WITH 20% OF LEGAL LIMITS)	REAR AXLE LOAD(TON) (ACTUAL)	REAR AXLE LOAD(TON) (WITH LEGAL LIMITS)	REAR AXLE LOAD(TON) (WITH 20% OF LEGAL LIMITS)	VDF ACTUAL	VDF WITH LEGAL LIMITS	VDF WITH 20% OF LEGAL LIMITS
3 AXLE	1.22	Y	AMRITS	JALANDHAR	DISEL	3.7	9.2	8.7	17.9	7.4	7.4	7.4	35.8	21.2	25	33.26	5.45	9.10
3 AXLE	1.22	Y	AMRITS	HAVELI	COALDRINK	2.5	3	2.8	5.8	5	5	5	11.6	11.6	11.6	0.67	0.67	0.67
3 AXLE	1.22	Y	AMRITS	JALANDHAR	SHOES	2.8	4.3	4.1	8.4	7.16	7.16	7.16	16.8	16.8	16.8	2.90	2.90	2.90
3 AXLE	1.22	Y	AMRITS	LUDHIANA	EMPTY	2.2	1.6	1.4	3	4.4	4.4	4.4	6	6	6	0.22	0.22	0.22
3 AXLE	1.22	Y	AMRITS	LUDHIANA	DHAN	3	5.9	5.6	11.5	6	6	6	23	21	25.2	6.07	4.43	8.46
3 AXLE	1.22	Y	AMRITS	KOLKATA	RADDI	3.15	4.5	4.8	9.3	6.3	6.3	6.3	18.6	18.6	18.6	3.13	3.13	3.13
3 AXLE	1.22	Y	AMRITS	AMBALA	EMPTY	1.8	1.5		1.5	7.4	7.4	7.4	12.5	12.5	12.5	2.03	2.03	2.03
3 AXLE	1.22	Y	AMRITS	GOHATI	PARCHUNE	2.66	4.55	4.2	8.75	5.32	5.32	5.32	17.5	17.5	17.5	2.23	2.23	2.23
3 AXLE	1.22	Y	AMRITS	RAJPURA	CEMENT	3.1	5.81	4.2	10.01	6.2	6.2	6.2	20.02	20.02	20.02	3.87	3.87	3.87
3 AXLE	1.22	Y	AMRITS	JALANDHAR	GAS	2.6	3.1	4.2	7.3	5.2	5.2	5.2	14.6	14.6	14.6	1.26	1.26	1.26
3 AXLE	1.22	Y	AMRITS	MUMBAI	EMPTY	2.11	2.19	1.9	4.09	4.22	4.22	4.22	8.18	8.18	8.18	0.25	0.25	0.25
3 AXLE	1.22	Y	AMRITS	LUDHIANA	OIL	2.65	4.35	4.1	8.45	5.3	5.3	5.3	16.9	16.9	16.9	1.98	1.98	1.98
3 AXLE	1.22	Y	AMRITS	BHIWADI	EMPTY	2.72	5.44	5.2	10.64	5.44	5.44	5.44	21.28	21	25.2	4.41	4.21	8.24
3 AXLE	1.22	Y	AMRITS	JALANDHAR	CEMENT	3.18	9.4	8.9	18.3	6.36	6.36	6.36	36.6	21	25.2	35.49	4.60	8.63
3 AXLE	1.22	Y	AMRITS	LUDHIANA	EMPTY	2.2	1.74	1.65	3.39	4.4	4.4	4.4	6.78	6.78	6.78	0.24	0.24	0.24
3 AXLE	1.22	Y	AMRITS	LUDHIANA	EMPTY	2.34	2.3	1.8	4.1	4.68	4.68	4.68	8.2	8.2	8.2	0.34	0.34	0.34
3 AXLE	1.22	Y	AMRITS	JALANDHAR	PETROL	3.6	5.9	5.3	11.2	7.2	7.2	7.2	22.4	21	25.2	6.25	5.15	9.18
3 AXLE	1.22	Y	AMRITS	JALANDHAR	RADDI	3.7	5.6	6.8	12.4	7.4	7.4	7.4	24.8	21	25.2	8.86	5.31	9.34
3 AXLE	1.22	Y	AMRITS	JALANDHAR	CYLINDER	2.6	5.4	5.8	11.2	5.2	5.2	5.2	22.4	21	25.2	5.24	4.13	8.16
3 AXLE	1.22	Y	AMRITS	JALANDHAR	EMPTY	2.1	1.9	1.8	3.7	4.2	4.2	4.2	7.4	7.4	7.4	0.22	0.22	0.22
3 AXLE	1.22	Y	AMRITS	JALANDHAR	DISEL	2.7	6.1	4.7	10.8	5.4	5.4	5.4	21.6	21	25.2	4.64	4.20	8.23

3 AXLE	1.22	Y	AMRITS	JALANDHAR	EMPTY	2.2	2.1	1.8	3.9	4.4	4.4	4.4	7.8	7.8	7.8	0.27	0.27	0.27
3 AXLE	1.22	Y	AMRITS	BARELI	WHEAT	3.5	8.4	4.7	16.3	7	7	7	32.6	21	25.2	23.05	5.00	9.03
3 AXLE	1.22	Y	AMRITS	JALANDHAR	EMPTY	2.1	2.01	1.8	3.91	4.2	4.2	4.2	7.82	7.82	7.82	0.23	0.23	0.23
3 AXLE	1.22	Y	AMRITS	JALANDHAR	DISEL	2.9	4.3	7.9	7.8	5.8	5.8	5.8	15.6	15.6	15.6	1.73	1.73	1.73
3 AXLE	1.22	Y	AMRITS	WAGHA BORDE	POWDER	2.81	4	1.9	4	5.62	5.62	5.62	8	8	8	0.60	0.60	0.60
3 AXLE	1.22	Y	AMRITS	CHANDHIGARH	GAS	2.89	6.74	3.5	6.74	5.78	5.78	5.78	13.48	13.48	13.48	1.22	1.22	1.22
3 AXLE	1.22	Y	AMRITS	LUDHIANA	EMPTY	1.95	2.21		4.02	7.8	7.8	7.8	14.12	14.12	14.12	2.69	2.69	2.69
3 AXLE	1.22	Y	AMRITS	LUDHIANA	EMPTY	2.5	2.1		4	5	5	5	8	8	8	0.40	0.40	0.40
3 AXLE	1.22	Y	AMRITS	JALANDHAR	SAND	2.7	7.8	1.81	15.1	5.4	5.4	5.4	30.2	21	25.2	16.50	4.20	8.23
3 AXLE	1.22	Y	AMRITS	JALANDHAR	EMPTY	2.15	2.85	1.9	5.71	4.3	4.3	4.3	11.42	11.42	11.42	0.51	0.51	0.51
3 AXLE	1.22	Y	AMRITS	JALANDHAR	EMPTY	2.19	2.04	7.3	3.84	4.38	4.38	4.38	7.68	7.68	7.68	0.26	0.26	0.26
3 AXLE	1.22	Y	AMRITS	LUDHIANA	PARCEL	2.71	5.34	2.86	10.44	5.42	5.42	5.42	20.88	20.88	20.88	4.12	4.12	4.12
3 AXLE	1.22	Y	AMRITS	JALANDHAR	EMPTY	2.1	1.8	1.8	3.5	4.2	4.2	4.2	7	7	7	0.21	0.21	0.21
3 AXLE	1.22	Y	AMRITS	JALANDHAR	EMPTY	2.2	2.2	5.1	3.8	4.4	4.4	4.4	7.6	7.6	7.6	0.26	0.26	0.26
3 AXLE	1.22	Y	AMRITS	ANJEER	RICE	3.16	4.49	1.7	7.58	6.32	6.32	6.32	15.16	15.16	15.16	1.85	1.85	1.85
3 AXLE	1.22	Y	AMRITS	DELHI	PARCEL	3.18	5.11	1.6	9.22	6.36	6.36	6.36	18.44	18.44	18.44	3.08	3.08	3.08
3 AXLE	1.22	Y	AMRITS	LUDHIANA	PARCEL	2.69	4.11	3.09	8.17	5.38	5.38	5.38	16.34	16.34	16.34	1.81	1.81	1.81
3 AXLE	1.22	Y	AMRITS	LUDHIANA	PARCHUNE	3.9	3.91	4.11	7.06	7.8	7.8	7.8	14.12	14.12	14.12	2.69	2.69	2.69
3 AXLE	1.22	Y	AMRITS	DELHI	EMPTY	2.72	5.67	4.06	11.09	5.44	5.44	5.44	22.18	21	25.2	5.13	4.21	8.24
3 AXLE	1.22	Y	AMRITS	JALANDHAR	DHAN	2.57	4.29	3.15	8.32	5.14	5.14	5.14	16.64	16.64	16.64	1.84	1.84	1.84
3 AXLE	1.22	Y	AMRITS	LUDHIANA	PARCEL	2.14	1.9	5.42	3.59	4.28	4.28	4.28	7.18	7.18	7.18	0.23	0.23	0.23
3 AXLE	1.22	Y	AMRITS	GOHATI	PARCEL	2.8	5.6	4.03	10.77	5.6	5.6	5.6	21.54	21	25.2	4.67	4.26	8.29
3 AXLE	1.22	Y	AMRITS	JALANDHAR	BRICK	2.7	5.28	1.69	10.32	5.4	5.4	5.4	20.64	20.64	20.64	3.94	3.94	3.94
3 AXLE	1.22	Y	AMRITS	JALANDHAR	WOOD	2.65	4.45	5.17	8.58	5.3	5.3	5.3	17.16	17.16	17.16	2.08	2.08	2.08
3 AXLE	1.22	Y	AMRITS	JALANDHAR	PARCHUNE	2.9	6.3	5.04	12.34	5.8	5.8	5.8	24.68	21	25.2	7.75	4.34	8.37

3 AXLE	1.22	Y	AMRITS	JALANDHAR	CONCRETE	2.76	5.8	4.13	11.4	5.52	5.52	5.52	22.8	21	25.2	5.70	4.24	8.27
3 AXLE	1.22	Y	AMRITS	HAVELI	EMPTY	2.76	5.1	6.04	9.77	5.52	5.52	5.52	19.54	19.54	19.54	3.30	3.30	3.30
3 AXLE	1.22	Y	AMRITS	AMBALA	EMPTY	2.6	4.2	5.6	8.12	5.2	5.2	5.2	16.24	16.24	16.24	1.72	1.72	1.72
3 AXLE	1.22	Y	AMRITS	JALANDHAR	SAND	2.12	1.9	7.3	7.3	7.3	4.24	4.24	11.5	11.5	11.5	1.81	0.51	0.51
3 AXLE	1.22	Y	AMRITS	LUDHIANA	EMPTY	2.49	4.1	3.92	7.92	4.98	4.98	4.98	15.84	15.84	15.84	1.53	1.53	1.53
3 AXLE	1.22	Y	AMRITS	LUDHIANA	EMPTY	2.19	1.76	1.8	3.42	4.38	4.38	4.38	6.84	6.84	6.84	0.23	0.23	0.23
3 AXLE	1.22	Y	AMRITS	CHANDHIGARH	PARCEL	2.18	1.84	3.82	3.51	4.36	4.36	4.36	7.02	7.02	7.02	0.23	0.23	0.23
3 AXLE	1.22	Y	AMRITS	CHANDHIGARH	KURKURE	2.61	3.69	1.66	7.09	5.22	5.22	5.22	14.18	14.18	14.18	1.17	1.17	1.17
3 AXLE	1.22	Y	AMRITS	JALANDHAR	SAND	2.5	4.1	1.67	7.96	5	5	5	15.92	15.92	15.92	1.56	1.56	1.56
															4.1437	2.24195	3.2608	

VEHICLE DAMAGE FACTOR FOR MAV																							
Direction - AMRITSAR TO JALANDHAR												FRONT AXLE LOAD(TON)						REAR AXLE LOAD(TON)			VDF		
VEHICLE TYPE	AXLE CONFIGURATION	<4.5m Y/N	ORIGIN	DESTINATION	COMMODITY	FRONT WHEEL LOAD(TON)	SECOND WHEEL LOAD(TON)	THIRD WHEEL LOAD(TON)	FOURTH WHEEL LOAD(TON)	FIFTH WHEEL LOAD(TON)	SIXTH WHEEL LOAD(TON)	FRONT AXLE LOAD(ACTUAL)	FRONT AXLE LOAD(WITH LEGAL LIMITS)	FRONT AXLE LOAD(WITH 20% OF LEGAL LIMITS)	SECOND AXLE LOAD(ACTUAL)	SECOND AXLE LOAD(WITH LEGAL LIMITS)	SECOND AXLE LOAD(WITH 20% OF LEGAL LIMITS)	REAR AXLE LOAD(ACTUAL)	REAR AXLE LOAD(WITH LEGAL LIMITS)	REAR AXLE LOAD(WITH 20% OF LEGAL LIMITS)	VDF ACTUAL	VDF WITH LEGAL LIMITS	VDF WITH 20% OF LEGAL LIMITS
MAV	1.1.22	Y	AMIRISAR	HYDRABAD	MANGO	2.7	2.1	1.74	4.2			5.4	5.4	5.4	4.2	4.2	4.2	17.2	17.2	17.2	1.74	1.74	1.74
MAV	1.222	Y	PAPER MILL	LUDHIANA	PARCHUNE	2.6	4.3	1.87	6.2			5.2	5.2	5.2				34.4	27	34.4	5.53	2.33	5.53
MAV	1.222	Y	AMIRISAR	LUDHIANA	KURKURE	3.8	7.9	2.4	7.1			7.6	7.6	9				45.2	27	45.2	17.09	3.69	18.76
	1.222	Y	AMIRISAR	LUDHIANA	PARCHUNE	2.9	5.3		7			5.8	5.8	5.8				39	27	39	9.10	2.54	9.10
MAV	1.222	Y	AMIRISAR	LUDHIANA	CEMENT	2.8	5.2		5.8			5.6	5.6	5.6				34.6	27	34.6	0.52	0.52	0.52
MAV	1.222	Y	AMIRISAR	LUDHIANA	BISCUIT	3.2	7	6.4	6			6.4	6.4	6.4				38.8	27	38.8	9.38	2.83	9.38
MAV	1.222	Y	AMIRISAR	LUDHIANA	COCA COLA	3.8	7.1	5.3	6.1			7.6	7.6	9				39	27	39	10.24	3.69	11.91
MAV	1.222	Y	JAMMU	LUDHIANA	PARCHUNE	2.7	6.2		7.1			5.4	5.4	5.4				41.4	27	41.4	0.44	0.44	0.44
MAV	1.222	Y	AMIRISAR	JALANDHAR	TANJALI GOO	2.79	3.4		4.7			5.58	5.58	5.58				26.6	26.6	26.6	3.48	3.48	3.48
MAV	1.222	Y	AMIRISAR	GOHATI	DAK PARCEL	2.8	3.7		5.5			5.6	5.6	5.6	6.6	6.6	6.6	30	30	30	3.49	3.49	3.49
MAV	1.1.22	Y	AMIRISAR	PANIPAT	CAR	3.1	3.3	2.1	7.2	7		6.2	6.2	6.2	1.6	1.6	1.6	28.4	28.4	28.4	14.3086	14.3086	14.3086
MAV	1.1.22	Y	AMIRISAR	SANGRUR	HAR K ASAMA	2.2	0.8	5.2	1.9			4.4	4.4	4.4	13.4	11.5	13.8	8	8	8	17.0014	9.34784	19.09
MAV	1.222	Y	AMIRISAR	JALANDHAR	LOHA	2.8	6.7	2.04	7.3	7		5.6	5.6	5.6				28.6	28.6	28.6	2.97	2.97	2.97
MAV	1.1.22	Y	AMIRISAR	HYDRABAD	EMPTY	2.1	1		1.4			4.2	4.2	4.2	4.4	4.4	4.4	8	8	8	0.43497	0.43497	0.43497
MAV	1.1.22	Y	AMIRISAR	LUDHIANA	EMPTY	2.5		2.1	1.7	1.7		5	5	5	14.4	11.5	13.8	7.6	7.6	7.6	22.6973	9.46298	19.2052
MAV	1.2.222	Y	AMIRISAR	LUDHIANA	EMPTY	1.8	2.2	5.3	1.6			3.6	3.6	3.6	11.4	11.4	11.4	6.6	6.6	6.6	3.913	3.913	3.913
MAV	1.2.22	Y	BORDER	LUDHIANA	ARMY GOODS	2.9	7.2		5.9			5.8	5.8	5.8	11.6	11.6	13.8	24	24	24	11.0855	11.0855	15.1918
MAV	1.2.22	Y	JAMMU	JALANDHAR	BISCUIT	2.8	5.7	1.89	6			5.6	5.6	5.6	7.2	7.2	7.2	24.6	24.6	24.6	8.18707	8.18707	8.18707
MAV	1.2.22	Y	AMIRISAR	JALANDHAR	PARCHUNE	2.7	5.8		6.1	1.85		5.4	5.4	5.4	4.6	4.6	4.6	25	25	25	8.08271	8.08271	8.08271
MAV	1.2.22	Y	AMIRISAR	JALANDHAR	EMPTY	2.15	2.1	2.2		1.5		4.3	4.3	4.3	12.2	11.5	13.8	5.9	5.9	5.9	5.20982	4.15541	8.40112
MAV	1.2.22	Y	AMIRISAR	JALANDHAR	EMPTY	1.9	2.3		2.4		1.1	3.8	3.8	3.8	4.4	4.4	4.4	7.8	7.8	7.8	0.26438	0.26438	0.26438

MAV	1.2.22	Y	AMIRISAR	JALANDHAR	PAPER	2.6	6.1		6.35			5.2	5.2	5.2	8.72	7.5	9	27.1	27.1	27.1	12.098	11.5061	12.2742
MAV	1.2.22	Y	AMIRISAR	JALANDHAR	PARCEL	2.15	2.2	6.72	1.9			4.3	4.3	4.3	4.6	4.6	4.6	7.8	7.8	7.8	0.35007	0.35007	0.35007
MAV	1.2.22	Y	AMIRISAR	MUMBAI	NAMAK	3.7	4.36	5.6	8.12			7.4	7.4	7.4	4	4	4	32.04	32.04	32.04	21.9559	21.9559	21.9559
MAV	1.2.22	Y	AMIRISAR	DELHI	EMPTY	2.2	2.3	6.38	1.98	1.7		4.4	4.4	4.4	4.16	4.16	4.16	7.36	7.36	7.36	0.31882	0.31882	0.31882
MAV	1.2.22	Y	AMIRISAR	AGRA	EMPTY	2.2	2	5.3	1.64	1.6		4.4	4.4	4.4				6.48	6.48	6.48	0.20095	0.20095	0.20095
MAV	1.2.22	Y	AMIRISAR	DELHI	EMPTY	2.2	2.08		1.72	1.5		4.4	4.4	4.4				6.44	6.44	6.44	0.20079	0.20079	0.20079
MAV	1.2.222	Y	AMIRISAR	DELHI	EMPTY	2.24	1.3		1.92			4.48	4.48	4.48	12.8	11.5	13.8	10.64	10.64	10.64	0.77431	0.59376	0.95622
MAV	1.2.222	Y	AMIRISAR	DELHI	EMPTY	2.15			1.5			4.3	4.3	4.3	12.8	11.5	13.8	6.5	6.5	6.5	0.70211	0.52156	0.88402
MAV	1.2.22	Y	AMIRISAR	DELHI	KURKURE	3.2	6.4					6.4	6.4	6.4	0	0	0	11.38	11.38	11.38	0.93214	0.93214	0.93214
MAV	1.2.22	Y	AMIRISAR	DELHI	PARCHUNE	3.8	6.4		5.3			7.6	7.6	9	9.36	9.36	9.36	21.12	21.12	21.12	2.61099	2.61099	4.2841
MAV	1.1.22	Y	AMIRISAR	LUDHIANA	BISCUIT	2.46			4.6			4.92	4.92	4.92	4.4	4.4	4.4	17.52	17.52	17.52	0.65784	0.65784	0.65784
MAV	1.2.22	Y	AMIRISAR	LUDHIANA	COALDRINK	2.46	4.68	7.19	4.6			4.92	4.92	4.92				17.52	17.52	17.52	0.6506	0.6506	0.6506
MAV	1.2.222	Y	AMIRISAR	LUDHIANA	EMPTY	2.2	2.2	6.3	1.68			4.4	4.4	4.4	10.6	10.6	10.6	3.36	3.36	3.36	0.43863	0.43863	0.43863
MAV	1.2.22	Y	AMIRISAR	LUDHIANA	PARCEL	2.5	6.71	6.8	8.7			5	5	5	0	0	0	49.24	49.24	49.24	21.9493	21.9493	21.9493
MAV	1.2.222	Y	AMIRISAR	LUDHIANA	DAK PARCEL	2.6	5.3	6.9	6.72	5.98		5.2	5.2	5.2	0	0	0	25.4	25.4	25.4	1.9105	1.9105	1.9105
MAV	1.1.22	Y	WAGHA BOR	LUDHIANA	COALDRINK	3.1		2.01	5.6			6.2	6.2	6.2	5.2	5.2	5.2	22	22	22	1.64249	1.64249	1.64249
MAV	1.1.22	Y	AMIRISAR	JALANDHAR	FREEZ	4.8	2.6	5.4	6.8			9.6	9.6	9.6	11.8	11.8	11.8	29.4	29.4	29.4	7.52924	7.52924	7.52924
MAV	1.2.22	Y	AMIRISAR	JALANDHAR	EMPTY	2.2	5.9	5.22	1.9			4.4	4.4	4.4	6.6	6.6	6.6	8	8	8	0.24616	0.24616	0.24616
MAV	1.2.22	Y	AMIRISAR	JALANDHAR	THREAD	2.6	3.3	5.9	5.2			5.2	5.2	5.2	0	0	0	22.6	22.6	22.6	1.33901	1.33901	1.33901
MAV	1.1.22	Y	AMIRISAR	JALANDHAR	PARCHUNE	2.7			6			5.4	5.4	5.4	0	0	0	24.8	24.8	24.8	1.83269	1.83269	1.83269
MAV	1.1.22	Y	AMIRISAR	AMBALA	EMPTY	2.2			1.9			4.4	4.4	4.4	0	0	0	7.8	7.8	7.8	0.20808	0.20808	0.20808
MAV	1.1.22	Y	AMIRISAR	LUDHIANA	EMPTY	2.6		5.6	1.7			5.2	5.2	5.2	5.8	5.8	5.8	7.16	7.16	7.16	0.41086	0.41086	0.41086
MAV	1.1.22	Y	AMIRISAR	JALANDHAR	EMPTY	2.4	2.9	9.22	1.98			4.8	4.8	4.8	9	9	9	8.16	8.16	8.16	0.41837	0.41837	0.41837
MAV	1.2.222	Y	AMIRISAR	DELHI	EMPTY	2.2	1.7		1.8	1.7		4.4	4.4	4.4	4	4	4	11.2	11.2	11.2	0.25729	0.25729	0.25729
MAV	1.2.222	Y	AMIRISAR	GOHATI	EMPTY	2.3	2			1.9		4.6	4.6	4.6	4.4	4.4	4.4	7.4	7.4	7.4	0.25057	0.25057	0.25057
MAV	1.2.222	Y	AMIRISAR	HYDRABAD	EMPTY	2.2	2.2					4.4	4.4	4.4	4	4	4	7.68	7.68	7.68	0.2122	0.2122	0.2122
MAV	1.2.222	Y	AMIRISAR	LUDHIANA	EMPTY	2.5	2	5.9	1.74	2		5	5	5				8.4	8.4	8.4	0.34258	0.34258	0.34258
MAV	1.2.222	Y	AMIRISAR	LUDHIANA	EMPTY	2.2	5.6	4.4	2.2	1.91	1.8	4.4	4.4	4.4				7.82	7.82	7.82	0.20822	0.20822	0.20822
MAV	1.1.22	Y	AMIRISAR	LUDHIANA	DAK PARCEL	2.84	2.01	6.7	2			5.68	5.68	5.68				21.62	21.62	21.62	1.34375	1.34375	1.34375
MAV	1.1.22	Y	AMIRISAR	LUDHIANA	EMPTY	2.21	1.87	7.6				4.42	4.42	4.42				7.62	7.62	7.62	0.21042	0.21042	0.21042
MAV	1.1.22	Y	AMIRISAR	LUDHIANA	EMPTY	2.24		7.2				4.48	4.48	4.48				7.22	7.22	7.22	0.21899	0.21899	0.21899
MAV	1.1.22	Y	AMIRISAR	LUDHIANA	EMPTY	2.46	2.16	6.3				4.92	4.92	4.92				6.94	6.94	6.94	0.31254	0.31254	0.31254
MAV	1.1.22	Y	AMIRISAR	LUDHIANA	EMPTY	2.4	2.36	6.4	1.6			4.8	4.8	4.8	4.32	4.32	4.32	8.6	8.6	8.6	0.30226	0.30226	0.30226
MAV	1.2.222	Y	AMIRISAR	LUDHIANA	EMPTY	1.89	7.2	6.3	1.9	1.62		3.78	3.78	3.78	4.72	4.72	4.72	6.58	6.58	6.58	0.1224	0.1224	0.1224
MAV	1.2.222	Y	AMIRISAR	DELHI	EMPTY	2.24	6	7.4	1.67	2.1		4.48	4.48	4.48	14.4	14.4	14.4	8.62	8.62	8.62	1.05931	1.05931	1.05931

MAV	1.2.22	Y	AMIRISAR	DELHI	LOHA	2.8	2.9	5.2	2.21			5.6	5.6	5.6	12	12	12	22.8	22.8	22.8	1.9046	1.9046	1.9046	
MAV	1.2.22	Y	AMIRISAR	DELHI	ALOO	2.7	4.3	5.8	5	1.95		5.4	5.4	5.4	5.8	5.8	5.8	20.4	20.4	20.4	1.1001	1.1001	1.1001	
MAV	1.2.222	Y	AMIRISAR	DELHI	EMPTY	2.1	6.72		4.9	7		4.2	4.2	4.2	8.6	8.6	8.6	8.2	8.2	8.2	0.28367	0.28367	0.28367	
MAV	1.1.122	Y	AMIRISAR	DELHI	ARMY GOODS	3.12	4	2.1	2.15	7		6.24	6.24	6.24	13.44	13.44	13.44	28.4	28.4	28.4	3.80953	3.80953	3.80953	
MAV	1.22.22	Y	AMIRISAR	DELHI	ARMY GOODS	2.8	3.1		7.2			5.6	5.6	5.6	8	8	8	28.7	28.7	28.7	3.08512	3.08512	3.08512	
MAV	1.1.122	Y	AMIRISAR	DELHI	EMPTY	2.25		1.6	7.35			4.5	4.5	4.5	6.2	6.2	6.2	7.9	7.9	7.9	0.2556	0.2556	0.2556	
MAV	1.1.122	Y	AMIRISAR	DELHI	PARCHUNE	2.8	4.2	2.1	1.85			5.6	5.6	5.6	0	0	0	20.2	20.2	20.2	1.12272	1.12272	1.12272	
MAV	1.1.122	Y	AMIRISAR	DELHI	EMPTY	2.2			4.9			4.4	4.4	4.4	8.4	8.4	8.4	7.88	7.88	7.88	0.30475	0.30475	0.30475	
MAV	1.1.122	Y	AMIRISAR	AAGRA	ALOO	3.1		6.1	1.9	6.6		6.2	6.2	6.2	0	0	0	28.4	28.4	28.4	3.15972	3.15972	3.15972	
MAV	1.2.222	Y	AMIRISAR	AAGRA	EMPTY	2.2	6.6	6.3	7.3			4.4	4.4	4.4	0	0	0	7.8	7.8	7.8	0.20808	0.20808	0.20808	
MAV	1.1.122	Y	AMIRISAR	AAGRA	PARCEL	2.6		6.4	1.8	7.1		5.2	5.2	5.2	13.2	13.2	13.2	21.8	21.8	21.8	1.79621	1.79621	1.79621	
MAV	1.2.222	Y	AMIRISAR	LUDHIANA	NAMAK	2.8	2.01	1.5	5.6			5.6	5.6	5.6	0	0	0	29	29	29	3.11205	3.11205	3.11205	
MAV	1.22.222	Y	AMIRISAR	LUDHIANA	EMPTY	2.24	2.4		7.4	2.9		4.48	4.48	4.48	4.02	4.02	4.02	7.22	7.22	7.22	0.22403	0.22403	0.22403	
MAV	1.22.22	Y	AMIRISAR	LUDHIANA	EMPTY	2.2	2.3	7.2	1.72	2.22	2.01	4.4	4.4	4.4	9.2	9.2	9.2	9.42	9.42	9.42	0.36171	0.36171	0.36171	
MAV	1.1.122	Y	AMIRISAR	LUDHIANA	EMPTY	2.6	3.18	2	1.81	1.66		5.2	5.2	5.2	4.6	4.6	4.6	8.46	8.46	8.46	0.40683	0.40683	0.40683	
MAV	1.222	Y	AMIRISAR	LUDHIANA	EMPTY	1.9	7.2	7.9		4.38		3.8	3.8	3.8	6.36	6.36	6.36	6.72	6.72	6.72	0.14727	0.14727	0.14727	
MAV	1.1.122	Y	AMIRISAR	LUDHIANA	AC	2.51	3.4		1.7			5.02	5.02	5.02				18.12	18.12	18.12	0.72605	0.72605	0.72605	
MAV	1.222	Y	AMIRISAR	DELHI	KURKURE	3.1	7.2		4.68			6.2	6.2	6.2	6.8	6.8	6.8	40.5	40.5	40.5	10.7049	10.7049	10.7049	
MAV	1.1.122	Y	AMIRISAR	JALANDHAR	PARCHUNE	3.2	3.2		6.33			6.4	6.4	6.4				21.74	21.74	21.74	1.69216	1.69216	1.69216	
MAV	1.2.222	Y	AMIRISAR	JALANDHAR	BISCUIT	2.75	2.21		5.27			5.5	5.5	5.5	6.4	6.4	6.4	39.56	39.56	39.56	9.51682	9.51682	9.51682	
MAV	1.2.222	Y	AMIRISAR	JALANDHAR	ARMY GOODS	2.76	2.24	2.1	6.2			5.52	5.52	5.52	4.42	4.42	4.42	21.86	21.86	21.86	1.32908	1.32908	1.32908	
MAV	1.2.222	Y	AMIRISAR	JALANDHAR	EMPTY	1.95	2.2	1.75	5.63	1.83		3.9	3.9	3.9	4.48	4.48	4.48	7.22	7.22	7.22	0.1378	0.1378	0.1378	
MAV	1.2.222	Y	AMIRISAR	KANPUR	EMPTY	2.01	2.11	5.69	1.78	1.76		4.02	4.02	4.02	4.4	4.4	4.4	7.32	7.32	7.32	0.15329	0.15329	0.15329	
MAV	1.2.222	Y	AMIRISAR	MERUT	EMPTY	2.04	2.24	5.26	1.9	1.67		4.08	4.08	4.08	4.22	4.22	4.22	7.1	7.1	7.1	0.15924	0.15924	0.15924	
MAV	1.2.22	Y	AMIRISAR	DELHI	EMPTY	1.94	6.18	4.16	1.88	1.73		4	4	4	4.48	4.48	4.48	7.34	7.34	7.34	0.15127	0.15127	0.15127	
MAV	1.2.22	Y	AMIRISAR	JALANDHAR	PAPER	2.7	5.68	4.16	1.94	1.95		3.88	3.88	3.88	12.36	12.36	12.36	8.1	8.1	8.1	0.58393	0.58393	0.58393	
MAV	1.2.22	Y	JAMMU	JALANDHAR	PARCEL	2.76	5.86		2.1			5.4	5.4	5.4	11.36	11.36	11.36	27.72	27.72	27.72	2.93462	2.93462	2.93462	
MAV	1.2.22	Y	AMIRISAR	JALANDHAR	NAMAK	2.9	5.64	9.21	6.67			5.52	5.52	5.52	11.72	11.72	11.72	25.04	25.04	25.04	2.29208	2.29208	2.29208	
MAV	1.2.22	Y	AMIRISAR	JALANDHAR	PARCEL	2.86	1.88		6.18			5.8	5.8	5.8	11.28	11.28	11.28	26.26	26.26	26.26	2.64894	2.64894	2.64894	
MAV	1.2.22	Y	AMIRISAR	JALANDHAR	EMPTY	2.18	5.2	5.4	6.33			5.72	5.72	5.72	3.76	3.76	3.76	26.4	26.4	26.4	2.34616	2.34616	2.34616	
MAV	1.2.22	Y	AMIRISAR	JALANDHAR	THREAD	2.72	4.69	7.9	6.3			4.36	4.36	4.36	10.4	10.4	10.4	7.74	7.74	7.74	0.42651	0.42651	0.42651	
MAV	1.122	Y	PATHANKOT	JALANDHAR	PARCEL	2.64	3.4	2.1	1.86			5.44	5.44	5.44	9.38	9.38	9.38	20.88	20.88	20.88	1.30302	1.30302	1.30302	
MAV	1.1.122	Y	AMIRISAR	KANPUR	AC	2.68	3.49	6.1	5.04			5.28	5.28	5.28				20.48	20.48	20.48	1.05038	1.05038	1.05038	
MAV	1.2.222	Y	AMIRISAR	LUDHIANA	KURKURE	3.16	2.3	6.4	5.02			5.36	5.36	5.36	6.98	6.98	6.98	29.94	29.94	29.94	3.42996	3.42996	3.42996	
MAV	1.2.22	Y	AMIRISAR	LUDHIANA	PARCHUNE	1.9	4.8	2	5.6			6.32	6.32	6.32	4.6	4.6	4.6	29.1	29.1	29.1	3.47426	3.47426	3.47426	
MAV	1.2.22	Y	AMIRISAR	LUDHIANA	BISCUIT	2.82	6.9	1.88	7.36	7.19		3.8	3.8	3.8	9.6	9.6	9.6	6.64	6.64	6.64	0.27928	0.27928	0.27928	
MAV	1.2.222	Y	AMIRISAR	KANPUR	AC	2.69	2.04	2.1	1.7	1.62		5.64	5.64	5.64	13.8	13.8	13.8	21.44	21.44	21.44	2.00234	2.00234	2.00234	
MAV	1.2.222	Y	AMIRISAR	DELHI	KURKURE	2.16	2.14	2.1	5.12			5.38	5.38	5.38	4.08	4.08	4.08	36.04	36.04	36.04	6.64617	6.64617	6.64617	
MAV	1.2.222	Y	JAMMU	DELHI	PARCHUNE	2.09	2.09	2.8	8.8			4.32	4.32	4.32	4.28	4.28	4.28	8.16	8.16	8.16	0.20349	0.20349	0.20349	
MAV	1.2.22	Y	AMIRISAR	DELHI	BISCUIT	2.12	6.4	2.1	2.09			4.18	4.18	4.18	12.8	12.8	12.8	8.16	8.16	8.16	0.69287	0.69287	0.69287	
																					VDF	15.75	6.34	11.01

ANNEXURE 3 MSA CALCULATION

SECTION 1

YEAR	TRAFFIC						TRAFFIC	MSA (ACTUAL)		MSA (LEGAL LIMIT)		MSA (20% OVER LEGAL LIMIT)		DESIGN LIFE (YRS)
	BUS	LCV-4	LCV-6	2-AXLE	3-AXLE	MAV		YEARLY	CUMMULATIVE	YEARLY	CUMMULATIVE	YEARLY	CUMMULATIVE	
2023	216	1189	424	288	371	548	3036	1.7124	1.71	0.8063	0.81	1.28	1.28	0
2024	226	1248	445	294	379	576	3169	1.7898	3.499815884	0.8412	1.651213136	1.34	2.62	1
2025	236	1311	468	301	389	604	3308	1.8709	5.37072119	0.8777	2.528865443	1.40	4.01	2
2026	247	1376	491	307	398	635	3454	1.9559	7.326625748	0.9158	3.444700529	1.46	5.47	3
2027	258	1445	516	314	407	666	3607	2.0449	9.371528322	0.9557	4.400444202	1.52	6.99	4
2028	269	1517	541	321	417	700	3766	2.1381	11.50962299	0.9975	5.397905555	1.59	8.58	5
2029	278	1593	568	328	427	735	3930	2.2355	13.74511442	1.0409	6.438786698	1.66	10.24	6
2030	288	1673	597	335	437	771	4102	2.3376	16.08271396	1.0864	7.52517296	1.74	11.98	7
2031	299	1756	627	343	448	810	4283	2.4446	18.5273587	1.1341	8.659245859	1.81	13.79	8
2032	310	1844	658	350	459	850	4472	2.5568	21.08412545	1.1839	9.843190654	1.90	15.69	9
2033	321	1936	691	358	470	893	4669	3	24	1	11	2	18	10
2034	330	2033	726	366	481	938	4873	2.7971	26.55539347	1.2905	12.36977727	2.07	19.74	11
2035	340	2135	762	374	493	984	5088	2.9259	29.48124431	1.3475	13.71724301	2.16	21.91	12
2036	350	2242	800	382	504	1034	5312	3.0608	32.54203995	1.4071	15.12433689	2.26	24.17	13
2037	360	2354	840	391	516	1085	5546	3.2022	35.74422986	1.4695	16.59382844	2.36	26.53	14
2038	370	2471	882	399	529	1140	5791	3.3504	39.09458013	1.5348	18.1286219	2.47	29.01	15
2039	379	2595	926	408	542	1197	6046	3.5055	42.600092	1.603	19.73166565	2.58	31.59	16

2040	388	2725	972	417	555	125 6	6313	3.6681	46.26821273	1.6745	21.4061536	2.70	34.29	17
2041	397	2861	1021	426	568	131 9	6592	3.8385	50.10675568	1.7493	23.15543529	2.83	37.12	18
2042	407	3004	1072	435	581	138 5	6885	4.0173	54.12401565	1.8277	24.98312077	2.96	40.08	19
2043	416	3154	1126	445	595	145 5	7191	4	58	2	27	3	43	20
2044	424	3312	1182	455	610	152 7	7510	4.4006	62.72912514	1.9954	28.88823137	3.23	46.40	21
2045	433	3477	1241	465	624	160 4	7844	4.6063	67.33546765	2.0853	30.97357358	3.38	49.78	22
2046	441	3651	1303	475	639	168 4	8194	4.8219	72.15736186	2.1794	33.15297759	3.54	53.32	23
2047	449	3834	1368	486	655	176 8	8559	5.0479	77.20523242	2.2779	35.43090235	3.70	57.02	24
2048	458	4026	1437	496	670	185 6	8943	5.2849	82.49011507	2.3812	37.81212216	3.87	60.89	25
2049	467	4227	1508	507	686	194 9	9345	5.5334	88.02348774	2.4894	40.30154313	4.05	64.94	26
2050	476	4438	1584	518	703	204 7	9766	5.7939	93.81739458	2.6028	42.9043117	4.24	69.18	27
2051	485	4660	1663	530	720	214 9	10207	6.0671	99.88447406	2.7215	45.62582654	4.44	73.62	28
2052	494	4893	1746	541	737	225 6	10668	6.3535	106.2379885	2.8459	48.47175103	4.64	78.26	29
2053	504	5138	1833	553	755	236 9	11153	7	113	3	51	5	83	30

VEHICLE TYPE	BUS	LCV - 4	LCV - 6	2 AXLE	3 AXLE	MAV
ACTUAL VDF	0.71	0.99	0.77	2.38	4.34	15.75
VDF AT LEGAL LIMIT	0.71	0.56	0.32	2.19	2.24	6.34
VDF AT 20% OVER LEGAL LIMIT	0.71	0.8	0.56	2.65	3.26	11.01

SECTION 2

YEAR	TRAFFIC						TRAFFIC	MSA (ACTUAL)		MSA (LEGAL LIMIT)		MSA (20% OVER LEGAL LIMIT)		DESIGN LIFE (YRS)
	BUS	LCV-4	LCV-6	2-AXLE	3-AXLE	MAV		YEARLY	CUMMULATIVE	YEARLY	CUMMULATIVE	YEARLY	CUMMULATIVE	
2023	229	1479	521	344	448	641	3664	2.03	2.03	0.96	0.96	1.52	1.52	0
2024	240	1553	548	355	461	680	3837	2.13	4.16	1.00	1.96	1.59	3.11	1
2025	253	1631	575	365	475	721	4020	2.25	6.41	1.06	3.02	1.68	4.79	2
2026	265	1712	604	376	489	764	4211	2.37	8.78	1.11	4.13	1.77	6.56	3
2027	278	1798	634	388	504	810	4412	2.49	11.28	1.17	5.29	1.86	8.42	4
2028	291	1888	666	399	519	858	4622	2.63	13.90	1.23	6.52	1.96	10.37	5
2029	306	1982	699	411	535	910	4843	2.77	16.67	1.29	7.81	2.06	12.43	6
2030	320	2081	734	424	551	964	5075	2.92	19.59	1.36	9.17	2.17	14.60	7
2031	336	2186	770	436	567	1022	5317	3.08	22.67	1.43	10.59	2.28	16.88	8
2032	352	2295	809	449	584	1084	5573	3.24	25.91	1.50	12.09	2.40	19.29	9
2033	369	2410	849	463	602	1149	5841	3	29	2	14	3	22	10
2034	387	2530	892	477	620	1217	6123	3.61	32.94	1.66	15.33	2.67	24.49	11
2035	405	2657	936	491	639	1290	6418	3.80	36.74	1.75	17.08	2.81	27.30	12
2036	424	2789	983	506	658	1368	6728	4.01	40.75	1.84	18.91	2.96	30.26	13
2037	445	2929	1032	521	678	1450	7054	4.23	44.98	1.94	20.85	3.12	33.38	14

2038	465	3075	1084	537	698	153 7	7396	4.46	49.44	2.04	22.89	3.29	36.66	15
2039	487	3229	1138	553	719	162 9	7755	4.70	54.14	2.14	25.03	3.46	40.13	16
2040	511	3391	1195	569	740	172 7	8133	4.96	59.11	2.26	27.29	3.65	43.78	17
2041	535	3560	1255	586	763	183 1	8529	5.24	64.34	2.38	29.67	3.85	47.63	18
2042	560	3738	1318	604	785	194 0	8945	5.52	69.87	2.50	32.17	4.06	51.69	19
2043	587	3925	1384	622	809	205 7	9383	6	76	3	35	4	56	20
2044	614	4121	1453	641	833	218 0	9843	6.15	81.85	2.78	37.59	4.51	60.48	21
2045	643	4327	1525	660	858	231 1	10325	6.49	88.34	2.93	40.52	4.76	65.24	22
2046	673	4544	1602	680	884	245 0	10832	6.85	95.20	3.08	43.60	5.02	70.26	23
2047	705	4771	1682	700	911	259 7	11365	7.23	102.43	3.25	46.85	5.29	75.55	24
2048	738	5009	1766	721	938	275 3	11925	7.64	110.07	3.43	50.28	5.58	81.13	25
2049	773	5260	1854	743	966	291 8	12513	8.06	118.13	3.61	53.89	5.89	87.02	26
2050	810	5523	1947	765	995	309 3	13133	8.51	126.64	3.81	57.69	6.21	93.24	27
2051	848	5799	2044	788	102 5	327 8	13783	8.99	135.63	4.01	61.70	6.56	99.80	28

2052	889	6089	2146	812	105 6	347 5	14466	9.49	145.12	4.23	65.93	6.92	106.72	29
2053	932	6393	2254	836	108 7	368 4	15185	10	155	4	70	7	114	30
VEHICLE TYPE				BUS	LCV - 4	LCV - 6	2 AXLE	3 AXLE	MAV					
ACTUAL VDF				0.71	0.99	0.77	2.38	4.34	15.75					
VDF AT LEGAL LIMIT				0.71	0.56	0.32	2.19	2.24	6.34					
VDF AT 20% OVER LEGAL LIMIT				0.71	0.8	0.56	2.65	3.26	11.01					

SECTION 3

YEAR	TRAFFIC						TRAFFIC	MSA (ACTUAL)		MSA (LEGAL LIMIT)		MSA (20% OVER LEGAL LIMIT)		DESIGN LIFE (YRS)
	BUS	LCV-4	LCV-6	2-AXLE	3-AXLE	MAV		YEARLY	CUMMULATIVE	YEARLY	CUMMULATIVE	YEARLY	CUMMULATIVE	
2023	227	1483	521	344	448	641	3665	2.03	2.03	0.96	0.96	1.52	1.52	0
2024	239	1557	548	355	461	680	3839	2.13	4.16	1.00	1.96	1.59	3.11	1
2025	251	1635	575	365	475	721	4022	2.25	6.41	1.06	3.02	1.68	4.79	2
2026	263	1717	604	376	489	764	4213	2.37	8.78	1.11	4.13	1.77	6.56	3
2027	276	1802	634	388	504	810	4414	2.50	11.28	1.17	5.30	1.86	8.42	4
2028	290	1893	666	399	519	858	4625	2.63	13.91	1.23	6.52	1.96	10.37	5
2029	305	1987	699	411	535	910	4847	2.77	16.68	1.29	7.81	2.06	12.43	6
2030	320	2087	734	424	551	964	5079	2.92	19.60	1.36	9.17	2.17	14.60	7
2031	336	2191	770	436	567	1022	5323	3.08	22.67	1.43	10.59	2.28	16.89	8
2032	353	2300	809	449	584	1084	5579	3.24	25.92	1.50	12.09	2.40	19.29	9
2033	370	2416	849	463	602	1149	5849	3	29	2	14	3	22	10

203 4	389	253 6	892	477	620	1217	6131	3.61	32.95	1.66	15.33	2.67	24.49	11
203 5	408	266 3	936	491	639	1290	6428	3.80	36.75	1.75	17.08	2.81	27.30	12
203 6	429	279 6	983	506	658	1368	6740	4.01	40.76	1.84	18.92	2.96	30.26	13
203 7	450	293 6	103 2	521	678	1450	7067	4.23	44.99	1.94	20.86	3.12	33.38	14
203 8	473	308 3	108 4	537	698	1537	7411	4.46	49.45	2.04	22.89	3.29	36.67	15
203 9	496	323 7	113 8	553	719	1629	7772	4.71	54.16	2.15	25.04	3.47	40.14	16
204 0	521	339 9	119 5	569	740	1727	8152	4.97	59.12	2.26	27.30	3.65	43.79	17
204 1	547	356 9	125 5	586	763	1831	8550	5.24	64.36	2.38	29.68	3.85	47.65	18
204 2	574	374 7	131 8	604	785	1940	8969	5.53	69.89	2.51	32.19	4.06	51.71	19
204 3	603	393 5	138 4	622	809	2057	9409	6	76	3	35	4	56	20
204 4	633	413 1	145 3	641	833	2180	9872	6.16	81.88	2.78	37.61	4.52	60.50	21
204 5	665	433 8	152 5	660	858	2311	10358	6.50	88.38	2.93	40.54	4.76	65.26	22
204 6	698	455 5	160 2	680	884	2450	10868	6.86	95.23	3.09	43.63	5.02	70.29	23
204 7	733	478 3	168 2	700	911	2597	11405	7.24	102.47	3.25	46.88	5.30	75.58	24

2048	770	5022	1766	721	938	2753	11969	7.64	110.11	3.43	50.31	5.59	81.17	25
2049	808	5273	1854	743	966	2918	12562	8.07	118.18	3.61	53.92	5.90	87.07	26
2050	849	5536	1947	765	995	3093	13185	8.52	126.70	3.81	57.73	6.22	93.29	27
2051	891	5813	2044	788	1025	3278	13840	8.99	135.69	4.02	61.75	6.56	99.85	28
2052	936	6104	2146	812	1056	3475	14528	9.50	145.19	4.24	65.99	6.93	106.78	29
2053	982	6409	2254	836	1087	3684	15252	10	155	4	70	7	114	30
VEHICLE TYPE				BUS	LCV - 4	LCV - 6	2 AXLE	3 AXLE	MAV					
ACTUAL VDF				0.71	0.99	0.77	2.38	4.34	15.75					
VDF AT LEGAL LIMIT				0.71	0.56	0.32	2.19	2.24	6.34					
VDF AT 20% OVER LEGAL LIMIT				0.71	0.8	0.56	2.65	3.26	11.01					

SECTION 4														
YEAR	TRAFFIC						TRAFFIC	MSA (ACTUAL)		MSA (LEGAL LIMIT)		MSA (20% OVER LEGAL LIMIT)		DESIGN LIFE (YRS)
	BUS	LCV-4	LCV-6	2-AXLE	3-AXLE	MAV		YEARLY	CUMMULATIVE	YEARLY	CUMMULATIVE	YEARLY	CUMMULATIVE	
2023	52	1588	471	222	351	352	3036	1.30	1.30	0.63	0.63	0.98	0.98	0
2024	54	1683	497	228	362	370	3194	1.36	2.66	0.66	1.29	1.03	2.01	1
2025	58	1784	524	235	373	389	3362	1.43	4.09	0.69	1.97	1.08	3.09	2
2026	60	1892	553	242	384	408	3539	1.50	5.59	0.72	2.69	1.13	4.22	3
2027	64	2005	583	250	395	428	3725	1.57	7.16	0.75	3.45	1.18	5.40	4
2028	68	2125	615	257	407	450	3922	1.64	8.80	0.79	4.24	1.24	6.64	5
2029	71	2253	649	265	419	472	4129	1.72	10.52	0.83	5.06	1.30	7.94	6
2030	75	2388	685	273	432	496	4348	1.81	12.33	0.86	5.93	1.36	9.30	7
2031	79	2531	722	281	445	521	4580	1.89	14.22	0.91	6.83	1.43	10.72	8
2032	83	2683	762	289	458	547	4823	1.98	16.21	0.95	7.78	1.49	12.22	9
2033	88	2844	804	298	472	574	5080	2	18	1	9	2	14	10

203 4	93	301 5	848	307	486	603	5352	2.18	20.47	1.04	9.82	1.64	15.42	11
203 5	97	319 6	895	316	501	633	5638	2.29	22.76	1.09	10.91	1.72	17.14	12
203 6	103	338 8	944	326	516	665	5941	2.40	25.16	1.14	12.05	1.80	18.95	13
203 7	108	359 1	996	335	531	698	6259	2.52	27.67	1.20	13.25	1.89	20.84	14
203 8	114	380 6	105 1	345	547	733	6596	2.64	30.31	1.26	14.51	1.98	22.82	15
203 9	120	403 5	110 9	356	564	769	6952	2.77	33.08	1.32	15.82	2.08	24.90	16
204 0	126	427 7	117 0	366	580	808	7327	2.91	35.99	1.38	17.20	2.18	27.08	17
204 1	133	453 3	123 4	377	598	848	7724	3.05	39.04	1.45	18.65	2.29	29.36	18
204 2	140	480 5	130 2	389	616	891	8142	3.20	42.23	1.52	20.17	2.40	31.76	19
204 3	147	509 4	137 4	400	634	935	8585	3	46	2	22	3	34	20
204 4	156	539 9	144 9	412	653	982	9052	3.52	49.11	1.67	23.43	2.64	36.92	21
204 5	163	572 3	152 9	425	673	103 1	9544	3.70	52.81	1.75	25.18	2.77	39.68	22
204 6	173	606 7	161 3	438	693	108 3	10065	3.88	56.68	1.84	27.01	2.90	42.59	23
204 7	181	643 1	170 2	451	714	113 7	10615	4.07	60.75	1.93	28.94	3.05	45.64	24

204 8	192	681 6	179 5	464	735	119 4	11196	4.27	65.03	2.02	30.96	3.20	48.83	25
204 9	201	722 5	189 4	478	757	125 3	11809	4.49	69.51	2.12	33.08	3.36	52.19	26
205 0	213	765 9	199 8	493	780	131 6	12458	4.71	74.22	2.22	35.30	3.52	55.71	27
205 1	224	811 8	210 8	507	803	138 2	13142	4.94	79.16	2.33	37.63	3.70	59.41	28
205 2	236	860 5	222 4	523	828	145 1	13867	5.19	84.35	2.45	40.08	3.88	63.29	29
205 3	249	912 2	234 6	538	852	152 3	14631	5	90	3	43	4	67	30
VEHICLE TYPE				BUS	LCV - 4	LCV - 6	2 AXLE	3 AXLE	MAV					
ACTUAL VDF				0.71	0.99	0.77	2.38	4.34	15.75					
VDF AT LEGAL LIMIT				0.71	0.56	0.32	2.19	2.24	6.34					
VDF AT 20% OVER LEGAL LIMIT				0.71	0.8	0.56	2.65	3.26	11.01					

IITPAVE INPUT FOR DESIGN OF PAVEMENT

No of Layers [HOME](#)

Layer: 1	Elastic Modulus(MPa)	<input type="text" value="3000"/>	Poisson's Ratio	<input type="text" value="0.35"/>	Thickness(mm)	<input type="text" value="300"/>
Layer: 2	Elastic Modulus(MPa)	<input type="text" value="243"/>	Poisson's Ratio	<input type="text" value="0.35"/>	Thickness(mm)	<input type="text" value="650"/>
Layer: 3	Elastic Modulus(MPa)	<input type="text" value="87"/>	Poisson's Ratio	<input type="text" value="0.35"/>		

Wheel Load(Newton)	<input type="text" value="20000"/>	Tyre Pressure(MPa)	<input type="text" value="0.56"/>
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Analysis Points

Point:1	Depth(mm):	<input type="text" value="300"/>	Radial Distance(mm):	<input type="text" value="0"/>
Point:2	Depth(mm):	<input type="text" value="300"/>	Radial Distance(mm):	<input type="text" value="155"/>
Point:3	Depth(mm):	<input type="text" value="650"/>	Radial Distance(mm):	<input type="text" value="0"/>
Point:4	Depth(mm):	<input type="text" value="650"/>	Radial Distance(mm):	<input type="text" value="155"/>

Wheel Set	<input type="text" value="2"/>	(1- Single wheel 2- Dual wheel)
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IITPAVE OUTPUT FOR DESIGN OF PAVEMENT



VIEW RESULTS

OPEN FILE IN EDITOR

VIEW HERE

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[HOME](#)

```
No. of layers          3
E values (MPa)        3000.00  243.00  87.00
Mu values             0.350.350.35
thicknesses (mm)     300.00  650.00
single wheel load (N) 20000.00
tyre pressure (MPa)  0.56
Dual Wheel
  Z      R      SigmaZ      SigmaT      SigmaR      TaoRZ      DispZ      epZ      epT      epR
300.00  0.00-0.4013E-01 0.2704E+00 0.2208E+00-0.6990E-02 0.1964E+00-0.7068E-04 0.6906E-04 0.4672E-04
300.00L 0.00-0.4013E-01 0.2043E-02-0.1977E-02-0.6990E-02 0.1964E+00-0.1652E-03 0.6906E-04 0.4672E-04
300.00  155.00-0.4211E-01 0.2853E+00 0.2241E+00-0.1462E-01 0.2013E+00-0.7346E-04 0.7385E-04 0.4634E-04
300.00L 155.00-0.4211E-01 0.2269E-02-0.2683E-02-0.1462E-01 0.2013E+00-0.1727E-03 0.7385E-04 0.4634E-04
650.00  0.00-0.1488E-01 0.3985E-02 0.3169E-02-0.2794E-02 0.1590E+00-0.7152E-04 0.3326E-04 0.2873E-04
650.00  155.00-0.1576E-01 0.4082E-02 0.3583E-02-0.3423E-02 0.1612E+00-0.7591E-04 0.3434E-04 0.3157E-04
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