Comparative traffic analysis of NH33 and Tata Ranchi state highway and prediction model of future road accident

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Abstract: It is widely known that road accidents in India are a major cause of death, as also they are one of the fundamental causes of damage caused to property, especially in urban areas. The irony is that the urban areas, though expected to be developed, see an augmented number of transportation problems like a higher traffic count than the length and breadth of the roads. This study is about the Prediction of a road accidents which will help us to analyze the future accident that is going to happen and according to that we take a precautionary measure. Traffic count data is a crucial component of the transport project selection phase since traffic count statistics can help officials define transport project needs. A count of traffic is the number of vehicles or foot traffic that is carried out along a particular road, road or intersection. It can be a manual as well as an automated procedure. While a traffic count is important to carry out construction activities, it is also important from the point of view of accident control. Management of road accidents is facilitated if the traffic count is known. In earlier days people were using NH33 for the movement between Ranchi and Tata but nowadays people are using Tata Ranchi state highway due to the worst road condition on NH33. Due to this people are forced to use Tata Ranchi state highway and its creates jam-like condition.

Index Terms *- road accident, traffic count, NH33*

1) INTRODUCTION

One of the main objectives of traffic study is to provide safe traffic movement. Road accidents cannot be prevented but they can be reduced considerably by suitable traffic study so it is essential to analyses every individual accident and maintain zone-wise accident records.

Types of road accident

a) Moving vehicle collides with parked vehicles.

b) Two vehicles approaching from different direction collides with an intersection.

c) Head on collision

d) Moving vehicles collides with an object.

Thus it becomes important for us to predict future road accident, so that we could take precautionary measure.

Traffic Data Collection is a necessary prerequisite for road transportation. Traffic data is an integral part of the national economy and this knowledge is essential to the development of a rational transport policy for both the government and the private sector for the movement of passengers and goods. Traffic Volume checks the total number of vehicles through the road over a length of time.

It is typically represented in terms of Passenger Car Unit (PCU) and calculated to quantify the Road Service Level and relevant characteristics such as congestion, load capacity, V / C Ratio, peak hour detection or extended peak hour, etc. Traffic volume count or TVC is generally conducted as part of transport surveys, TVC may be graded or unclassified.

The purposes of the classified traffic volume count are:

- To draw inferences based on the data collected.
- Provide alternative approaches and recommendations for change to the defined problem.
- The tasks addressed include the description of the daily movement of vehicles and the peak hour, the assessment of the quality of operation and the analysis of the modal configuration of the various road hierarchies.

Common patterns that can be observed in traffic flow are hourly and weekly as follows:

- Typical hourly patterns of flow of traffic, especially in urban areas, usually show a number of distinctive highs. Point in the morning accompanied by a lean flow to another high in the middle of the day, during which there could be a new height in

the late evening. The spike in the morning is often sharper, reaching the peak over short period of time and immediately falling to its lowest point.

- The volume of traffic typically ranges each week. Traffic during business days (Monday to Friday) may not vary significantly, but the amount of traffic during the weekend is likely to vary from working days on different types of roads as well as in multiple directions.

Traffic Volume Survey is an important component of city planning, especially for city planners. This includes taking into account the vehicles passing through the survey station. Along with the traffic count, it is also important to study the noise pollution caused during the peak hours. To construct urban areas free from noise pollution and most livable cities for all the citizens, these analyses play a pivotal role.

The study of Classified Traffic Volume Count is intended to understand the factors that form the basis of:

- Efficiency of the current road transportation system
- Traffic distribution
- Measuring the proneness of the roads to accidents

On the basis of the conclusion derived regarding the above three factors, the widening of roads is carried out. The dimensions of the road can be a major reason why accidents take place.

Analysis has proved that road accidents are a major cause of the untimely death of the people of India and most road accidents take place during bad weather conditions or during the working hours. It is a clear indication of the fact that a Traffic Count is required as much as the traffic distribution is important to be noted.

The awareness of the Traffic Count and noise pollution will allow city planning to take place constructively and the cities can be turned 'smarter'.

2) REVIEW OF LIETRATURE

a) Zheng, P., & Mike, M. (2012) suggested that most applications of manual counts require small samples of data at any given location. Manual counts are rarely used when the effort and expense of automated equipment are not justified. Manual counts are necessary when automated equipment is not available. Manual checks are commonly utilized for time of not exactly a day. Typical spans for a manual check are 5, 10, or 15 minutes. Traffic checks during a busy time of Monday morning and Friday evening times of heavy traffic shows extraordinarily high volumes and aren't typically utilized in investigation.(1)

b) Ghermandi, G., Fabbi, S., Bigi, A suggested that the automatic count method provides a means for gathering large amounts of traffic data. Automatic counts are usually taken in 1-hour intervals for each 24-hour period. The counts extend for a week, month, or year. When the counts are recorded for each 24-hour time, the peak flow period can be identified. (2)

c) Belova, O. V., & Vulf, M. D investigated that Pneumatic road tube sensors stretching across streets around the city and when your vehicle travels over these small rubber tubes so what the road tubes are doing is they're collecting the number of vehicles that are crossing over them and they're doing that by puffs of air that are is forced through the road tube into the counter and the counter records that puff of air and then the software translates that into actual vehicles crossing the tube.

d) **Han, J.-H., & Han, S.-J. Video image detection (VID) -** The traffic parameters are collected by frame-by-frame analysis of video images captured by roadside cameras. The following parameters are collected: Depending on the processing methodology almost all traffic parameters are captured from video analysis. Simple video systems often collect flow volume and occupancy. More complex systems allow the extraction of further parameters. (4)

e) S minu , R S lija observed that there is huge traffic occur in certain part of Chennai due to which traffic jam and conjunction occurred and it's became very difficult during peak hrs. So they conducted a questionnaire survey about the traffic and observed the peak hour's flow of traffic. After this they suggested a flyover in order to reduce this problem and with proper dimensions of flyover. The suggested flyover is on the basis of peak hrs flow. (5)

f) Al faruki Ahmed focus on the fact that the harmful effects of road construction and we need to consider the impact of road construction on wild life. Al faruki conducted survey in which he divided the area in 5 corridor. Data collected mph was on the basis of local people observation and also result found during survey. Al faruki compare the result on the basis of death of snake due to accident and by human kill. It was found that majority death of snake was due to road accident. (6)

g) Kausik G conducted a survey at survey between Balwa to mansa highway because of high conjunction issue are occurring. Kausik g conducted a traffic volume survey to know if there is any issue in planning or design. Result obtained from traffic volume survey was compared to IRC reccommdation and it was found that there is no issue in Design of road and planning process. Kausik G also conducted parking survey to know if problem is on parking system. After the result they found that main issue was in parking system. kausik g also stated that we need to improve.

3) RESEARCH METHODOLOGY

3.1) Excel procedure to find correlation

a) If we want to find correlation in excel as in manual techniques it is very difficult to find. In excel we 1st type all the data like Total no of road accident in number, no of person killed and person injured.

b) We are using a formula that is (=CORREL) as a function. Then excel asked 2 functions so just provide 2 data set among which i want to find correlation like Correlation between CORRELATION BETWEEN NO ROAD ACCIDENT AND PERSON KILLED.

c) If sing is (+) then means relationship is positive that mean if ROAD ACCIDENT then PERSON KILLED also increase same in 2nd case.

d) In magnitude value has ranged between -1 to +1 because it is a relative measure and if close to 1 high magnitude.

e) At last plot a graph using scatter and also equation of the graph using trend line function.

3.2) Excel procedure for regression

a) Regression analysis uses correlation and according to it they make an equation between dependent variable and independent variable.

b) Whichever data set prediction we want to take it as a dependent variable. And denotes it as (y) and independent variable denote it as (x).

c) Expected cases = A+B×dayswhere a is intersect

d) 1st I have to find intercept, so we are using formula =INTERCEPT and in intercept they asked for now Ys then know Xs where y is dependent variable.

f) Similarly for slope we use function as =SLOPE and same as we have done in case of intercept (provide know Ys and Know Xs)

3.3) Traffic volume count

By using camera we are going to collect all the traffic in the morning rush hours (8.15 am to 11 am) and evening rush hours (3.30 – 7 pm) From the Recorded video we will count the total traffic. We will make a table to analyze traffic in excel. From IRC 106 we will take pcu value and calculate the traffic according to pcu factor. From the result, we will find peak hour traffic and peak 15 min traffic

Peak 15 min traffic is calculated by using formulae

Peak factor = (total hourly volume) / [(peak 15-minute volume within the hour x 4)]

Where, V = peak-hour volume (vph), V15 = volume during the peak 15 minutes of flow

At last, we will make a vehicle composition chart to analyze the type of vehicle used mostly. (8)

3.4) Spot method analysis

- In this method, we 2 surveyor are standing at the distance of 50 m to note down reading
- Surveyor 1 will be standing at the starting point and see the vehicle which passes them and inform to second surveyor who is standing at last point of 50 m distance
- When surveyor1 raises their hand which mean vehicle has just past them.
- At that particular point when surveyor 1 raise their hand surveyor surveyor 2 starts stop watch.
- Moment at which that particular vehicles pass them surveyor 2 stop watch and note down total time
- By using speed , distance time relation we will find out the velocity
- This is to be done for truck car and bike with sample size 100 each
- By using irc method we will find 98^{th} 85^{th} 15^{th} percentile speed.

4) RESULT AND DISCUSSION

4.1) CORRELATION ANALYSIS

YEARS	Total no of road accident in numbers	NO OF PERSON KILLED	PERSON INJURED
1994	3,25,864	64,463	3,11,500
1995	3,51,999	70,781	3,23,200
1996	3,71,204	74,665	3,69,502
1997	3,73,671	76,977	3,78,361
1998	3,85,018	79,919	3,90,674
1999	3,86,456	81,966	3,75,051
2000	3,91,449	78,911	3,99,265
2001	4,05,637	80,888	4,05,216
2002	4,07,497	84,674	4,08,711
2003	4,06,726	85,998	4,35,122
2004	4,29,910	92,618	4,64,521
2005	4,39,255	94,968	4,65,282
2006	4,60,920	1,05,749	4,96,481
2007	4,79,216	1,14,444	5,13,340
2008	4,84,704	1,19,860	5,23,193
2009	4,86,384	1,25,660	5,15,458
2010	4,99,628	1,34,513	5,27,512
2011	4,97,686	1,42,485	5,11,394
2012	4,90,383	1,38,258	5,09,667
2013	4,86,476	1,37,572	4,94,893
2014	4,89,400	1,39,671	4,93,474
2015	5,01,423	1,46,133	5,00,279
2016	4,80,652	1,50,785	4,94,624

Table 1

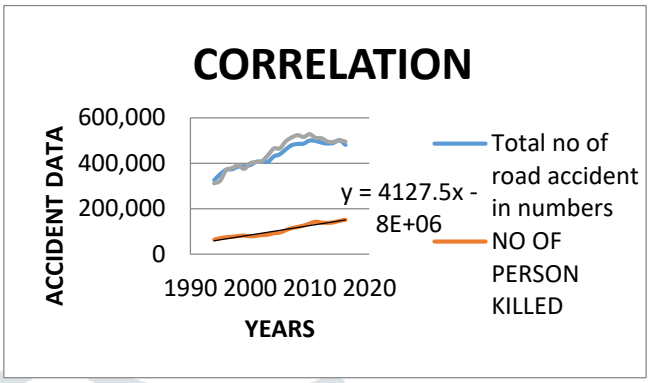


chart 2

CORRELAYION BETWEEN NO ROAD ACCIDENT AND PERSON KILLED
CORRELATION VALUE - 0.946796
MAGNITUDE - 0.948626(high)
SIGN - + (Which means it is directly proportional)
CORRELAYION BETWEEN NO ROAD ACCIDENT AND PERSON INJURED
CORRELATION VALUE - 0.977799
MAGNITUDE - 0.972530444 (high)

4.2) REGRESSION ANALYSIS

Total no of road ac	Expected accident	year	no of person kil	expectedkill	YEAR	injured	expected
3,25,864	350942.2935	1994	64,463	59,900	1994	3,11,500	349224.652
3,51,999	358688.8755	1995	70,781	64,027	1995	3,23,200	358214.98
3,71,204	366435.4575	1996	74,665	68,155	1996	3,69,502	367205.308
3,73,671	374182.0395	1997	76,977	72,282	1997	3,78,361	376195.636
3,85,018	381928.6215	1998	79,919	76,410	1998	3,90,674	385185.964
3,86,456	389675.2036	1999	81,966	80,537	1999	3,75,051	394176.292
3,91,449	397421.7856	2000	78,911	84,665	2000	3,99,265	403166.621
4,05,637	405168.3676	2001	80,888	88,792	2001	4,05,216	412156.949
4,07,497	412914.9496	2002	84,674	92,920	2002	4,08,711	421147.277
4,06,726	420661.5316	2003	85,998	97,047	2003	4,35,122	430137.605
4,29,910	428408.1136	2004	92,618	1,01,175	2004	4,64,521	439127.933
4,39,255	436154.6957	2005	94,968	1,05,303	2005	4,65,282	448118.261
4,60,920	443901.2777	2006	1,05,749	1,09,430	2006	4,96,481	457108.589
4,79,216	451647.8597	2007	1,14,444	1,13,558	2007	5,13,340	466098.917
4,84,704	459394.4417	2008	1,19,860	1,17,685	2008	5,23,193	475089.245
4,86,384	467141.0237	2009	1,25,660	1,21,813	2009	5,15,458	484079.573
4,99,628	474887.6057	2010	1,34,513	1,25,940	2010	5,27,512	493069.901
4,97,686	482634.1877	2011	1,42,485	1,30,068	2011	5,11,394	502060.229
4,90,383	490380.7698	2012	1,38,258	1,34,195	2012	5,09,667	511050.557
4,86,476	498127.3518	2013	1,37,572	1,38,323	2013	4,94,893	520040.885
4,89,400	505873.9338	2014	1,39,671	1,42,450	2014	4,93,474	529031.213
5,01,423	513620.5158	2015	1,46,133	1,46,578	2015	5,00,279	538021.542
4,80,652	521367.0978	2016	1,50,785	1,50,705	2016	4,94,624	547011.87
	552353.4259	2,020		1,67,215	2020		582973.182
	591086.336	2,025		1,87,853	2025		627924.822
	629819.246	2,030		2,08,490	2030		672876.462

Table 2

Column1	ACCIDENT	KILLEED	INJURY
INTERCEPT	-15095742.25	-8170358.753	-17577489.51
SLOPE	7746.582016	4127.511858	8990.328063

Dependent variable (value that we want to find or prediction) here dependent variable is no of accident, no of person killed, person injury and Independent variable is year

so,expected confirmed cases = a+b*year

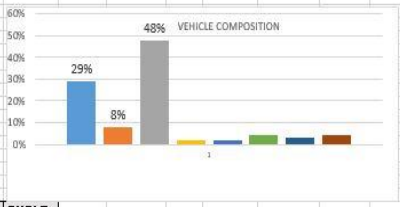
Table 3

4.3) TRAFFIC COUNT (RANCHI TATA SH) – This is done to analyze the traffic flow at SH, so that we can do a compratitive analysis.

FEB 8 8 15 TO 11 AM

		1		1.2		0.75		2.2		2.2		1.4		2		0.4	TOTAL		HOURLY FLOW	
TIME	CAR JEEP VAN	PCU (CAR JEEP	AUTO	PCU (AUTO)	TWO WHEELER	PCU (TWO WEELER)	BUS	PCU BUS	TRUCK	PCU TRU	LCV	PCU LCV	OTHERS	PCU	CYCLE	PCU CYCLE	VEHICLES	PCU ' S	VEHICLE	PCU ' S
8.15 - 8.30	232	232	34	40.8	356	267	21	46.2	11	24.2	39	54.6	51	102	34	13.6	778	780.4		
8.30 - 8.45	256	256	56	67.2	198	148.5	7	15.4	23	50.6	21	29.4	43	86	42	16.8	646	669.9		
8.45 - 9	322	322	76	91.2	324	243	13	28.6	12	26.4	32	44.8	41	82	34	13.6	854	851.6		
9 - 9.15	187	187	51	61.2	358	268.5	16	35.2	8	17.6	14	19.6	32	64	12	4.8	678	657.9	2956	2960
9.15 - 9.30	278	278	83	99.6	435	326.25	18	39.6	6	13.2	18	25.2	9	18	34	13.6	881	813.45	3059	2993
9.30 - 9.45	198	198	65	78	198	148.5	6	13.2	21	46.2	25	35	21	42	35	14	569	574.9	2982	2898
9.45 -10.00	247	247	49	58.8	356	267	18	39.6	12	26.4	28	39.2	32	64	31	12.4	773	754.4	2901	2801
10.00 - 10.15	234	234	72	86.4	378	283.5	12	26.4	14	30.8	31	43.4	19	38	31	12.4	791	754.9	3014	2898
10.15 - 10.30	134	134	36	43.2	467	350.25	23	50.6	2	4.4	36	50.4	12	24	25	10	735	666.85	2868	2751
10.30 - 10.45	156	156	34	40.8	345	258.75	16	35.2	11	24.2	38	53.2	7	14	12	4.8	619	586.95	2918	2763
10.45 - 11	122	122	65	78	412	309	14	30.8	32	70.4	41	57.4	6	12	8	3.2	700	682.8	2845	2692
TOTAL VEHICLE	2366		621		3827		164		152		323		273		298		8024			
PERCENTAGE	29%		8%		48%		2%		2%		4%		3%		4%					

PEAK HOURS - 8.30 TO 9.30 AM , PEAK 15 MIN - 8 .45 TO 9 AM
Peak factor = (total hourly volume) / [(peak 15-minute volume within the hour x 4)]
= V / (V15Peak x 4) = 2992.85 / 851.6 *4 = 0.878
Where
V = peak-hour volume (vph)
V15 = volume during the peak 15 minutes of flow
LEVEL OF SERVICE = VOLUME IN PCU / CAPACITY IN PCU AS PER IRC TABLE FOR 4 LANE 2 WAY
= 2993/ 3600 = 0.83 (VERY HIGH)



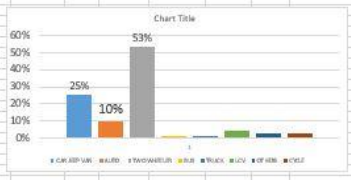
CAR JEEP VAN	AUTO	TWO WHEELER	BUS	TRUCK	LCV	OTHERS	CYCLE
29%	8%	48%	2%	2%	4%	3%	4%

Table 4

8th feb 3.30 pm 7 pm

PCU VALE		1		1.2		0.75		2.2		2.2		1.4		2		0.4	TOTAL		HOURLY FLOW	
TIME	CAR JEEP VAN	PCU (CAR JEEP)	AUTO	PCU (AUTO)	TWO WHEELER	PCU (TWO WEELER)	BUS	PCU BUS	TRUCK	CU TRUC	LCV	PCU LCV	OTHERS	PCU	CYCLE	PCU CYCLE	VEHICLES	PCU ' S	VEHICLES	PCU ' S
3.30 - 3.45	196	196	85	102	340	255	6	13.2	15	33	42	58.8	8	16	19	7.6	711	681.6		
3.45 - 4.00	173	173	68	81.6	307	230.25	3	6.6	18	39.6	38	53.2	14	28	22	8.8	643	621.05		
4.00 - 4.15	169	169	75	90	326	244.5	7	15.4	12	26.4	34	47.6	5	10	14	5.6	642	608.5		
4.15 - 4.30	142	142	68	81.6	354	265.5	2	4.4	9	19.8	18	25.2	3	6	19	7.6	615	552.1	2611	2463
4.30 - 4.45	112	112	76	91.2	328	246	4	8.8	8	17.6	34	47.6	12	24	9	3.6	583	550.8	2483	2332
4.45 - 5.00	143	143	65	78	396	297	14	30.8	5	11	19	26.6	21	42	23	9.2	686	637.6	2526	2349
5 - 5.15	196	196	82	98.4	423	317.25	8	17.6	1	2.2	38	53.2	35	70	32	12.8	815	767.45	2699	2508
5.15 - 5.30	159	159	56	67.2	349	261.75	4	8.8	9	19.8	22	30.8	23	46	19	7.6	641	600.95	2725	2557
5.30 -5.45	193	193	63	75.6	389	291.75	11	24.2	18	39.6	9	12.6	32	64	43	17.2	758	717.95	2900	2724
5.45 - 6	232	232	45	54	431	323.25	7	15.4	24	52.8	34	47.6	45	90	34	13.6	852	828.65	3066	2915
6 - 6.15	254	254	78	93.6	521	390.75	23	50.6	12	26.4	42	58.8	21	42	41	16.4	992	932.55	3243	3080
6.15 -6.30	176	176	92	110.4	397	297.75	18	39.6	4	8.8	23	32.2	42	84	32	12.8	784	761.55	3386	3241
6.30 - 6.45	223	223	63	75.6	456	342	14	30.8	8	17.6	14	19.6	21	42	8	3.2	807	753.8	3435	3277
6.45 - 7	281	281	98	117.6	502	376.5	21	46.2	11	24.2	21	29.4	18	36	21	8.4	973	919.3	3556	3367
TOTAL VEHICLE	2649		1014		5519		142		154		388		300		336		10502			
PERCENTAGE	25%		10%		53%		1%		1%		4%		3%		3%					

PEAK HOURS - 6 PM TO 7 PM , PEAK 15 MIN - 6.45 TO 7 PM
Peak factor = (total hourly volume) / [(peak 15-minute volume within the hour x 4)]
= V / (V15Peak x 4) = 3556 /973 *4 = 0.91
Where
V = peak-hour volume (vph)
V15 = volume during the peak 15 minutes of flow
LEVEL OF SERVICE = VOLUME IN PCU / CAPACITY IN PCU AS PER IRC TABLE FOR 4 LANE 2 WAY
= 3367/ 3600 = 0.9352 VERY HIGH



CAR JEEP VAN	AUTO	TWO WHEELER	BUS	TRUCK	LCV	OTHERS	CYCLE
25%	10%	53%	1%	1%	4%	3%	3%

Table 5

a) Likewise, entire week traffic has been calculated and it was observed that peak hour traffic is at 8th feb Monday 6pm to 7pm and peak 15 minute traffic is 6.15.
b) Level of service is very high as per IRC and it is suggested to construct or renowned NH33 because all the traffic coming from Kolkata is diverging SH, hence this traffic is also creates a jam condition at city Centre.

4.4) SPOT SPEED AT NH33

This method has done to compare speed of different mode of transport with design speed that should be there for highway

4.4.1) CAR/ VAN/JEEP

SPEED RANGE	AVG SPEED	NO OF VEHICLES	% VEHICLE	CUM FREQUENCY
0 -10	5	0	0	0
10 -20	15	23	23	23
20 - 30	25	67	67	100
30 - 40	35	0	0	100
	TOTAL	100		

BY INTERPOLATION

98% SPEED IS 24.39

15 % SPEED IS 13.18

85 % SPEED IS 23.05

50 % IS 21.14

- Same method has been done for trucks and speed is very less, hence it is due to the worst traffic condition.
- As per irc speed at NH should be between 80- 100 but at present road condition 85th percentile speed which also a design speed is only 23.05 kmph (9)

5) CONCLUSION

- I would like to conclude by mention that the traffic condition at NH33 is very bad due to poor road condition.
- Due to poor road condition of NH33 it lead to increase traffic flow, hence at the peak flow it create a jam-like condition during peak hours in SH.
- It was observed that land width is adequate quantity so there is an issue of land at NH33.
- It is suggested to construct or renovate NH33 because it leads SH jam.

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