

Failure Study of Underpass & Its Improvement: A Case Study at NH 65, Loni Kalbhor, Pune.

^[1] Sakshi Bhagepalle, ^[2] Kedar Kakade, ^[3] Onkar Kakade, ^[4] Yogesh Honrao, ^[5] Shubham Bavkar
^[6] Rajeshkhar G. Rathod

^[1, 2, 3, 4, 5] Student, MIT-School of Engineering MIT-ADT University,

^[6] Assistant Professor, MIT-School of Engineering, MIT-ADT University

Abstract: -- This study is to analyze the failure of existing underpass at NH 65, Loni Kalbhor, Pune (i.e. Sholapur Highway). The main aim of this study is to find the failure reasons and improvement of underpass service. An underpass was not fully utilized because road users were not aware of the underpass, with no sign boards. Local residents have no idea about entry and exit of the underpass and dumping of garbage is done. The service road width was reduced because partly road width was occupied by the local residents and underpass was not properly maintained. Finding the underpass users is by methods: Observations, Volume Count Survey, Origin and Destination Survey (O&D) and House Hold Survey. Underpass usage can be improved by implanting proper sign boards, margins for the service road, providing full width of the service road, installing the signals. To create awareness about the usage of underpass and service road by advertising either sides of the roads.

Index Terms— Underpass, service roads, volume count survey, sign boards, signals.

I. INTRODUCTION

A. General

The purpose of this case study is to improve performance of Underpass at National Highway NH 65, Loni-Kalbhor, Pune. Underpass are integral to the system of public roads, vital to the economy, and critical to improve mobility for all. An underpass is for pedestrians and/or cyclists beneath a road or railway, allowing them to reach the other side in safety. They are constructed when it is necessary for pedestrians to cross a railway line or a dual carriageway such as an interstate highway, and they appear at the exits from underground rapid transit systems. The location is situated about 4kms away from Toll Plaza (Shewalwadi). Underpass at Lonikalbhor is not being used efficiently. Proper guidance and improvements in service roads can lessen the congestion, accidents due to crossings on the highways.

B. Problem

1. There are reasons for less usage of underpass.
2. The service road on left is occupied by local people.
3. The construction materials are dumped on service roads/Government property.
4. Garbage is dumped on the sides of underpass. There is no proper guidance for underpass.

5. Because of this reasons people prefer crossing the highway instead of using underpass.

6. Longer queues, delays and congestion is found due to crossings on highway.

II. LITERATURE REVIEW

A. According to Researcher Khatoon et al, (2013) pedestrians in Delhi have greater risks as increasing number of cars and motorized two wheelers encourage the construction of large numbers of flyovers/grade separators to facilitate signal free movement for motorized vehicles.

B. According to Researcher Zhuang et al, (2011) many accidents occur while crossing roads. He did Field observation of 254 pedestrians at unmarked roadway in China. Pedestrians preferred safe to short paths and they crossed second half of the road with significantly higher speed.

C. According to Researcher Ahmed et al, (2005) he observed increasing traffic at Vishakhapatnam City. Geometrical improvements between junction reduce the Vehicle Operating Cost, cost of fuel & lubricants of Vehicles.

D. According to Researcher Parker (1996) observed that knowledge of traffic composition plays an important role

in determining capacity. It was found that the percentage of heavy goods vehicles (HGVs) within traffic stream has a major effect on capacity due to length, limited desired speed and engine power to weight ratio. As the presence of HGV's in the traffic stream increases, the capacity reduces in term of throughout of vehicle per hour.

followed by the data collection effort in the form of traffic volume counts. The study was conducted in LoniKalbhori NH65 between the 13th and 26th of November 2017 and Traffic patterns were observed at (7:00am to 9:00pm). Study of Traffic Volume was done for two weeks, working days as well as weekends (Saturdays and Sundays).

III. METHODOLOGY

A. General

The Traffic Management Plan of Loni-Kalbhori at Pune-Solapur Highway NH 65 was aimed to ease and regulate traffic. The users of Underpass were also observed. This survey was done to identify issues and identify the traffic circulation pattern in and around the study area. This was

IV. RESULTS AND DISCUSSION

Vehicle Volume Count survey at Loni Kalbhori junction which is 4kms away from Toll Plaza (Shewalwadi).

Table no.1: A. Vehicles travelling from Solapur to Pune

Date	Two wheelers	Three wheelers	Four wheelers	Buses	Trucks	Tankers	Containers	Tempos	Heavy vehicles	Cycles
13.11.17	10523	874	5110	598	796	415	126	627	116	74
14.11.17	9896	783	4984	576	682	402	115	592	108	68
15.11.17	9824	756	4867	568	679	396	109	612	121	76
16.11.17	9783	791	4879	543	693	399	118	617	98	71
17.11.17	11014	787	5797	559	719	345	121	609	107	65
18.11.17	9883	792	5610	568	772	409	129	589	112	61
19.11.17	9921	823	5102	582	718	417	118	614	108	58
20.11.17	11045	867	5126	585	784	421	123	634	114	86
21.11.17	9892	786	4987	564	686	413	117	596	109	71
22.11.17	9835	761	4859	571	664	396	103	617	125	69
23.11.17	9791	793	4881	539	681	401	126	621	87	72
24.11.17	11025	785	5784	561	723	354	117	604	98	64
25.11.17	9879	796	5621	563	769	412	135	578	115	58
26.11.17	9929	832	5112	584	709	425	120	598	94	66

Table no.1, shows the volume of vehicles travelling from Solapur to Pune on 13.11.17 to 26.11.17 timing 7am to 9pm. Ratio of Two wheelers and Four wheelers are larger as compared to all the other vehicles because most of the companies are located at cities. Volume of buses at constant range throughout 13.11.17 to 26.11.17.

Table no.2:B. Vehicles travelling from Pune to Solapur.

Date	Two wheelers	Three wheelers	Four wheelers	Buses	Trucks	Tankers	Containers	Tempos	Heavy vehicles	Cycles
13.11.17	8274	592	4682	666	748	466	199	507	200	35
14.11.17	7896	480	4486	650	728	450	192	510	191	27
15.11.17	7782	496	4572	657	735	462	186	492	192	21
16.11.17	8011	510	4317	648	743	449	191	484	189	26
17.11.17	8412	587	4832	516	751	452	172	501	199	17
18.11.17	7814	496	4784	510	742	458	175	512	209	15
19.11.17	8210	482	4712	521	781	462	177	497	198	14
20.11.17	8289	597	4677	658	748	468	197	512	202	37

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21.11.17	7901	486	4491	647	717	461	194	506	196	25
22.11.17	7885	498	4569	652	740	464	179	484	194	22
23.11.17	7913	516	4316	645	751	435	196	476	183	29
24.11.17	8423	556	4851	517	756	455	174	512	195	12
25.11.17	8119	452	4794	502	739	453	177	509	197	10
26.11.17	8206	469	4786	516	776	464	181	493	209	9

Table no.2, shows the volume of vehicles travelling from Pune to Solapur on 13.11.17 to 26.11.17 timing 7am to 9pm. Ratio of Two wheelers and Four wheelers is less compared to Table no.1. Ratio of cycles is less compared to Table no.1.

Table no.3:C. Vehicles using road from Highway to MIT College, Lonikalbhor

Date	Two wheelers	Three wheelers	Four wheelers	Buses	Trucks	Tankers	Containers	Tempos	Heavy vehicles	Cycles
13.11.17	1395	175	1330	39	96	86	43	93	63	121
14.11.17	1263	167	1193	37	98	85	39	87	57	117
15.11.17	1329	164	1287	38	88	79	42	78	67	109
16.11.17	1294	152	1161	35	81	83	40	83	59	98
17.11.17	1102	93	986	38	89	90	36	86	52	103
18.11.17	872	57	789	25	93	87	45	72	49	65
19.11.17	692	52	657	15	86	80	48	65	53	53
20.11.17	1286	171	1296	35	97	87	41	88	61	124
21.11.17	1163	163	1156	29	95	83	35	91	58	121
22.11.17	1201	161	1164	34	91	81	44	82	65	103
23.11.17	1186	146	1176	36	79	76	39	78	54	95
24.11.17	1173	96	1203	28	85	88	37	76	52	94
25.11.17	764	58	776	24	86	91	42	71	59	63
26.11.17	652	49	662	16	81	84	45	68	62	55

Table no.3, shows the volume of vehicles using road from Highway to MIT College on 13.11.17 to 26.11.17 timing 7am to 9pm. Ratio of Cycle users are more because of School and College of MIT. Volume of Heavy vehicles, Containers, Trucks, Buses are more as a Company manufacturing semiconductors and passive components is situated near MIT College.

Table no.4: D. Vehicles using the underpass from Solapur Pune Highway and joining College Road

Date	Two wheelers	Three wheelers	Four Wheelers	Buses	Trucks	Tankers	Tempo	Cycle
13.11.17	120	1	20	8	3	2	11	14
14.11.17	126	1	30	6	2	3	14	19
15.11.17	120	0	18	9	4	4	12	13
16.11.17	133	2	28	6	2	5	9	15
17.11.17	100	0	20	3	4	2	17	11
18.11.17	46	1	4	1	4	3	9	20
19.11.17	44	3	7	2	5	5	22	18
20.11.17	130	0	19	4	3	2	13	23
21.11.17	120	1	27	7	2	4	20	20
22.11.17	116	0	17	8	5	5	16	18
23.11.17	132	3	23	4	2	7	13	16

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24.11.17	93	0	16	5	3	5	10	20
25.11.17	41	0	3	2	5	1	16	25
26.11.17	47	2	8	3	6	4	20	17

Table no.4, shows the volume of vehicles using the underpass from Solapur Pune Highway and joining College Road on 13.11.17 to 26.11.17 timing 7am to 9pm. Compared to the volume of Highway vehicles users of underpass are very few. Here the underpass is mostly used by the workers.

Table no.5: E. Vehicles using the underpass from College Road and joining Solapur Pune Highway.

Date	Two wheelers	Three wheelers	Four Wheelers	Buses	Trucks	Tankers	Tempo	Cycle
13.11.17	118	0	22	5	4	2	13	12
14.11.17	121	1	29	4	3	4	21	21
15.11.17	115	0	19	6	5	3	19	12
16.11.17	136	3	23	3	1	5	11	18
17.11.17	97	1	12	5	4	4	17	21
18.11.17	43	3	4	2	4	2	10	19
19.11.17	49	0	20	2	4	3	16	17
20.11.17	131	2	23	6	6	3	21	20
21.11.17	125	1	29	7	2	5	16	27
22.11.17	120	0	22	8	3	4	14	17
23.11.17	132	3	27	11	2	8	12	14
24.11.17	98	1	19	4	4	5	13	18
25.11.17	44	0	5	7	6	2	5	20
26.11.17	48	1	6	6	7	3	15	12

Table no.5, shows the volume of vehicles using the underpass from College Road and joining Solapur Pune Highway on 13.11.17 to 26.11.17 timing 7am to 9pm. Compared to Table no.4 the users of underpass from College Road and joining Solapur Pune Highway are more as there is traffic congestion at evenings.

Comparisons of Daily Traffic Intensity by Column graph.
A. Results of Solapur Pune Highway by Traffic Volume Count survey.

Fig no.1 shows the daily traffic intensity of two wheelers. Volume of two wheelers is larger at Mondays and Fridays

Fig no.1: Graph for two wheelers

Fig no.2: Graph for three wheelers

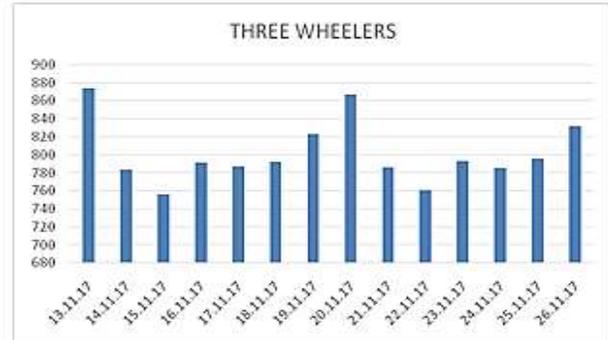
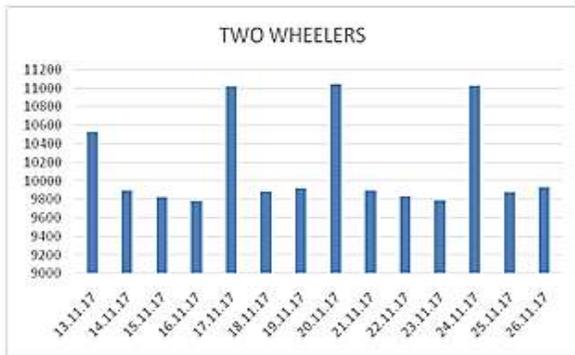


Fig no.2 shows the daily traffic intensity of three wheelers. Volume of three wheelers is larger at Mondays and Fridays.

Fig no.3: Graph for four wheelers

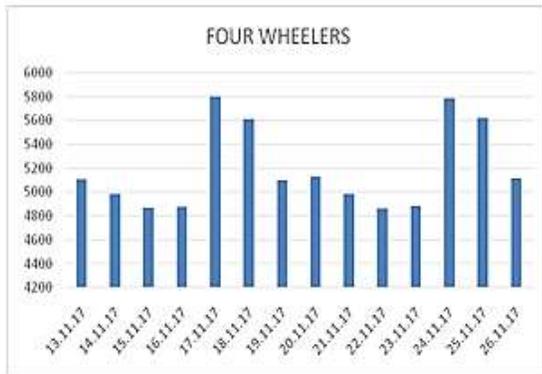


Fig no.3 shows the daily traffic intensity of four wheelers. Volume of four wheelers is larger at Fridays and Saturdays.

Fig no.4: Graph for buses

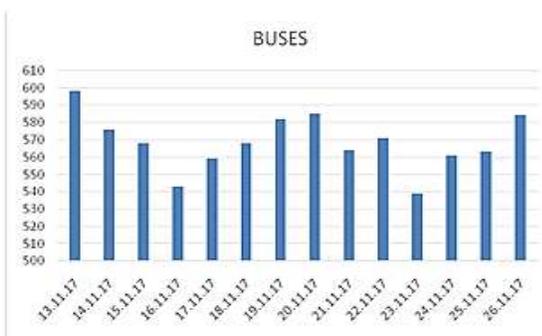


Fig no.4 shows the daily traffic intensity of buses. Volume of buses is larger at Mondays and Sundays.

Fig no.5: Graph for trucks

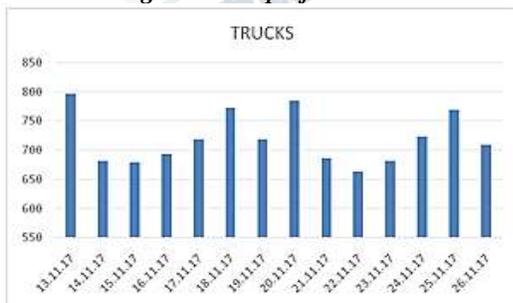


Fig no.5 shows the daily traffic intensity of trucks. Volume of trucks is larger at Mondays and Fridays.

Fig no.6: Graph for tankers

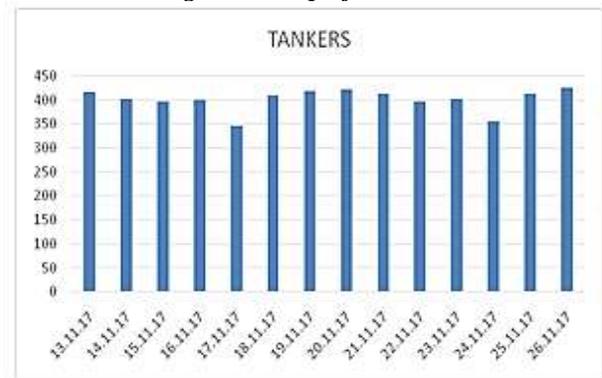


Fig no.6 shows the daily traffic intensity of tankers. Volume of tankers is less at Fridays compared to the other days.

Fig no.7: Graph for containers

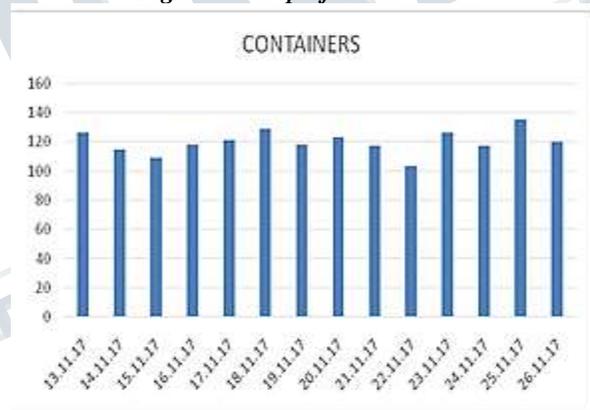


Fig no.7 shows the daily traffic intensity of containers.

Fig no.8: Graph for tempos

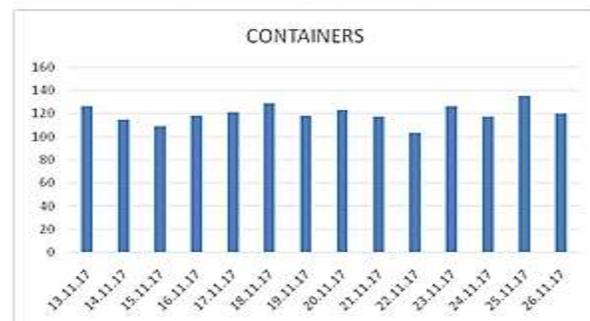


Fig no.8 shows the daily traffic intensity of tempos. Volume of tempos is larger at Mondays and Thursdays.

Fig no.9: Graph for heavy vehicles

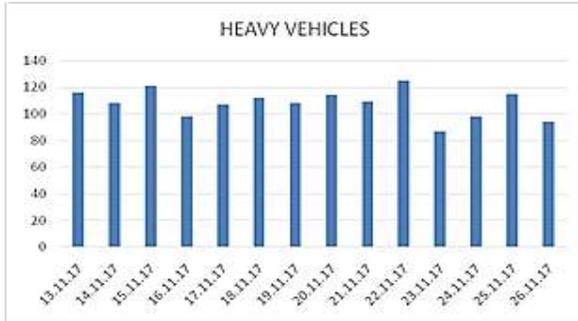


Fig no.9 shows the daily traffic intensity of heavy vehicles like construction vehicles.

Fig no.10: Graph for cycles



Fig no.10 shows the daily traffic intensity of cycles. Volume of cycles is less at Saturdays and Sundays compared to the other days.

B. Results of Pune Solapur Highway by Traffic Volume Count Survey.

Fig no.11: Graph for two wheelers

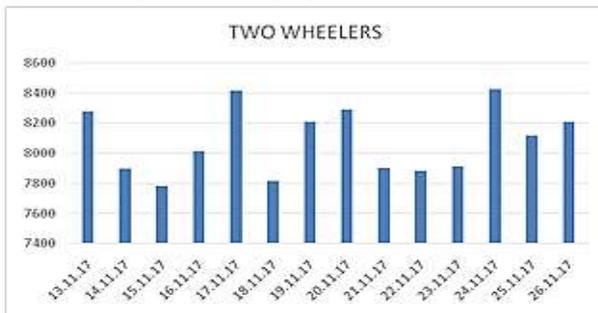


Fig no.11 shows the daily traffic intensity of two wheelers. Volume of two wheelers is larger at Mondays and Fridays.

Fig no.12: Graph for three wheelers

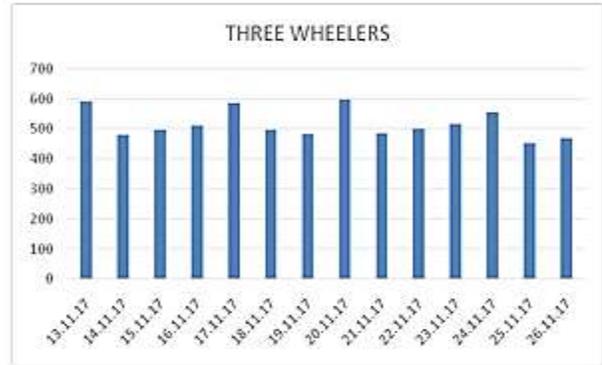


Fig no.12 shows the daily traffic intensity of three wheelers. Volume of three wheelers is larger at Mondays and Fridays.

Fig no.13: Graph for four wheelers

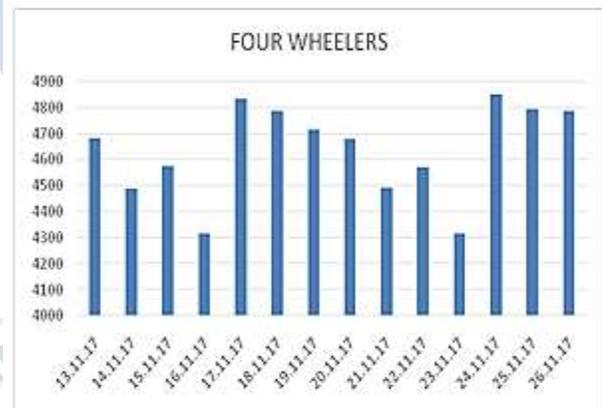


Fig no.13 shows the daily traffic intensity of four wheelers. Volume of four wheelers is larger at Fridays, Saturdays and Sundays.

Fig no.14: Graph for buses



Fig no.14 shows the daily traffic intensity of buses. Volume of buses is less at Fridays, Saturdays and Sundays.

Fig no.15: Graph for trucks

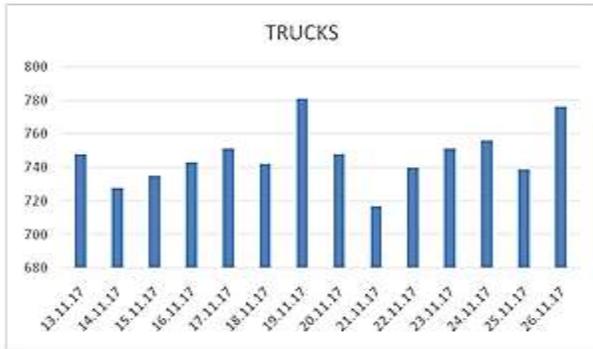


Fig no.15 shows the daily traffic intensity of trucks. Volume of trucks is larger at Sundays.

Fig no.16: Graph for tankers

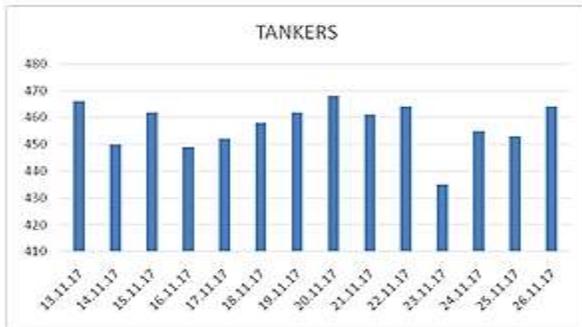


Fig no.16 shows the daily traffic intensity of tankers. Volume of tankers is greater at Mondays, Tuesdays and Sundays.

Fig no.17: Graph for containers

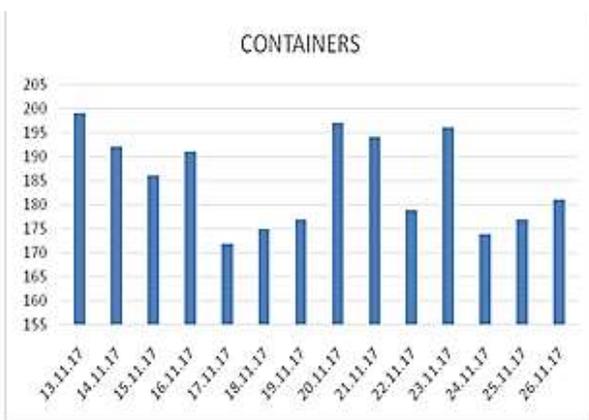


Fig no.17 shows the daily traffic intensity of containers. Volume of containers is less at Fridays, Saturdays and Sundays.

Fig no.18: Graph for tempos

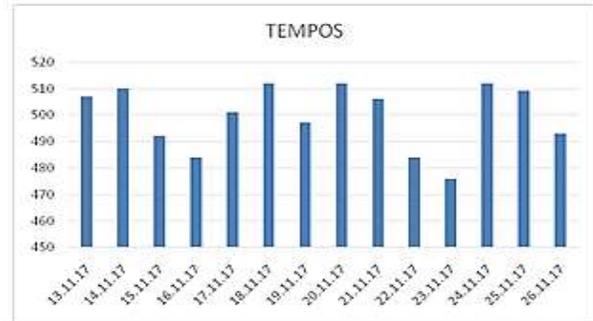


Fig no.18 shows the daily traffic intensity of tempos. Volume of tempos is less Wednesdays and Thursdays.

Fig no.19: Graph for heavy vehicles

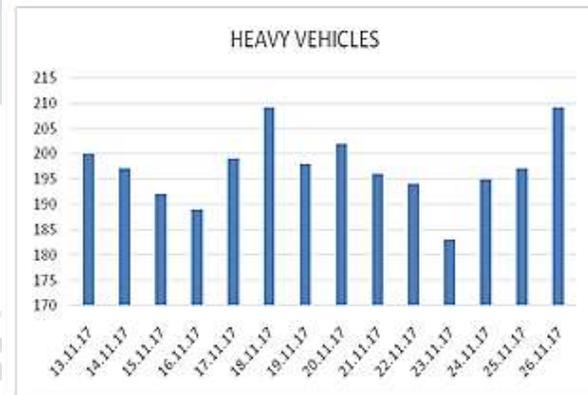


Fig no.19 shows the daily traffic intensity of heavy vehicles like construction vehicles. Volume of heavy vehicles is greater at Mondays, Saturdays and Sundays.

Fig no.20: Graph for cycles



Fig no.20 shows the daily traffic intensity of cycles. Volume of cycles is less at Fridays, Saturdays and Sundays compared to the other days.

C. Results of MIT College Road users by Traffic Volume Count Survey.

Fig no.21: Graph for two wheelers

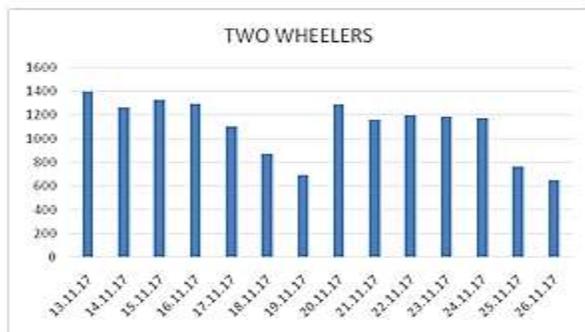


Fig no.21 shows the daily traffic intensity of two wheelers. Volume of two wheelers is less at Saturdays and Sundays compared to other days.

Fig no.22: Graph for three wheelers

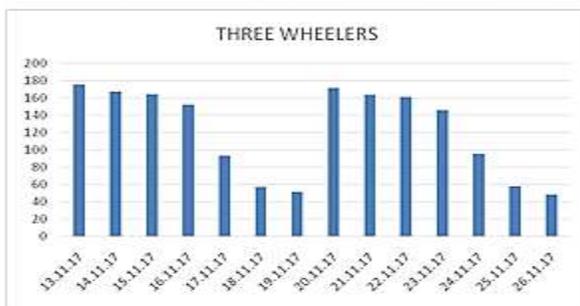


Fig no.22 shows the daily traffic intensity of three wheelers. Volume of three wheelers is less at Fridays, Saturdays, and Sundays.

Fig no.23: Graph for four wheelers

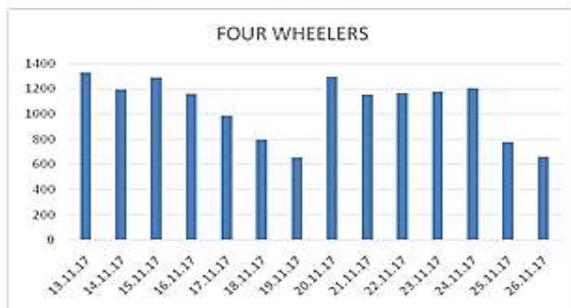


Fig no.23 shows the daily traffic intensity of four wheelers. Volume of four wheelers is less at Saturdays and Sundays.

Fig no.24: Graph for buses

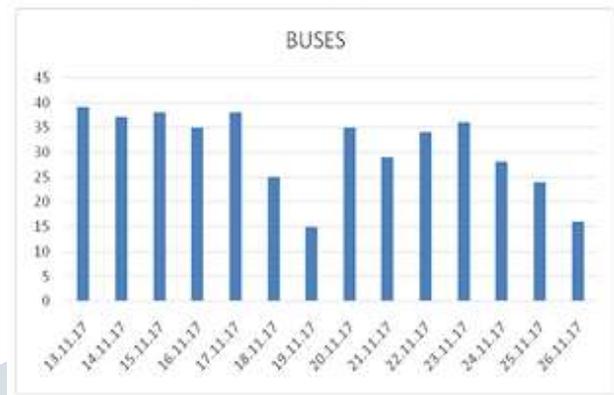


Fig no.24 shows the daily traffic intensity of buses. Volume of buses is less at Saturdays and Sundays.

Fig no.25: Graph for trucks

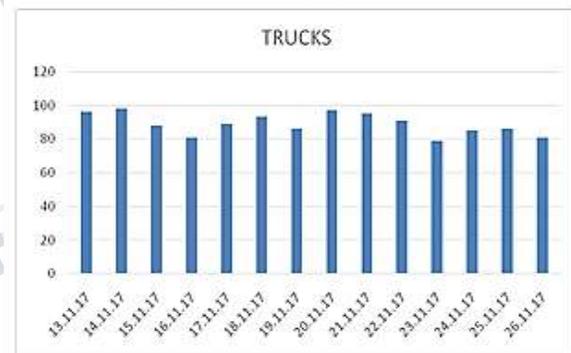


Fig no.25 shows the daily traffic intensity of trucks.

Fig no.26: Graph for tankers

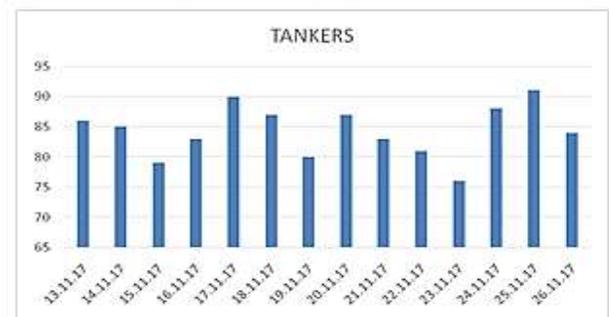


Fig no.26 shows the daily traffic intensity of tankers. Volume of tankers is greater at Fridays and Saturdays.

Fig no.27: Graph for containers

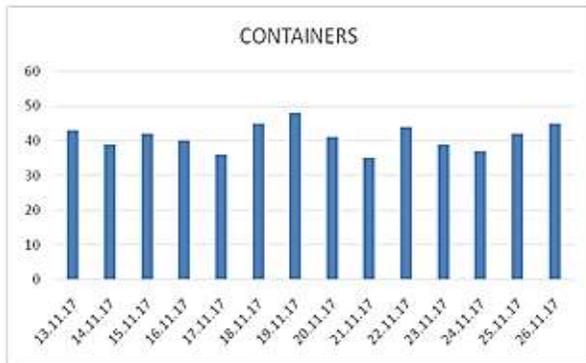


Fig no.27 shows the daily traffic intensity of containers.

Fig no.28: Graph for tempos



Fig no.28 shows the daily traffic intensity of tempos. Volume of tempos is greater at Mondays and Tuesdays.

Fig no.29: Graph for heavy vehicles

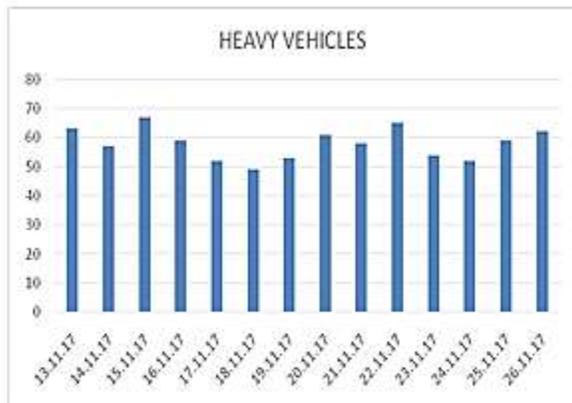


Fig no.29 shows the daily traffic intensity of heavy vehicles like construction vehicles.

Fig no.30: Graph for cycles



Fig no.30 shows the daily traffic intensity of cycles. Volume of cycles is less at Saturdays and Sundays compared to the other days.

D. Results of vehicles passing the underpass from Solapur Pune Highway and joining College Road.

Fig no.31: Graph for two wheelers

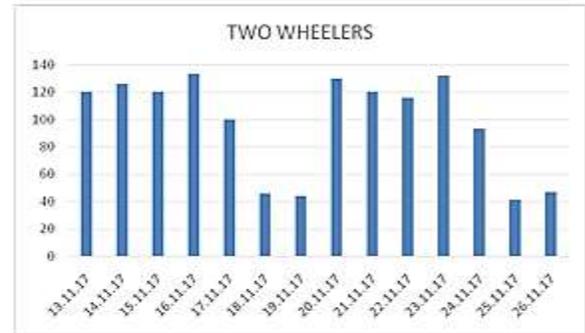


Fig no.31 shows the daily traffic intensity of two wheelers. Volume of two wheelers is less at Saturdays and Sundays compared to other days.

Fig no.32: Graph for three wheelers

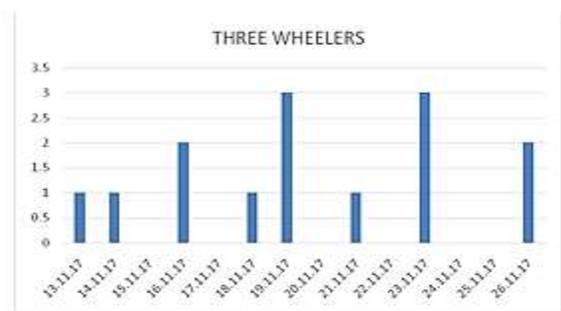


Fig no.32 shows the daily traffic intensity of three wheelers. Volume of three wheelers is very less as users of underpass are very few.

Fig no.33: Graph for four wheelers

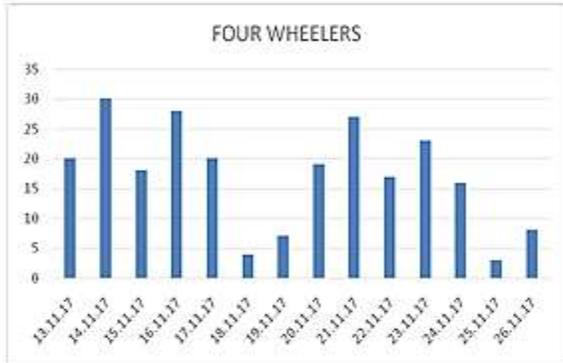


Fig no.33 shows the daily traffic intensity of four wheelers. Volume of four wheelers is less at Saturdays and Sundays.

Fig no.34: Graph for buses

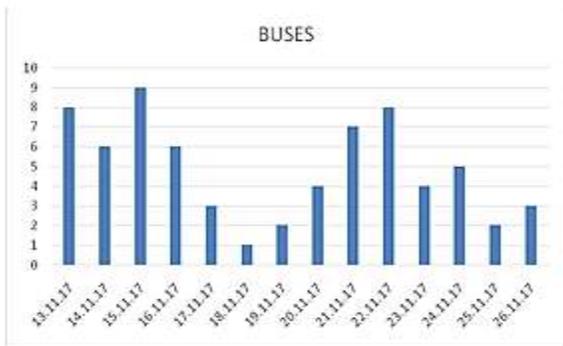


Fig no.34 shows the daily traffic intensity of buses. Volume of buses is less at Saturdays and Sundays.

Fig no.35: Graph for trucks

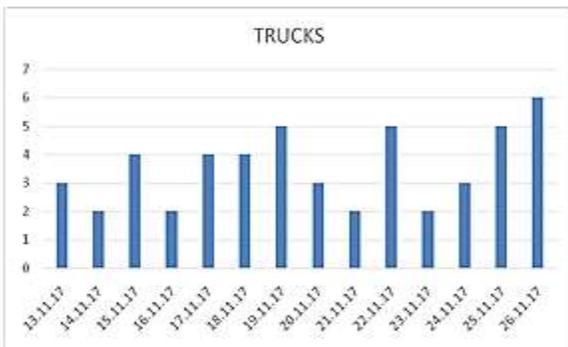


Fig no.35 shows the daily traffic intensity of trucks. There are few trucks which pass the underpass.

Fig no.36: Graph for tankers

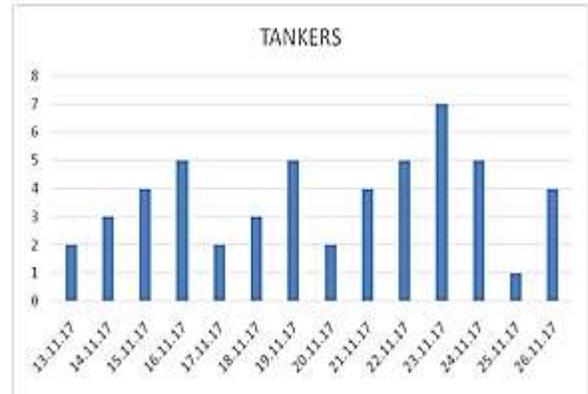


Fig no.36 shows the daily traffic intensity of tankers. These are water tankers which are used in college for construction, gardening purpose.

Fig no.37: Graph for tempos



Fig no.37 shows the daily traffic intensity of tempos. These tempos use the underpass because construction work is being done near the underpass.

Fig no.38: Graph for cycles



Fig no.38 shows the daily traffic intensity of cycles. The underpass users by cycles are the workers.

E . Results of vehicles passing the underpass from Solapur Pune Highway and joining College Road.

Fig no.39: Graph for two wheelers

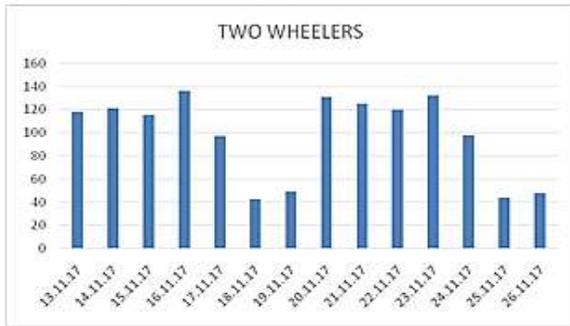


Fig no.39 shows the daily traffic intensity of two wheelers. Volume of two wheelers is less at Saturdays and Sundays compared to other days.

Fig no.40: Graph for three wheelers



Fig no.40 shows the daily traffic intensity of three wheelers. Volume of three wheelers is very less as users of underpass are very few.

Fig no.41: Graph for four wheelers

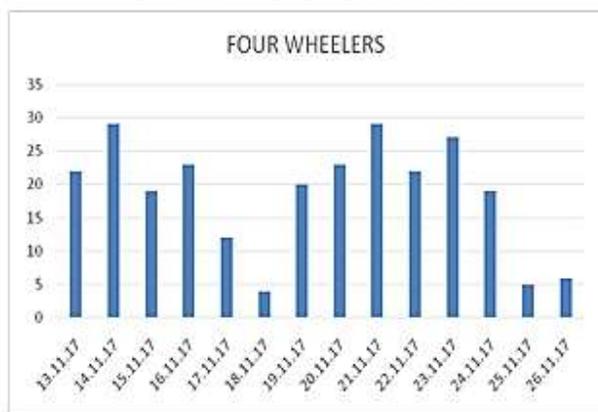


Fig no.41 shows the daily traffic intensity of four wheelers. Volume of four wheelers is more compared to Table no.33 as at evening the underpass is used by four wheelers from college because there is congestion at highway for crossing.

Fig no.42: Graph for buses

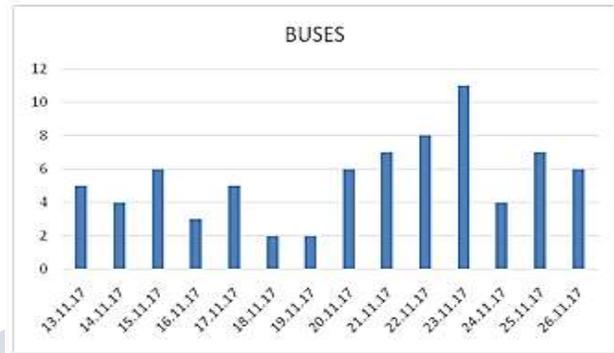


Fig no.42 shows the daily traffic intensity of buses. Volume of buses is less at Saturdays and Sundays.

Fig no.43: Graph for trucks

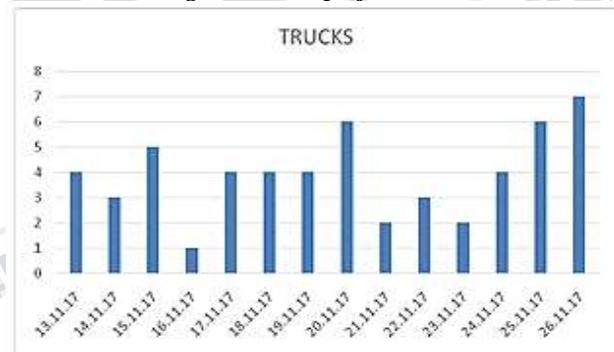


Fig no.43 shows the daily traffic intensity of trucks. There are few trucks which pass the underpass.

Fig no.44: Graph for tankers

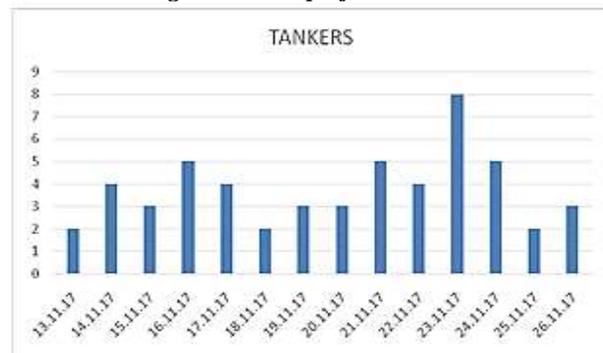


Fig no.44 shows the daily traffic intensity of tankers. These are water tankers which are used in college for construction, gardening purpose.

Fig no.45: Graph for tempos

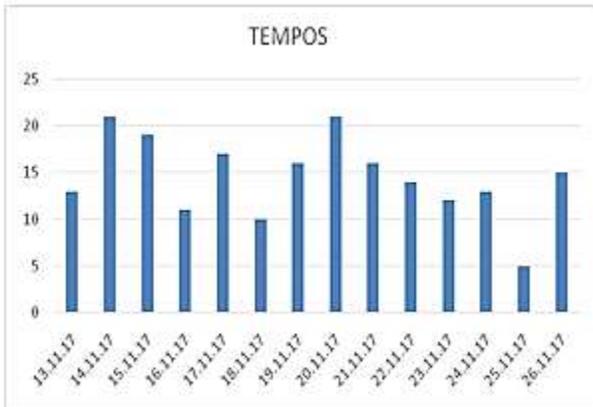


Fig no.45 shows the daily traffic intensity of tempos. These tempos use the underpass because construction work is being done near the underpass.

Fig no.46: Graph for cycles

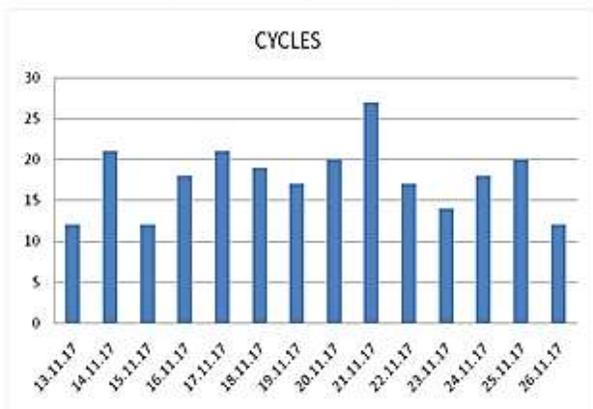


Fig no.46 shows the daily traffic intensity of cycles. The underpass users by cycles are the workers.

V. CONCLUSION

From the studies it can be conclude that,

1. The service road on left is occupied by local people should be vacant so that vehicle movement take place.
2. The construction materials are dumped on service roads should be removed and panelize them for same so that people won't dump any material.

3. Underpass has to maintain clean and proper sign boards have to install to use it effectively.
4. There should be traffic signal for easy and safe movement of vehicles before underpass along with proper zebra cross.
5. From the interaction with vehicle users it has come to know that people are not aware about underpass so to make it use effective, proper sign board for underpass required.

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