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Management of Pedestrian Movements

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Abstract

Central Station is the main railway terminus in the city of Chennai, formerly known as Madras. It lies adjacent to the current headquarters of the Southern Railway, as well as the Ripon Building. Park Town station handles the movement of local transit trains. The objective is to study the passengers interchange facilities from central to park town station. Pedestrian safety manual record says that nearly 46% of those are killed in road traffic crashes are pedestrians. The Road inventory survey has been carried out to collect the information on width of the carriageway, median width, shoulders, etc. The pedestrian volume and traffic volume has been collected from the secondary source and forecasting of pedestrian volume and traffic volume is calculated based on the past trends for the next 15 years. The foot over bridge is proposed to have better passenger interchange facilities from central to park town station. Then the design calculation of foot over bridge is done by adopting limit state design method and the foot over bridge is analyzed for safe design using STAAD PRO. Finally the estimation of materials required and cost of foot over bridge are calculated. As a result of this study, pedestrian using the foot over bridge will get benefit in terms of safety and saving in time instead of crossing the road.

Key Words: Interchange, Limit state design, Pedestrian, Road inventory survey, STAAD PRO, Transit

Introduction

Pedestrian is any person who is travelling by walking for at least part of his or her journey. In addition to the ordinary form of walking, a pedestrian may be using various modifications and aids to walking such as wheelchairs, motorized scooters, walkers, canes, skateboards, and roller blades. The person may carry items of varying quantities, held in hands, strapped on the back, placed on the head, balanced on shoulders, or pushed / pulled along. A person is also considered a pedestrian when running, jogging, hiking, or when sitting or lying down in the roadway.

Road traffic crashes kill about 1.24 million people each year. More than one fifth of these deaths occur among pedestrians. Pedestrian collisions, like all road traffic crashes, should not be accepted as inevitable because they are, in fact, both predictable and preventable. Key risk factors for pedestrian road traffic injury are vehicle speed, alcohol use by drivers and pedestrians, lack of safe infrastructure for pedestrians and inadequate visibility of pedestrians. Reduction or elimination of the risks faced by pedestrians are an important and achievable policy goal. Proven interventions exist, yet in many locations pedestrian safety does not attract the attention it merits.

The Pedestrian safety manual provides information for use in developing and implementing comprehensive measures to pedestrian safety. The extent of pedestrian fatalities and injuries, and the importance of addressing the key associated risk factors for pedestrian injury, are examined. The steps outlined for conducting a situational assessment to help with prioritizing interventions and preparing a related plan of action, are intended to assist with the implementation of effective interventions, and evaluation of pedestrian safety measures. While the focus of the manual is on sub national administrative units, the strategies presented can be applied at the national level. It is hoped that the modular structure of this manual enables adoption to suit the needs and problems of individual countries.

Literature Review

Aprichit Manee & Wannalak (2004), Plans a key role in a global trade environment the optimization of the (MTP) is therefore an important way for the MTO to enhance the competitiveness of MTO's efficiency. The object is to minimize the total cost of transport activities and the penalty cost of late delivery giving more safeties for pedestrian. **Brich.C (1994)**, discussed about the reduced transit, reduced transport cost and safety of the pedestrian. **Rockwel (2004)**, Van der Spek says travelers are more concerned about transferring and waiting at station or stops than by travelling itself .When passengers are treated as the focal point of attention and if the design for the connectors is viewed as an integral whole, then better solution would be developed. **Hitcham, Azendine Boulmark (2004)**, GIS Technology presents a solution for the problem of origin-destination trip modeling for transportation Networks by using GTS part of the journey to which it is best suited. **Michael D. Meyer (1995)**, said that safety needs for bicyclists, pedestrians, equestrians and transit users. Improve the connectivity to transit facility. He identified off-street pathway opportunities, activity centers and connectivity to the activity centers. **Miley, Eric Rothstein (2010)**, discussed about the demand for transportation services. He presented the maximization of quality of service to customers and safety. **Mansha Swami (2013)**, Transportation is only an attractive option if the access and aggress distance is not too large. The combination of longer trip length and of seam less transfers is necessary to make transport more attractive transportation. **Stephen C.Brich (1994)**, The Intermodal surface transportation Efficiency Act provide the nation with a means of maintaining its existing infrastructure while laying the foundation for a national intermodal transportation system. Virginia has typically taken a needs based mode by mode approach when determining the requirements for state investment in transportation. Because of ISTEA legist ration state have to develop true multimodal transportation. Transportation has always been a vital element of Virginia's economy. **Steven L. Jones (2003)**, there is two primary objectives, research and education. The research objective was to conduct a survey in the study area. The educational goal of the project was to introduce students to the many aspects of transportation planning and operations. The forces which resulted in increasing emphasis on transportation include Globalization /increased competition. An aging society is in need of mobility. Environmental impact associated with roadway congestion. **Sanjiv N.Sahai, Fulton (2005)**, Route integration is secured through a series of feeder routes linked to dedicated bus lanes. Physical integration with other modes has involved the construction of over 300 km of cycle routes complemented by improved pedestrian pathways and car-free pedestrian plazas linking to BRT network directly, safely and conveniently. Land use planning has been integrated requiring higher density, mixed-land use, around bus stops and interchanges. Thereby it facilitates more convenient travel by public transit. Demand management measure checks the growth in private vehicle usage. **Torbjorn H. Netland (2011)**, this paper puts forward four literature –based propositions for future research on safety of pedestrian. Develop an effective operative terminal system. Develop a holistic performance measurement system for the terminal. Develop new value increasing services at the system. Develop cooperation models for the network actors. The focus is to provide appropriate attention to the most costly element of intermodal services the terminal. **Todd litman (2012)**, Traffic impact studies evaluate traffic impact and mitigation strategies for a particular development or project. Local transport planning develops plans for a metropolitan region. State provincial and national transportation planning develops plans for a large jurisdiction to be implemented by a transportation agency. Strategic transportation plans develop long-range plans, typically 20-40 years into the future. **Todd litman (2013)**, Conventional transport planning is mobility based, it assumes that the planning objective is to maximize travel speed, and evaluates transport system performance based primarily on automobile travel condition. A new paradigm recognizes that the ultimate goal of most transport activity is accessibility, which refers to people's overall ability to reach desired services and activity. This expands the range of modes, objectives and impacts.

Need For Study

The Subway has been constructed for pedestrian interchanges. But it is fully occupied with road side shops in front of Subway and also interior part of Subway which is a hindrance for pedestrian using Subway. Proper lighting system, drainage system and proper maintenance has not been carried out which minimizes the number of pedestrian using Subway. Therefore there is a need to provide Foot-Over Bridge to manage the movement of pedestrian at Central.

Figure 1: Front view of Chennai Central Station and the encroachment of shops and inside the subway in front of Central Station

Objective and Scope of The Study

- To study the passengers interchange facilities in the study area.
- To analyze and predict the passenger volume.
- To suggest suitable interchange facilities for passengers.

This study provides better connectivity between passenger transits. It improves capacity and reliability for passengers. It reduces conflicts and widely dispersed operations among transportation modes. It removes traffic from interstate and highway systems, as well as from city streets. It accommodates future growth for current rail, transit, and bus service providers.

Study Area

Central Station

Central Station is the main railway terminus in the city of Chennai, formerly known as Madras. It lies adjacent to the current headquarters of the Southern Railway, as well as the Ripon Building, and is one of the most important railway hubs in South India. The other major railway hub stations in the city are Chennai Egmore and Tambaram. Chennai Central connects the city to New Delhi and also the prominent cities of India such as Ahmedabad, Bangalore, Bhopal, Coimbatore, Hyderabad, Jaipur, Kolkata, Lucknow, Mumbai, Patna, Thiruvananthapuram, and so forth. The 138-year-old building of the railway station, one of the most prominent landmarks of Chennai, was designed by architect George Harding.

Park Town Station

Park Town is a neighborhood in downtown Chennai India. The area got its name from the People's Park which was situated near the Ripon Building. It was earlier known as White Town, as the Europeans used to stay here. Today the area is a major transit hub with all the 3 Chennai's suburban lines and the MRTS line converging here. It also houses several key Government offices.

Major Government landmarks include:

- Chennai Central
- Government General Hospital

- Madras Medical College
- Chennai Corporation
- Southern Railway Headquarters

The three Chennai's suburban routes and Chennai MRTS cross through Park Town, which makes it a popular transit point. The Park Town MRTS station is situated behind the Government General Hospital. Chennai Park is one of the busiest suburban stations in the city. Both the stations lie opposite to Chennai Central Terminus. Additionally, two lines of the Chennai Metro will meet at Chennai Central metro station, which is located in this zone. Hence, in the near future, Park Town area will become a bigger transit or interchange zone for 6 different railway lines which comprise the 3 suburban lines, 1 MRTS line and 2 Metro lines. The location of Central station and MRTS Park Town Station and the various locations such as important government offices, Educational institutions, Hospitals, etc. which influences the pedestrian traffic is marked in Fig. 2. It was observed that the major crowd of pedestrian traffic is crossing the road from Central station to Park town Station and vice versa in the morning and evening peak hours is represented in Fig. 3.

Figure 2: Map showing the location of Central station and MRTS Park Town Station and location of important places which influences the Pedestrian traffic at Central

Figure 3: Movement of the Pedestrian from MRTS Park Town Station to Central and from Central to MRTS Park Town Station during the peak hours

Data Collection

The Primary data was collected from Road Inventory Survey. This data is used in analyzing the existing facilities, preparing the preliminary designs and also shifting of utilities and services. The secondary data has been collected from various sources like

Second Master Plan by CMDA and Chennai Comprehensive Traffic Study (CCTS) by Wilbur Smith Associates.

Road Inventory Survey

The road inventory study was carried out at all station areas and their immediate influence areas. The inventory details of study area is detailed into several parameters such as Road Conditions, Road width, length of the road, Median width, Signals, bus bays/bus stops, obstructing utilities on the foot path, pedestrian intensity and vacant lands. The width of the Road from towards park town is 100cms. Width of median is 65 cm. Width of the footpath is 1.5 m.

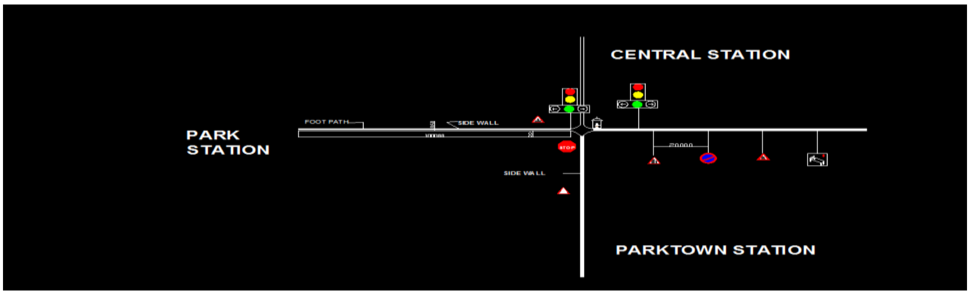

Figure 4: Road inventory Survey Details at Central

Pedestrian Volume Survey

Pedestrian volume survey gives the number of commuters in that particular area. From the past records of pedestrian volume shown in Table 1, it was observed that the pedestrian traffic volume is increased to 1.5 % per year and it is predicted that this pedestrian traffic demand will be very high in the year 2030.

Table 1: Pedestrian Volume At Central

YEAR	TIME(PEAK HOUR)	PEDESTRIAN (NO.)
2008	6PM - 7 PM	8220
2009	6 PM - 7 PM	8343
2010	6 PM - 7 PM	8468
2011	6 PM – 7 PM	8595
2012	6 PM – 7 PM	8723
2013	6 PM – 7 PM	8854
2014	6 PM - 7 PM	8987

Source: Secondary data from CMDA for the year 2008 to 2013

Traffic Volume Survey

Traffic volume study is conducted to identify the number of vehicles crossing a road per unit time during peak hours by manual methods. A complete traffic volume study is conducted including the classified volume study by recording the volume of various types and classes of traffic. The distribution of Traffic by turning movements and on different lanes per unit time is identified. It is predicted that the future volume of the traffic will increase by 7.5 % per year.

Table 2: Traffic Volume At Central

Year	**Time (Peak Hour)**	**Vehicles (PCU)**
2008	6PM - 7 PM	144196
2009	6 PM - 7 PM	155012
2010	6 PM - 7 PM	166637
2011	6 PM – 7 PM	179135
2012	6 PM – 7 PM	198743
2013	6 PM – 7 PM	209834
2014	6 PM -7 PM	230097

Source: Secondary data from CMDA for the year 2008 to 2013

Design and Analysis of Foot over Bridge

The Foot-over Bridge is proposed to plan at central to minimize the congestion created by pedestrian traffic crossing the road.

Design Calculation of Foot Over Bridge (FOB)

Limit State Method is adopted

Design of Steel Beam (I – Section)

Section used from steel table: ISMB 400

Assumption

(Taken form steel table for provided section)

Area of the section A = 7846 mm^2

Depth of the section D = h = 400 mm

Breadth of flange = b = 140 mm

Section modulus = z = 1022.9 x 103 mm^3

I_{xx} = 20458.4 x 104 mm^4

R_{xx} = 16.15 mm

R_{yy} = 2.82 mm

T = thickness of flange (t_f) = 16 mm

T = thickness of web (t_w) = 8.9 mm

Calculation d_1 = $h - 2 \times t_f$

= 400 - (2 x 16)

= 368 mm

T / t = t_f / t_w = 16 / 8.9

= 1.797 < 2.0 mm

d_1 / t = d_1 / t_w = 368 / 8.9

= 41.3 < 85mm

L / r_{yy} = 5500 / 2.82

= 1950.35 mm

D / T = h / t_f = 550 / 16

	=	34.375 mm
From table 14(b)	=	94 N / mm^2
f_{cc}	=	π^2 E / λ_2
	=	2 x 2 x 105 / 19502
	=	51.9 N / mm^2
σ_{ac}, cal	=	P / A
	=	415 x 106 / 7846
	=	51.618 N / mm^2
M / Z	=	18.39 x 106 / 1022.9 x 103
	=	17.97 N / mm^2
C_m	=	0.85 (given)
		σ_{ac}, cal / σ_{ac} +C_m. σ_{ac},cal/ σ_{bc} [1- σ_{ac},cal/0.6f_{cc}] $\leq$1
	=	0.649 + 0.45
		1.09 $\leq$ 1

Hence safe

Design of Steel Beam (L – Section)

Section used from steel table: ISA 200 x 100

Assumption

(Taken form steel table for provided section)

Area of the section A	=	2903 mm^2		
Thickness t	=	10 mm		
Section modulus = z	=	92.8 x 10^3 mm^3		
I_{xx}	=	1210.0 x 10^4 mm^4		
Radius of root r_1	=	12 mm		
Radius of toe r_2	=	8 mm		
Calculation				
d_1	=	h - 2 x t		
	=	200 - (2 x 10)		
	=	180 mm		
T / t	=	r_1 / r_2	=	12/8
	=	1.597 < 2.0 mm		
d_1 / t	=	d_1 / t	=	368 / 10
	=	36.8 < 85 mm		
L / r_{yy}	=	5500 / 2.82		
	=	1950.35 mm		
D / T	=	h / t	=	550 / 10
	=	55 mm		
From table 14(b)	=	94 N / mm^2		
f_{cc}	=	π^2 E / λ_2		
	=	π^2 x 2 x 105 / 19502		
	=	51.9N / mm^2		
σ_{ac}, cal	=	P / A		
	=	415 x 106 / 2903		
	=	51.618		

M / Z = 18.39 x 106 / 1022.9 x 103
= 17.97 N / mm^2
C_m = 0.85 (given)
σ_{ac}, cal / σ_{ac} +C_m. σ_{ac},cal / σ_{bc} [1- σ_{ac},cal / 0.6f_{cc}] $\leq$ 1
= 0.649 + 0.45
1.09 $\leq$ 1
Hence safe

Design of Steel Beam (C – Section)
Section used from steel table: ISMC 300
Assumption
(Taken form steel table for provided section)
Area of the section A = 4564 mm^2
Depth of the section D = h = 300 mm
Breadth of flange = b = 90 mm
Section modulus = z = 424.2 x 10^3 mm^3
I_{xx} = 6362.6 x 10^4 mm^4
Radius of root r_1 = 13 mm
Radius of toe r_2 = 2.82 mm
T = thickness of flange (t_f) = 13.6 mm
T = thickness of web (t_w) = 7.6 mm
Calculation = h – 2 x t_f
= 300 - (2 x 13.6)
= 272.8 mm
T / t = t_f / t_w = 13.6 / 7.6
= 1.789 < 2.0 mm
d_1 / t = d_1 / t_w = 272.8 / 7.6
= 35.89 < 85 mm
L / r_{yy} = 5500 / 2.82
= 950.35 mm
D / T = h / t = 550 / 13.6
= 40.44 mm
From table 14(b) = 94 N / mm^2
f_{cc} = π^2 E / λ_2
= π^2 x 2 x 105 / 45642
= 94.7 N/mm^2
σ_{ac}, cal = P / A = 415 x 106 / 4564
= 90.929
M / Z = 18.39 x 106 / 424.2 x 103
= 43.35 N/mm^2
= 0.85 (given)
σ_{ac}, cal / σ_{ac} +Cm. σ_{ac},cal/ σ_{bc} [1- σ_{ac},cal / 0.6f_{cc}] $\leq$1
= 0.649 + 0.45
1.09 $\leq$ 1
Hence safe

Wind Load Calculation

Wind speed (V_z): V_b K_1 K_2 K_3

V_z	=	design wind speed at any height z in m/s.
K_1	=	probability factor.
K_2	=	terrain, height and structure height factor.
K_3	=	topography factor.
		Wind speed (m / sec)
K_3	=	1
K_2	=	1
K_1	=	1
V_b	=	50
V_z	=	50
P_z	=	0.6 X V_z
Wind pressure	=	0.6 x 502
Wind pressure	=	1500

Analysis of Foot Over Bridge using STAAD PRO

The analysis of Foot over Bridge is done using STAAD PRO to determine the position of maximum values of displacement, bending moment and shear force and checked for the safety.

Structure Type	**TRUSS**		
Number of Nodes	74	Highest Node	74
Number of Elements	165	Highest Beam	232
Number of Plates	10	Highest Plate	242
Number of Basic Load Cases	10		
Number of Combination Load	10		

Results of Load cases are presented below

Type	**L/C**	**Name**
Primary	1	EQ X
Primary	2	EQ -X
Primary	3	EQ Z
Primary	4	EQ -Z
Primary	5	WL X
Primary	6	WL -X
Primary	7	WL Z
Primary	8	WL -Z
Primary	9	DEAD LOAD
Primary	10	LIVE LOAD
Combinatio	11	1.5 DL + 1.5 LL
Combinatio	12	DL + 1.5 EQ X
Combinatio	13	DL + 1.5 EQ -X

Combinatio	14	DL + 1.5 EQ Z
Combinatio	15	DL + 1.5 EQ -Z
Combinatio	16	DL + LL
Combinatio	17	DL + WL X
Combinatio	18	DL + 1.5 WL -X
Combinatio	19	DL + 1.5WL Z
Combinatio	20	DL + 1.5 WL -Z

Nodes

Node	**X**(m)	**Y**(m)	**Z**(m)
1	0.000	0.000	0.000
2	3.000	0.000	0.000
3	6.000	0.000	0.000
4	9.000	0.000	0.000
5	12.000	0.000	0.000
6	15.000	0.000	0.000
7	18.000	0.000	0.000
8	21.000	0.000	0.000
9	24.000	0.000	0.000
10	27.000	0.000	0.000
11	30.000	0.000	0.000
12	0.000	3.600	0.000
13	3.000	3.600	0.000
14	6.000	3.600	0.000
15	9.000	3.600	0.000
16	12.000	3.600	0.000
17	15.000	3.600	0.000
18	18.000	3.600	0.000
19	21.000	3.600	0.000
20	24.000	3.600	0.000
21	27.000	3.600	0.000
22	30.000	3.600	0.000
23	0.000	0.000	3.000
24	3.000	0.000	3.000
25	6.000	0.000	3.000
26	9.000	0.000	3.000
27	12.000	0.000	3.000
28	15.000	0.000	3.000
29	18.000	0.000	3.000
30	21.000	0.000	3.000
31	24.000	0.000	3.000
32	27.000	0.000	3.000
33	30.000	0.000	3.000

34	0.000	3.600	3.000
35	3.000	3.600	3.000
36	6.000	3.600	3.000
37	9.000	3.600	3.000
38	12.000	3.600	3.000
39	15.000	3.600	3.000
40	18.000	3.600	3.000
41	21.000	3.600	3.000
42	24.000	3.600	3.000
43	27.000	3.600	3.000
44	30.000	3.600	3.000
45	0.000	-5.500	0.000
46	3.000	-5.500	0.000
47	0.000	-5.500	3.000
48	3.000	-5.500	3.000
49	27.000	-5.500	0.000
50	30.000	-5.500	0.000
51	27.000	-5.500	3.000
52	30.000	-5.500	3.000
53	0.000	3.600	1.500
54	3.000	3.600	1.500
55	6.000	3.600	1.500
56	9.000	3.600	1.500
57	12.000	3.600	1.500
58	15.000	3.600	1.500
59	18.000	3.600	1.500
60	21.000	3.600	1.500
61	24.000	3.600	1.500
62	27.000	3.600	1.500
63	30.000	3.600	1.500
64	0.000	4.600	1.500
65	3.000	4.600	1.500
66	6.000	4.600	1.500
67	9.000	4.600	1.500
68	12.000	4.600	1.500
69	15.000	4.600	1.500
70	18.000	4.600	1.500
71	21.000	4.600	1.500
72	24.000	4.600	1.500
73	27.000	4.600	1.500
74	30.000	4.600	1.500

BEAMS

Beam	**Node A**	**Node B**	**Length** (m)	**Property**	**β** (degrees)
1	1	2	3.000	4	0
2	2	3	3.000	4	0
3	3	4	3.000	4	0
4	4	5	3.000	4	0
5	5	6	3.000	4	0
6	6	7	3.000	4	0
7	7	8	3.000	4	0
8	8	9	3.000	4	0
9	9	10	3.000	4	0
10	10	11	3.000	4	0
12	13	14	3.000	4	0
13	14	15	3.000	4	0
14	15	16	3.000	4	0
15	16	17	3.000	4	0
16	17	18	3.000	4	0
17	18	19	3.000	4	0
18	19	20	3.000	4	0
19	20	21	3.000	4	0
20	21	22	3.000	4	0
21	1	12	3.600	6	0
23	3	14	3.600	6	0
24	4	15	3.600	6	0
25	5	16	3.600	6	0
26	6	17	3.600	6	0
27	7	18	3.600	6	0
28	8	19	3.600	6	0
29	9	20	3.600	6	0
30	10	21	3.600	6	0
31	11	22	3.600	6	0
33	3	13	4.686	6	0
34	4	14	4.686	6	0
35	5	15	4.686	6	0
36	6	16	4.686	6	0
42	23	24	3.000	4	0
43	24	25	3.000	4	0
44	25	26	3.000	4	0
45	26	27	3.000	4	0
46	27	28	3.000	4	0
47	28	29	3.000	4	0
48	29	30	3.000	4	0

49	30	31	3.000	4	0
50	31	32	3.000	4	0
51	32	33	3.000	4	0
62	23	34	3.600	6	0
63	24	35	3.600	6	0
64	25	36	3.600	6	0
65	26	37	3.600	6	0
66	27	38	3.600	6	0
67	28	39	3.600	6	0
68	29	40	3.600	6	0
69	30	41	3.600	6	0
70	31	42	3.600	6	0
71	32	43	3.600	6	0
72	33	44	3.600	6	0
73	24	34	4.686	6	0
74	25	35	4.686	6	0
75	26	36	4.686	6	0
76	27	37	4.686	6	0
77	28	38	4.686	6	0
83	1	23	3.000	2	0
84	2	24	3.000	2	0
85	3	25	3.000	2	0
86	4	26	3.000	2	0
87	5	27	3.000	2	0
88	6	28	3.000	2	0
95	13	54	1.500	2	0
96	14	55	1.500	2	0
97	15	56	1.500	2	0
98	16	57	1.500	2	0
104	22	63	1.500	2	0
105	28	40	4.686	6	0
106	29	41	4.686	6	0
107	30	42	4.686	6	0
108	31	43	4.686	6	0
109	32	44	4.686	6	0
110	6	18	4.686	6	0
111	7	19	4.686	6	0
112	8	20	4.686	6	0
113	9	21	4.686	6	0
114	10	22	4.686	6	0
115	1	45	5.500	6	0
116	23	47	5.500	6	0
117	2	46	5.500	6	0

118	24	48	5.500	6	0
119	11	33	3.000	2	0
120	33	52	5.500	6	0
121	11	50	5.500	6	0
122	10	49	5.500	6	0
123	32	51	5.500	6	0
124	7	29	3.000	2	0
125	8	30	3.000	2	0
126	9	31	3.000	2	0
127	10	32	3.000	2	0
161	12	13	3.000	4	0
162	2	13	3.600	6	0
163	34	35	3.000	4	0
164	35	36	3.000	4	0
165	36	37	3.000	4	0
166	17	58	1.500	2	0
167	37	38	3.000	4	0
168	38	39	3.000	4	0
169	39	40	3.000	4	0
170	18	59	1.500	2	0
171	40	41	3.000	4	0
172	41	60	1.500	2	0
173	41	42	3.000	4	0
174	42	61	1.500	2	0
175	42	43	3.000	4	0
176	43	62	1.500	2	0
177	43	44	3.000	4	0
178	7	17	4.686	6	0
179	8	18	4.686	6	0
180	9	19	4.686	6	0
181	10	20	4.686	6	0
182	11	21	4.686	6	0
183	29	39	4.686	6	0
184	30	40	4.686	6	0
185	31	41	4.686	6	0
186	32	42	4.686	6	0
187	33	43	4.686	6	0
188	12	53	1.500	2	0
189	53	34	1.500	2	0
190	54	35	1.500	2	0
191	55	36	1.500	2	0
192	56	37	1.500	2	0
193	57	38	1.500	2	0

194	58	39	1.500	2	0
195	59	40	1.500	2	0
196	60	19	1.500	2	0
197	61	20	1.500	2	0
198	62	21	1.500	2	0
199	63	44	1.500	2	0
200	2	12	4.686	6	0
201	64	12	1.803	5	0
202	64	34	1.803	5	0
203	13	65	1.803	5	0
204	65	35	1.803	5	0
205	14	66	1.803	5	0
206	66	36	1.803	5	0
207	15	67	1.803	5	0
208	67	37	1.803	5	0
209	16	68	1.803	5	0
210	68	38	1.803	5	0
211	17	69	1.803	5	0
212	69	39	1.803	5	0
213	18	70	1.803	5	0
214	70	40	1.803	5	0
215	19	71	1.803	5	0
216	71	41	1.803	5	0
217	20	72	1.803	5	0
218	72	42	1.803	5	0
219	21	73	1.803	5	0
220	73	43	1.803	5	0
221	22	74	1.803	5	0
222	74	44	1.803	5	0
223	64	65	3.000	3	0
224	65	66	3.000	3	0
225	66	67	3.000	3	0
226	67	68	3.000	3	0
227	68	69	3.000	3	0
228	69	70	3.000	3	0
229	70	71	3.000	3	0
230	71	72	3.000	3	0
231	72	73	3.000	3	0

Plates

Plate	Node A	Node B	Node C	Node D	Property
233	1	2	24	23	1
234	2	3	25	24	1

235	3	4	26	25	1
236	4	5	27	26	1
237	5	6	28	27	1
238	6	7	29	28	1
239	7	8	30	29	1
240	8	9	31	30	1
241	9	10	32	31	1
242	10	11	33	32	1

Section Properties

Prop	**Section**	**Area cm^2**	**I_{yy} cm^4**	**I_{zz} cm^4**	**J cm^4**	**Material**
2	ISMC 400	62.9	504.8	15.1E+ 03	32.0	STEEL
3	ISMB 400	78.5	622.0	20.5E +03	47.2	STEEL
4	ISMB 550	132	1.83E+03	64.9E+ 03	115.	STEEL
5	ISA	50.2	2.5E+03	527.557	38.5	STEEL
6	ISWB 600A	184	5.3E+03	116E+ 03	250.	STEEL
7	ISMB 100	14.6	41.00	258.000	2.04	STEEL
8	ISLB 150	18.1	55.00	688.000	2.18	STEEL
9	ISHB 150	34.5	432.0	1.46E+03	7.98	STEEL
10	ISHB 200	47.5	967.0	3.61E+ 03	11.0	STEEL
11	ISHB 225	54.9	1.3 E +03	5.28E +03	13.1	STEEL
12	ISWB150	21.7	95.00	839.000	3.00	STEEL
13	ISHB 150A	39.0	460.0	1.54E +03	9.89	STEEL
14	ISWB 200	36.7	329.0	2.62E+03	8.18	STEEL
15	ISLB 200	25.3	115.0	1.7E+ 03	3.56	STEEL
16	ISJC 150	12.6	37.90	471.000	1.42	STEEL
17	ISLC 75	7.26	11.50	66.100	0.69	STEEL
18	ISHB 350	85.9	2.45E+03	19.2E +03	32.2	STEEL
19	ISHB 450	111	2.98E+03	39.2E+03	56.1	STEEL
20	ISWB 175	28.1	189.0	1.51E +03	4.41	STEEL
21	ISWB 225	43.2	449.0	3.92E+03	11.4	STEEL
22	ISA 55X55X5	5.27	6.166	24.172	0.44	STEEL

Plate Thickness

Prop	**Node A** (cm)	**Node B** (cm)	**Node C** (cm)	**Node D** (cm)	**Material**
1	12.000	12.000	12.000	12.000	Concrete

Materials

Mat	**Name**	**E** (kN/m^2)	**γ**	**Density** (kg/m^3)	**α** (1/°K)
1	STEEL	205.0	0.30	7.83E+3	12E-6
2	ALUMINUM	68.94	0.33	2.71E+3	23E-6
3	CONCRETE	21.71	0.17	2.4E +3	10E-6

Supports

Node	**X** (kN/mm)	**Y** (kN/mm)	**Z** (kN/mm)	$\mathbf{r_x}$ (kN-m/deg)	$\mathbf{r_y}$ (kN-m/deg)	$\mathbf{r_z}$ (kN-m/deg)
45	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
46	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
47	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
48	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
49	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
50	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
51	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
52	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed

Releases
There is no data of this type.

Basic Load Cases

Numb	**Name**
1	EQ X
2	EQ –X
3	EQ Z
4	EQ –Z
5	WL X
6	WL –X
7	WL Z
8	WL –Z
9	DEAD LOAD
10	LIVE LOAD

Combination Load Cases

Comb.	**Combination L/C Name**	**Primary**	**Primary L/C Name**	**tor**
11	1.5 DL + 1.5 LL	9	DEAD LOAD	1.50
		10	LIVE LOAD	1.50

12	DL + 1.5 EQ X	9	DEAD LOAD	1.00
		1	EQ X	1.50
13	DL + 1.5 EQ –X	9	DEAD LOAD	1.00
		2	EQ –X	1.50
14	DL + 1.5 EQ Z	9	DEAD LOAD	1.00
		3	EQ Z	1.50
15	DL + 1.5 EQ –Z	9	DEAD LOAD	1.00
		4	EQ –Z	1.50
16	DL + LL	9	DEAD LOAD	1.00
		10	LIVE LOAD	1.00
17	DL + WL X	9	DEAD LOAD	1.00
		5	WL X	1.50
18	DL + 1.5 WL –X	9	DEAD LOAD	1.00
		6	WL –X	1.50
19	DL + 1.5WL Z	9	DEAD LOAD	1.00
		3	EQ Z	1.50
20	DL + 1.5 WL –Z	9	DEAD LOAD	1.00
		8	WL –Z	1.50

Wind Load Definition: Type 1

Intensity (N/mm^2)	**Height** (m)
N/A	N/A

Seismic Loading: 1 EQ X

Code	**Direction**	**Factor**
	X	1.000

Seismic Loading: 2 EQ –X

Code	**Direction**	**Factor**
	X	-1.000

Seismic Loading: 3 EQ Z

Code	**Direction**	**Factor**
	Z	1.000

Seismic Loading: 4 EQ -Z

Code	Direction	Factor
	Z	-1.000

Wind Loading: 5 WL X

Direction	Type	Factor
X	1	1.000

Wind Loading: 6 WL -X

Direction	Type	Factor
X	1	-1.000

Wind Loading: 7 WL Z

Direction	Type	Factor
Z	1	1.000

Wind Loading: 8 WL -Z

Direction	Type	Factor
Z	1	-1.000

Self Weight: 9 DEAD LOAD

Direction	Factor
Y	-1.000

Floor Loads: 10 LIVE LOAD

Load (N/mm^2)	**Min Ht.** (m)	**Max Ht.** (m)	**Min X** (m)	**Max X** (m)	**Min Y** (m)	**Max Y (m)**
-0.015	0.000	0.000	0.000	30.000	0.000	3.000

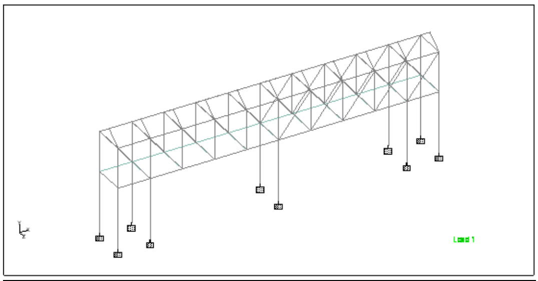

Figure 5: Full Structure of Foot Over Bridge

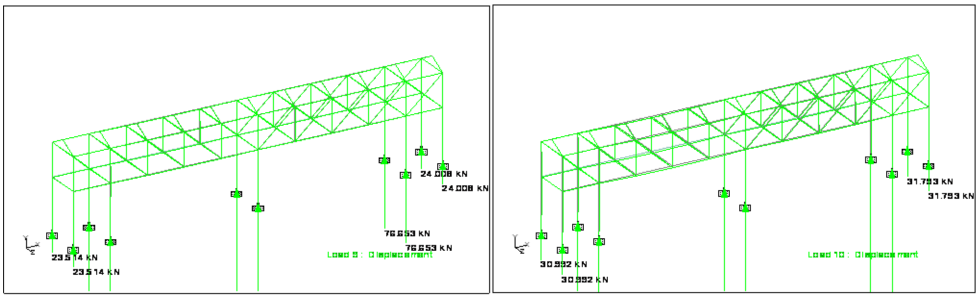

Figure 6: Displacement diagram of Foot Over Bridge for Dead Load and Live

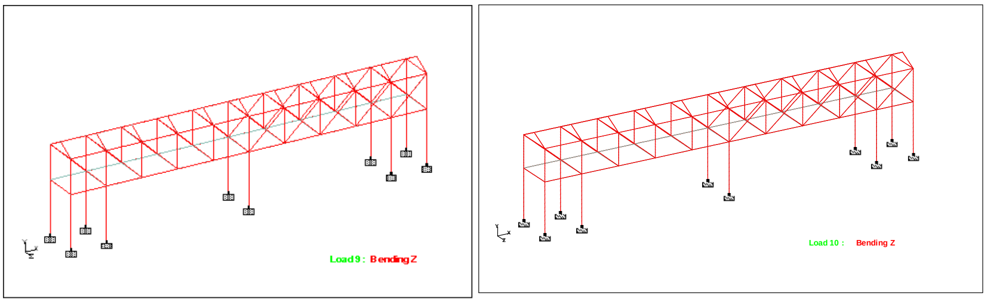

Figure 7: Bending Moment diagram of Foot Over Bridge for Dead Load and Live Load

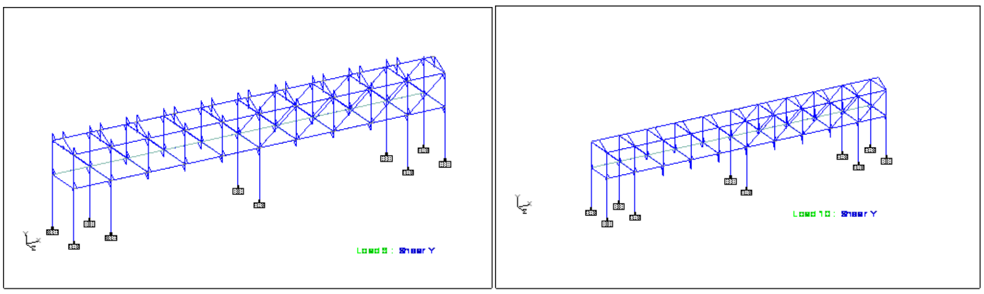

Figure 8: Shear force diagram of Foot Over Bridge for Dead load and Live Load

Cost Estimation of Proposed Foot Over Bridge

Cost Estimation for a Foot Over Bridge of 30 meter span has been done in order to reduce the pedestrian congestion caused by crossing the road. The total cost estimated for the proposal is (1564472) 15 lakhs.

S.No	Profile	Length(M)	Weight(KN)	Cost/Kg	Total Cost
1	ISMB	150	152.218	40	608872
2	ISWB	123.2	174.992	40	699968
3	ISA	180.25	24.108	40	96432
4	ISMB	66	39.8	40	159200
	TOTAL	391.118		1564472	

Layout of the Plan and Elevation of the Foot Over Bridge

The proposed plan and elevation of the Foot over Bridge with structural detailing is shown in Fig. 9 and the dimensions of the Foot Over Bridge (Steel) are given below,

Span of the foot over bridge = 30 m
Width of the foot over bridge = 3 m
Clear height = 5.5 m
Total height = 8 m
Truss height = 1 m
Roof material to be used = 1 mm thick galvanized color coated sheet
Type of Foundation = Pile foundation

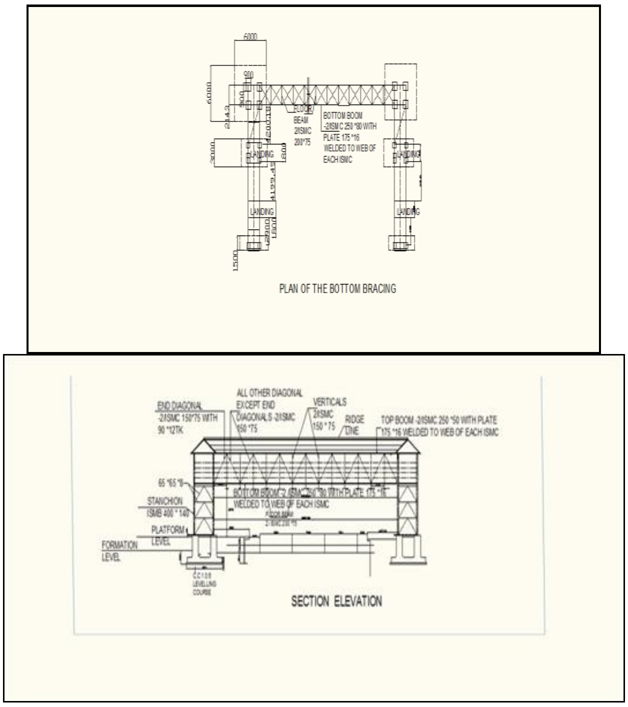

Figure 9: Proposed Plan and Elevation of the Foot Over Bridge

Conclusion

The findings of this research can be an effective tool for Central Station integrated traffic management system. The inhabitants of Central Station would get the highest facilities as well as it might reduce the traffic congestion of surrounding area. As a result of this study traffic conflicts in the area of Central Station will resolved and random parking will come in disciplined area. People will drive smoothly without traffic congestion. As a result of proper management system people will be attractive in this area, so economic benefits will be in good phase.

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