



# A STUDY ON PEDESTRIAN LEVEL OF SERVICE OF SIDEWALKS USING PTV VISWALK

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**ABSTRACT:** Pedestrian level of service (PLOS) is a tool to measure the performance of the facility provided for movement of the pedestrian. Estimation of Pedestrian level of service (PLOS) is the most common approach to assess quality of operations of pedestrian facilities. There is no suitable methodology is available for Indian context where street vendor is a predominant factor, which reduces the mobility and safety of the pedestrian. As per IRC design guidelines the street vendors are excluded from the design for footpath. So far very few studies made regarding integrating street vendors in footpath design guidelines. This study tries to suggest improvement for the existing conditions of footpaths facing worst pedestrian level of service with street vendors. In the present study five types of areas are selected based on their land use namely, residential area, institutional area, commercial area, recreational area and terminal area. One sidewalk is selected in each of the above areas and by using camera mounted on elevated points (roof tops, metro walkways etc...) pedestrians data and vehicle data is recorded over a selected stretch of road and sidewalk, Data analysed and used to make the micro-simulation model of each sidewalk with street vendors in PTV VISWALK software, so that it should be calibrated for the existing condition of a sidewalk and after successful simulations the results are recorded and few proposals are made based on the questionnaire survey of pedestrians and street vendors for improvement in the existing condition, Pedestrian level of service of sidewalk without altering the pedestrian volume on sidewalk in the proposed models.

**Key words:** PLOS, micro simulation in PTV VISWALK, IRC design guidelines and sidewalk.

## I. INTRODUCTION

Population is increasing day by day as it can be seen in many metropolitan cities like Hyderabad that there is considerable rise in traffic and as well as urbanization. This has led to more space covering per each individual as compared to previous year. Concerned authorities concentrating on the core problems like congestion, delay and neglecting the pedestrian traffic which is of great concern in present days. More number of pedestrians can be seen in today's market places and important CBD areas where more amount of traffic is affected due to pedestrians moving around in that particular area. Street vendors are to be given a due concern since they are Encroaching a considerable area of the footpath. Objectives of this work to study the present condition of the pedestrians' facilities having street vendors in different localities like (residential, commercial, etc..), find out the PLOS of the existing condition due to both commuters and vendors in selected stretch and assessing the difficulties faced by both pedestrians, vendors by carrying out the questionnaire survey and suggest some improvement proposals of the existing condition through micro simulation in PTV VISWALK software without altering any flow (pedestrian flow, vehicle volume) in the proposed model.

### 1.1 Need of the study

- In India the major factor influencing the Pedestrian Level of Service of sidewalks is the presence of street vendors occupying the most of sidewalk area affects the pedestrian perception of comfort, convenience & safety over the sidewalks.
- So an improvement proposal is made to make the footpaths more efficient for pedestrian usage by micro-simulation of pedestrians in PTV VISWALK software.

### 1.2 Objectives & Scope of the study

The objectives of the present study are as follows

- To analyse the pedestrian level of service of sidewalks in the presence of street vendors for the existing condition using PTV VISWALK software models.
- To assess the difficulties faced by pedestrians and street vendors from the questionnaire survey data.
- To make sidewalk model proposals and develop proposed models in PTV VISWALK software based on the questionnaire survey data.

The scope of the present study is as follows

- To collect the data from field by Videography technique and questionnaire survey.
- To develop PTV VISWALK model for the chosen sidewalk and calibrate it to the existing condition.
- To assess the difficulties faced by pedestrians and street vendors from the questionnaire survey data.
- To make proposals for the improvement in existing condition, PLOS of sidewalk.
- To develop proposed models in VISWALK and analyse the results after simulation.

## II. LITERATURE REVIEW

Socrates basbas et al, (2020) focussed on the assessment of the section of the pedestrian area located in the centre of the municipality of kalamaria, it is one of the biggest municipalities in the Thessaloniki area, Northern Greece the construction of metro station in this area is likely to increase the pedestrian flow. The main aim of their study is to identify the variations in PLOS as the pedestrian composition and flow change in PTV VISWALK, but the results showed that even tripling of the pedestrian flow will not cause any drop in existing PLOS, except that the bottlenecks are formed at specific locations of the street due to the existence of tables from bars and cafes.

Exa Heydemans, R. Jachrizal Sumabrata (2017) conducted a study to determine the feasibility of the platform in Station Pondok Cina for accommodating the addition of the number of passengers, in this case pedestrian's level of service is a feasibility parameter of the station. The study was conducted by comparing the existing condition of St. Pondok Cina's platform with the future condition in coming years. The future condition is made in simulation model and it is processed by PTV VISWALK software and the results showed that existing station design cannot accommodate the future pedestrians. They developed three models of St. Pondok Cina's platform by considering future pedestrians and found the access in platform affects the space modulus that the model 3 has four accesses in platform have greater value of pedestrian space modulus as compared to model 2 with two accesses and model 1 with one access.

## III. METHODOLOGY & STUDY AREAS

### 3.1 Methodology:

The methodology of the present study is as follows

- Study area selection and data collection through videography and questionnaire survey.
- PLOS determination for sidewalks by considering the street vendors through micro-simulation model in PTV VISWALK by calibrating it to the existing condition.
- making proposal models for Improvement in PLOS, existing condition of sidewalk using PTV VISWALK by adjusting the width of sidewalks and relocation of street vendors.

### 3.2 Study areas:

In this study one sidewalk taken from each of the following areas

1. Residential area-mehdipatnam, 2. Recreational area-NTR Gardens main gate, 3. Terminal area-secunderabad east metro station, 4. Commercial area-sultan bazaar metro station, 5. Institutional area-NCC Gate OU.

### Plans of the sidewalks drawn in AUTOCAD

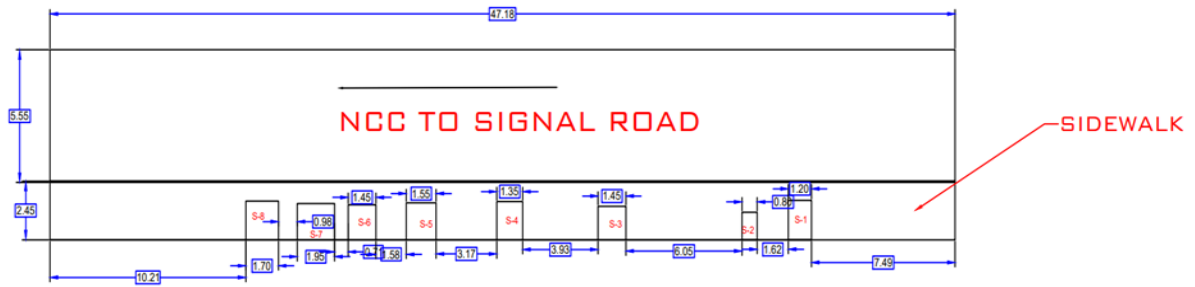


Fig 3.1 NCC Gate OU sidewalk plan view

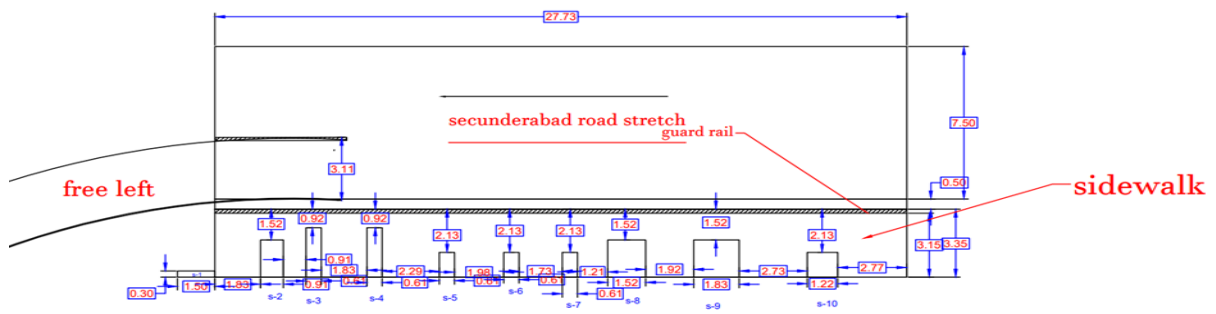


Fig 3.2 Secunderabad east sidewalk plan view

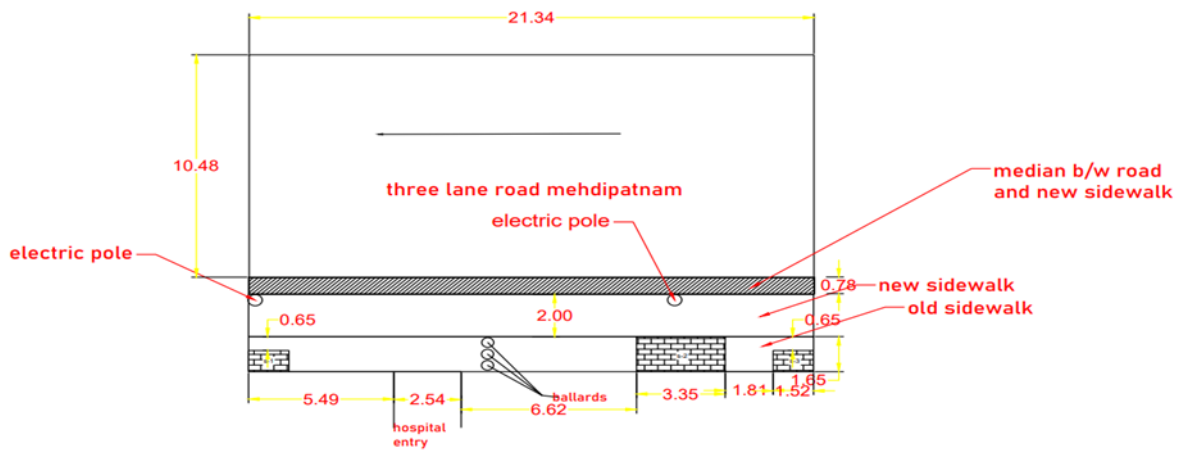


Fig 3.3 Mehdipatnam sidewalk plan view

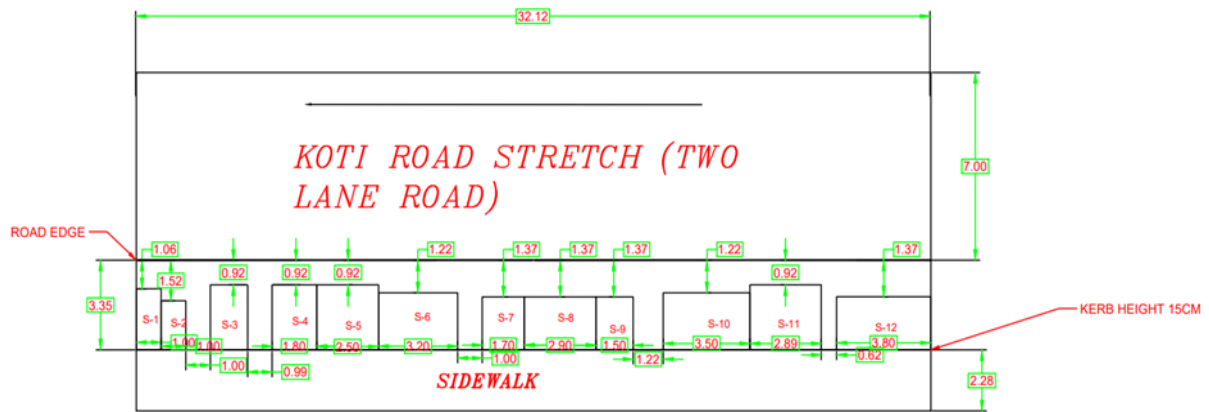


Fig 3.4 Sultan Bazaar metro sidewalk plan view

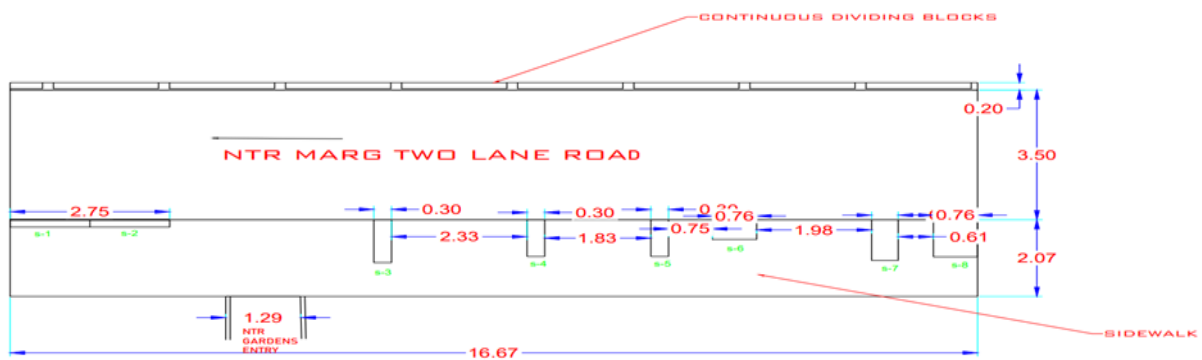


Fig 3.5 NTR Gardens sidewalk plan view (Actual dimensions are double that of above dimensions)

#### IV. DATA COLLECTION & DATA ANALYSIS

Based on the questionnaire survey the following proposals were given to the existing sidewalks.

##### NCC gate OU sidewalk:

Proposal-1: Increase in the width of sidewalk from 2.45m to 4m and diverting the pedestrians from road to footpath in the PTV Viswalk.

Proposal-2: Completely relocating the vendors to another area.

##### Sultan Bazaar Metro Sidewalk:

Proposal-1: In the proposal-1 the street vendors are relocated to footpath, all pedestrians are directed to walk on the width between the road edge and footpath kerb.

Proposal-2: Street vendors are removed from the area and pedestrians allowed to walk on the sidewalk.

##### Mehdipatnam Sidewalk:

Proposal: All pedestrians are directed to walk on new sidewalk.

##### NTR Gardens Sidewalk:

Proposal-1: Street vendors rearranged on the sidewalk.

Proposal-2: Street vendors removed from the sidewalk.

##### Secunderabad east metro station sidewalk:

Proposal: Secunderabad Sidewalk free from street vending activities.

The following figure showing the interface of viswalk software, its tools and pedestrian facility details.

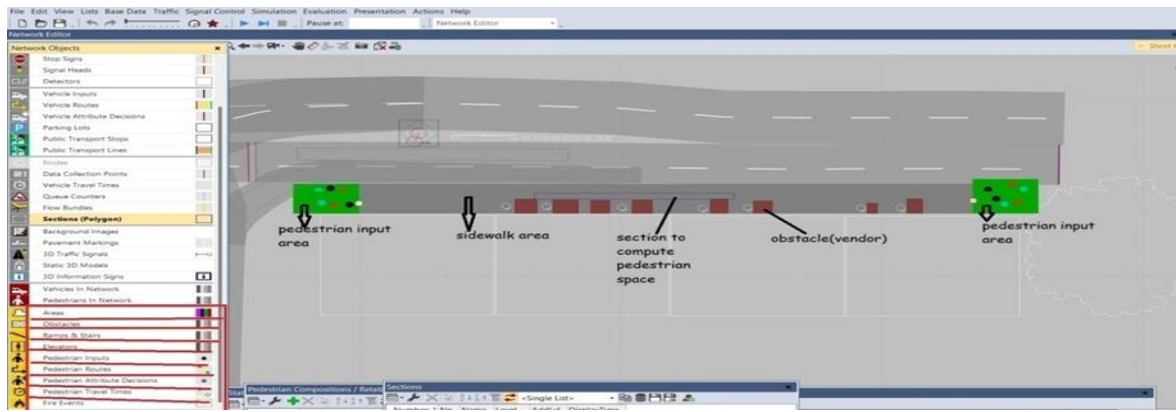


Fig 4.1 interface of viswalk software, its tools and pedestrian facility details

## V. RESULTS AND DISCUSSIONS

Table 5.1 showing the pedestrian density, pedestrian speed, nearest neighbour distance of the developed sidewalk models in PTV Viswalk

Location	Condition	Pedestrian speed in 'm/min'	Pedestrian density 'ped/m <sup>2</sup> '	Nearest neighbor distance in 'm'
NCC GATE OU	Existing	54.76	0.575	0.925
	Proposal-1	53.71	0.105	1.145
	Proposal-2	57.23	0.27	1.27
Secunderabad east metro	Existing	39.75	0.805	0.75
	Proposal	48.92	0.205	1.145
Mehdipatnam	Existing	65.02	0.15	1.14
	Proposal	64.617	0.17	1.135
Sultan bazaar metro	Existing	50.325	0.20	1.05
	Proposal-1	51.88	0.145	1.175
	Proposal-2	49.94	0.21	1.015
NTR Gardens	Existing	53.68	0.245	1.155
	Proposal-1	53.81	0.15	1.185
	Proposal-2	55.49	0.11	1.29

Pedestrian density comparison of Secunderabad East metro sidewalk models

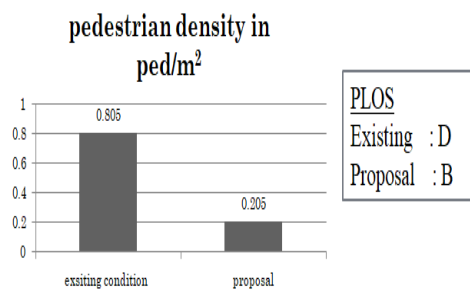


Fig 5.1 pedestrian density at Secunderabad east metro sidewalk

Pedestrian density comparison of Sultan Bazaar metro sidewalk models

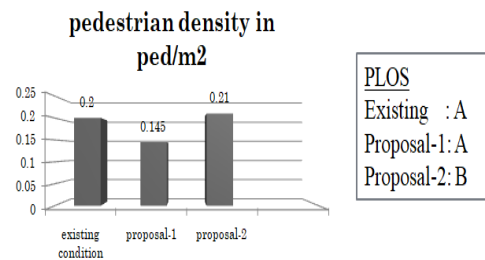


Fig 5.2 pedestrian density at Sultan Bazaar metro sidewalk

Pedestrian density comparison of NTR Gardens sidewalk models

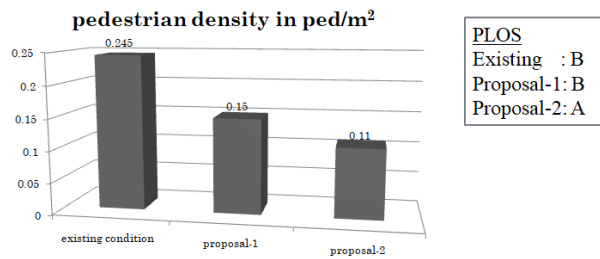


Fig 5.3 pedestrian density at NTR Gardens sidewalk

Pedestrian density comparison of Mehdiapatnam sidewalk models

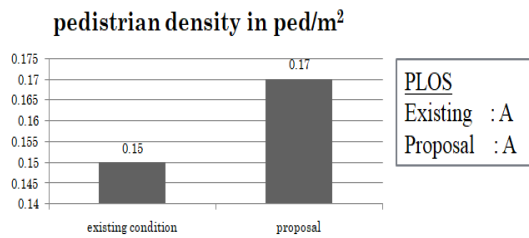


Fig 5.4 pedestrian density at Mehdiapatnam sidewalk

Pedestrian density comparison of NCC gate OU sidewalk models

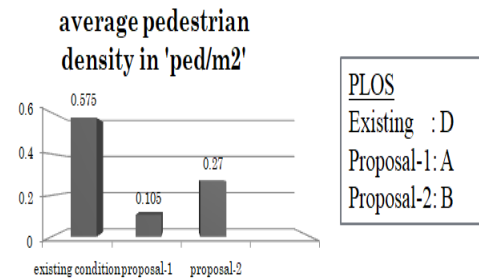


Fig 5.5 pedestrian density at NCC Gate OU sidewalk

Table 5.2 showing the PLOS based on pedestrian space before and after proposals of the Hyderabad city sidewalks considering the Indo HCM 2017 guidelines

CONCLUSIONS:

Areas of study & its sidewalk	Sidewalk models	PLOS based on pedestrian space	Description of sidewalk
Residential (mehdiapatnam Sidewalk)	Existing Condition	A	Around 2.04m of outer lane is occupied by pedestrians and 85% of pedestrians are walking on that width
	proposal	A	All the pedestrians are directed to walk on new sidewalk
Commercial (sultan bazaar metro sidewalk)	Existing condition	A	Pedestrians walking on the space between the outer lane, kerb (street vendors are there in that space) and on 1.53m lane width
	Proposal-1	A	All the street vendors relocated to sidewalk and pedestrians walking on that shoulder width
	Proposal-2	B	All pedestrians walking on sidewalk (no vendors on sidewalk)
Institutional (NCC gate OU sidewalk)	Existing condition	D	1.02m of road width is allocated for pedestrians' activity which is observed from video footage
	Proposal-1	A	Width of the sidewalk increased from 2.45m to 4m All pedestrians enrouted to the sidewalk
	Proposal-2	B	All street vendors are relocated from sidewalk area
Recreational (NTR gardens sidewalk)	Existing condition	B	All street vendors, trees are considered in the model
	Proposal-1	A	Street vendors position changed on the sidewalk which is away from the NTR gardens entrance
	Proposal-2	A	Street vendors are completely removed from the sidewalk area.
Terminal (Secunderabad sidewalk)	Existing condition	D	All pedestrians are directed to walk on the sidewalk in the developed model
	Proposal	B	Complete removal of street vendors from the sidewalk

➤ Institutional area (NCC gate sidewalk): in the existing site condition the PLOS of the sidewalk from pedestrian space is 'D' and all pedestrians are strictly directed to walk on the sidewalk in the two proposals of the sidewalk, in proposal-1 the sidewalk width is increased from 2.45m to 4m then the PLOS from pedestrian space is 'A' and in proposal-2 the width of sidewalk is remained as 2.45m without any street vendors on it then its PLOS from pedestrian space is 'B'. Average delay for vehicle, queue lengths on the

road stretch after proposal-1 are reduced to some extent and vehicle journey speed on the road after proposal-1 is also improved.

- Commercial area (Sultan bazaar metro sidewalk): in the existing condition pedestrians are walking on the lane and shoulder then PLOS of shoulder form pedestrian space is 'A', in proposal-1 all the street vendors are relocated to sidewalk and all the pedestrians walking on the shoulder then the PLOS from pedestrian space is 'A', in proposal-2 all the street vendors are removed from the sidewalk and all the Pedestrians are directed to walk on the sidewalk then the PLOS from pedestrian space is 'B'. After proposal-1 Average delay for the vehicle in the network reduces, vehicle travel speed on the selected stretch of the road is increases and also vehicle density decreases in that selected stretch of road.
- Terminal area (Secunderabad east sidewalk): in the existing condition it is very difficult to assess the lane width occupancy by pedestrians so all the pedestrians are routed on to the sidewalk then the PLOS from the pedestrian space is 'D', in proposed model all the street vendors are removed from the sidewalk and direct the pedestrians to walk on it then the PLOS from pedestrian space is 'B'.
- Residential area (Mehdipatnam sidewalk): Around 85% of pedestrians are walking on the 2.04m lane width then the PLOS of that width from pedestrian space is 'A'. in proposed condition all the pedestrians are routed on to the new sidewalk then the PLOS of the new sidewalk from the pedestrian space is 'A'. After proposal-1 the vehicle density on the road stretch decreases, vehicle travel speed increases and average delay for the vehicle on the road stretch reduces.
- Recreational area (NTR gardens sidewalk): in the existing condition all the pedestrians are walking on the encroached sidewalk then the PLOS from pedestrian space is 'B', in proposal-1 all the street vendors are rearranged on the sidewalk which is away from the NTR gardens entry gate then the PLOS of sidewalk from pedestrian space is 'A' and proposal-2 the street vendors completely removed from the sidewalk then the PLOS of sidewalk from pedestrian space is 'A'.
- Nearest neighbor distance in the section depends on the pedestrian density in that section i.e. The NND is inversely related to the pedestrian density.
- Pedestrian journey speed fluctuates due to the presence of obstructions in their movement because pedestrian covers more length on the selected stretch in between its two ends due to the shy distance from the obstacles.
- Pedestrian density increases at the Bottleneck of sidewalks as there is a less walk able space for pedestrians to travel through it.
- The Pedestrians occupied road Width is exclusively allocated for them so the speed of vehicles on the remaining width is affected due to inadequacy in the road width for their movement.
- Inadequate Road Width also leads to increase in Queue Length, increase in Queue Delay for the vehicles in front of a traffic signal and increases the vehicle density.
- The service quality of sidewalks is approximated as moderate for NCC Gate OU sidewalk, moderate for sultan bazaar metro sidewalk, poor for secunderabad east metro sidewalk, very poor for Mehdipatnam old sidewalk and good for NTR Gardens sidewalk from the questionnaire survey data.

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