

IMPACT OF THE AUTOMOBILE ON PUBLIC STREET PERFORMANCE WITH SPECIAL REFERENCE TO THE MAIN THOROUGHFARE OF MATARA TOWNSHIP

Lakana, Kinipul * , Janaka, Wijesundara
University of Moratuwa, Katubedda, Sri Lanka

Abstract

Vehicle domination in streets has deteriorated the public realm depriving people their once democratic, safe public space with a prolific diversity of functions and applications. Spatial limitations, environmental pollution and safety hazards are on a rise mainly in developing countries that are blindfolded with economic development as the priority but not the human well-being. Even in Sri Lanka, more commercialized townships such as Matara are undergoing the complexities of excess vehicular eco-system. Relevantly, this research attempts to assess the severity of traffic and traffic prioritized street design towards the pedestrian/ public performance on streets under physical/ sensory, environmental and safety related parameters.

By defining an applicable analytical criterion in the literature review based on prominent scholarly findings on the subject, the research investigates effects and magnitudes of traffic and related street design errors against the public performance on the main thoroughfare of Matara township under three different functional facets. The analysis is primarily fed with researcher's observational information which are complimented and validated by third person (users) input with help of viable analytical tools/ techniques.

Findings of the research ascertain the crucial flaws of city's existing street design that are rather biased towards mere vehicular activity instead of the public. Ability of comparative analysis helps to define variation of magnitude and nature of the impact on each criterion assessed, related to the three case study scenarios. The study probes a familiar, yet underrated spatial planning dilemma into sophisticated depths and intends to support associated studies in the future

Keywords: automobile domination, human dimension, street function, pedestrian performance, urban thoroughfare, public place

* Corresponding Author: Lakana Kinipul; E-mail- revver94@gmail.com

1. Introduction

Designing urbanities along the evolution of human spatial planning always prioritized people as its primary consumer. It has been the practice to shape our cities to best merge people with nature and to achieve social, cultural and economic wellbeing. Urban designers and city planners bring together architecture, public space, sustainability, social equity, transportation and other aspects of city life to create a space that consciously addresses each issue. With the time, numerous subjects/ elements got involved in urban design, promising convenience and betterment for people however, most of them have only turned against people causing adversities to the natural order of human existence.

Ever since its invention, the automobile/ vehicle has become a fundamental possession and transportation mode of people. Like the humans themselves, automobiles demanded space for functionality, shelter, production and maintenance. Thus, it has become a crucial determinant of space from the household car shelter, through massive highways to vast production facilities. Generating almost every architecture and town planning requires careful consideration to the automobile activity and for decades it has defined the townships spatially, socially and environmentally. Despite advanced city planning strategies however, the exponential growth of the number of cars on streets has now turned against the city's primary user- people.

Matara being one of the most prominent and characterized trade hubs in the Southern Province, features a composition of both formal and informal vending cultures that cater to thousands of people from all corners, on a daily basis. The main thoroughfare that enables access to all such trade spaces as well as public and transitory spaces are prioritized to the pedestrian activity in both day and night times. However, with the increasing vehicular activity in both static and dynamic forms as well as related urban design interventions, it can be observed critical threats to the natural order of functionality in such streetscapes with interference to the spontaneous pedestrian activity.

The research is based upon an urban design- architecture common ground to assess a particular spatial adversity and its influence to humans within a critical day-to-day scenario of the collision of human and automobile realms to ascertain equity on streets. The study is conducted being supportive to the pedestrian to assert the downsides of car-centric orthodox street planning interventions. The main research objective is to understand how the automobile and traffic-oriented street design is depreciating the public performance on streets under a set of criteria developed with association to prominent scholarly work written on "good streets/ street designs". Associated with a local case study, the research discusses the negative effects of vehicles under several fundamental criteria within a selected local thoroughfare.

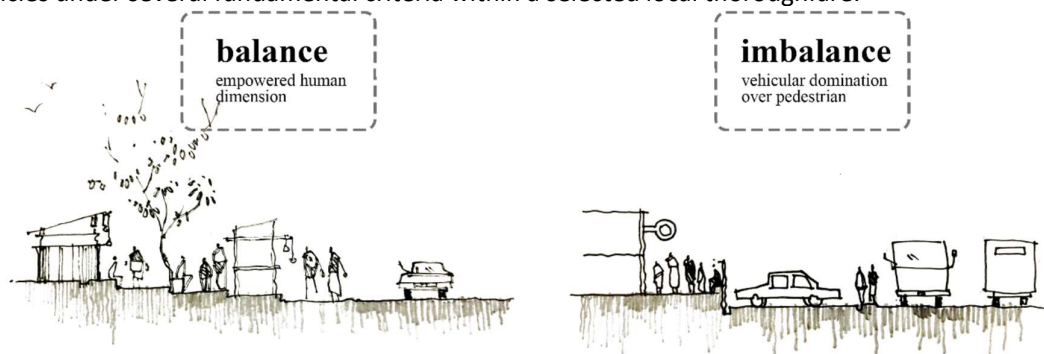


Figure 1: Automobile domination over human dimension of streets
Source- Author

2. Literature Review

2.1 Street as a public space

“Throughout the history of cities, successful urban development has not been possible without an organized physical layout and a system of street interconnectivity within cities”(Harirchian et al., 2018). Since ancient times, streets have played a critical role in cities, connecting spaces, people and goods, and thereby facilitating commerce, social interaction and mobility.

The concept of linear path is recognized by people as streets, in the built urban context where order has taken prominence. Kevin Lynch in his work mentions streets as a fundamental element in the city as a composition. The street is described by (Kamel et al., 2017)(as stated by Kostof (1992)) as “the only legitimacy of the street is as public space. Without it, there is no city”. More than any other part of a city, a street accommodates public with no restriction upon social status of users, intended function or tie of the day. Thus, it is the keystone of assuring publicness in a city.

2.2 Street and the human dimension

Human dimension on a general point of view, is the realm where the human being and only the aspects viable to him become the dominant elements. As mentioned by Harirchian et al. (2018) all from personal spaces to public spaces since the early times of the human evolution, had been spontaneously oriented on the priority to human beings that affected their physical and psychological well-being. Kamel et al. (2017) state that it was one of the drive forces which resulted in humans achieving the quality and advancement in terms of social, cultural and economic premises. However, seemingly with their own misconduct, the human dimension is being exposed to severe threats in the recent past, resulting in rather ‘non-human’ elements snatching the priority from the people.

Nieuwenhuijsen & Khreis (2017) assert that prioritizing the human dimension in city planning is a viable strategy of empowering the spaces for people. Regarded to all elements of a city, crucially the streets should be constructed or modified to function as a pedestrian prioritized, public activity rich, multi-faceted entity. Assurance of aforesaid lively, safe, sustainable and healthy city approaches in the planning stages themselves can cut enormous costs from healthcare, pollution mitigation and automobile infrastructure.

The conventional pattern of streets and city systems changed entirely with the emergence of modernism. Harirchian et al. (2018) describe that the street was a corridor for the Modernists to travel from A to B, and city life was not an important part of it. Indeed, with the emergence of modernism, streets have moved from a place of life to a place of mobility. It is obvious in Le Corbusier's designs that he has proposed a complex of buildings, open spaces and a new form of street in his own “Contemporary City” plan that was prepared in 1922. This new form of road was an instrument for the movement of motor vehicles and was designed strictly for private cars, without taking into consideration the use of pedestrians and property. In the early decades of the 20th century, this pattern culminated in the degradation of streets and the consumption of a great deal of land and resources to create highways.

2.3 Automobile and street- the past, present and future

Designing streets has been carried out predominantly by transport planning engineers in recent decades. As stated by Nieuwenhuijsen & Khreis (2017), by increasing the number and width of the lanes, reducing on-street parking spaces and decreasing the spaces of the sidewalks, they empower convenience for traffic passage in streets thus, being known as the main street designers. Kürkçüoğluve Ocağcı (2015) compliment the aforementioned, the protection of people could not be assured by these streets that were built to facilitate the movement and high speed of cars. However, with the interventions of sophisticated personnel such as Jane Jacobs and Jan Gehl, the so called “modernist street planning” ventures were taken into criticism and people who foresaw the adversities of the automobile domination in the streets began to demand the priority back to the pedestrian.

According to Gehl (2010), car traffic has been a pressing urban planning problem for more than 50 years. The introduction of cars and car traffic has been decisive in creating confusion about scale and dimensions in cities. He also states that urban planning intervention across the globe are rarely responsive to car scale and human scale as two distinctive realms because cars have already delivered severe confusions in understanding urban scale.

2.4 Adversities of vehicle domination in streets

NACTO (2013) asserts that on the contrary to the developed urbanities and their urban interventions to mitigate traffic activity, developing countries find it rather difficult to implement similar strategies due to their higher dependability upon the automobile and the poor economic affordability to retrofit the infrastructure in a public- dominant manner. Therefore, such cities vastly struggle with the traffic hazard and the number of cars added to the arterial network is also consistent. As mentioned by Nieuwenhuijsen & Khreis (2017) under the existing scenario, the global traffic mass exceeds two billion units by 2030. The severity of this growth of vehicles appears with environmental hazards due to pollution, safety hazards due to traffic collisions, automobile-oriented infrastructural development and public health related complications. Campbell et al. (2004) in their findings show that, in addition to the policy making criteria, governments have to feed the public with motives and transform their mindset to perceive the unpleasant futures their coming generations would inherit if no change is made in their actions. Unless restricted in considerable masses or public transportation is not promoted, the cities would undergo far worse socio-economic vulnerabilities that are difficult to recover.

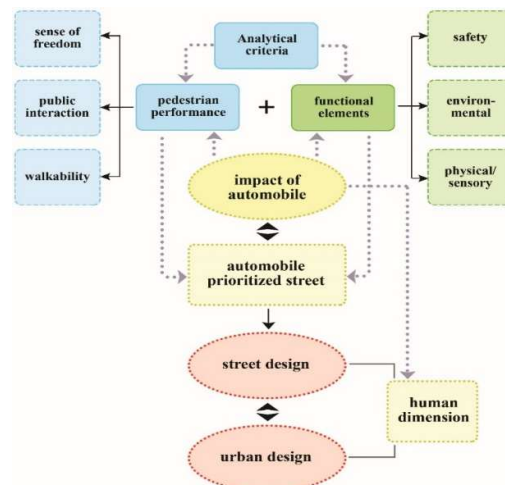


Figure 2: Distribution of adversities in analytical criteria
 Source- Author

3. Research Methodology

3.1 Developing the Theoretical framework

Upon the inception of research methodology, a pragmatic theoretical framework is built to explore the relevant case studies into depths. The framework is assisted with a set of fundamental philosophies that are associated with the street context. It would be a preliminary justification and an affirmation of the validity of criteria under which the cases are going to be analysed.

For the generation of theoretical framework, following literature works are involved.

1. Allan B. Jacobs- *Great Streets*
2. Victor Dover, John Massengale- *Street Design- The Secret to Great Cities and Towns*
3. National Association of City Transportation Officials (NACTO)- *Urban Street Design Guide*

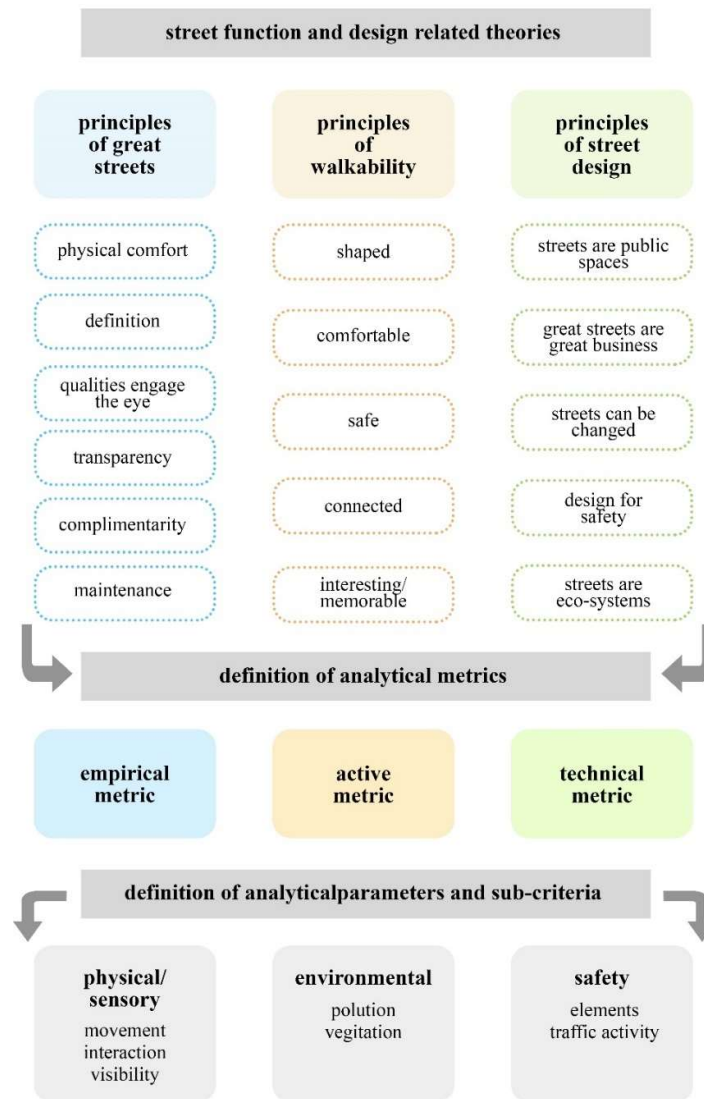


Figure 4: Deriving analytical parameters through literature
 Source- Author

3.2 Establishing analytical criteria

The generated theoretical framework for the design is based on the impact of automobile to the pedestrian/ public in terms of the criteria which were developed focusing on requirements and principles brought in the above three scholarly works. In the analytical review part of the dissertation, it is studied the ways that automobiles are interfering the design along with functionality and definitively the order of the street.

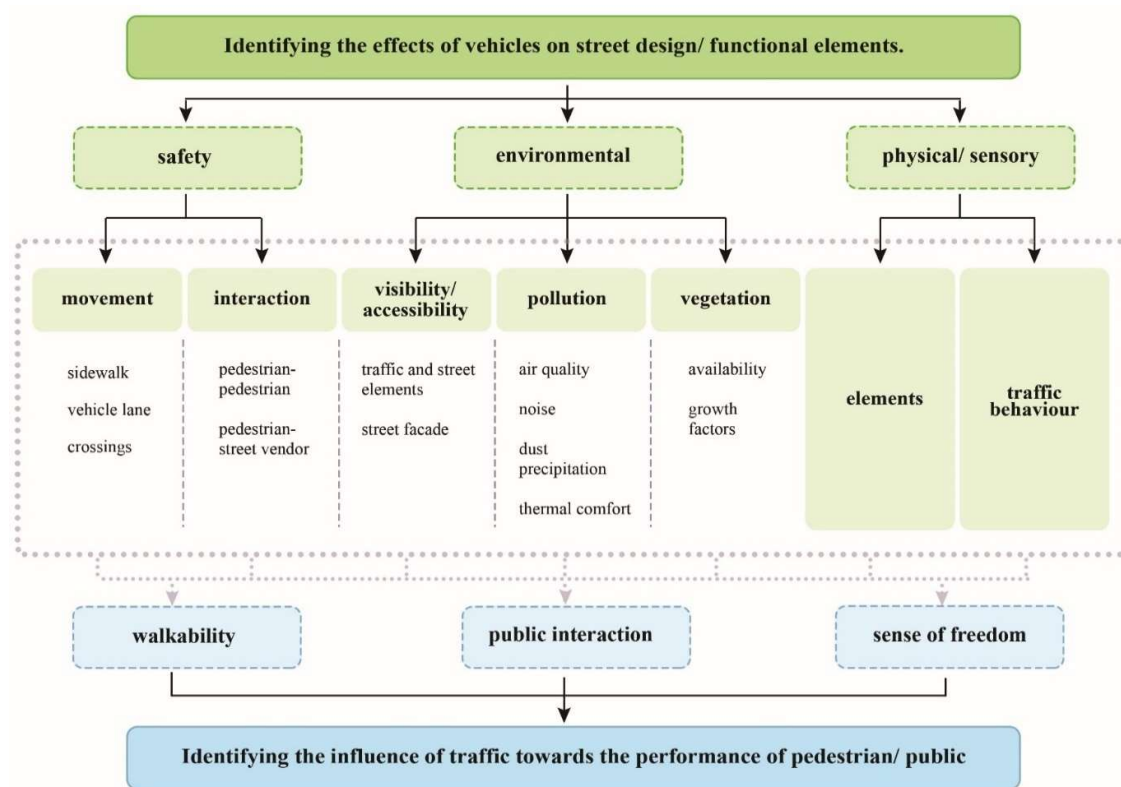
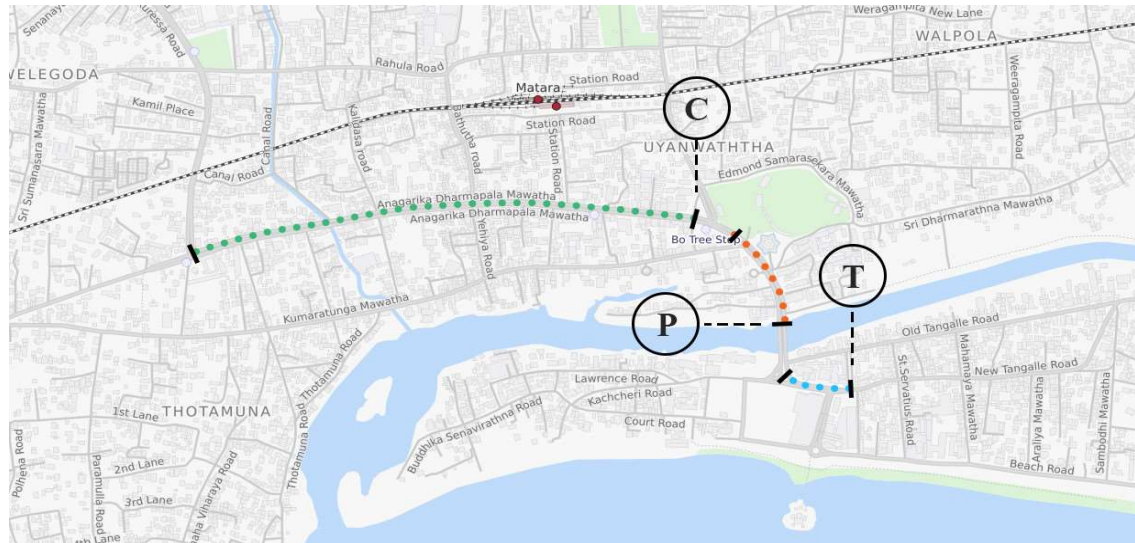


Figure 5: Deriving sub- analytical criteria for analyses
 Source- Author

3.3 Study Area

Matara being a rapidly developing township, bears reputation as the most prominent service and business hub in the Southern Province accommodating an enormous daily influx of people during the day. Later additions and alterations to the city's thoroughfare network such as the Nilwala By-pass has significantly achieved ribbon development on economic grounds. Even though how prominent the pedestrian activity is related to these commercial and service spaces, the thoroughfare itself has become a severity to its public activity with heavier circulation of traffic flowing across the city. Recent urban developments have seemingly cared only towards containing more vehicles on the roadway, instead of the comforts of public. The day-by-day expansion of public/ pedestrian activity in the city is bottlenecked due to vehicular invasion of the urban thoroughfare.



T- Transitory Passage P- Public Passage C- Commercial Passage

Figure 6: Selected passages in Matarara main thoroughfare
Source- Author

T- Transitory Passage

Progressing through the thoroughfare towards Colombo side, transitory passage from the Old Market Road Junction to the roundabout was selected as the first case of the study. The reason for naming this passage as Transitory Passage is its characterization as a prominent transit node of the city with Matarara bus stand being located on one side and on the opposite being the major bus stop for the Wellawaya side passengers. Technically it is the drop-off point for all town visitors, hence the pedestrian activity specially in terms of the transit users are significantly greater.

P- Public Passage

Definition of Public Passage comes with its availability of numerous significant public spaces within the city centre. Beginning from the upper bank of Nilwala River (end of the bridge) and running up to the sacred Matarara Bo Tree, this passage houses to several prominent public buildings and intersections which are all-time public hotspots. Upper end of this passage which is the Matarara Bo Tree demarcates entrance to the commercialized city centre which is of a different characterization. However, the passage is often occupied by ample pedestrians and is a transitional passage in between the Transitory and Commercial Passages.

C- Commercial Passage

The central part of the city is characterized to be heavily commercialized especially due to the ribbon development achieved on the either side of the thoroughfare. Accordingly, the third case of the study was termed as the Commercial Passage. the street facade predominantly consists of business and service-oriented spaces of private sector. Renowned shopping malls and shopping streets such as Kalidasa Road attracts thousands of people on a daily basis. The passage also gives access to private educational institutes that contributes to a significant fraction of the daily pedestrian activity of the city. Both sides of the thoroughfare are identically exposed to

commercial development with numerous intersections to other prominent parts of the city are given.

4. Analysis

4.1 Influence of traffic towards the performance of the pedestrian/ public

Questionnaire (snowball sampling method from 35 participants) and semi-structured interviews (8 participants) were assisted to assess this rather subjective matter. Responses for the questionnaire was collected under a point system and the results of questionnaire analysis is brought under point distribution of mean values for each situation/ factor assessed. For ease of comparison, points for all three cases are evaluated complimentary.

Firstly, it is represented the extents that responders believe, a set of situations regarded to narrowed sidewalks and widened traffic lanes have impacted the preferable pedestrian performance in each case. Responses are graded on a scale of 0-5 where 0 is not relevant at all and 5 is extremely relevant.

Narrow sidewalk

- Pedestrian congestion in peak times
- Lack of street elements such as seating and shades.
- Lack of vegetation
- Lack of hotspots for pedestrian interaction
- Lack of street vendors and informal shops

	Transitory passage	Public passage	Commercial passage
Pedestrian congestion in peak times	4.2	3.8	3.9
Lack of street elements such as seating and shades.	4.1	4.2	4.3
Lack of vegetation	3.7	4.1	4.5
Lack of hotspots for pedestrian interaction	3.9	3.9	4.5
Lack of street vendors and informal shops	3.8	3.8	3.6

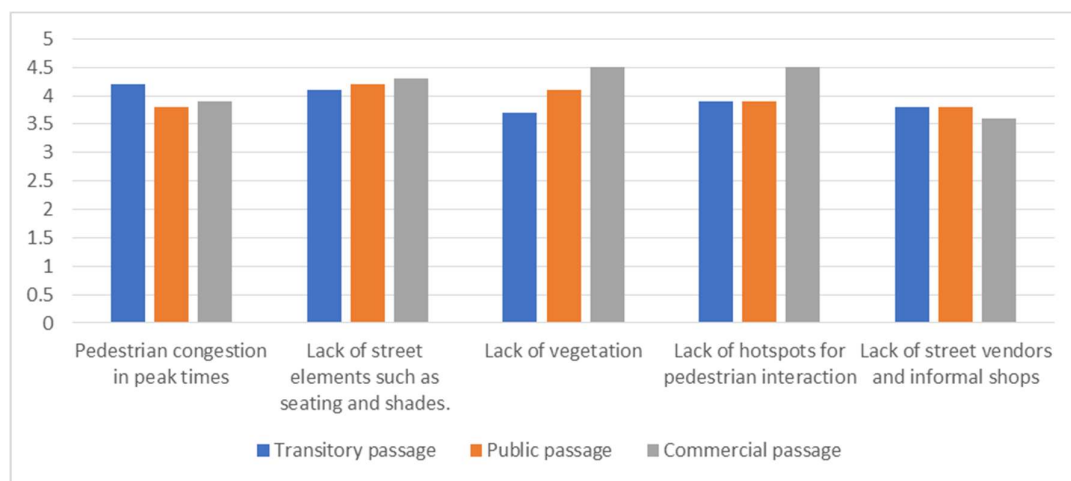


Figure 7: Point distribution- narrow sidewalk
 Source- Author

According to prior observations done on the city's street condition, inadequate width allocated for sidewalk was affirmed for deprivation of certain crucial aspects such as greenery and street amenities. Out of the three passages, the most congestion was identified in transitory passage due to the greater number of transportation users in peak times. Lack of shade and street furniture was a common problem stated for all three passages. The amount of vegetation was not affirmed as adequate however the problem was minimally observed in the transitory passage. Due to the formal development of business spaces, the commercial passage generically was asserted to be the lowest to have street vendor activity and vendor-pedestrian interaction. Higher points given by responders well affirmed the inadequacy of sidewalk space that has led public street performance into a lower standard.

Wider traffic lanes

	Transitory passage	Public passage	Commercial passage
High speed traffic	3.9	4.2	4.2
Higher traffic volume	4.0	3.6	4.1
Careless driving	4.1	4.2	4.1
Difficulty to cross the road	3.9	4.1	4.0
On-street parking blocking the sidewalks	2.1	2.8	4.2

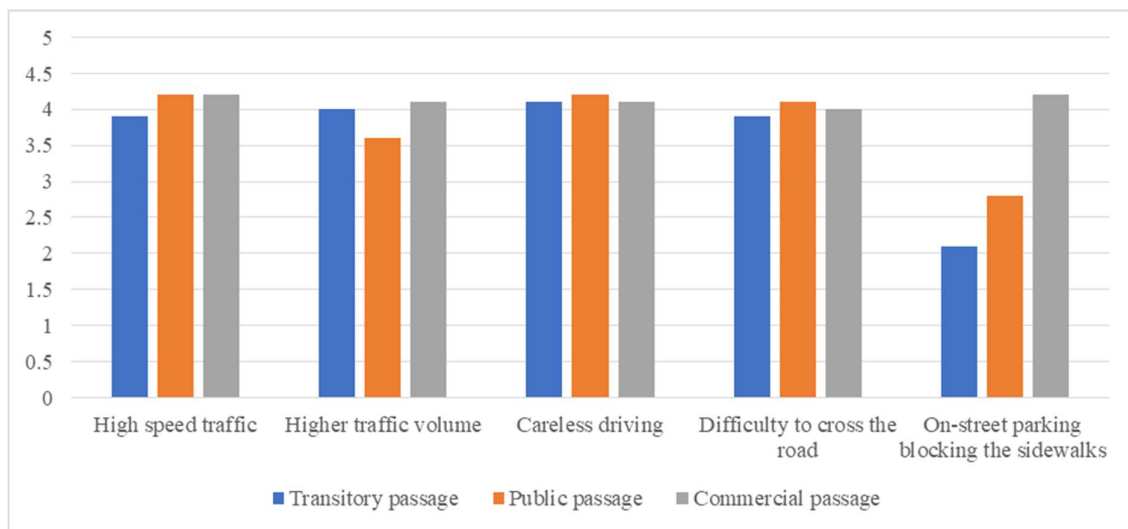


Figure 8: Point distribution- wider traffic lanes
 Source- Author

Width of traffic lane has the ability to control traffic behaviour drastically such that more width results in more vigorous activity and vice versa. As experienced by responders, high speed traffic can be noticed well in the commercial and public passages due to their spacious, uninterrupted lanes. Higher traffic volume is lower in the public passage due to the lesser interrupted traffic lanes, nevertheless this could change specially in active hours of hospital. Reckless driving is mainly by the three-wheeler and motorcycle riders which has become an obvious scenario in the thoroughfare. Greater width of the complete road being highest in several spots of the public lane as well as the inadequacy of pedestrian crossings has made it the most difficult to cross. Blockage of pedestrian sidewalk is greatest in the commercial passage due to parking being

misused specially by motorcycles and three-wheelers. Additionally, it was assessed the responders' own experiences, how severe have they experienced any physical discomforts or health related problems due to the follow mentioned conditions in the thoroughfare. Similar to the previous session, responses are graded on a scale of 0-5 where 0 is not relevant at all and 5 is extremely relevant.

Physical discomforts

	Transitory passage	Public passage	Commercial passage
Poor air quality (exhaust gases, odours)	4.2	3.8	3.9
Dust and soot precipitation	4.3	4.1	4.0
Intolerable vehicle sounds	3.7	4.1	4.5
High heat from vehicles	3.9	3.9	4.5
Glare by reflective surfaces of vehicles	3.8	3.8	3.8

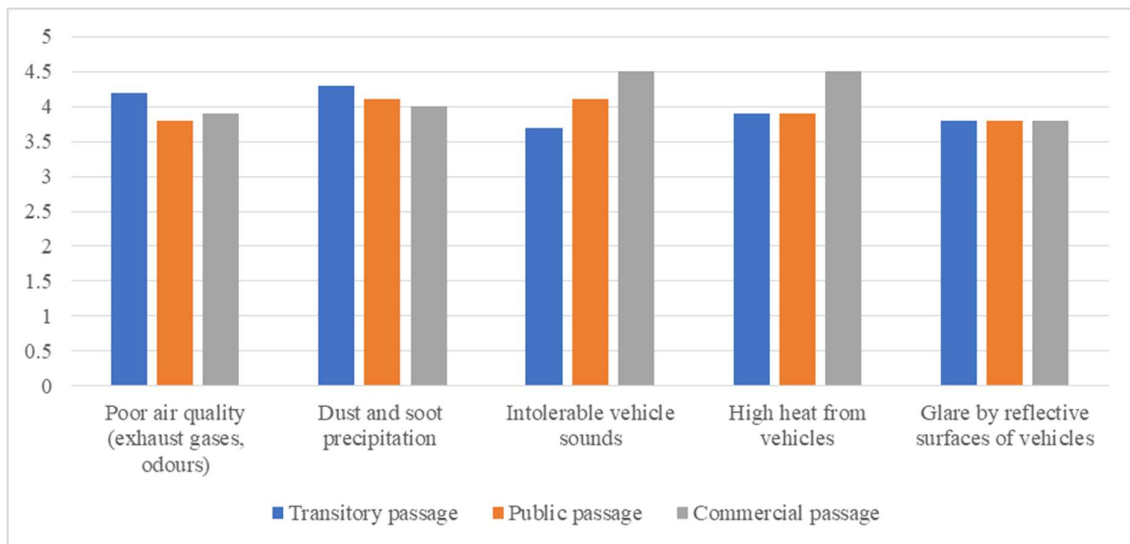


Figure 9: Point distribution- physical discomforts
 Source- Author

The severity score for poor air quality was highest in the transitory passage, perceptibly due to the presence of both transitory vehicles and ordinary vehicular traffic. Buses being parked along the sidewalk to a considerable distance and pedestrian exposure to their exhaust gases as well as transitory users staying there for considerable periods could be assumed as the reasons. Dust and soot precipitation scenario is also similar to the causes of poor air quality. The most noise pollution is reported to be found in the business passage assumably due to longer traffic blockages. Unrestricted honking and idle sounds of engines can be the probable causes. It is difficult to exactly distinguish the harsh roadside temperatures from vehicular heat transfer due to overall thermal radiation of the setting. Nevertheless, the commercial passage was scored to contain the highest thermal discomfort by the responders. Glare caused by reflective vehicular surfaces were equally scored upon experience of the responders. However, it could be assumed that availability of shade in the transitory passage mitigates the discomfort of glare to an extent.

Overview of Public Reviews

Table 7: Public review (semi-structured interviews)

Transitory passage	Public passage	Commercial passage
Congestion on the sidewalk		
<ul style="list-style-type: none"> • Peak time congestion 	<ul style="list-style-type: none"> • Peak time congestion • Prone to accidents 	<ul style="list-style-type: none"> • Congested in new year/ festive seasons
Scale of the road and crossing		
<ul style="list-style-type: none"> • Insufficient number of crossings 	<ul style="list-style-type: none"> • Wide road • People crossing at random places. 	<ul style="list-style-type: none"> • Crossing is manageable • Traffic blocks the crossing
Public interaction on the sidewalk		
<ul style="list-style-type: none"> • Lack of pedestrian interactive spots • Regular vendors. 	<ul style="list-style-type: none"> • Presence of some pedestrian interactive spots • Regular vendors. at some places 	<ul style="list-style-type: none"> • Public interaction is prominent in festive seasons.
Visual linkage and accessibility between pedestrian- traffic- street elements- façade		
<ul style="list-style-type: none"> • Poor signage • Visual interference by buses 	<ul style="list-style-type: none"> • Visual interference by road traffic 	<ul style="list-style-type: none"> • Unregulated parking • Unloading vehicles obstructing the sidewalk
Environmental factors and physical comforts		
<ul style="list-style-type: none"> • Air polluted with smoke and dust • Higher noise • Lower thermal comfort 	<ul style="list-style-type: none"> • Glare from vehicles • Lower thermal comfort • Vegetation to some extent 	<ul style="list-style-type: none"> • Lower thermal comfort • Threat on vegetation growth
Road safety of passengers		
<ul style="list-style-type: none"> • Absence of speed breakers • Inadequate gap between road and sidewalk • Highly likely for traffic hits on pedestrians 	<ul style="list-style-type: none"> • Careless drivers • Need of a proper automated crossing. 	<ul style="list-style-type: none"> • Comparatively safe crossing • Inadequate gap between road and sidewalk

The most prominent part of the quantitative analysis is the semi- structured interview due to its non-restricted coverage of inquiry area related to the effects of traffic and related street design to the public activity on streets. Even though it was not formally held, preliminary sessions of interviews held on research development stages validated the research position and assisted to build the very criteria which was employed in observational analysis, on the previous section. Regardless of its lack of technical structure as in other research techniques, the information gained from these interviews consolidated the findings and assertions of previous analyses. For ease of reference, each criterion has been overviewed by author.

4.2 Discussion

Under the observational, questionnaire and interview analyses it could be identified the impact of automobile to the human dimension of streets being two-fold as initially brought out in the methodology chapter. Fundamental criteria of inquiry were employed in the observational analysis where most of the applicable aspects of direct and indirect vehicular impact to the pedestrians was assessed. Likely the questionnaire and interview analyses were made slight adjustments to fit into the third persons' addressable scope. However, the three analyses could altogether moderate the research findings as follows.

When overviewing vehicular impact to the street design and elements, even though inadequate sidewalk for both pedestrian and vending activities are common in all three passages, it is manageable to an extent in the commercial passage due to it being lately constructed addressing arguably perceptive planning. Complimentarily, passages have been deprived with street amenities such as interactive waiting and gathering spots, seating, and shading. Wayside parking is an interference for comfortable walking, visibility and accessibility of street elements along with street façade. This could be well identified in the commercial passage. However, an added advantage is that its contribution in between the sidewalk and road as a buffer for ensured pedestrian safety.

Similarly, road acquisition of majority of thoroughfare foot print has eased vehicular activity yet on the other hand, has deprived the pedestrians their preferred comfort and opportunity of interactive street functions. Due to high speeds of regular traffic and careless driving, pedestrian safety is at a stake. Wider road has created scale complexity with legibility difficulties of street façade and signage. Crossing the road is difficult in general due to four lane width yet, manageable in public and commercial passages due to the raised median (even though the median is inadequate to contain crowds).

Environmental pollution and related health adversities are well evident in all three passages. Effluent gases, soot and dust from vehicles dull the air quality causing immediate health disorders for pedestrians. Noise pollution is worst in the Transitory Passage due to frequent transitory vehicle activity and loose traffic regulations on noise. Daytime thermals are almost unbearable in the Commercial Passage due to lack of shading, radiative dense building stock, high albedo sidewalk paving and proximity to the vehicular lane. Along with these adverse atmospheric minimized, better comfort and hygiene could be achieved if there had been significant street vegetation. Unfortunately, green mass is significantly low specially in the Public Passage in terms of shading trees. Strategies such as planters on the median are being deprived with ideal growth factors due to overloaded vehicle pollution and low maintenance.

Even though all three passages were taken from the same thoroughfare, their functional facets responded to each analytical criterion distinctively in most of the sensitive sub criteria. Accordingly, third person input were also affirming traffic and related adversities to pedestrian

performance in terms of walkability, public interaction and pedestrian freedom. Even though these topics are likely intangible and difficult to quantify this particular study has attempted to define them to an extent by means of a local case study. Similarly, the problems have been identified and for more in-depth findings, further researches can now be deployed with the foundations laid by this study.

In a nutshell, Matara main thoroughfare under its defined three passages with distinctive functional facets, is confronting vehicular adversities already in the street related to human dimension depreciation. Rather humane design interventions should be assisted here to mitigate the effects of rapid urbanization that would only worsen the complication. Findings of this study is readily adoptable for future street designs with ensured traffic and pedestrian balance.

Conclusion

Collision between the realms of automobile and pedestrian/ public on street has always been an apparent situation yet underrated due to the rat race of nations after a misinterpreted “development” where economics outperform society, culture and environment. The primary objective of this research was to establish the aforementioned collision in an analytical platform and to lay foundation to further detailed studies on associate grounds. In an overview of the research chapters, the first chapter established the research background and the program of inquiry, emphasizing the progression of dissertation in a wholistic picture. Then literature review inquired the prominent principles on street function, street design and the impact of the automobile to the humans on street.

After a thorough and comprehensive look upon the scholarly work on theorizing the ideal street for humans, an analytical framework was built adopting philosophies and principles with a sophisticatedly modified analytical criteria to fit in to the local context. Accordingly, in the fourth and fifth chapters, the selected cases in Matara main thoroughfare under transit, public and business passages were analysed for depleted pedestrian/ public performance due to the traffic and traffic prioritized street design interventions. The study took rather an empirical facet through researcher’s direct observations building the primary analytical input which was consolidated by involving a third party (user groups) input. The third-party input was acquired in forms of semi-structured interviews as well as a questionnaire (snowball sampling) method. Investigating criteria was based upon physical/ sensory, environmental and safety related vehicular impacts to the pedestrian/ public.

Findings of the study asserted the influence of automobile on functional elements of street under the criteria developed in research methodology. Criteria included reviews related to movement, interaction, visibility, pollution, vegetation, safety elements and traffic activity which was mainly addressed under an observational quantitative review. Accordingly, the followings situations were affirmed as direct/ main causes of the traffic and related street design in Matara main thoroughfare.

- Sidewalk to road proportion of space has restricted numerous crucial public amenities and activities on the street.
- Opportunities for interaction among pedestrian-vendors are ineffective and inadequate in the current sidewalk.
- Interference to pedestrian’s visibility of street elements and street façade is worsened by static and mobile traffic.
- Traffic contributes to critical environmental impacts- air pollution, noise pollution, dust precipitation and thermal discomfort making the atmospherics unhealthy and uncomfortable for public.

- Negligence of vegetation which is a crucial drive of liveability in vehicle prioritized street design
- Unsafe traffic activity and road design interventions endangering the pedestrians.

Intensity of aforementioned situations relevant to each passage had a significant difference to each other. Reasons could be identified as the physical differences of thoroughfare setting, evolution/ expansion of each passage upon the recognized functional facet, diversity and volume of users and modifications under different urban planning stages (recent design interventions being more pedestrian prominent).

Complimentarily it was ascertained the ways that orthodox vehicle prioritized street design and unregulated vehicular activity deteriorating the pedestrian performance on streets. The results of the questionnaire asserted that walkability, public interaction and sense of liberty of pedestrians are strongly interrupted by the excessive vehicular activity. The analysis holistically concluded Matara main thoroughfare to be a poor catalyst of street (public) activity which has been heavily bottlenecked by the vehicular activity and traffic prioritized street design. Thus, it is relevant to most local townships with orthodox city planning where human dimension has been ignored.

Reference

- Biswas, S. (2017). Effects of On-Street Parking In Urban Context : A Critical Review Effects of On-Street Parking in Urban Context : A Critical Review. *Transportation in Developing Economies*, 3(1), 1–14. <https://doi.org/10.1007/s40890-017-0040-2>
- Burton, E., & Mitchell, L. (2006). *Urban, Inclusive Design- Streets for Life* (First edit). Elsevier. Ltd.
- Campbell, B. J., Zegeer, C. V., Huang, H. H., & Cynecki, M. J. (2004). *A Review of Pedestrian Safety Research in the United States and Abroad*. University of North Carolina, Highway Safety Research Center.
- Gehl, J. (2010). *Cities for People*. Island Press.
- Harirchian, M., Esmaeili, M., & Kermanshahi, S. (2018). *A New Perspective on Urban Street Design A NEW PERSPECTIVE ON URBAN STREET DESIGN* Minoo Harirchian University of Tehran Email : minoo.harirchian@ut.ac.ir Maral Esmaeili University of Tehran Shahab Kermanshahi , Corresponding Author University of Tehran Em. July 2019.
- Jacobs, A. (1993). *Great Streets*. The MIT Press.
- Kamel, B., Wahba, S., Kandil, A., & Fadda, N. (2017). *Reclaiming Streets as Public Spaces for People : Promoting Pedestrianization RECLAIMING STREETS AS PUBLIC SPACES FOR PEOPLE PROMOTING PEDESTRIANIZATION SCHEMES IN AL- SHAWARBI COMMERCIAL STREET - DOWNTOWN CAIRO* Nesma Ahmed Fadda. January. <https://doi.org/10.2139/ssrn.3170365>
- Küçükyağcı, P. Ö., & Arın, Ö. (2018). A STUDY ON MEASURING PEDESTRIAN COMFORT LEVEL IN ISTANBUL ATLAS INTERNATIONAL REFERRED. *ATLAS INTERNATIONAL REFERRED JOURNAL ON SOCIAL SCIENCES*, 4(July), 626–636. <https://doi.org/10.31568/atlas.125>
- Massengale, J., & Dover, V. (2014). *Street Design- The Secret to Great Cities and Towns*. John Wiley & Sons.
- Mitchell, D., Claris, S., & Edge, D. (2016). Human-Centered Mobility: A New Approach to Designing and Improving Our Urban Transport Infrastructure. *Engineering*, 2(1), 33–36. <https://doi.org/10.1016/J.ENG.2016.01.030>
- NACTO. (2013). *Design street urban guide National Association of City Transportation Officials*.
- National Association of City Transportation Officials (NACTO). (n.d.). *Urban Street Design Guide*. Island Press.
- Nieuwenhuijsen, M. J., & Khreis, H. (2017). Car free cities : Pathway to healthy urban living Car free cities : Pathway to healthy urban living. *Environment International*, 94(September 2016), 251–262. <https://doi.org/10.1016/j.envint.2016.05.032>
- Rees, W. (1997). Urban ecosystems: the human dimension. *Urban Ecosystems*, 1(1), 63–75. <https://doi.org/10.1023/A:1014380105620>