BAU Journal - Health and Wellbeing

Volume 1 Issue 3 *Urban Health & Wellbeing Building Collaborative Intelligence for Better Lives in Cities*
ISSN: 2617-1635

Article 22

October 2018

# ENHANCING PEDESTRIAN SAFETY TO IMPROVE URBANHEALTH

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## Abstract

Walking is such an essential human activity and it is a part of every trip. Whatever the main purpose for travel, walking will remain the first and last mode used; no doubt there is a link between walking, urban health, and pedestrian safety. Unfortunately, safe walking has been ignored in the mission of planning for many transportation systems in the cities. The number of individuals killed or seriously injured on Arab cities' road's network has significantly increased the late decades. Nonetheless, there has been no meaningful change in the pedestrian facilities throughout the most recent ten years. There are numerous factors that affect and cause this numbers. And the main problem is the Lack of an initiative to decrease pedestrian risks and improve their safety. This research paper will discuss briefly the factors affecting pedestrian's safety in order to attempt to set some guidelines that will assist in risk reduction, increase the pedestrian safety rates and consequently will improve urban health in Arab communities.

## Keywords

Urban Design, walkways, Pedestrian safety, urban health, Public health

# ENHANCING PEDESTRIAN SAFETY TO IMPROVE URBAN HEALTH

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**ABSTRACT:** *Walking is such an essential human activity and it is a part of every trip. Whatever the main purpose for travel, walking will remain the first and last mode used; no doubt there is a link between walking, urban health, and pedestrian safety. Unfortunately, safe walking has been ignored in the mission of planning for many transportation systems in the cities. The number of individuals killed or seriously injured on Arab cities' road's network has significantly increased the late decades. Nonetheless, there has been no meaningful change in the pedestrian facilities throughout the most recent ten years. There are numerous factors that affect and cause this numbers. And the main problem is the Lack of an initiative to decrease pedestrian risks and improve their safety. This research paper will discuss briefly the factors affecting pedestrian's safety in order to attempt to set some guidelines that will assist in risk reduction, increase the pedestrian safety rates and consequently will improve urban health in Arab communities.*

**KEYWORDS:** *Urban Design, walkways, Pedestrian safety, urban health, Public health*

## 1. INTRODUCTION

Walking is a part of every trip. Whatever the main purpose of travel, walking is the first and last mode used for several reasons; it doesn't require a particular machine, perfect, non-expensive, easy on infrastructure, clean, emission-free, accessible for all, healthy for people and source of great pleasure. Each trip begins and ends with pedestrian activity; almost every person is a pedestrian at different times and places in their lives.( InTech,2013) , (The Canadian Council , 2013),( BE(hons),2017) ,( Wellington ,2007)

Moreover, walking as activity has a crucial role in the enhancement of population health, physical fitness as well as wellbeing. Likewise, walking gives less pressure and confusion in comparison to driving activity. ( Kashani ,2011) , (Geneva WHO,2013) (F.C. Hodgson ,2004) Accessibility is the basis for all pedestrian design and facilities should be planned, designed, operated, and maintained to be usable by all people. (Zegeer , 2002)

People who live in walkable neighborhoods walk one hour per week more than those who live in less walkable neighborhoods. By doing this activity they meet forty percent of their physical activity target and have their risk of being overweight. (Tolley , 2003)

Europeans have higher levels of walking and cycling in comparison with Americans and Arabs. This might explain the higher rates of non-communicable diseases namely; obesity, diabetes, and hypertension among Americans and Arabs and the higher life expectancies among Europeans. (P u c h e r , Dijkstra, 2003) In other words, walking and cycling for daily travel may contribute indirectly to the improvement of public health.

The prevalence of non-communicable diseases namely; cardiovascular disease, cancer, chronic lung diseases, and diabetes has markedly increased in the Arab world. Two-thirds of the 52•8 million deaths worldwide in 2010 were caused by non-communicable diseases. Physical inactivity was a prevalent behavioral risk factor. Inadequate physical activity is highly prevalent in the high-income Arab countries such as Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates in which people rely mainly on cars for transportation. *Non-communicable diseases in the Arab World*. Available from: https://www.researchgate.net/publication/259772867_Non-communicable_diseases_in_the_Arab_World [accessed Jul 25 2018].

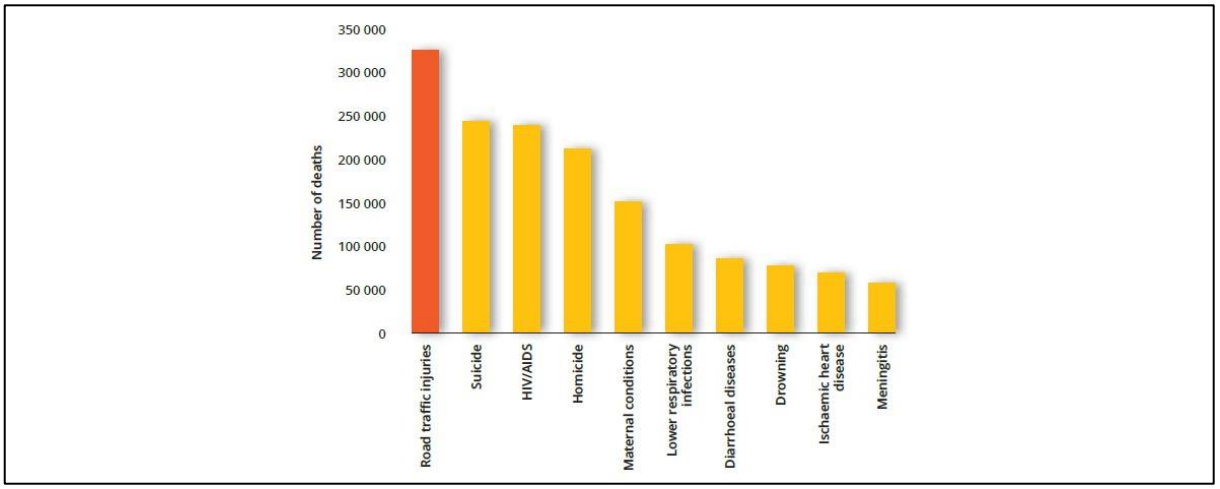



Fig. 1 Top ten causes of death among people aged 15–29 years, 2012
Reference: WHO. International classification of

Another rising health problem in the Arab world which also results from a sedentary lifestyle and physical inactivity is obesity. Obesity plays a major role in the pathogenesis of diabetes mellitus. (Obesity-linked diabetes in the Arab world: a review)Diabetes Mellitus is a major public health problem with increasing prevalence and long-lasting complications. Six countries in the Arabic nation are on the top-ten list regarding diabetes and obesity prevalence. These countries represent 5% of the total world population. (Alzaman , 2016) One of the proposed actions to address physical inactivity is the need of redesign of urban spaces in order to create a more supportive environment that encourages people to be more physically active. (Health in the Arab world: a view from within 2 Non-communicable diseases in the Arab world)

There are several documented benefits of physical activity particularly walking, for instance, on the cardiovascular system; it has short-term gains such as improved fitness, body composition, and blood pressure and lipid profiles. Longer term benefits include decreased risk of coronary heart diseases and mortality. (Walking – the first steps in cardiovascular disease prevention).A study found that women who walked at an easy pace for at least 1.5 hours per week had significantly better cognitive function and less cognitive decline than those who walked less than 40 minutes per week. Another Research found that postmenopausal women who walk approximately 1 mile per day have greater bone density than those who walk shorter distances. Last and not the least one study concluded that walking for 30 minutes, three to five times per week for 12 weeks associated with minimal symptoms of depression.

By developing more walkable neighborhoods, there will be opportunities to obtain additional benefits for the environment, individuals' health, and economic development( Walkable neighborhoods provide health, environmental and financial benefits,2017) From all above the walking level in any community depends on people's ability to walk to different destinations and back in a safe mode.

Safety is the state of being "safe", the condition of being protected from a cause of danger. Safety can also refer to the absence of risk or, less strict and the control of recognized hazards in order to achieve an acceptable level of risk. The ultimate safety is impossible. The safety of people dependably is seen inside the pedestrian environment. In the past safety was frequently accomplished by barring pedestrians or potentially making places not accessible. (Zaki, 2017) (https://en.wikipedia.org/wiki/Safety)

A deeper look at the urban communities detects that safety and design go as an inseparable unit. The best urban areas in the world for traffic safety incorporate Stockholm, Berlin, Hong Kong, and Tokyo (see Figure
1.1). these urban communities and others with bring down levels of car accidents and deaths share certain qualities. (Welle, 2015)

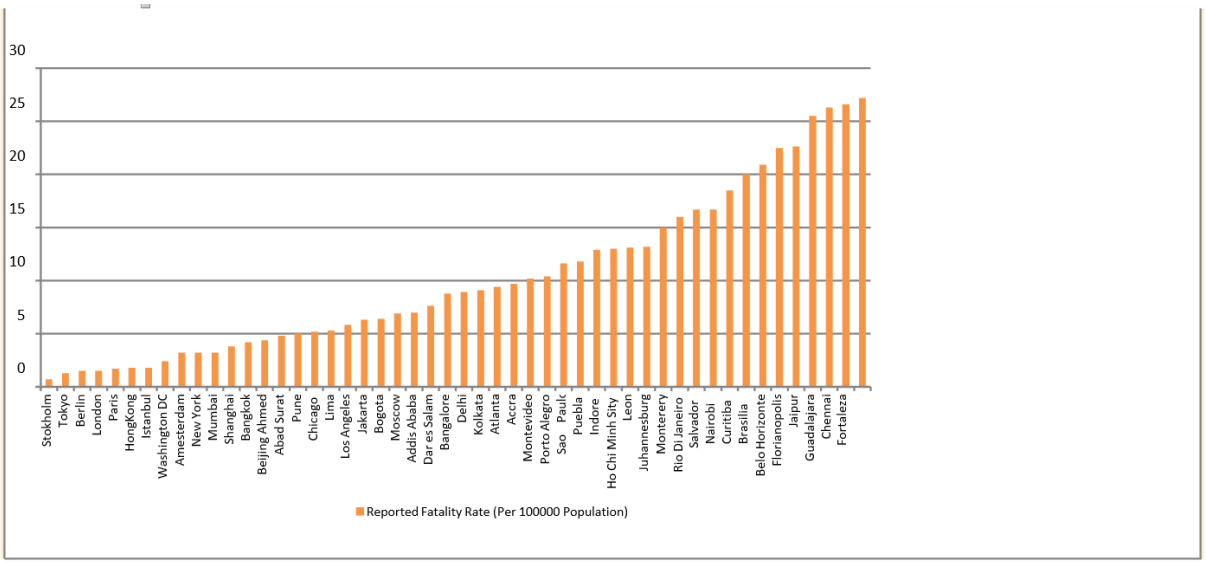



Fig. 2 Reported Traffic Fatalities per 100,000 Inhabitants in Selected World Cities
Source: EMBARQ technical note (Welle and Li 2015).
Note: Actual fatalities may vary for some cities with poor crash reporting systems.

The above-mentioned cities additionally have far-reaching traffic safety plans; these cities pay attention in their core and focus on decreasing vehicle speeds to make communities easy to walk and cycling, in addition to this they providing a well-designed infrastructure for pedestrians. The approach is called safe
systems (Bliss and Breen 2009) (Welle
,2015)

## 2. PROBLEM

Around 1.24 million road traffic deaths happen every year on the world's streets, that make road traffic injuries the eighth driving reason for death globally and the main source of death for youngsters
matured 15– 29 years. And the number of deaths is expected to continue ascending as vehicle armadas develop, to end up as the fifth biggest reason for death by 2030. ( N., & L. (n.d.). PEDESTRIAN SAFETY. Institute for Social and Health Sciences.P.2.) The larger part of these deaths occurs in and around urban zones, excessively influencing powerless street users, for example, pedestrian and bicyclists. The statistics indicated that about 36% of all road users' deaths including a pedestrian. (N., & L. (n.d.). PEDESTRIAN
SAFETY. Institute for Social and Health Sciences.P.2.) On the other hand, between 20 and 50 million others
are affected by non-fatal injuries and many are disabled as a result. The dramatical increase in the number of vehicles may affect the pedestrian's safety on two levels: the first increase in accidents numbers and the second the increase of fuel's burning which has a negative impact on the urban environment and make a big threat on public health.

The percentage of the world's inhabitants living in cities is raised from 50 percent in 2007 to reach 70 percent in 2030 (UNICEF 2012). And the world's car ownership has just passed 1 billion and is expected
upon to achieve 2.5 billion by 2050 (Sousanis 2014). This increase in the number of vehicle use due to many reasons such as the growth of cities that result in long distances that is difficult to travel without the car and the inefficient walking conditions.( http://www.who.int/mediacentre/factsheets/fs358/ar/) (Welle ,2015)

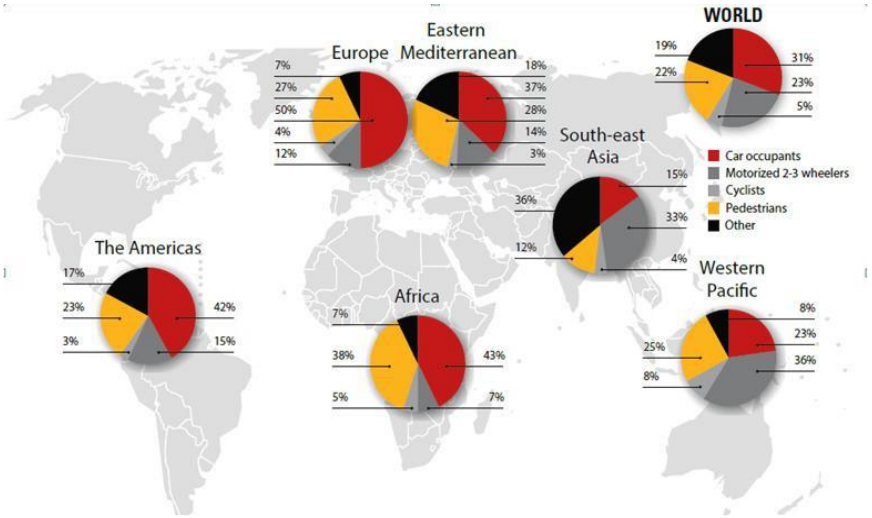



Fig. 3 Pedestrian deaths distributed around the world among road user types, and region

Refrence : Pedestrian safety: a road safety manual for decision-makers and practitioners. (2013). Geneva: World Health Organization. P.28.

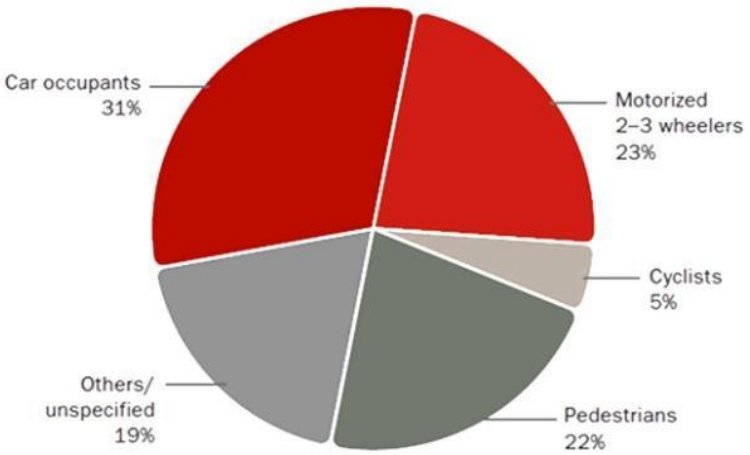



Fig. 4 Distribution of road traffic deaths by type of road user, global, 2010 [1]

Reference: Legislative review conducted by WHO. Vehicle safety data from UNECE WP29. Other data collected by questionnaire and cleared by General Authority for Roads, Bridges and Land Transport (GARBLT).

The Arab countries also have high rates of pedestrian fatalities (see Figure 5).The Figure shows the death rates due to road traffic accidents per 100,000 populations in various Arab Middle Eastern Countries.( http://www.worldlifeexpectancy.com/middle-east/road-traffic-accidents-cause-of-death)( El-Menyar,2014) (https://www.researchgate.net/figure/The-death-rates-due-to-road-traffic-accidents-per-100-000-populations-in- various-Arab_fig1_262193773)

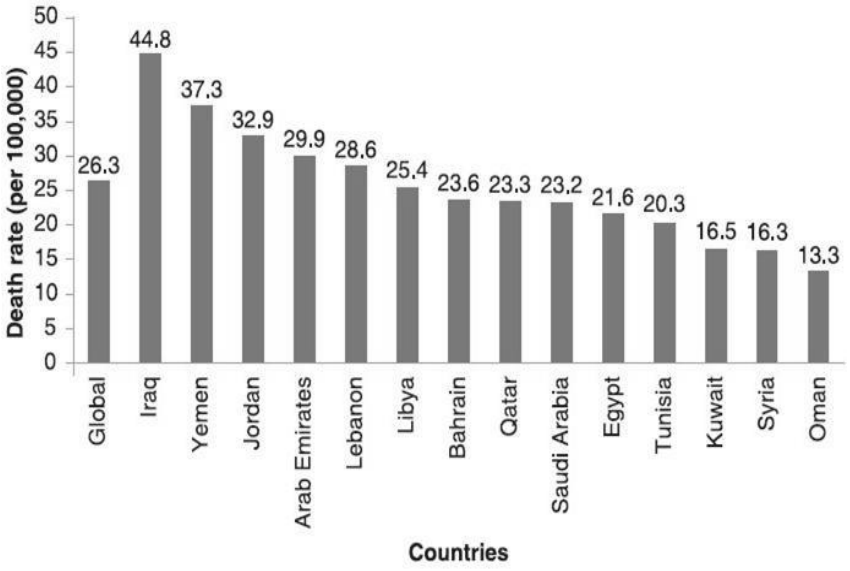



Fig. 5 Distribution of traffic crashes rates in Arab countries per /100k
Reference: https://www.researchgate.net/figure/The-death-rates-due-to-road-traffic-accidents-per-100-000-populations-in-various-Arab_fig1_262193773

Pedestrians classified as the weakest group and are at a high rate risk of injury or death compared with other road users. (Jennie, 2010) There are many reasons to consider pedestrians as large vulnerable road users and the main reason for this the lack of their protection and the limited biomechanical of body tolerance to violent forces if hit by a vehicle. Pedestrian crashes are more dangerous kind of accidents contrasted with other sorts of accidents. 5% of deaths crashes result in lethal harms and 10% to 39% debilitating injuries. (ÇİÇEK,2009) . If communities are not walkable, it is most likely because of the fact that they are prevented from doing as so. Either the infrastructure is insufficient or has serious gaps. Or maybe there are no continuous walkways. Maybe there is a physical barrier. (Zegeer, 2002) The Successful researches to protect pedestrian and advance safe walking require a comprehension of the idea of risk factors for pedestrian crashes.(WHO,2013) To achieve a good pedestrian planning requires proper knowledge of behavioral features, and understand that safe street is influenced by many factors and it requires a good application of various solutions to encourage using of pavements and also to achieve more safety for the existing possibilities. (Movahed, 2012) This paper made a classification of factors that affect pedestrian's safety; most of these factors exist in Arab countries.

## 3. FACTORS AFFECTED PEDESTRIANS SAFETY

### 3.1 The Pedestrian characteristic

Street Design ought to accommodating all individuals whatever their age or abilities. Poor infrastructure can compound the issues of handicapped people and the good plan can reduce the percentage of the presence of additional disabled people.(Thomas,2007) The characteristics include the pedestrian's physical and intellectual abilities that may be different in : Height, Speed of reflexes, Stamina, Visual perception, Attention span and cognitive abilities, Tolerance of adverse, temperatures and, environments, Balance and stability, Fear for personal safety and security, Manual dexterity and coordination, Accuracy in judging speed and distance, Difficulty localizing the direction of sounds, Energy expended in movement . (
Wellington,2007)

There are many types of pedestrians: The normal act for pedestrians is to walk on foot and this can have done by the capable pedestrian, Runner, Adult Pedestrian, Young pedestrian, physical or sensory Impaired pedestrian, Aged Pedestrian, Pedestrian with a guide puppy, Sensory debilitated walker, Pedestrian with a stick. And the second shape of an act is people on small wheels: this may include Roller skates, Skateboards, scooters, Pedestrian with a stroller. And the last shape of an act the Mobility impaired: that may Portability bikes, Manual wheelchairs, Electric wheelchairs. (Wellington, 2007)

There are many types of pedestrians who classified as more Vulnerable Pedestrian firstly the

children. because of The range of physical, subjective and passionate characters and abilities, and parts of their disposition and identity, adds to their weakness and vulnerability The little physical stature of kids confines their capacity to see approaching vehicles or to be seen by vehicle drivers. As youngsters' sensual abilities additionally less created, they experience issues seeing autos in their fringe vision and additionally finding the bearing of the sound of an approaching vehicle. Besides, kids are easy diverted and distracted and experience issues in concentrating on highlights of the street condition ( N., & L. (n.d.). *PEDESTRIAN SAFETY*. Institute for Social and Health Sciences) Exploring a traffic domain can be riskier also for an elderly pedestrian because of changes in their mobility and the time-constrained such as memory, Weak vision and hearing, slower response time and limited awareness, bring down levels of consideration, diminished walking speed and other age-related variables. This makes it harder for them to judge distances and the speed of oncoming traffic (The Canadian Council of Motor Transport Administrators ,2013) (Jennie,
2010)(R,2010) . In addition to elderly people, Pedestrians with disabilities should have a right to safety in the walking environment. (https://adata.org/learn-about-ada )It should be a guarantee that all individuals have a level of access to public transportation. However, Individuals with inabilities may have constrained visual and subjective capacity or a mix of handicaps. The handicapped pedestrian – debilitated, visually impaired wheelchair users and pedestrians who utilize exceptional devices to walk experiment significantly higher accidents dangers. (R, 2010) There are many common countermeasures for elderly people and people with special needs this is because of some overlap between their characteristics and abilities.

Socioeconomic status is a huge determinant of pedestrian injury. By and large, individuals from poorer groups have a tendency to be at a higher danger of pedestrian injuries. Due to a lack of community awareness (http://www.who.int/mediacentre/factsheets/fs358/ar/)

**Other classifications that affect in pedestrian's characteristic**

- **Gender:** Men and women have been shown to perceive traffic safety differently. ( Welle, 2015)

  Men are more likely to be exposed to traffic accidents than females because of their activities.
- **Age group:** 48% of traffic fatalities occur in the world between people aged 15-44. (http://www.who.int/mediacentre/factsheets/fs358/ar/) The people aged over 75 are involved in 18 percent of pedestrian deaths, although they represent only six percent of the population. Their probability of being struck is also greater than most other age groups. The children aged fewer than

  19 represent 46 percent of injuries, yet Representing only 30 percent of the population.
- **Recent Immigrants and Visitors:** The recent immigrants May have limited understanding of new country language, traffic laws, of typical roadway behaviors. This situation makes them more vulnerable to accidents. The Tourists also need to be able to and voyaging agents securely arrive and discover their approach to destinations and gatherings. ( Welle,2015) This requires special attention from the Ministries of Tourism and Immigrant Affairs to study possible solutions to reduce risks
- **Pedestrian volume:** Pedestrian volume is also a considerable factor on pedestrian safety. It is safer for pedestrians to cross the intersection in a group because a larger group of pedestrians cannot be hidden by the visible obstruction of a driver who is making a left turn. (c, Y ,2017)

### 3.2 Natural environment

#### 2-1 the weather and topography

Weather regularly comes up as a factor that individuals find critical in the choice to walk. A project made by ADONIS found that dry climate positively affected the choice to walk even on short trips. The inclement weather isn't just the inconvenience of walking but it can totally prevent people to walk yet in addition to that the urban design concept and way that one needs to dress in the suitable garments for the climate. (F,C ,2004) For example every year in December, on average, 269 pedestrians are injured and seven pedestrians are killed in British Columbia this is because of serves weather conditions. https://www.icbc.com/about- icbc/newsroom/Pages/2014Dec9.aspx Another study made in 2016 to explain the relation between weather and pedestrian safety and the outcomes exhibit that direct and heavy rainfall events are very problematic are exceptionally hazardous to Pedestrian security, requiring consideration from the movement wellbeing group in show climate and future atmosphere. ( Badri, A., & Andrey, J. C,2016) It is critical to consider the impact of weather on pedestrian safety

many reasons: Pedestrian keep making trips amid harsh weather and there is multiple confirmed evidence of spots like New York and England that there is the additional danger of impacts for a pedestrian who walked out amid bad weather , It is hard for a pedestrian to adapt to dangers, for example, slippery roads/sidewalks /walkways and absence of visibility,4- Pedestrian frequently ignoring traffic rules through precipitation because of the criticalness to find shelter or quick access to the required destination.

The topography has real effects on walking and cycling environment because of due to energy considerations made by the user and this may cause an extra need of effort from the pedestrian as well as may cause more obstacles to stumbling walking or stumbling out of vision and may make them feel less secure at night.( A. A. (2013) It may also cause rainwater drainage problems on the walkways if it is not taken into consideration at the beginning of the design stages.

### 3.3 The Land use and urban form

There is very important hyperlink between land use, urban form motorized travel and pedestrian safety. Land use Considered as a factor that influences the route choice according to the location of services, What's more, there are some road formats that likewise affect on pedestrian walking decision, for instance, urban areas that incorporating a maze of roads in their plan and in this way expanding unsafe distance for travel. (F.C. Hodgson, 2004) According to Jane Jacobs, a well-used street is a safe street. She states that in order to handle strangers, a city street must possess a clear demarcation between public and private space, and the sidewalks should have users on it fairly continuously. A Changing in zoning laws and sidewalk warrants to allow mixed-use and a substantial number of commercial activities such as stores/cafes/restaurants helps in monitoring on streets and this they give people solid reasons for using sidewalks (R,2010) (Zegeer,2002) There are particular key elements of urban form that, particularly when taken together, can prompt expanded wellbeing: (1) the block size. (2) Street connectivity. (3) Street widths (4) The accessibility to destinations (5) The population density (Welle,2015)

The long Block size may permit and encourages higher vehicle speeds and putting pedestrians at higher hazard. Because of the faster, a driver goes, the more difficult it is for him to stop or avoid hitting a pedestrian in their path. Long blocks regularly have crosswalks just in intersection areas. And this indirectly encouraging the unsafe crossing at midblock. The fewer junctions didn't interrupt travel but led to a higher speed. This safe accessibility through land use may be achieved by Mixed uses can enhance road imperativeness. Lighting, variation use of buildings and crime prevention through urban design encourage more nighttime activity. The City planners also should set goals for access to public transportation, parks, and retails. ( Welle,2015) The diversity of uses: this is to ensure the presence of people who use the street for different purposes on varying time schedules. Jane Jacobs states that there are four necessary conditions to generate diversity are mixed primary uses, short blocks, a mixture of old and new buildings, and dense concentration of people. ( R,2010)

### 3.4 Urban design

Creating safer urban areas for activities doesn't just mean enhancing streets. Urban design plays an essential part in building a more safe and accessible environment. The safer cities can encourage improvement to enable more individuals to utilize mass travel, walking, and bicycling instead of pointless engine vehicle trips. (Welle, 2015) (F,C, 2004) It is difficult to understand how the little details of the pedestrian environment would have an impact on the decision to walk. Walking in an environment that lacks pedestrian infrastructure and that permits the use of high-speed vehicles increases the risk of pedestrian injuries. ( Elvik R,2009) The urban design should consider: (1) the legibility that allow pedestrians to see and understand their immediate surroundings and those ahead, (2) Visibility that makes pedestrians visible to other users , And (30) Providing alternative routes to avoid potentially threatening cases. (N.Z, 2007)

**A Walkway** is a part of the public right-of-way that provides a separate area for individuals traveling on foot. It should be accessible and safe. ( Zegeer, 2002) This facility has a big role to improve pedestrian's safety. Fears about personal safety are one factor that has been identified as influencing both pedestrian route choice and mode choice. (F.C. 2004) Studies have shown that some people do not walk because they are frightened about being attacked. For example, Graffiti on the walkway can influence individuals to feel unsafe (see Figure 2.21) and additionally the measure of litter. Many times sidewalks are not safe or uncomfortable because of its surfaces conditions that may be aggravated by adverse weather conditions, clashes, poor maintenance or cleaning, installation of unsuitable urban furniture or equipment, substandard execution, low-quality materials, and other relapsing factors or sub-standard repair work on pavements and splints due to emergency operations.( Corazza,2016) (doi:10.1016/j.jtte.2016.04.001.P.2.) The bad surface condition and sudden changes in level or material can cause many pedestrian accidents such as fall – slips, ,

trips and stumbles. (Ryan, 2011) gradient changes such as ramps over relatively small distances is an important part of pedestrian's walkway because it requires more energy from the user when ascending and it also requires more control when descending

.

**The covers and grates** should be sited within the street furniture zone .whenever its possible .If not possible, they can be placed at the edge of the through route. In Addition, to minimize pedestrian hazards the grate openings should be less than 13 mm wide and 150 mm long. Any elongated openings should be position perpendicular to the main direction of pedestrian movement , The covers surface should be selected to be rough texture but without regular, large bumps that could result in the vision impaired mistaking them for a tactile surface, They should always be flush with the surrounding surface and it should be slip resistant, even when wet.( Pedestrian design. (2002). ) (N.Z ,2007) It should well installed so as not to be easily dismantled and be exposed to theft as it usually made from Cast iron

The **Street furniture** elements should be designed to provide the convenience of the pedestrian. Some researchers caution against the excessive use of street furniture. Furniture zone should be placed where it couldn't potentially block pedestrian movement. (R,2010) (http://www.pedbikeinfo.org/planning/facilities_streetscape_furniture.cfm)

The safe **landscaping and plantation** selection: A large number of people are injured needlessly each year because of unsafe site (Ryan,2011) The careful use of landscaping along a street can provide separation between motorists and pedestrians it creates a 'buffer' between the footpath and the roadway, this element serves the pedestrian safety from two aspects it reduces the visual width of the roadway (which can help to reduce the vehicles speeds), and it provides a more safe and pleasant street environment for all. This can include a variety of trees, bushes, and/or flowerpots, which can be planted in the buffer area between the sidewalk or walkway and the street.( Zegeer, 2011) Landscaping with mature trees that are properly pruned can add shade that protects pedestrians from the scorching sun. It enhances the street general environment and providing shade and shelter from wind for pedestrians.

In many studies, night-time, visibility or the absence of adequate **street lighting** or dark spots where potential assailants could hide were mentioned as deterring people from walking and pose a threat to safety**.** Also Fear of strangers in the night keeps many pedestrians off the trail from dusk to dawn. Various risks threatened the pedestrians and Unusual accidents happened of pedestrians because of low illumination is existed. Pedestrian crashes happened most often amid the late evening and early evening hours, times when exposure is probably highest and visibility might be an issue.( Pedestrian and Bicycle Crash Types .FHWA COURSE ON BICYCLE AND PEDESTRIAN TRANSPORTATION ) Moreover, The Crosswalk lighting can basically enhance pedestrian safety. Because of the lightness from vehicle headlights alone often doesn't provide sufficient reaction time for drivers to identify and react to pedestrians crossing on the roadway. Crossing lighting should be provided at signalized, un signalized, and midblock crossings.

The generality of accidents is linked to walking on the sidewalks and a large portion of them comprise of crossing vehicle road for getting on a transport or in the wake of getting off. Every one of the **transit stations** ought to consider about the safety of pedestrian, and it doesn't imply that fundamental in each station ought to be a covering way for Pedestrian; every one of the stations ought to situate in places in which the pedestrian can cross in a safe way. The purpose is to provide a safe and accessible way for public transportation users. (Zegeer, 2002)

**The grade separation** is a way that allows pedestrians to cross without a stop by traffic flow. Grade separation refers to an infrastructure element and is meant to put pedestrians and vehicles in different levels, and it Provides completely separation of pedestrians and motor vehicle traffic.( http://www.jesse-co.com/pedestrian-bridges) The Changes in levels – whether above grade or below grade – cause inconvenience to pedestrians. Many studies have shown that pedestrians prefer to jaywalk rather than use foot over-bridges and pedestrian tunnels (R. (2010)) the overpasses usually requiring a greater vertical separation than underpasses; therefore it needs long stairs or ramps and greater travel distance. It should cover to protect against weather and to prevent falling objects.The underpasses usually provide less personal security that the overpasses because of its lower nature that make it difficult for monitoring. It also may have drainage problems. The Inappropriate circumstances of some underpasses may prevent people to cross and complete their trips. it should be designed to be open, clean, secure and accessible. (Wellington, 2007). (Campbell, 2004)

**Railway crossings** are rare compared with vehicle road crossings; pedestrians can feel extremely troubled when using them. The train travel speed is very quickly, is very fright and is incapable to stop suddenly or

make a deviation to avoid a collision.A common human mistake is a misjudgment of the speed or distance separation of trains. This called the "large object illusion" the perception that large objects are moving more slowly than small ones traveling at the same speed. Not all road users are aware enough about crossings that have no active warnings (lights, bells, etc.) so they may fail to detect for an approaching train.More consistent treatments should be considered. A point worthy of mention some if pedestrians were better educated about the risks of rail-grade crossings. (The Canadian Council of Motor Transport Administrators, 2013)

**Pedestrian signals** should be used at traffic signals with arrangements with many of conditions related to pedestrian activity or direction, This should be related to the permitted signal period to cross a street and prevent pedestrian crossings when conflicting traffic may impact the pedestrian safety. ( http://pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=46) (http://www.wisegeek.com/what-are-pedestrian-signals.htm)

### 3.5 Traffic components

#### The vehicle speed

Vehicle speed influences both the frequency and the severity of the pedestrian injuries. This is because those faster moving vehicles require a longer breaking distance and this makes it difficult to driver to stop and avoid impact on a pedestrian. Evidence shows that most pedestrians (80%) are killed at impact speeds of 50km/h and over, while most (90%) would survive if hit by a car traveling 30km. 1A Pedestrian who hit by a car with 64.4 km/h has 85 percent shot of being executed; by 48.3 km/h (30 mi/h), the probability goes down to 45 percent, while probability comes down at 32.2 km/ h, the accident rate is just 5 percent. Faster speeds improve the probability of a walker being hit. At higher speeds, drivers are less probable to see a Pedestrian and are even less probable to have the capacity to stop so as to abstain from hitting one. ( Zegeer,2002)
Even small increases in speed can result in a dramatic increase in the impact forces experienced by crash victims. It is estimated that for every 1 km/h increase in mean speed, the number of injury crashes will rise by around 3% (thus an increase of 10 km/h would result in a 30% increase in injury crashes). ( Welle,2015)

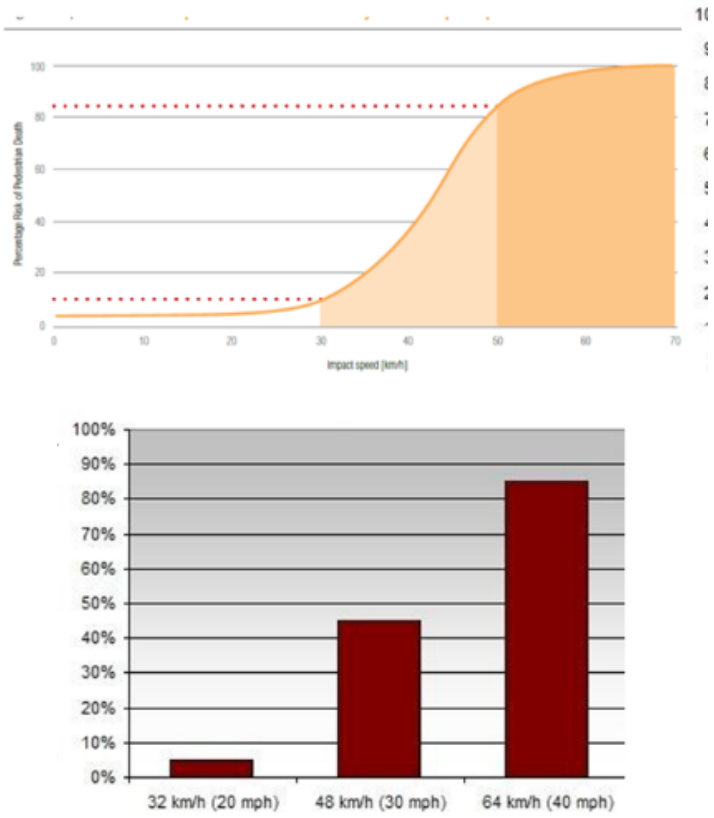



Fig. 6 : The relationship between pedestrian safety and the impact speed of vehicles Fetalities based on speed of vehicle - A pedestrian's chance of death if hit by a motor vehicle
Reference: Photographed by the author April 2015

**Mixed traffic use**

**Vehicles design**

Vehicle design has an important effect on the severity and distribution of pedestrian injuries caused by vehicle impact. Many studies refer to that the Sport utility vehicles, high bumpers and blunter frontal profiles pick-up trucks and vans are more likely to cause severe injuries and death to children than are passenger cars. This because of When struck by a higher elevated vehicle, smaller pedestrians are often thrown forward or knocked to the ground and run over instead of rolling up onto the vehicle's hood. The drivers of higher elevated vehicles with a larger frontal configuration also may be more likely to have their view of smaller child pedestrians blocked. ( N., & L. (n.d.). PEDESTRIAN SAFETY. Institute for Social and Health Sciences.P.5)( Jennie, ,2010) Therefore vehicle front-end design started as a considerable issue in future motor vehicle design safety standard. The Australian New Car Assessment Program (ANCAP) has recently been extended to include a pedestrian test. The pedestrian impact test assessment injuries to pedestrians struck by a vehicle traveling at 40km/h. such a process to have a positive impact on safer vehicle choices for both drivers and pedestrians. ( Jennie, ,2010) . The New Technologies that coupled with a better understanding of pedestrian injury produced by crashes led to insert other solutions which are already in use in some vehicles. For example, a measure now implemented by Volvo Car Company is external pedestrian frontal airbags including air pockets that protect the pedestrian head from the A-pillars and other Unforgiving surfaces. ( The Canadian Council of Motor Transport ,2013) (https://www.volvocars.com/us/about/our-innovations/intellisafe
)(https://www.unece.org/fileadmin/DAM/trans/roadsafe/unda/Sweden_Volvo_Vision_2020.pdf)

### 3.6 Human behavior

In fact, street users expect other users' behavior in order to avoid collisions. Thus, widely varying pedestrian and/or vehicle maneuvers may result in a misconception of each other's decisions, which can lead to safety issues. The Vehicle driver's behavior judged to be exclusive to fault in 35 percent of the accidents. For example, the car driver hit a pedestrian and run and failure to yield were the most frequently cited driver contributing factors.Exceeding safe speed was one of most frequent vehicle driver faults. (Pedestrian and Bicycle Crash Types .FHWA COURSE ON BICYCLE AND PEDESTRIAN TRANSPORTATION.) In this factor, the dominant attitudes of drivers, failure and ignoring to acknowledge the rights of pedestrians and speed limits of traffic in areas of high pedestrian activity greatly increased the potential for accidents. ( Jennie, 2010) ( N., & L. (n.d.). PEDESTRIAN SAFETY. Institute for Social and Health Sciences.P.5.)

Many researchers reported that pedestrian behavior is a significant cause of their injuries and fatalities. (Jennie,2010) (Mwakalonge,2015) (See figure 2.53). Participants distracted by music or texting were more likely to be hit by a car in the practical pedestrian environment than the undistracted participants, and there is no behavioral variations were spotted between male and female participants. (Mwakalonge,2015) 2 The Pedestrian was judged to be exclusive to fault in 43 percent of the accidents. ( Pedestrian and Bicycle Crash Types .FHWA COURSE ON BICYCLE AND PEDESTRIAN TRANSPORTATION.) Also the use of smart phones is growing exponentially worldwide An estimated 77% of the world's population owns a mobile phone (WHO, 2013) Pedestrians much like drivers they have constantly occupied with multitasking like using hand-held devices for listening to music, snacking , Internet use or distract by reading that draw their attentiveness while walking. There are similar effects of distracted walking and those experienced in distracted driving. (Wang, T., Cardone, G., & Corradi, A.2015). Studies demonstrate that utilization of a phone while crossing the road conflict with cautious behavior and reduce situational awareness and pose a threat to pedestrians. But there is still less information on the role of distraction in collision causation for pedestrians due to a lack of reliable collision data on this factor The majority of studies reviewed are in agreement with that there is positive correlation between distraction and unsafe walking behavior. For example, a survey-based study indicated that 25% of the respondents indicated that they believed listening to music while crossing the street was dangerous and unsafe behavior, while most people did not consider this as an issue. Contemplating all the data that has been gathered from the studies, it is evident that distracted walking poses a real safety problem. (The Canadian Council of Motor Transport Administrators, 2013). The contribution of distracted walking will most likely be higher in countries where there is a greater mix of traffic, less controlled crossings or where awareness of the risks is low.

There are many other behaviors of road users that may affect pedestrian's safety and have an influence on the decision to walk.

People in cities are confronted by beggars every day. A walk down a major urban street will usually mean being asked for money numerous times. Some are more aggressive, making loud and sometimes repeated demands, or following pedestrians down the street. Others will touch, shove, or respond with hostility or bigotry if one declines to give money. (Teir,1993) Aggressive begging is also a source of fear and intimidation for individuals. The fears created by beggars are neither irrational nor over-estimated. The

number of people on the street has grown significantly in recent years. (Teir,1993) Local authorities should outline solutions for such problems.

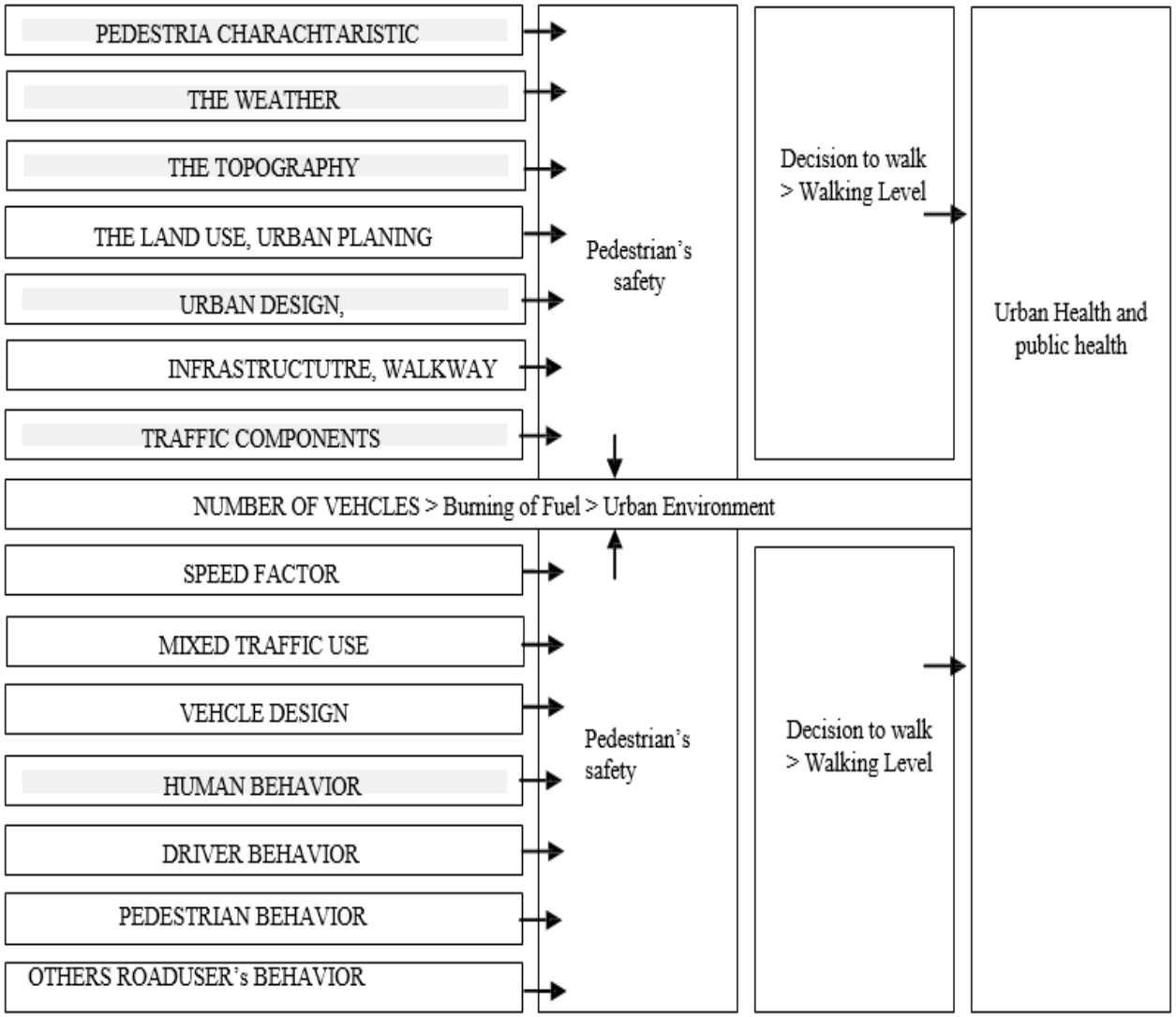
Apart from overcrowding, there are two significant factors which be a reason of inconvenience for pedestrian are Noise and Air pollution, both of which are caused by vehicular traffic. The high levels of clamor cause pressure and inconvenience for pedestrians
The most effective method to clean the air is To limit car movement, Encourage nonpolluting forms of transit, such as electric cars , Arrangement of trees and bushes to cushion pedestrian space sand Provide open spaces to increase air circulation (R,2010)

## 4. CONCLUSIONS

It has become clear through this paper that countries with a low percentage of pedestrian's accidents and high rates of safety in their statistics have high rates of the walking level and low rates of many diseases. Therefore, this research reviewed the importance of studying the Guidelines for the accessible and safe pedestrian's environment through the good studying of variable factors on the pedestrian's environment. Thus achieving a healthy community.

- The neglect of pedestrian and bicycling safety has made walking and cycling dangerous activities in many Arabic cities.
- Arabic countries should consider the pedestrian's safety issue at a national level. This will require support from local authorities, governments, and officials., Also Public policymakers at all levels must not only provide the necessary funding for better pedestrian environment and facilities but also adopt and implement a range of policies to encourage more compact, mixed-use development that naturally permits and encourages walking and cycling as a part of daily life. This issue cannot be solved through a single sector; it should be coordination between the public health community and Transportation professionals, urban planners, architects, and private developers. All of them must provide the improvements in walking and cycling conditions so desperately needed to reduce the dangers of walking and cycling in Arabic cities.
- The safety issue must be brought home to Arabic communities by public campaigns emphasizing the direct impacts on individuals, their families, and their friends.
- This guidelines and safety countermeasure should come from two key safety issues: exposure and risk. Sustainable urban development practices that can (a) reduce exposure by preventing the need for vehicle travel, thus preventing a crash before a trip would even begin; and (b) reduce risk by encouraging safer vehicle speeds and prioritizing pedestrian and bicyclist safety.
- There are several objectives that governments, urban planners, and transportation professionals should address to improve pedestrian safety and mobility: Decrease and management of motor's speed of , management pedestrian's crossing locations to increase risks, Provide sidewalks and walkways separate from motor vehicle traffic and Increasing the level of caution and signs , Improve human's behavior and awareness via public programs and campaigns
- - Governments need to address the lack of gap that results from this range of responsibilities..(http://dx.doi.org/10.1787/9789282103654-en)
- Ensuring that walking is an engaging alternative and complement to the motorized transportation system and it is a core response to the challenges of climate change, fossil fuel dependence, pollution, maintaining mobility for an aging population, health, and managing the explosion in motorization expected in low- and middle-income countries. (ITF,2012)
- Environmental interventions (For example roadway barriers, selected traffic-calming designs, or pedestrian crossings) are effective in reducing children's daily exposure to highly congested roads
- Improving nighttime lighting to enhance pedestrian safety in many situations.
- A variety of strategies are available to improve pedestrian safety. A comprehensive approach involving the "three E's" (Engineering, Education, and Enforcement), as well as making pedestrian-conscious land use decisions, is recommended. Engineers, educators, planners, and enforcement officials all play a role in helping to identify and implement effective safety improvements.
- All streets must be designed safe and pleasant for pedestrians of all ages, gender, and abilities. The Governance should set a strict law to protect the rights of people with special needs. In accordance with this law, equitable access and related facilities must be accommodated in all aspects of design.
- The Protection from the elements of the weather is critical to the pedestrian's perception of comfort. Streets should
- be narrow in a place having a hot climate, future climate and climate's change should be considered , The meteorological experts should be involved to warn citizens from the walking during bad weather
- A city street must possess a clear demarcation between public and private space, and the sidewalks must have users

- on it fairly continuously. A substantial number of stores/ bars/restaurants help in surveillance on streets. And the location of services impact on where pedestrians actually walk services availability . Having destinations close to each other; sitting schools, parks, and public spaces appropriately
- Local authorities should advocate for improvements in public transportation and Focus on making transportation safe, accessible, and be welcoming to all users. Good lighting, clear signage, and courteous drivers can be just as important as having an appropriate infrastructure in place.
- The pedestrian system should be safe. Sidewalks and crossing should be designed to minimize conflicts with motorized and non motorized vehicle traffic this can reduce the risk of crashes.
- The local authorities should clean all public spaces from Graffiti's that may people feel unsafe as well as the amount of litter and the level of neglect.
- Slippery surfaces, such as smooth granite and paint, and uneven surfaces, such as cobblestones and brick, should not be used in the primary pedestrian or bicycle travel paths. Bumpy surfaces may be especially uncomfortable for wheelchair users and a tripping hazard for all pedestrians. Also grates and Covers should have a rough surface
- texture, but without regular, large protrusions that could result in the vision impaired mistaking them for a tactile surface
- Governments should use a semi-immersive practical pedestrian street to investigate the influence of conversing on
- phone, texting, and listening to music on pedestrian safety.
- Local authorities, NGO and media should educate pedestrians about the value of wearing light colored clothing and reflective materials especially at night time; it is also considered important to educate both pedestrians and drivers to the rights and responsibilities of all road users.
- Must take into account good tests before giving driving license and Periodic blood tests for drivers .
- Researchers in coordination with governments should develop and enforce vehicle design standards for pedestrian protection , and The technical specifications of vehicles imported from abroad or manufactured internally and the pedestrian's safety requirements should be reviewed .This can be done through monitoring and follow-up reports of traffic accidents according to the types and brands of cars and their specifications
- Pedestrian safety remains an important public health problem, and effective evidence-based solutions exist.
- The high percentage of death and injuries is the expected result of unsafe streets and walkways.
- Pedestrian's Safety > Walking levels > Public health




Factors affected pedestrian's safety

**REFERENCES**


- A. A. (2013). The effects of topography on walking and cycling in suburban centres:. Australasian Transport Research Forum 2013 Proceedings.
- Advances in Landscape Architecture. (2013). InTech.1.
- Alzaman, N., & Ali, A. (2016). Obesity and diabetes mellitus in the Arab world. Journal of Taibah University Medical Sciences, 11(4), 301-309. doi:10.1016/j.jtumed.2016.03.009
- Badri, A., & Andrey, J. C. (2016). The Influence of Weather and Climate Change on Pedestrian Safety. Waterloo, Ontario, Canada: University of Waterloo.
- BE(hons), B. B., M., M., & C. (2017). UNDERSTANDING PEDESTRIAN SAFETY IN NEW ZEALAND. IPENZ Transportation Group Conference.P.10.
- Corazza, M. V., Mascio, P. D., & Moretti, L. (2016). Managing sidewalk pavement maintenance: A case study to increase pedestrian safety. Journal of Traffic and Transportation Engineering (English Edition), 3(3), 203-214.
- Countermeasures to Improve Pedestrian Safety in Canada. (2013). The Canadian Council of Motor Transport Administrators.P.10.
- C, Y., & Guoguo, A. (2017). Pedestrian safety under permissive left-turn signal control. International Journal of Transportation Science and Technology, P.60.
- ÇİÇEK, B. E. (2009). PEDESTRIAN SAFETY AROUND ELEMENTARY SCHOOLS (master's thesis). MIDDLE EAST TECHNICAL UNIVERSITY/THE GRADUATE SCHOOL OF SOCIAL SCIENCES.P.12
- Elvik R, et al. The handbook of road safety measures, 2nd ed. Bingley, Emerald Group Publishing Limited, 2009
- F.C. Hodgson, M. Page, M.R. Tight (2004) A Review of factors which influence pedestrian use of the streets: Task 1 report for an EPSRC funded project on Measuring Pedestrian Accessibility. Institute of Transport Studies, University of Leeds, Working Paper 581.15.P.18.
- ITF (2012), Pedestrian Safety, Urban Space and Health, OECD Publishing.
- Jennie, O. (2010). IMPROVING PEDESTRIAN SAFETY. CURTIN - MONASH ACCIDENT RESEARCH CENTRE.P.1.
- Jennie, O. (2010). IMPROVING PEDESTRIAN SAFETY. CURTIN - MONASH ACCIDENT RESEARCH CENTRE.P.5.
- Kashani Jou, K. (2011). Pedestrian Areas and Sustainable Development. International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering Vol:5, No:5, 2011, .P.5.
- Pedestrian design. (2002). San Diego Region: Planning and Designing for Pedestrians.P.4.
- Pedestrian Areas and Sustainable Development [36] R. Tolley, "walk21 IV: Health, Equity & Environment", Conclusions of walk21 IV Conf. Portland Oregon, 2003.
- Pucher, J., & Dijkstra, L. (2003). Promoting Safe Walking and Cycling to Improve Public Health: Lessons From The Netherlands and Germany. American Journal of Public Health, 93(9), 1509-1516. doi:10.2105/ajph.93.9.1509
- Pedestrian planning and design guide. (2007). Wellington, N.Z.: Land Transport New Zealand.P.8.
- Pedestrian safety: a road safety manual for decision-makers and practitioners. (2013). Geneva: World Health Organization. P.20.
- Jennie, O. (2010). IMPROVING PEDESTRIAN SAFETY. CURTIN - MONASH ACCIDENT RESEARCH CENTRE.P.3.
- R. (2010). EVALUATION OF THE URBAN PEDESTRIAN ENVIRONMENT: A QUALITATIVE APPROACH (doctoral thesis). ANNA UNIVERSITY CHENNAI.CHAPTER 2.P.34.
- R. (2010). EVALUATION OF THE URBAN PEDESTRIAN ENVIRONMENT: A QUALITATIVE APPROACH (doctoral thesis). ANNA UNIVERSITY CHENNAI.P.CHAPTER 2 .P.29.
- Teir, R. (1993). Maintaining safety and civility in public spaces: A constitutional approach to panhandling. Louisiana Law Review.
- Manual for streets. (2007). London: Thomas Telford Pub.P.63
- Movahed, S., Azad, S. P., & Zakeri, H. (2012). A Safe Pedestrian Walkway; Creation a Safe Public Space Based on Pedestrian Safety. Procedia - Social and Behavioral Sciences, 35, 572-585. doi:10.1016/j.sbspro.2012.02.124.P.4.
- Mwakalonge, J., Siuhi, S., & White, J. (2015). Distracted walking: Examining the extent to pedestrian safety problems. Journal of Traffic and Transportation Engineering (English Edition), 2(5), 327-337. doi:10.1016/j.jtte.2015.08.004.P.3.
- Pedestrian planning and design guide. (2007). Wellington, N.Z.: Land Transport New Zealand.P.20.
- R. (2010). EVALUATION OF THE URBAN PEDESTRIAN ENVIRONMENT: A QUALITATIVE APPROACH (doctoral thesis). ANNA UNIVERSITY CHENNAI.CHAPTER 2.
- Ryan, T., Allen, E., & Rand, P. (2011). Detailing for landscape architects: aesthetics, function, constructibility. Hoboken: Wiley.P.2.
- Pedestrian planning and design guide. (2007). Wellington, N.Z.: Land Transport New Zealand.P.101.
- ( Wang, T., Cardone, G., & Corradi, A. WalkSafe: A Pedestrian Safety App for Mobile Phone Users Who Walk and Talk While Crossing Roads.) (Mwakalonge,2015)
- Welle, B. (2015). Cities safer by design: guidance and examples to promote traffic safety through urban and street design: version 1.0. Washington: World Resources Institute.
- Zaki, E. G., & Abdelhalim, K. (2017). Towards more pedestrian-friendly streets in Cairo. Cairo: American University in Cairo. ,
- Zegeer, C. V. (2002). Pedestrian facilities users guide: providing safety and mobility. McLean, VA: Federal Highway Administration, Turner-Fairbank Highway Research Center.P.7.
- Charron, D. (2017, ). Https://www.washingtonpost.com/news/where-we-live. Walkable neighborhoods provide health, environmental and financial benefits. Retrieved October 9, , from

http://www.washingtonpost.com/news/where-we-live/wp/2017/10/09/walkable- neighborhoods-provide-health-environmental-and-financial- benefits/?noredirect=on&utm_term=.1435380093c3