

Infrastructural Waste in Nigerian Urban Centres: Case of Pedestrian Bridges in Uyo Metropolis, Nigeria

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Abstract

Walking is the basic human instinct to move from one place to another. Even in modern cities with a well-developed traffic system, walking is still indispensable. A cross-over bridge is a facility that provides a safe and comfortable environment for all road users to move around the city without having to worry about traffic mishap. A pedestrian bridge is a type of bridge that is enclosed or covered between two sides of a road. They are constructed for the safety and convenience of pedestrians. They are aimed at decreasing traffic congestion, reducing vehicular air pollution, separating people from vehicular noise, easing traffic movement and reducing vehicular accidents in the city. They are constructed in dense traffic junctions for people in order to maintain traffic system. Unfortunately this infrastructure has become a major waste especially in terms of cost and usage; since majority of pedestrians have refused to use them but prefer to run across the high way, thereby defeating the purpose for which these bridges were constructed. Lots of accidents have thus occurred due to pedestrians crossing busy roads. About 65

Index terms— infrastructure; urban waste; pedestrian bridges; uyo metropolis; akwa ibom state.

1 Introduction

ots of accidents have occurred due to pedestrians crossing busy roads. And with a very high rate of human casualties, it still baffles several observers that many city dwellers still prefer plodding dangerously when crossing busy roads in the city, than using the pedestrian bridges where available.

For a long time now, transportation has been one of the most important of man's activities in space. Man's ability to move himself and his materials from one point to another on the earth's surface significantly influences his life and his environment. Generally, resources and needs are usually spatially distributed in landscape but the areas of desires exist away from the areas of fulfillment and the spatial inequality created calls for interactions and movement within urban setting. Thus, both intra and inter city transportation system bridges this gap bringing people and resources together in both space and time. Furthermore, one of the ways by which man organizes the space around him is through the creation of settlement around him and man usually uses transportation as a tool to bring orderliness into the settlement.

However, there is the inevitability of transportation in the city and the basic necessities of life. For instance, man's basic need of food, clothing and shelter could hardly be achieved without transportation. Hence transportation could be referred to as "the life wire of our socio-economic and political life". This means that without transportation life as it is today would be inconceivable. When the relationships between transportation and city are compared, transportation is particularly carried out in the existence of a city and the existence of city is greater than demand for transport. What this means is that transportation in the city anywhere in the world denotes that transportation is a potent to influence any city growth and development. But what is being witnessed today in some emerging cities like Uyo and many others in Nigeria beset mobility problems, called "negative externality" or "maker or breaker of the cities".

Experience has shown that most urban traffic problems are further aggravated by the concentration of most of the working avenues in the same locations, such that traffic is basically in one typical direction during the morning rush hour and evening peak periods. In Uyo for example, the population of new settlers into the city from other major urban areas is hectic. Most especially new comers moving away from the northern parts of the country as a result of occasional banditry, kidnappings, religious uproar and sectorial killings. Thus the increase in the population of new arrivals is becoming more difficult to handle, especially resulting in the increasing "bumper to bumper" traffic experienced along major roads and junctions in Uyo in recent time.

This work therefore takes a critical look at what the Akwa Ibom State Government has done to be able to ease this traffic problem through provision of pedestrian bridges; and the perception of users of such infrastructure. It is to establish if the huge material and financial resources expended on such infrastructure is worth the while.

2 II.

3 Methodology

At the dawn of the twenty-first century, one of the most persistent and challenging problems facing Nigerian cities is inadequacy and misuse of urban infrastructure and the subsequent deterioration of the available ones. The availability of less space in urban areas has increased demand for parking spaces especially in central business areas. Inadequate offstreet parking in most of our urban centres has metamorphosed into the problem of on-street parking coupled with inadequate traffic management commonly experienced in most Nigerian cities.

In view of the above, this work examined the challenges posed by pedestrian bridges and traffic congestion problems in Uyo, Nigeria. The study was conducted using questionnaires, on the spot interviews and field observation. The questionnaire was designed to determine the reasons why pedestrians do not use the available pedestrian bridges in town. Four hundred and fifty one (451) questionnaires were administered to the students of University of Uyo, one hundred and seventy four (174) to shop owners and hawkers and one hundred and two (102) to commuters, making a total of seven hundred and twenty seven (727).

4 III.

5 Theoretical Frame Work

The history of prefabricated steel truss bridges dates back to the 1930s when modular systems were used to meet the needs of the British military in remote locations. In the 1950s, deck girder bridges were developed as a replacement for deteriorating timber bridges. (See Fig. ?? below). Today, truss designs are longer, wider, stronger, and more durable. These designs combined with technological improvements and manufacturing efficiencies, will continue to support the ever-growing and ever-changing needs of society as they relate to pedestrian bridges.

According to Wikipedia, a pedestrian bridge is a bridge designed for pedestrians and in some cases cyclists, animal traffic and horse riders, rather than vehicular traffic. Footbridges complement the landscape and can be used decoratively to visually link two distinct areas or to signal a transition. In many developed countries, pedestrian bridges are both functional and can be beautiful works of art and sculpture. For poor rural communities in the developing world, a pedestrian bridge may be a community's only access to medical clinics, schools and markets, which would otherwise be unreachable when rivers are too high to cross. Simple suspension bridge designs have been developed to be sustainable and easily constructible in such rural areas using only local materials and labour.

Pedestrian bridges are often situated to allow pedestrians to cross water or railways in areas where there are no nearby roads to necessitate a road bridge. They are also located across roads to let pedestrians cross safely without slowing down the traffic. Most pedestrian bridges are equipped with guard rails to reduce the risk of pedestrians falling. Where they pass over busy roads or railways, they may also include a fence or other such barrier to prevent pedestrians from jumping, or throwing projectiles onto the traffic below. In some cases, the bridges may be totally caged and airconditioned, for comfort and safety. (See fig. 2) below. According to the Ministry of works, Uyo, Akwa Ibom State, an overhead or pedestrian bridge is estimated to cost between 7.5 to 10 million naira. That the state could go into such huge venture is because of the perceived advantages of pedestrian bridges which were highlighted to include:

? helps to minimize traffic congestion ? helps in reducing road accidents ? provides security to pedestrians while crossing roads ? enhancement of aesthetic value of the city It was further learnt that the state government intends to erect more pedestrian bridges in Uyo, at strategic positions in an effort to turn the state into a modern city. That the state government would ensure that it provides pedestrian bridges on dual carriage ways to safe guard the lives of pedestrians who cross the road. And that the pedestrian bridges would enhance the aesthetic and architectural features of the state and help avoid loss of lives during the yuletide and other festive periods.

6 b) Study Area

Akwa Ibom State has one of the highest population densities in Nigeria. It lies between latitude 4°32'N and 5°33'N North and longitude 7°25'E and 8°25'E East. The state covers a total area of 604 km² (233 sq mi), elevation of

32 m (105feett) above sea level, has a population of over 5 million people and more than 10 million people in the diaspora. Akwa Ibom State was created in 1987 from the former Cross River State. Uyo, the capital city of Akwa Ibom State is located approximately between latitude 5 00' and 5 05' North of the equator and longitude 7 45' and 7 55' East of the Green Wich Meridian. There are currently four pedestrian bridges in Uyo metropolis. These include:

- ? pedestrian bridge at Edet Akpan Avenue.
- ? pedestrian bridge at Ikpa Road by University of Uyo, main gate.

7 Discussion of Findings a) Why Uyo Residents Neglect Pedestrian Bridges

Our investigations show that most pedestrians avoid the use of pedestrian bridges in Uyo like in other cities of Lagos, Port Harcourt and Abuja; thus raising the question if the huge amount invested in this infrastructure is not an economic waste. A handful of respondents have the following to say why they prefer running across very busy streets instead of using the pedestrian bridges:

? Uduak Ndomson says "I have used it once and it is scary! The design of most of the bridges is not friendly at all. They are too long and too high for those who have phobia for height. I will rather take a keke (tricycle) that is going to the other side of the road than climb a bridge." ? Stanley Etim, a photographer says Ikpa road is too narrow for a pedestrian bridge. He also noted that there is a speed bump close to the Annex gate so why build a bridge there when vehicles usually slow down when they approach there. ? A physically challenged person, Idongesit Okon, complained that climbing the pedestrian bridge remains a tedious task and clumsy for him and individuals like him. He also said that people like him were never taken into consideration while designing the pedestrian bridges. So if today it becomes a law in Akwa Ibom State that every pedestrian must use the bridge, what would be his faith, he asked. ? "It is faster and energy saving, to walk across the road, as the bridges are built so high, while walking when you look at cars down, you feel dizzy," so expressed Udoka Francis another resident at Annex gate. ? Mrs. Abraham Peters, a resident, who lives along Edet Akpan Avenue, said "Nigerians generally love disobeying laws; some people do not really know why they should use a pedestrian bridge when they want to cross a major road but I have never used it before.

? Dorcas Ephraim says she doesn't like using the bridge because her skirts will be open to viewers under the bridge, as the bridge is bounded by steel trusses. ? A mechanical engineering student, Adindu Okpara, said he would prefer the use of speed limiters and speed bumps than climbing the pedestrian bridge on Ikpa road. ? A resident along Edet Akpan Avenue, Mr Usungurua says "why waste such energy going up about 32 stairs, then walk across before climbing down another 32. The location is good but I would rather have the keke (tricycle) stop me at the opposite side than climb those flights of stairs. ? Ndifreke Akpaimo says "to me the pedestrian bridge at Ikpa road is not needed. The road is not an express one and I just need less than a minute to go across whereas it would take me about five minutes or more to climb the pedestrian bridge. ? Lady Glory Essien says "it is tiring, I know what it takes to climb a stair at home how much more that number in the public? besides I don't like heights. ? Catherine Okpara says "I have never climbed one before, I cannot imagine the experience".

8 b) Why Abuja Residents Neglect Pedestrian Bridges

There is no doubt that ensuring that Abuja residents make proper use of pedestrian crossings or overhead bridges within the Federal Capital City (FCC) has become an inexorable tough task for the FCT Administration especially its Transportation Secretariat. Ordinarily, it is safer to use a pedestrian crossing or an overhead bridge whenever one is available especially as the roads are very busy nowadays in the city, but still many residents in the nation's capital are not willing to use the bridges, when crossing major roads in the Territory. Unfortunately, for the few residents who patronize them, they are faced with inconveniences from illegal activities like roadside trading (hawking) and begging, including misdemeanour by miscreants. Consequently, there is an increasing rate of some pedestrians being killed, with many more injured or maimed for life. Surprisingly, this development had Figure ??: Pedestrian Bridge by Mashe Umaru Gwamna Some said that the fact remains that part of the reasons for the total neglect or wrongful use of the pedestrian crossings, is that some residents are ignorant or refused to understand that the pedestrian bridges are meant to ensure their safety when crossing major roads and not punish them.

A cross section of residents, who shared their views on reason why people prefer crossing busy express roads, thereby neglecting a handful of pedestrian crossings and overhead bridges.

? A resident, who was seen along NICON junction, Mr. Sendi Longs, said "I don't know why we Nigerians love disobeying laws; some people do not really know why they should take a pedestrian bridge while they want to cross a major road.

Vehicles have been killing people, which was why government came up with the idea of constructing pedestrian crossings. People should thus stop complaining about the location of these facilities, as they should know that trekking is part of physical exercise to help them keep fit. He said that people really needed to be educated, because a lot of people seem not to know the benefits of using those pedestrian bridges". ? "Crossing the road directly is faster for me, than using the pedestrian bridges, which comes with a lot of stress, as one gets tired easily, leaving pains in ones legs. The bridges are so high and the steps are too many, I had to count the staircase

one day while climbing one of them, they were about 86 in number, that's too much for me, so it's better to run across the road to the other side. It is faster and energy saving, as the bridges are built so high ,while walking when you look at cars down ,you feel dizzy," so expressed another resident at Banex junction, Uloma Okafor. He said, in building the pedestrian crossings government did not consider physically challenged Persons. He therefore noted because of the failure factor in the interest of the disabled, traffic warders be stationed at strategic places along busy roads, to always stop vehicles for physical challenged persons to cross, while the government should religiously ensure that residents use the available pedestrian bridges when crossing the roads. ? Similarly, a physically challenged person, Nehemiah Sule, noted that climbing the pedestrian bridge remains a Herculean task and clumsy for him and individuals like him. "At times especially in the evening people are so choked, we get stressed up, so crossing the road directly is preferable, than going through the stress of climbing the bridges. "Crossing the roads directly has its own disadvantages, as when crossing you may calculate that cars coming are far way, but before you could realize they are very close. Most cars on express road come with speed and hit you. So it is risky, but for people like me, taking pedestrian bridge is not easy, it is even more dangerous to our health. "But Government should always consider us while constructing these bridges and other useful things that will help the citizens," he stressed. ? Furthermore, a civil servant, Usman Jubril, said road safety signs like the zebra crossing are not even used in the country, as most people are always in a hurry to get to their destinations. "Using the zebra crossing, most motorists are not patient to allow pedestrians crossing the road, as they drive their cars close to the safety lines. He advised individuals to be careful when relying on the Zebra crossings where there are no pedestrian bridges, as some drivers are nonchalant, so they hit some individuals because everyone wants to beat the traffic. Jibril said people in FCT need to be sensitised on various road safety measures -whether it is the use of pedestrian bridge or the zebra crossing. He however added that the government should make it mandatory for people to know that once they don't use any available overhead bridge or the zebra crossing there will be penalty or mobile court to persecute them. ? For Peter Osakwe, to tackle the issues of abuse of pedestrian crossings, the governments must enforce drastic measure by implementing rules that will go a long way to motivate residents to start using the facilities. "For me I love using those bridges because no one should tell me that I need to protect my life. Even as stressful as the staircases are, I still prefer using them for my personal safety". ? Furthermore, one Odianosa Fregene, noted many people erroneously feel it was easier for them to cross the road rather than use the pedestrian crossings, as they look at the distance of the bridges and think it is awkward, without Knowing the damning consequences involved while doing otherwise. She reiterated that Governments should create more awareness to let residents know the benefits of not crossing the high ways directly ? Also, a builder, Miss. Helen Ibrahim, emphasized that the design and construction of the bridges is mainly for the safety of cars and the pedestrian. "We construct all bridges so that people would not be endangered while using the roads, because their safety is most important."The neglect of pedestrian crossings can be addressed only if the FCT administration collaborates with vital agencies to enlighten the public about the pedestrian crossings. "Pedestrian laws has been enforced by the Lagos state government, it can also be replicated here (Abuja) by the FCT administration, by commissioning some people that will force defaulting individuals to comply with the use of the pedestrian bridges. "Traffic warder, VIO and Road safety need to be stricter on the use of zebra crossing to also reduce increasing death rate from avoidable road mishaps," she stressed.

? Also, Head, Public Relations of FCT Transportation Secretariat, Ifeanyi Ughamadu, said there are many overhead bridges without encumbrances, "So I don't know why pedestrians, should not use the bridges where they are available. "If the bridge is not available and one decides to cross roads, it would be understandable, but where the bridges are available, you don't have reasons not to use them. "As a way out, he disclosed that the FCTA has since embarked on construction of barricades near the bridges, to force people to stop crossing the road directly without using them. "For instance, in Area 1 where we have provided a pedestrian bridge, we have gone a step further by constructing some barricade a kilo meter front and back from the bridge, to dissuade people from crossing the road wrongfully. "But, we find out that in most cases, even as we barricade the bridges people still go and open up the barricades, and create an opening where they will sneak through rather than use the bridges to cross major roads. (See Fig. ??)

Figure ??: Damaged Barricade, to avoid using pedestrian bridge "It is a very disturbing trend, but we are not resting on our oars to tackle the menace, because once we catch anybody doing such, of course the law is there to take care of such persons," he stressed. Continuing, he added, "We find out that most people, who are supposed to use these pedestrian bridges, are not using them because of these illegal activities on top of them. We have received reports of people being attacked on top of the bridges by all these miscreants. So we are working seriously on that. On issue of location of the bridges being far from bus stops, he said the concern is being addressed by the secretariat through synergy with transporters in the city. "We are trying force operators of high capacity vehicles to drop passengers close to where we have these pedestrian bridges. Because it would be unwise to drop passengers a kilo meter away from where the bridges are actually available. "If you notice, now most of these high capacity vehicles normally discharge passengers close to these bridges. But dismissing the allegations that the bridges are very far from junctions where the pedestrians are heading to, he said, "We don't construct over-head bridges just like that, but we take a lot of things into consideration; we look at the length of roads; various interjections etc. "We construct a bridge where there is a need for one. For instance, between National Assembly headquarters and Area 1 we have a pedestrian bridge there. So, people in the area are supposed to walk a little distance that it is just about half a kilo meter and access the bridge. "The bridge must not just

be sited where you want it, if not we will have more than ten bridges within just a short distance. "The PRO therefore pleaded with residents, not to see the pedestrian bridges as a profitable avenue for their businesses, as it is not supposed to be so, because they are forcing other people not to use the bridges. He stressed that the bridges are not meant for activities like trading, begging and misdemeanour by miscreants, but it is only meant purely for purpose of ensuring safety of people crossing major roads in the Territory. "We have gone severally to all the notorious ones, where illegal activities are taking place-to round up the miscreants doing some businesses on top of bridges, and we have taken them to our Mobile courts to be tried.

9 c) Why Lagos Residents Neglect Pedestrian Bridges

With pedestrians shunning the bridges on the major highways in Lagos, accidents are on the increase as the state intensifies efforts to arrest offenders, according to Motunrayo Joel.

10 ? John Adeyemi was driving home from work on a wet

Wednesday night in April when he witnessed the crushing of a young man by a lorry after he attempted to cross the expressway, shunning one of the pedestrian bridges along the Ikorodu road.

Giving the gory details of the accident, Adeyemi, who works with a leading newspaper company in Nigeria, said the unpleasant experience shattered his night as the shocking incident haunted him in his sleep. He said death like this was avoidable if the need for pedestrian bridges on the expressway was appreciated. "The pedestrian bridges add aesthetic value to our society but the major reason for their construction was to avoid accidents on the roads. It is however unfortunate that people still prefer to risk their lives by crossing the road even when there are government agents put in place to arrest offenders. They prefer arguing out with the officers to using the bridges. "I would have killed the man but I applied brakes to avoid him. He was however unlucky as the lorry beside me hit him and ran over him with his body parts flying all over the road," Adeyemi said. Such deaths are becoming daily occurrences on the Lagos roads, especially on the Ikorodu Road, Lagos-Abeokuta Expressway, and areas like Ikeja and Lagos Island where the pedestrian bridges are erected. Despite warnings from the state government and its agencies, most Lagosians have chosen to turn a deaf ear to these warnings. Regardless of the risk and the fatal consequences involved in crossing the expressways, some pedestrians uphold the view that the choice to use the bridges is personal. A trip around Lagos reveals that apart from the people who dash across the express roads at rush hour of each day, those who hawk goods on the expressways freely choose to break the traffic rule.

? Bunmi Olusola is a hawker in Ojota, who takes advantage of the gridlock on the road to sell to motorists. To her, the law banning people from crossing the highway is a way of taking away food from some peoples' tables. She said, "I can't be carrying my goods over the pedestrian bridge, it's stressful. I find it easier crossing the road. I know it's not safe, but that is what I prefer. I hawk goods here all the time so how will I make money if I have to cross the road, using the pedestrian bridges. No motorist will wait for me if I have to climb the bridge before coming to sell to them. We are used to the system." ? To some pedestrians, crossing the highway is worth the risk because of the "stress" involved in using the bridges. Mary Sidney defended those who cross the highways, blaming the act on the unfriendly design of the bridges. She said her health could not endure climbing the tall and lengthy bridges. "It is not easy climbing most of those bridges," she said. "I nearly had a heart attack the day I tried to climb one of them. The design of most of the bridges is not friendly at all. They are too long and too high for those who have phobia for height. I will rather take a bus that is going to the other side of the road than climbing a bridge." ? John Obi said the huge flow of people on the Ojota pedestrian bridge was enough to scare people from using it despite the government's effort to upgrade it to modern one. "The bridge is always filled with people climbing up and down. There is no easy movement and so I find it difficult to use. If one is not careful, you can fall on the staircase. I prefer crossing the expressway to getting stuck in human traffic," he said. ? To ensure that the people make use of the bridges, thereby stopping accidents on the roads, the Lagos State Government empowers officers of the Kick against Indiscipline to arrest anyone who crosses the road. At Ojota, many of the officers, in green uniforms, can be seen patrolling median of the dual carriageways, waiting to arrest pedestrians who break the law. The agency has an office by the foot of the bridge linking motorists with the Lagos-Ibadan Expressway. Here, offenders are tried in an emergency court and if necessary fined. One of the officers, said his colleagues were having a difficult time persuading the people to use the bridge, adding that those arrested sometimes attempted to force their way to freedom by fighting them. ? He said, "Anyone caught crossing the expressway will be sent to our office at Alausa, Ikeja, after which the person would be taken to the Ikeja High Court. The fellow, if found guilty, would be asked to pay a fine. The guilty offender could be asked to engage in community service." ? An official of the Lagos State Traffic Management Authority said Ojota produced the highest number of traffic offenders because of the huge flow of traffic and human beings to various destinations in Lagos. He narrated the story of a man killed by a vehicle on the road. ? "Cases of people being hit by vehicles happen at least once in a week in the area (Ojota). Some of the victims thought they could move faster than the vehicles but in the twinkling of an eye, they are knocked down dead. We warn people not to cross the road but they prove to be stubborn even with the presence of agency officials," he said. ? Around the airport area in Ikeja, cases of people being knocked down as they try to cross the expressway are also on the increase. However, some pedestrians point out that the bridges are not safe sometimes. Chukwudi Ndimi

said that the governments of Lagos and Ogun states had ignored the plight of the people who were left with no alternative but to cross the expressway at Berger bus stop. He said, "Everyday, hundreds of people cross the expressway. There is the need to construct a pedestrian bridge across the highway to ease the flow of people who cross the expressway.

Lives have been lost there on many cases but a bridge over the road can stop this tragic occurrence." ? There are about seven pedestrian bridges between the Alaka end of the Ikorodu Road and Ketu bus stop. At night, pedestrians said it was unsafe to use any of the bridges. The same was said of other bridges in other parts of Lagos, with many of them being taken over by mad men and hooligans at night. ? "The bridge at Barracks bus stop on the Ikorodu road is a no go area at night," said Monica Johnson, who lives on Yaba road. "Thugs take over the bridge at night and we have heard cases of rape and robbery at night on the bridge, so people avoid it at night. They cross the road and it has led to the death of some people who were knocked down by vehicles," she added They also engage in community service. We also use the United Nations One-week Road safety Day to enlighten the public on the advantage of using expressway safety facilities," he said. ? Speaking on the number of pedestrians who had lost their lives between 2010 and 2013 he said, "In 2010 we lost three pedestrians, in 2011 three, in 2012 seven and in 2013 four. So, between January 2010 and May 2013 a total number of 17 pedestrians had died." ? The Lagos State Commissioner for Transportation, Kayode Opeifa, said that pedestrians' refusal to use overhead bridges was one of the reasons why there was gridlock in the state. "On the Ikorodu Road axis, pedestrians' refusal to use the bridges located at major bus stops is responsible for some of the traffic gridlock experienced in the state. Traffic builds up while motorists are trying to slow down for pedestrians who are trying to cross the highways. In my opinion and based on my assessment, the traffic build-up is not caused by commercial buses' drivers, contrary to belief of most motorists," he said.

V.

11 Conclusion

Judging from what was found out in Lagos and Abuja, where pedestrians consistently refuse to use the pedestrian bridges, one would have thought that Akwa Ibom State government would have learnt a lesson from there and thus avoid this huge amount invested in these infrastructure in Uyo Metropolis. Furthermore, we feel the users should have been consulted as to what their traffic needs are along these roads -especially when it was mentioned, and rightly so, that Ikpa road in Uyo is just a single lane road, not prone to so much risk of pedestrian crossing, and as such will not require a pedestrian bridge. We do not believe that overhead pedestrian bridges are signs of technological advancement, especially if such bridges fail to serve their intended purpose -that of saving the lives of commuters. We therefore submit that these bridges are infrastructural waste. Alternatively, speed limiters are therefore being suggested. In addition we recommend adequate awareness where people are thought to value their lives and that of others. Furthermore, proper sensitization should be carried out on both pedestrians and motorists using major highways in the state.

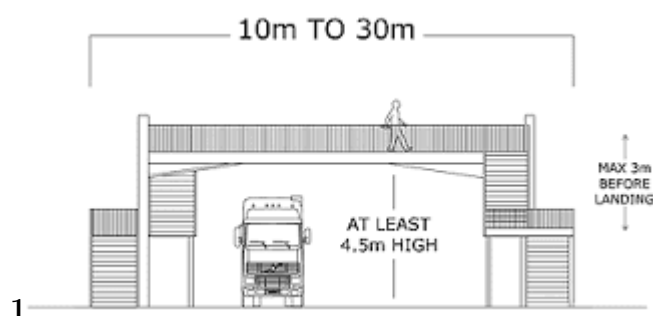


Figure 1: Figure 1 :

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2

Figure 2: Figure 2 :



3

Figure 3: Figure 3 :



Figure 4: B



Figure 5:



Figure 6: B

Figure 7:

the convention states as follows: To enable persons with disabilities to live independently and participate fully in all aspects of life. It further states that appropriate measures be taken to ensure persons with disabilities have access, on an equal basis with others, to the physical environment, to transportation, to information and communication, including technologies and systems, and to other facilities and services open

information and communication

Figure 8:

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