Md. Nazmul Haque, Sharmin Siddika, Mizbah Ahmed Sresto: POVEZAVA MED MESTNIMI ZELENIMI ULICAMI IN TRAJNOSTNOSTJO: PRIMER OBMOČJA MESTA KHULNA (KCC), BANGLADEŠ NEXUS BETWEEN URBAN GREEN STREETS AND THE SUSTAINABILITY: CASE ON KHULNA CITY CORPORATION (KCC) AREA, BANGLADESH

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1.02 Pregledni znanstveni članek / Review Article

POVZETEK

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Hitra urbanizacija v Bangladešu je negativno vplivala na ekosistem in posledično na podnebje. Območje preučevanja v tem članku je mesto Khulna (KCC). Glavni cilj te študije je predlagati izvedljive modele zelenih ulic za zmanjšanje onesnaženosti okolja. Predlagani so zeleni pasovi, ki zmanjšujejo vpliv škodljivih plinov in hkrati ohranjajo ekološko ravnovesje, kar prispeva k izpolnitvi 11. cilja trajnostnega razvoja. Članek ima tri dele. V prvem delu sta predstavljeni raziskava rabe in pokrovnosti tal ter raziskava javnega mnenja, izvedeni glede na sedanje stanje. Nato je predstavljen predlog sistema zelenih ulic na različnih križiščih, avtocestah in v soseskah mesta Khulna, ki temelji na nekaj uspešnih primerih. Nazadnje je predstavljen konceptualni okvir za izpolnitev 11. cilja trajnostnega razvoja. Iz raziskave je razvidno, da se je v zadnjih 20 letih vegetacija zmanjšala za 5 %. Prikazano je tudi, da je skupna količina ogljikovega dioksida (CO2), ki jo lahko sprejmejo velika drevesa po desetih letih, približno 32.000 kg na leto. Skupna količina CO2, ki jo lahko porabi grmičevje, je 34.810 kg na leto. Glede na raziskavo o zadovoljstvu uporabnikov je več kot 90 % ljudem všeč zamisel o zelenih ulicah, več kot 60 % pa jih meni, da bo uporaba ulic po ozelenitvi bolj praktična. Uspešno sprejetje zelenih ulic bo pripomoglo k doseganju za življenje prijetnih in zdravih skupnosti, mestno območje pa bo z izpolnitvijo 11. cilja trajnostnega razvoja postalo trajnostno.

KLJUČNE BESEDE zelene ulice, križišče, cesta, trajnostnost, urbanizacija

ABSTRACT

Rapid Urbanization in Bangladesh has created a negative impact on the ecosystem and it's resulting a change in the climate. In this research, Khulna City Corporation (KCC) is chosen to be the study area. The main objective of this study is to propose feasible models of green streets to reduce environmnetal pollution. Then it proposes green belts to alleviate the effect of harmful gases while maintaining ecological balance to achieve Sustainable Development Goals (SDGs) 11th goal. The study is completed in three phases. Firstly, Land Use Land Cover (LULC) detection and public opinion survey was conducted considering the existing scenario. Secondly, green street system was proposed in different intersection points, highways and neighborhoods of Khulna city on the basis of some successful cases and finally a conceptual framework for achieving SDG's 11th goal is shown. This research shows that about 5% vegetation has decreased over the last 20 years. Also it shows the total amount of carbon-di-oxide (CO2) that can be consumed by big trees after 10 years is approximately 32,340 kg per year. The total amount of CO₂ that can be consumed by shrubs is 34,810 kg per year. According to user satisfaction survey more than 90% people like the idea of green street and more than 60% people thinks that using the streets will be more convenient after its implementation. The successful adoption of green streets will help to achieve livable and healthy communities and also it will push the urban area towards sustainability by achieving SDG's 11th goal.

KEY-WORDS

green streets, intersection, road, sustainability, urbanization

1. INTRODUCTION

The intermitten change in world's climate is the result of haphazard development causing imbalance in our ecosystem. Impenetrable spaces of urban areas is considered to be a challenge for developing green infrastructure, specially the streets. Green infrastructure can be defined as an interrelated network of strategically planned green space that reserves the environment and natural ecosystem (Benedict and McMahon, 2002). Researchers have estimated that construction of green infrastructure is approximately 5 to 30 percent cheaper than traditional infrastructure (Kloss and Calarusse, 2006; Garrison and Hobbs, 2011). One of the essential element of green infrastructure is Green Street. A green street can be comprehended as a technique which includes vegetation and engineered system applied to a street and transforming it into pedestrian friendly, transit oriented, use of recycled materials, parking lane with permeable pavement and ability to manage storm water runoff (Abelt and McLafferty, 2017). It primarily moderates impermeable surface with additional trees and plants to increase permeability so that runoff water can be easily treated (Tilley and Slonecker, 2007-2008). Regardless of having multi-functional assistances and affordability the application of Green Street is not widely encouraged due to lack of proper guidance (Copeland, 2016).

With the increasing density of population and hasty development, permeable surfaces in cities are reducing (Sieber and Pons, 2015). Climate change is causing urban flooding, temperature rise and drought, which affects the city ecosystem (Demuzere, et al., 2014; Baruch, et al., 2018; Paul and Meyer, 2001). Not only flood and temperature rise caused by imperviousness exacerbates the adverse climate condition but also environmental pollution such as air and sound pollution causes degradation of the surrounding atmosphere. The major reason behind air pollution is use of fossil fuel in vehicles and emission of CO₂ by burning down of it. Noise is another ecological problem intensifies with the increase of vehicular movement and traffic congestion. Air pollution can be mitigated by adopting green streets instead of urban parks because it is difficult to find open space in dense city areas (Lazzari, et al., 2018). Noise can be reduced by creating wide vegetation belts or plantation of dense hedges and shrubs (Lacasta et al., 2018). Moreover, Green Street enriches the aesthetic aspect of any city (Sabbion, 2018).

Bangladesh has constructed a large road network consisting 85,000 kilometer of highways and paved roads (Alam, 2008). City streets are administrated by City Corporation or Municipality. Maximum safety, reliability, protecting air quality by reducing vehicular emission, noise limit, traffic operation, balancing infrastructure and vegetation ratio, road side beautification all these are vital in designing a city street system (Karim, 2019). But for a developing country such as Bangladesh, constructing ecofriendly streets face several challenges due to lack of coordination among agencies, lack of resources, lack of policy and strategy and lack of understanding about certain technologies in a fast changing ecosystem. The condition of streets can be improved by significantly upgrading the design of pavements and evolving towards sustainable green streets (Alam, 2008).

The street system of Khulna city is challenged by impulsive urban development which causes social, environmental and economic degradation. The road condition of Khulna City Corporation is not up to the mark (Haque, et al., 2019). Broken pavements, abrupt traffic movement, waterlogging, clogged drainage, emission of harmful gas, burning fossil fuel are the most common problems seen in the city streets. The existing street condition adds to the detriment of environment, more specifically air and noise pollution (Afroze et al., 2010). The objective of this study is to propose models of green streets to reduce environmnetal pollution and establishing green belts to alleviate the effect of carbon-di-oxide while maintaining ecological balance to achieve SDGs 11th goal of Sustainable Cities and Communities.

Several researcher have tried to explain the concept of green street implementation in several countries and cities in their paper. (Christ, 2010) have tried to review the case study in Portland, Oregon. Portland is one the first countries to adopt green street as sustainable infrastructural development. They have implemented it vastly in low density residential areas and are now expanding it to higher density residential areas. The primary goal of adopting Green Street was to manage runoff from storm water, enrich communal livability and flourish local economy. Another successful case study is seen in Washington D.C. where Green Street is implemented in broader scale and in dense urban areas. (Manual, 2014) in his report titled 'City of Philadelphia Green Streets Design' reflected on case study in Philadelphia where city agencies have adopted pilot projects of green streets. The aim was to set up a series of regulation and standards which was applicable in implementing green streets city-wide to treat storm water runoff.

2. POLICY ADAPTATION AND IMPLEMENTATION OF GREEN STREETS

2.1 A case study in the city of Cleveland (Im, 2019)

The city of Cleveland has taken initiatives to become a more environment friendly community by encouraging people to go green. They are steadfast to become a more pedestrian friendly and cycling friendly community by reducing the carbon footprint. In 2011, Cleveland conceded Ordinance 798-11 that said that the city of Cleveland has taken initiative to create a complete green network by adopting green streets that will expand the social, economic and environmental condition of the city as well as the citizens. The benefits of adopting green streets are:

- Healthy and convenient communities
- Quality of air
- Safety improvement
- Access improvement
- Economic development

Planning Process: Cleveland Complete and Green Street Task Force with the help of Alta Planning and Design team had developed plans for implementing Green Streets for the city of Cleveland. It involved workshop of stakeholders at local, regional and national level. The workshop led to understanding the pressing need of adopting Green Street and provide a permanent solution in reducing environment degradation. Table 1 represents various section design of the road adopted by the Cleveland government.

2.2 A case study in the city of Seattle, state of Washington, U.S. (SDOT, 2017)

The planning for Green Street in the city of Seattle was first proposed in 1985. The original plan was prepared for Downtown Seatle but an additional mapping was also prepared for the neighborhood green streets in Northgate. The Seattle Comprehensive Plan (SCP) and Transportation Strategic Plan (TSP) were prepared and this document provides the guidelines and

Design of Walkways	Intersection Design	Design for Cyclists	Transit Design	Green infrastructure for the right-of-way
Accessibility to the users	Clear space	Shared roadways	Accessible through multiple modes	Street trees
Width of the sidewalks where two people can walk side-by-side.	Visibility	Shared roadways with marked pavement	Simplicity of function	Adjusted soil
A sense of safety and security	Legibility	Separated bikeways	Safety and security	Sheet flow diffusion
Landscaping for visual and psychological comfort	Accessibility	Cycle tracks	Sustainable development	Pavement modification and permeable pavers
Drainage system for storm water runoff	Lighting	Parking of bicycle	The incorporation of arts in transit	Porous asphalt and recycled roadway surface.

Table 1: Overview of different section of the roads. (Source: Im, 2019)

regulations for the development of neighborhood Green Street. There were 17 green streets adopted in Downtown Seattle. Some 41 neighborhood green streets were also recommended in different neighborhoods which are yet to be adopted formally and still is in planning phase. It also contains information about design, construction and maintenance of the street. Table 2 shows two types of streets proposed- i) green streets ii) neighborhood green streets.

Principles for the basic design of Green Streets

There are several principles applied while designing the green streets and neighborhood green streets-

- Emphasize on walkways and open space compared to typical streets.
- Planning and design considering existing landscape.
- Restriction on volume and speed of transportation modes.

3. METHODOLOGY

3.1 Description of the study area

Khulna, a coastal region, located in the southern part of Bangladesh. It is the third largest and second biggest port city of Bangladesh. It has a coordinate of 22°51′8″ north latitude and 89° 32′35″ east longitude (Karim, et al., 2013). The total metropoliton area comprises of 4,389 square kilometers with a population of 2,318,527. Khulna city is surrounded by a total of 356.64 km of roads (Kabir, 2019). But there is no green street implementation or adoptation plan taken by the city. The roads that are most vulnerable due to heavy traffic and affected by higher pollution requires implementation of gren streets. For this different important roads of Khulna city such as BIDC road, Khulna-Jessore highway, Khulna-Shatkhir Road, Sher-E-Bangla road and Khan Jahan Ali Road were selected (Fig. 1).



3.2 Methods of data collection

The required data are collected from primary and secondary sources to run the research. Satellite images such as Landsat-8 and Landsat-7 image were collected from US Geological Survey (USGS) website. First of all a complete reconnaissance survey

Purpose of adapting Green Streets	Purpose of adapting Neighborhood Green Streets	
It enhanced pedestrian movement and created a sense of space in areas with medium to high density residential areas.	It gives more importance on local communities need for specific street type.	
Created a lively environment for pedestrians in the right of way of street to attract pedestrian.	Improve the environment for pedestrian movement to attract pedestrians.	
Strong and efficient connectivity between residential communities and surrounding area by enhancing streetscape for people who uses the service.	Preserved open space for residential neighborhoods.	
Location	Location	
Downtown Seattle.	Neighborhood outside Downtown Seattle.	
Typical Adjacent Land Use	Typical Adjacent Land Use	
Residential or mixed use.	Residential or mixed use including residential uses.	
Implementation	Implementation	
The planning and construction of green street was funded by the developers interested in exchange for extended floor area ratio, determined by Seattle's land use code.	Funded by the Local Improvement District (LID), Neighborhood matching funds and other transit agencies through private development.	

Table 2: Purpose of adopting green streets and neighborhood green streets. (Source: SDOT, 2017)

was done for getting proper idea about the study area. For collecting primary data several field surveys were conducted based on a pre-determined questionnaire. For collecting the data in physical and acceptable manner field visit is done which is usually known as field survey. A total of 3 field trips were conducted for this survey. People living along the selected study area roads and people who uses the roads on a daily basis were surveyed for primary data collection. Simple random sampling technique was followed for the survey. Images of different neighborhood roads, highways and intersection points was taken from google map. Road width, length, median and walkway width were calculated with the help of google map. CO2 absorption capability of a trees were calculated using relevant equation. The total amount of CO2 absorbed are accumulated to estimate the percentage of CO2 reduced by trees.

3.3 Spatiotemporal analysis

A spatiotemporal evaluation of land use and land cover (LULC) was performed (Fig. 2) in order to detect the pattern of land use change and specially for monitoring the changes in vegetation coverage (Khamchiangta and Dhakal, 2020).



3.4 Public opinion survey

For conducting field survey simple random sampling method was applied in within defined study area. In simple random sampling the samples are picked indefinitely. The total population of Khulna City Corporation is approximately 663,342. From this number, 300 individuals were selected as sample size in simple random sampling method to provide public opinion who uses the consecutive streets or resides beside the streets.

3.5 Implementation of Green Streets

For implementing green streets, major intersection points of Khulna city was chosen for identifying the existing scenario. Secondly green street system was proposed in different intersection points, highways and neighborhoods of Khulna city by using Sketch up software. For this study BIDC road Khulna, Khulna-Jashore highway, Khan Jahan Ali road, Sher-E-Bangla road, Khulna--Shatkhira road, Royal more intersection point was selected.

Little changes in the road can make it more convenient to plant trees. After several field survey, green street construction proposals was designed by the authors maintaining compatibility with the existing scenario. If the distance is considered 10 meters from one big tree to another and 2m distance from one shrub to another then the possible number of trees can be calculated along the selected roads. Mehogany, neem, rain tree, basak and akanda were selected for plantation because they are locally available, cheap, well-adapted to the warm and humid climate and can grow swifty even in saline soil.

It is found that a ten years old big tree can consume about 22 kg CO_2 and shrabs can consume about 5.9 kg CO_2 every year where saplings will absorb significantly less than this (Pirates, 2016). According to this statement the total amount of CO_2 was also calculated which will be consumed ofter the implementation of green streets.

Finally conceptual framework was formed to relate how green streets help to achieve SDG's 11th goal. Also a user's satisfaction survey was also performed to identify people's opinion.

4. RESULTS

4.1 Land use land cover (LULC) detection and monitoring

According to the land use classification percentage in table 3 the coverage of vegetation was about 30.15% in the year 2000, 29.25% in 2010 and 25.25% in 2020. It is clear that about 4.9% of overall vegetation reduced during the last 20 years. As existing vacant land and water bodies are also decreasing and the amount of buildup area is increasing (Fig. 3) so it can be an alarming problem for urban area people and ecological system.



Table 3: Percentage of land use type over the years. (Source: Author, 2020)

	Land Use Type	Year 2000	Year 2010	Year 2020
)	Water Body	18.35 %	15.85 %	13.65 %
	Vegetation	30.15 %	29.65 %	25.25 %
	Build Up Area	39.65 %	43.55 %	52.45 %
	Vacant Land	11.85 %	10.95 %	8.65 %

Figure 4: Disease caused by air pollution. (Source: Field survey, 2020)



Figure 6: Level of satisfaction. (Source: Field survey, 2020)



Convenient Moderately convenient Barely convenient Not convenient

4.2 Survey results

Field survey report states that the current state of street system causes severe noise pollution. According to Fig. 4 almost 21% people stated that they face sleep disturbance due to noise pollution. As the streets have no planned vegetation along the roadway the buildings located near them endure major noise pollution. Not only sleep disturbance, 27% of the residents complained they suffer from heart disease and 13% residents have hearing impairment. 27.5% people are annoyed due to the constant honking of heavy vehicles and not following traffic rules. Even during the night time unregulated vehicular movement and heavy transportation mode causes inconvenience.



Figure 5: Disease caused by air pollution. (Source: Field survey, 2020)

The amount of CO₂ produced through vehicles that uses fossil fuel causes heavy air pollution. Moreover, not enough tree beside the road side makes the effect of CO₂ emission more acute. Trees absorb CO₂ and emits O₂. Due to lack of trees CO₂ is released into the environment and get mixed with the air. Fig. 5 states 31% of the residents of surveyed areas have breathing problem because of air pollution. 25.40% people suffer from various chronic diseases and 2% have lung cancer. Heart disease is another critical problem faced by almost 17% of the surveyed person.

People living in the respective areas are not satisfied with the present street condition. There are inconveniences such as polluted environment, abrupt movement of vehicles, no regulated traffic rules or modified vehicles, unsafe and insufficient walkways, no shade or trees. All these makes the present layout of roads unsuitable for use. To almost 70% of people (Fig. 6) who uses the roads in the study area have said that the road condition is barely convenient or inconvenient.

Figure 7: Problems caused by sound pollution. (Source: Field survey, 2020)



Almost 90% of people have agreed upon adopting green street policy (Fig. 7). They are willing to change the current condition of streets and walkways. Moreover convenient vehicles are also preferred.

4.3 Green Street implementation and model

BIDC Road, Khulna

The length of BIDC road is around 3.5 km (Fig. 8). It is located Khalishpur area. The road contains no median and only a few space is available in both sides of the road for planting trees and shrubs.

List of trees and shrubs	Distance from one plant to another	Amount of trees and shrubs
Tree: Mahogany (Swietenia mahagoni)	10m	200
Tree: Neem (Azadirachta indica)	10m	200
Tree: Rain tree (Samanea saman)	10m	200
Shrubs: Basak (Adhatoda vasica)	2m	1500
Shrubs: Akanda (Calotropis gigantea)	2m	1500

Table 4: List of trees and shrubs. (Source: Author, 2020)



Figure 8: (a) Existing BIDC road, (b) Proposed road (Cross Section), (c) Proposed road (Top view), (d) Road Information (Top view). (Source: Author, 2020)

Khan Jahan Ali Road Section 1 and 2

About 1.06 km was chosen from the total section of Khan Jahan Ali road. From the existing condition of Fig. 9 and Fig. 10 it is clear that one of the section contains median and another one is continuous two way lane.

From Table 5 the total amount of CO_2 that can be consumed by big trees after 10 years is

- = (Amount of total big tree* 22) kg
- = (90*22) which is 1980 kg per year

So, the total amount of CO_2 that can be consumed by shrubs is = (Amount of shrubs* 5.9)

= (300*5.9) which is 1770 kg per year



From table 4 the total amount of CO_2 that can be consumed by big trees after 10 years is

- = (Amount of total big tree* 22) kg
- = (600*22) which is 13200kg per year

So, the total amount of CO_2 that can be consumed by shrubs is

- = (Amount of shrubs* 5.9)
- = (3000*5.9) which is 17700 kg per year

List of trees and shrubs	Distance from one plant to another	Amount of trees and shrubs
Mahogany (Swietenia mahagoni)	10m	30
Neem (Azadirachta indica)	10m	30
Rain tree (Samanea saman)	10m	30
Basak (Adhatoda vasica)	2m	150
Akanda (Calotropis gigantea)	2m	150

Table 5: List of trees and shrubs. (Source: Author, 2020)

Khulna-Jashore Highway

Selected portion of Khulna-Jashore highway is about 2 km (Fig. 11).

From table 6 the total amount of $\rm CO_2$ that can be consumed by big trees after 10 years is

= (Amount of total big tree*22) kg

= (360*22) which is 7920 kg per year

So, the total amount of CO_2 that can be consumed by shrubs is = (Amount of shrubs* 5.9)

= (1200*5.9) which is 7080 kg per year

Khulna-Shatkhira Road

Selected portion of Khulna-shatkhira road is about 1.3 km (Fig. 12).

From table 7 the total amount of CO_2 that can be consumed by big trees after 10 years is = (Amount of total big tree* 22) kg

List of trees and shrubs	Distance from one plant to another	Amount of trees and shrubs
Mahogany (Swietenia mahagoni)	10m	120
Neem (Azadirachta indica)	10m	120
Rain tree (Samanea saman)	10m	120
Basak (Adhatoda vasica)	2m	600
Akanda (Calotropis gigantea)	2m	600

Table 6: List of trees and shrubs. (Source: Author, 2020)

= (240*22) which is 5280 kg per year

So, the total amount of CO₂ that can be consumed by shrubs is

= (Amount of shrubs* 5.9)

= (800*5.9) which is 4720 kg per year

List of trees and shrubs	Distance from one plant to another	Amount of trees and shrubs
Mahogany (Swietenia mahagoni)	10m	80
Neem (Azadirachta indica)	10m	80
Rain tree (Samanea saman)	10m	80
Basak (Adhatoda vasica)	2m	400
Akanda (Calotropis gigantea)	2m	400

Table 7: List of trees and shrubs. (Source: Author, 2020)



Figure 11: (a) Existing Khulna-Jashore highway road, (b) Proposed road (Cross Section), (c) Proposed road (Top view), (d) Road Information (Top view). (Source: Author, 2020)



Figure 12: (a) Existing Khulna-shatkhita road, (b) Proposed road (Cross Section), (c) Proposed road (Top view), (d)Road Information (Top view). (Source: Author, 2020)



Sher-E-Bangla Road

About 1.05 km was chosen from the total section of Sher-e-Bangla road (Fig. 13).

List of trees and shrubs	Distance from one plant to another	Amount of trees and shrubs
Mahogany (Swietenia mahagoni)	10m	60
Neem (Azadirachta indica)	10m	60
Rain tree (Samanea saman)	10m	60
Basak (Adhatoda vasica)	2m	300
Akanda (Calotropis gigantea)	2m	300

Table 8: List of trees and shrubs. (Source: Author, 2020)

From table 8 the total amount of CO_2 that can be consumed by big trees after 10 years is

- = (Amount of total big tree* 22) kg
- = (180*22) which is 3960 kg per year

So, the total amount of CO_2 that can be consumed by shrubs is

- = (Amount of shrubs* 5.9)
- = (600*5.9) which is 3540 kg per year

Total amount of CO₂ Absorbed by Trees

The total amount of CO_2 that can be consumed by big trees after 10 years is 32,340 kg per year.

The total amount of CO_2 that can be consumed by shrubs is 34,810 kg per year.

4.4 Grees Streets for Maintaining Ecological Balance

Without implementing green streets the pollution caused by unplanned roadway system and haphazard development results in serious environmnetal imbalance (Fig. 14). If there is not enough vegetation along the road system the emission of harmful gases from vehicles will add to carbon footprint. Trees work as a natural element to purify harmful gases from the air and also works a barrier to absorb sound. A healthy environmnetal condition automatically leads to a sustainable development and resilient city. Thus, green streets are able to maintain ecological balance more effectively than typical street system.



4.5 Framework for Achieving SDG's 11th Goal

A sustainable city requires city's capability to resist any hazardous incident and rebuild its resilience. Green street is another solution to cope with the problems arise due to urbanization. It reduces sound pollution by absorbing noises through green belts. Such initiative enhances community livability. Green street proposes permeable roadway and pavements to control water logging and increases greenieries that enriches biodiversity. The overall road condition improves that has huge impact on the socio, economic and environmnetal condition of Khulna city.

5. CONCLUSION

To make a city grow and prosper, there is no alternative of swift and efficient road network and planned circulation of vehicular movement. The existing street condition of Khulna City Corporation are responsible for air pollution, sound pollution, waterlogging, traffic fatalities and traffic congestion. The selected roads of the study area more specifically BIDC road, Khulna Jashore highway, Sher-e-bangla road, Khulna-Shatkhira road, Khan Jahan Ali highway have insufficient road service facilities. Most of the vehicles uses fossil fuel and emits harmful gases. There is no automated monitoring system for roadway traffic regulation except installed traffic police at intersection points. The analysis shows vegetation and water bodies have reduced up tp 5% and 3% from year 2000 to year 2020. By adopting green streets their will be green belts on both side of the roads will reduce air and sound pollution. Also adopting Green Street is a less expensive project to take on rather than tradional road construction with

MASTER THESIS



Figure 14: Graphical representation showing the consequences of implementing Green Street in KCC. (Source: Author, 2020)

long term sustainable and ecological impact on social, economic as well as environmental aspect. This will help attain SDGs 11th goal of Sustainable Cities and Communities to turn Khulna City Corporation into a resilient city.

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