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Traffic Impact Assessment for Sustainable Development Along the Highways in Bangladesh: Considerations for a New Industrial Setup

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Abstract: A useful method for evaluating the effects of traffic generated by a proposed development on the local transportation system is the traffic impact assessment (TIA). A TIA typically contains a description of the size and complexity of the planned project, an overview of the anticipated effects, and any upgrades that may be necessary to make the roadway infrastructure safe for the proposed development. With this study's design horizon in mind, we hope to ensure that the transportation system will operate efficiently and safely. Development must have the necessary utilities and transportation systems to sustain itself. Every proposed development must then include an evaluation of the site's appropriateness in terms of factors like compatibility with highways and plans, access location geometry, and capacity and traffic control, among others. The main objective of the TIA report is to identify whether a particular development project will have an impact on the safety and efficiency of adjacent roads. Moreover, the report paves the way for additional study and the development of traffic management plans to reduce traffic congestion. TIA is also needed to support the EIA being prepared for any project development along the highway road. So, it is important to evaluate TIA while new industrial installations are set up along the Highways in Bangladesh.

Keywords: Traffic Impact Assessment (TIA), Environmental Impact Assessment (EIA), Industrialization, Transportation System, Sustainable Development, Road Networks

1. Introduction

Bangladesh's industrial sector is crucial to the country's overall economic development. Its per capita income and social structure can be improved in two clear ways: through industrialization and specialization in manufacturing for future economic growth and social progress. The country's main exports include textiles, ships, seafood, jute, and leather items. There are many industries that have achieved self-sufficiency, including the textiles, pharmaceutical, steel, and food production sectors. Over the past two decades, the apparel and textile industries have expanded at a remarkable rate. Tens of millions of people are employed across the world in the textile and garment industry. Economic expansion, new employment opportunities, and access to basic necessities like healthcare and education are all facilitated by efficient transportation networks. Many low-income nations, however, are failing to reap the benefits. One of the most important aspects of every nation's actual structure is its system of roads and other forms of communication. Roads & Bridges, Metro Rails, Railways, Inland waterways, Seaports, Maritime shipping, and Civil aviation are all integral parts of Bangladesh's transportation network. It's good for both domestic and foreign travel. The advancement of Bangladesh has coincided with a considerable enhancement of the country's communication infrastructure. A dedicated lane-based public transportation system has demonstrated promising results and must play an important role in the development of sustainable transportation systems

[12]. Large highway construction projects have been completed, and many more are in the planning stages. Bangladesh's transportation industry encompasses a wide range of modes. Because most of the land is very flat, transportation by road, rail, and water are all viable options for moving people and products throughout the country.

The term "development" refers to the process by which a society's social, political, and economic conditions are improved. Improvements in both human capital and physical capital such as infrastructures are anticipated, both quantitatively and qualitatively. Transportation and economic prosperity are said to be directly related. New developments result in increased traffic. Commercial vehicles are larger and more sluggish than personal automobiles. Therefore, they have a bigger impact on road capacity than the latter [7]. The amount of new vehicle traffic generated by development can be influenced by its size, activity areas, proximity, ease of parking, and other similar factors. The Seventh Plan correctly identified the primary issue facing urban road space in major cities in Bangladesh as extreme traffic congestion [3]. Accurate traffic generation forecasting is necessary for regional planners to design the traffic system to accommodate additional traffic and to plan internal circulation, access points, parking facilities, and traffic management at a site. The deployment of incident management strategies can significantly mitigate the effects of incidents [5]. Commercial land use along the National Highway reduces the journey speed and creates traffic jams which degrade the basic characteristics of the National Highway. TIA reports will help in enhancing the performance of the National Highways [15]. As an added bonus, the study may tell us if our proposed land use would be safe next to a major road. It's an in-depth analysis of the technical aspects of traffic and safety in relation to a certain project.

A Traffic Impact Analysis (TIA) is a thorough analysis of how the proposed development will affect traffic patterns on the surrounding network [1]. It entails evaluating the negative impacts generated by the proposed development and mitigating them with the appropriate measures [10]. Generally, the traffic impact of a development lessens with distance from it, with the greatest effect being felt on the road links adjacent to the network [13]. TIA is used as a tool to help decision-makers evaluate the potential effects of new developments on existing infrastructure. This is not just a matter of custom at home; it has spread internationally. This practice is commonplace in advanced nations. In contrast, it has only recently been introduced or is still to be institutionalized in developing countries like Bangladesh [8]. For a long, TIA has been recognized as an integral and mandatory part of EIA in developed countries [11]. Cluster analysis is used to select the time period for study, and it is used to propose a new concept for the classification of construction projects, one that bases its selection of the study time period on the degree of similarity between the various categories [2]. The design phase of establishing traffic management strategies needs a traffic analysis to calculate lane closure timings by estimating queue lengths, travel times, and delays [4].

A traffic impact assessment (TIA) is a scientific examination of the potential for traffic congestion and other hazards brought on by a planned development project. The primary purpose of a TIA report is to determine if a proposed development will affect the safety and efficiency of surrounding roads. In addition, the report clears the way for further research and the creation of traffic management plans to aid in the reduction of traffic congestion. The TIA takes into account the effects on all users of the road, not just drivers, including those who rely on public transportation, walkers, and cyclists. The TIA takes into account the operational impact in addition to the physical impacts on the transport infrastructure. Governments, developers, consultants, academics, and members of the community should be encouraged to play key roles in three stages: the promotion of the necessity, the formulation, and the evaluation [6]. An efficient planning support system can significantly improve stakeholder cooperation and facilitate agreement on the most suitable alternatives [14]. Stakeholders must provide cost-effective recommendations and mitigation plans for the elimination of negative impacts, as well as develop collective actions for controlling traffic and environmental impacts associated with proposed developments [9].

2. Methodology

An in-depth literature review is conducted first to define the concept of TIA. Next, settle on a subject of inquiry. This paper evaluates TIA in the context of a new Industrial Setup development project. Data in imperial units were collected through a random survey, and traffic counts were determined by reviewing camera-recorded videotapes at a collection site. The procedure involves recording for an hour and then rewinding the footage in order to collect data. The Geometric Design Standards for Roads and Highways Department handbook provides the basis for the PCU factors used here. The Roads and Highways Department (RHD) provided additional secondary data on traffic and land uses, including the type and scale of all land uses.

2.1. Objectives

The study's goals are to provide developers, stakeholders, and consultants with a clearer picture of what is expected of them in a TIA and to propose uniform guidelines for conducting TIAs for proposed new developments, expansions of existing developments, requests for new or modified access along the highway in Bangladesh.

2.2. Study Area

The study was conducted at a place called Golora, Manikganj on the 49th Km of Dhaka-Aricha Highway. Dhaka Division includes the district of Manikganj. Area-wise, it's 1,383.66 kilometers squared (534.23 sq mi). The 2011 Bangladesh census found a total population of 1,392,867 in the Manikganj District; 676,359 were males and 716,508 were

females. There were 1,264,157 people living in rural areas (90.76%) and 128,710 living in urban areas (9.24%) in total. The literacy rate in Manikganj was 49.20% among residents aged 7 and up, with male literacy at 52.59% and female literacy at 46.05%. Manikganj is primarily an agricultural community. Most of the harvest consists of rice, jute, wheat, mastered, tobacco, chile peppers, carrots, and other vegetables. Dhaka tobacco industries, Akij Textile Mills, Akij Particle Board Ltd., Monno Textile, Basundhara Steel Factory, Manikgonj Garment Factory, etc., are just some of the newer businesses that have opened up in the area.

2.3. Data Collection

Primary and secondary sources of information are used to fill in the blanks for this study. Secondary sources include various organizations, book data, published research papers, and expert suggestions, all of which will be detailed below. Field surveys were conducted on the 21st and 23rd of October'2022, Friday and Sunday to gather primary data. Data for different types of trips were collected between the hours of 7:00 and 8:00 AM, 8:00 and 9:00 AM, 9:00 and 10:00 AM, 1:00 and 2:00 PM, 2:00 and 3:00 PM, 5:00 and 6:00 PM, 6:00 and 7:00 PM, and 7:00 and 8:00 PM. Following the guidelines established by ITE, this data set was compiled. A day of operation and a day of inactivity each week were chosen for the traffic count. Vehicles heading in the direction of Dhaka and those heading in the direction of Aricha are counted independently.

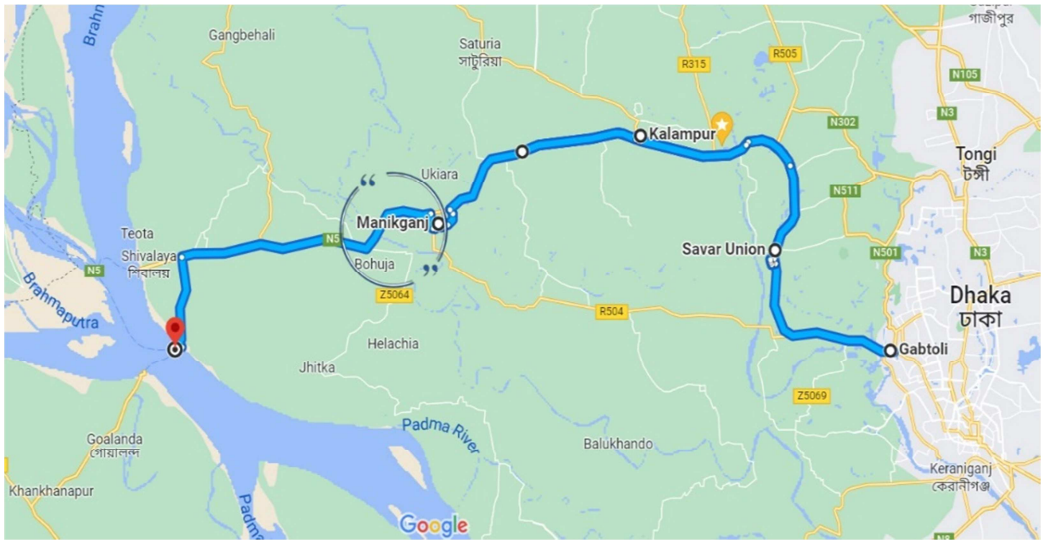

Figure 1. *Study area at Dhaka-Aricha Highway (Golora, Manikganj).*

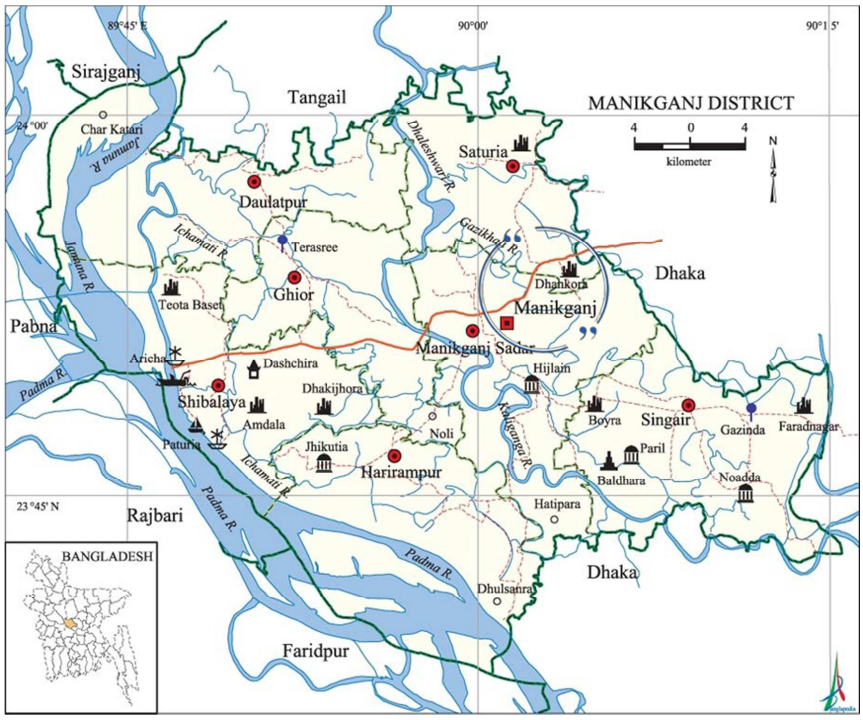

Figure 2. *Study Area Map (Golora, Manikganj).*

2.4. Data Analyses

Microsoft Excel Analysis was used for all of the rigorous calculations in the data analysis section. Methodical, step-by-step, and prudent data were used in the calculation of the accessibility index. We looked at traffic data that had been entered into an Excel spreadsheet to try to draw a conclusion. We compiled summaries of the information and crafted visual charts to aid Division smart.

3. Results and Discussion

The manual method of traffic volume count is the most common method of collecting traffic volume data, which involves a group of people recording the number of vehicles passing through a predetermined location using tally marks in inventories. A weekday, also known as a workday, is any day of the working week. A weekend day is a day when people traditionally do not work but instead relax or engage in leisure activities. In traffic engineering, weekday weekend days are traditionally used to calculate average daily traffic. As a result, weekday and weekend data were chosen. The lane was also divided into two, Lane-1 called Dhaka to Aricha and Lane-2 called Towards Aricha to Dhaka.

Table 1. *Background Traffic on the road (24 Hr- Week Day).*

Vehicle Type	Heavy Truck	Med. Truck	Light truck	Med. Truck	Large bus	Minibus	Utility car	Sedan Car	CNG/Auto Ricksha	Motor Cycle	Ricksha	Bicycle	Others	Total
Background Traffic	670	628	597	485	640	649	628	672	414	700	840	100	550	7573

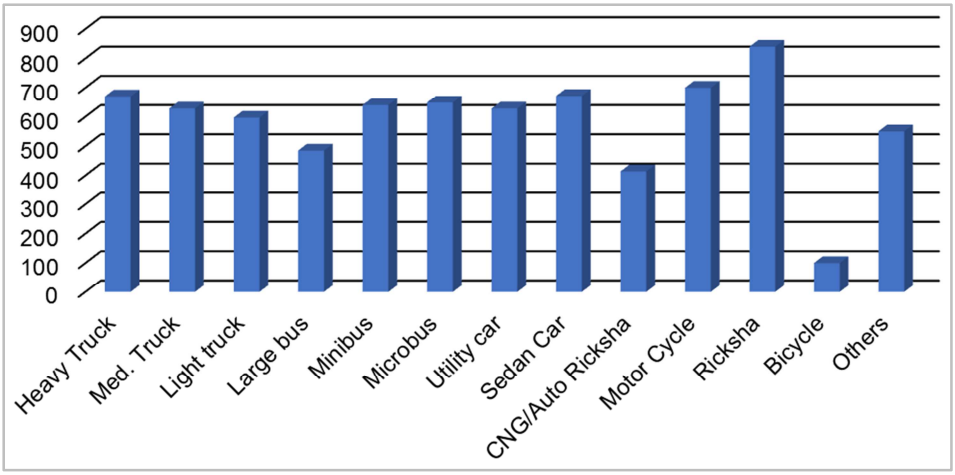

Figure 3. *Background Traffic on the road (24 Hr- Week Day).*

Since we had assumed to set up an RMG factory on a 10-acre land on the highway side. We also assumed that on about 500000.00 SFT of floor space, 1500 workers working about 1.10 million pieces of premium quality woven shirts will be produced every month.

For new trip calculation, the survey was conducted for sampling on Akij Textile Mills Ltd at a place called Golora, Manikganj on the 49th Km of Dhaka-Aricha Highway. It is a subsidiary of the Akij Group, a company that has been in business in Bangladesh for over 60 years, has a wide range of products, and is committed to contributing to the country's economic growth and social advancement through the provision of goods and services of the highest possible quality. Spinning was the group's primary focus for over 15 years, but as new innovations in yarn dyeing, weaving, and fabric dyeing & finishing became available, the focus shifted. As a result, the RMG industry can rely on Akij Textile as a single source supplier for everything from yarn to finished woven fabric for export.

1) Spinning Production Capacity
   40 M.Ton /Day.
2) Yarn Dyeing Capacity.
   40 M.Ton /Day
3) Weaving capacity
   3.00 Million Yards/Month.
4) Finishing capacity
   a. Two individuals production lines in finishing.
   b. 400 Million (180 Million for solid and 220 Million for yard).

So, hypothetically we used the surveyed traffic volume for assuming a new set-up RMG factory on a 10-acre land at the highway side. So, the newly generated traffic volume is as Table 2.

Table 2. *Industry Generated Traffic (24 Hr-Week Day).*

Vehicle Type	Heavy Truck	Med. Truck	Light truck	Med. Truck	Large bus	Minibus	Utility car	Sedan Car	CNG/Auto Ricksha	Motor Cycle	Ricksha	Bicycle	Others	Total
Industry Generated Traffic	8	12	7	4	25	7	6	12	33	45	55	60	15	289

Table 3. *Background Traffic on the road and Industry Generated Traffic (24 Hr- Week Day).*

Vehicle Type	Heavy Truck	Med. Truck	Light truck	Med. Truck	Large bus	Minibus	Utility car	Sedan Car	CNG/Auto Ricksha	Motor Cycle	Ricksha	Bicycle	Others	Total
Background Traffic	670	628	597	485	640	649	628	672	414	700	840	100	550	7573
Industry Generated Traffic	8	12	7	4	25	7	6	12	33	45	55	60	15	289

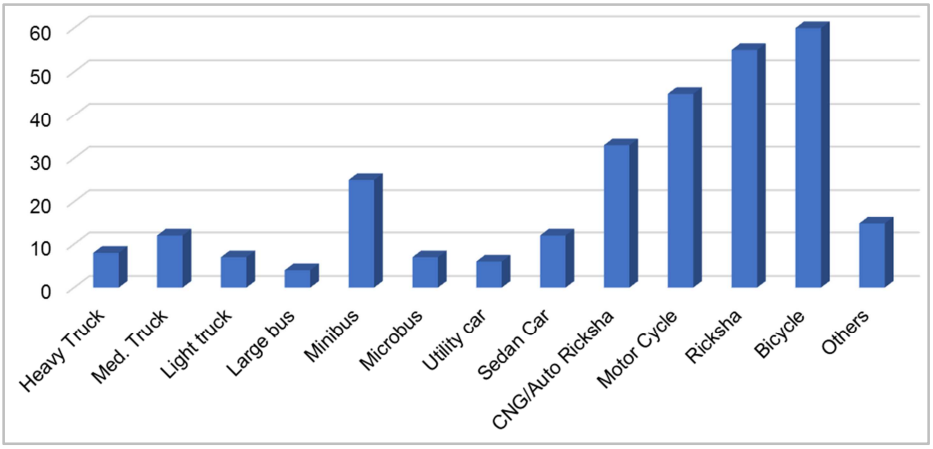

Figure 4. *Industry Generated Traffic (24 Hr-Week Day).*

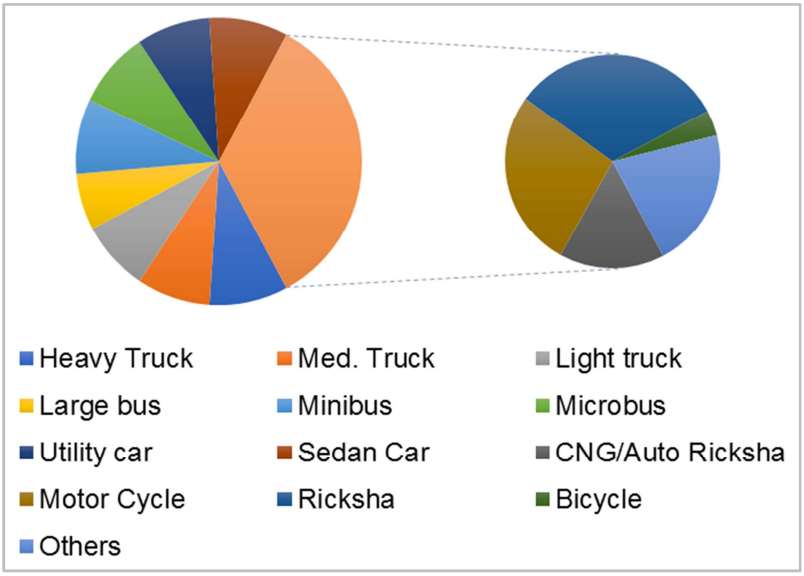

Figure 5. *Background Traffic on the road and Industry Generated Traffic (24 Hr- Week Day).*

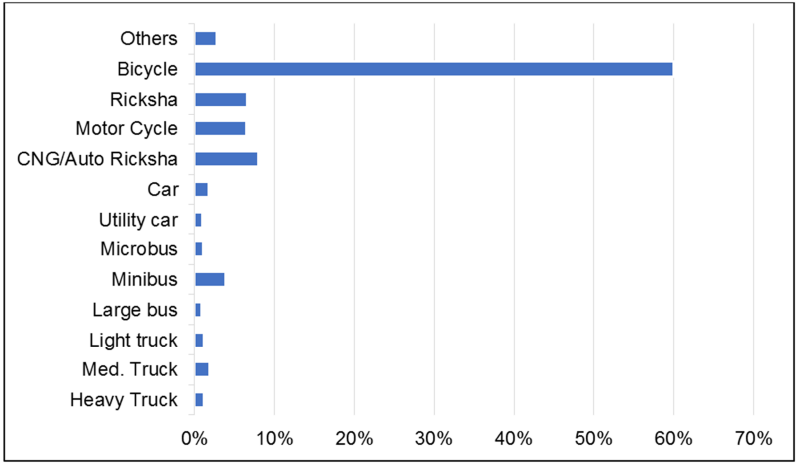

Figure 6. *Traffic growth percentage (%) (24 Hr).*

Table 4. *Traffic growth percentage (%) (24 Hr).*

Vehicle Type	Heavy Truck	Med. Truck	Light truck	Med. Truck	Large bus	Minibus	Utility car	Sedan Car	CNG/Auto Ricksha	Motor Cycle	Ricksha	Bicycle	Others	Total
Increase of Traffic	1.19	1.91	1.17	0.82	3.91	1.08	0.96	1.79	7.97	6.43	6.55	60	2.73	3.82%

Table 5. *Trip Generation for new Industry Generated Traffic (24 Hr).*

Vehicle Type	Heavy Truck	Med. Truck	Light truck	Med. Truck	Large bus	Minibus	Utility car	Sedan Car	CNG/Auto Ricksha	Motor Cycle	Ricksha	Bicycle	Others	Total
Industry Generated Traffic	8	12	7	4	25	7	6	12	33	45	55	60	15	289
Passenger Car Unit (PCU) for different vehicles	3	3	3	3	3	1.5	1.5	1	1	0.30	0.30	0.30	2.5	-
Trips	24	36	21	12	75	10.5	9	12	33	13.5	16.5	18	37.5	318

3.1. Traffic Impact Analysis

From the above data analysis, it can be seen that the traffic will increase on the road by 3.82% if the proposed industry is established and 318 new trips will be generated.

Now we will also predict the no of trips according to the Institute of Transportation Engineers (ITE) trip generation rate for light industrial setup is 0.63 per 1000 SF GFA.

Table 6. *Trip Generation rate of ITE.*

Institute of Transportation Engineers (ITE) Common trip generation (PM Peak Hour)		
Code Description	**Unit of Measure**	**Trips Per Unit**
Industrial		
110 General Light Industrial	1000 SF GFA	0.63
130 Industrial Park	1000 SF GFA	0.4
140 Manufacturing	1000 SF GFA	0.67
150 Warehouse	1000 SF GFA	0.19
151 Mini Warehouse	1000 SF GFA	0.17

As such we have assumed 500000.00 SFT for setting up a new industry.

$$\text{So, New generated trips} = \frac{500000}{1000} x\ 0.63 = 315 \text{ Trips}$$

The proposed development generates a total of 315 peak-hour trips. So, under the current traffic conditions, traffic congestion problems will be experienced at the existing road lane and intersections in terms of capacity.

Due to the new development, its increasing vehicle traffic is certainly affecting the neighboring development and the surrounding transport network. So here is an impact on traffic for newly created trips if the industry is set up here. The new development which generates new traffic that can lead to congestion and safety issues hence requires the need to update infrastructure, such as new signs, turning lanes, or crossroads, and makes a hues impact. The impacts include traffic problems and safety issues for road users that can be created by the development such as:

1) Reduced the capacity of the road.
2) Increased travel time delays.
3) Creating traffic bottlenecks on the highway.
4) Causing traffic congestion at intersections.
5) Queue length can grow.
6) Increased fuel consumption.
7) Transportation crisis during peak hours.
8) Increased roadway accidents.
9) And all of these result in unrecorded economic losses.

3.2. Necessity of Traffic Impact Assessment

Transportation plays a critical role in achieving several SDGs, particularly those having to do with trade and investment, small and medium-sized enterprises (SMEs), and economic growth. There are many obstacles to achieving the SDGs in the realm of transportation, including efforts to mitigate climate change and environmental degradation, enhance the transportation infrastructure and traffic safety, and address issues related to employment and decent wages.

By conserving and optimizing resource use, sustainable industrial development protects against environmental degradation. Manufacturers can improve their resource productivity by examining their entire supply chain, from the sourcing of raw materials to the design of finished products and the logistics of their return markets. The ability to meet the mobility needs of a society in a way that minimizes negative impacts on the environment and does not compromise the ability of future generations to do the same is what is meant by sustainable transportation.

The potential effects of such projects can only be estimated, but they can be better understood with the aid of impact assessments. The negative effects of a project can be avoided or mitigated with the information gleaned from assessments. Also, they might be able to improve the project's perks. Therefore, TIA is a crucial method for analyzing the potential transportation effects of a development project. It pinpoints the transportation system upgrades required to ease traffic, keep people safe, allow for easier access to the project site, and mitigate any negative effects the work may have.

Finally, a thorough Traffic Impact Assessment is necessary for any proposed development that would significantly increase traffic (TIA). Whether or not the proposed development project calls for upgrades to the current infrastructure or modifications to existing public transportation services, this evaluation can help. The potential for safety issues and unforeseen congestion at the development's point of connection to the road is increased if no clear picture of the type or scale, timing, and location of traffic movements are available.

4. Conclusion

All kinds of development besides national highways should be done so carefully and in a planned way so that development cannot create adverse impacts at both the national and local levels. Commercial use along the national highway reduces the journey speed and creates traffic jams which degrade the basic characteristics of the National Highway. This study will help the respective authority visualize and get a clear idea about the impacts of such land use beside a national highway. It will also help in enhancing the performance of a national highway.

References

[1] Botha, J. L. 2005. Trends in the Traffic Impact Assessment Process, Proceedings of the 24th Southern African Transport Conference (SATC 2005), pp. 814-821.

[2] Chen, J., Li, Y., Li, G. and Li, Y. (2009) Period Selection of Traffic Impact Analysis Based on Cluster Analysis. Journal of Transportation Systems Engineering and Information Technology, 9 (6), pp. 63-67.

[3] E CS-17, Bangladesh Army (201 9), "Traffic Impact Assessment and Feasibility Study of Proposed Kalshi Flyover from ECB Chattar to Mirpur DOHS, Dhaka, Bangladesh".

[4] Edara, P. and Cottrell, B. (2007). Estimation of traffic mobility impacts at work zones: State of the practice. Proceedings: 86th Annual Meeting Conference. Transportation Research Board of the National Academies, Washington DC, 21–25 January.

[5] Hussein, D., William, G. and Sakda, P. 2008. Traffic Impact Assessment of Incident Management Strategies 11th International IEEE Conference on Intelligent Transportation Systems Beijing, China, pp. 441-446.

[6] Limapornwanitch, K. Montalbo, C. M. Jr., Hokao, K. and Fukuda, A. (2005), The Implementation of Traffic Impact Assessment in Southeast Asian Cities: Case Studies of Thailand and The Philippines, Journal of the Eastern Asia Society for Transportation Studies, Vol. 6, 4208-4223.

[7] Leake G. R. and Gray J. E., (1979). "Trip generation of Selected Industrial Groups", Institute of Transport Studies, University of Leeds, Leeds, UK, Paper No. 113.

[8] Nuzhat and Hoque, BUET (2014), Implementation of Traffic Impact Assessment in Developing Countries: Case Study of Bangladesh, Conference: Intl. Conf. on Future Trends In Civil and Structural Engineering – FTCSE.

[9] Regidor, J. R. F. and Teodoro, R. V. R. (2003), Institutionalizing traffic impact assessment in the Philippines: Some issues and challenges, Journal of the Eastern Asia Society for Transportation Studies, Vol. 5, 3192-3205.

[10] Rahman. R. and May. L. W., (2019) An Overview of the Practice of Traffic Impact Assessment in Malaysia, International Journal of Engineering and Advanced Technology, 8 (5C): 914-920.

[11] S Padma, S Velmurugan, Namrita Kalsi, Kayitha Ravinder, Madhu Erramapalli, S Kannan (2020), Traffic Impact Assessment for Sustainable Development in Urban Areas, Transportation Research Procedia, Vol. 48, pp. 3173-3187, ISSN 2352-1465.

[12] Vaishali, M. P., Rakesh, K. and Geetam, T. 2007 Impacts of Bus Rapid Transit Lanes on Traffic and Commuter Mobility. Journal of Urban Planning and Development, 133 (2), pp. 99-106.

[13] Withanaarachchi, B, Setunge, S and Bajwa, S 2012, Traffic impact assessment and land use development and decision making. Proceedings of the 8th IIIRR annual International conference on Disaster Management 2012, Kumamoto, Japan, pp. 256-273.

[14] Xinhao, W. 2004 Integrating GIS, simulation models and visualization in traffic impact analysis. Computers, Environment and Urban Systems, 29, pp. 471-496.

[15] Sarker, S. P. K. and Rahman, M. M., 2021, Traffic Impact Assessment for New Industrial installation at Dhamrai Area along the Dhaka-Aricha Highway, Bangladesh, International Journal of Environment and Climate Change, vol. 11 (8), pp. 102-113.