SDG ORIENTED STREET DESIGN GUIDELINE FOR BULANDSHAHR, (U.P.)

Guideline (version 2.0)

PART A : PLANNING

Transportation Research and Injury Prevention Programme
Indian Institute of Technology, Delhi
February 2020
Team
Geetam Tiwari  
Ruchi Varma  
Dinesh Mohan  
Samradh Singh Chauhan  
Caleb Philip  
Naina Agarwal

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PART A: PLANNING

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The Sustainable Development Goals (SDGs) are a bold, universal agreement to end poverty in all its dimensions and craft an equal, just and secure world – for people, planet and prosperity by 2030 - by UNITED NATIONS

The 17 SDGs comprise of 169 targets to be achieved by 2030

The Government of India has played a leadership role in defining the SDGs.
01 Introduction

WHY WAS THE GUIDELINE DEVELOPED?

In 2015, the United Nations announced Agenda 2030, a mandate of development aimed at ending all forms of poverty in all countries, and to promote prosperity while protecting the planet. This Agenda, popularly known as Sustainable Development Goals, is a call to action for people, prosperity and planet.

Since 2017, TRIPP, IIT Delhi has been working on SDG Oriented Planning and Design in Small cities and Community Participation to develop approaches for Tier II and Tier III cities to adopt transport related SDGs in their city. Three cities have been selected as part of this study, namely Patiala, Punjab; Bulandshahr, Uttar Pradesh & Naintial, Uttarakhand.

Indian Road Congress (IRC) provides various guidelines to road making agencies and engineers, to plan, design, and construct streets based on standards. Table 1 shows a list of multiple guidelines to be referred by planning authorities and engineers for multiple details. Some of these guidelines have been updated. However, there are no city-specific guidelines that support planning and design integrated with the Sustainable Development Goals.

SDG Oriented Street Design Guideline (PART A & B) for Bulandshahr, aligns the planning and design approach to road safety and transport in Bulandshahr with Global Goals. It supports Bulandshahr in developing a local agenda and vision, oriented to the SDG framework. It delivers high quality planning and design of sustainable urban mobility roadmap (and related SDG targets) and street design according to international best practices and national policies and guidelines assisting the decision makers to develop SDG sound urban transport policies.

WHO ARE THE INTENDED USERS?

Bulandshahr city is the administrative headquarters of the Bulandshahr district in the Indian state of Uttar Pradesh. It is a part of the National Capital Region (NCR of Delhi) and is in close proximity to the Indian capital, situated at around 100 km distance from New Delhi. The guideline supports the city agencies to develop a planning and design approach for implementing SDG oriented streets.

The agencies primarily include District Administration and Bulandshahr Development Authority (BDA) who has the responsibility for balanced development in the city and the district.

Nagar Nigam, Bulandshahr is responsible for governing, developing and managing the city and related urban services. Including road making agencies such as Public Works Department, Water and Utilities, Electricity Department.

The guideline can also be used by other government and non-government organisations, consultants working on streets, transport and road safety. This can also be useful to students from design, engineering and planning institutions.

HOW WAS THE GUIDELINE DEVELOPED?

First Information Report (FIR) data was collected from respective police stations of the city. Based on the fatality data, high crash locations were determined and audited with the ‘Urban Road Safety Audit’ toolkit. The audit results indicated deficiencies in pedestrian infrastructure, a complete neglect of bicycle infrastructure and signage on the street.

Over discussion with local authorities, Street Design Guideline was developed to support BDA and Nagar Nigam, mainly responsible for planning and design of the road network of the city. A draft guideline was presented in a city level workshop in September 2019 and all stakeholders shared inputs and scope of improvement. Proposed design were exhibited in a six week long public exhibition at 2 different locations.

Based on the inputs by IATSS and city authorities, TRIPP finalised the guideline and presented it to the city along with a capacity workshop in September 2019.

STRUCTURE & CONTENT

The guideline has been developed in two parts. Part A covers planning guidance and focuses on the importance integrating SDG in the master plan process.

This guideline provides a summary of Bulandshahr street networks and its road safety statistics followed by other design issues faced by various user groups in the city. Localization of the transport SDGs in city of Bulandshahr - SDG 3.6 (Reduce road injuries and death), SDG 3.9 (Urban air pollution PM10 & PM2.5) and SDG 11.2 (Affordable & sustainable transport systems) has been covered in this study.

SDG Integrated Master Planning assists local governments and urban development authorities like BDA to integrate their upcoming master plan with a strategy and road map to integrate SDG comprehensive mobility vision that leaves no one behind. It offers a course correction to development trajectory of cities so that they can grow with sustainable mobility choices and projects.

Part B covers design guidance and offers support to develop SDG oriented street design.
Figure 1: Bulandshahr Master Plan 2021
Source: https://lowcosthousing.online/bulandshahr-master-plan-2021.html
BULANDSHAHR, UTTAR PRADESH

Bulandshahr city is the administrative headquarters of the Bulandshahr district in the Indian state of Uttar Pradesh. It is a part the National Capital Region (NCR of Delhi) and is in close proximity to the Indian capital, situated at around 100 km distance from New Delhi.

The first urban local body was constituted in the year 1880 after which various services were introduced in Bulandshahr and thus people migrated from nearby rural areas to the city. Bulandshahr witnessed maximum population growth in the 1971-81 decade during the era of green revolution in agriculture. The first development plan or the Master Plan of Bulandshar for the period of 1989 to 2001 was passed in the year 1993.

However, the proposed development did not follow the plan and thus the objectives of the 1989-2001 Bulandshahr Master Plan were not met. A new Master Plan was prepared for the year 2021, the current progress status of which is not clear yet. Moreover the city has still not developed well both economically or industrially.

The population of the district was 3,498,507 (Census 2011) and the population of the city was 230,024 (Census 2011). There was 30% increase in the city’s population during 2001-2011 decade and is expected to grow at a rate of 44% in the coming decade.

The city’s population is expected to reach around 3.32 lakh in the year 2021 according to the Bulandshahr Masterplan - 2021. The existing area of the city is 32 square kilometres (as per the municipal authority) and the population density is 7188 inhabitants per square kilometre.

The Bulandshahr Khurja Development Authority (BKDA) has the responsibility to prepare and follow the development plans. Khurja is another municipal board situated 20 km away from Bulandshahr and can be called as a twin city, thus the Bulandshahr Khurja Development Authority was found for a balanced regional development of the whole urban area.
HOW DOES BULANDSHAHR TRAVEL?

Almost half of the population in Bulandshahr walks to work. Based on the modal share for work trips in Bulandshahr (census 2011), this constitutes 48% of the total trips. More than 70% of the trips are made on foot or by using bicycle.

However, there is a huge 64% increase in the total number of vehicles registered (per year) in the period of 5 years i.e. 2012-2017. The average increase in vehicle registrations per year in this period of five years is 11%. This increase in number of vehicles indicate towards the pressure on the road networks of the city and especially in the central parts which are more dense and have less road widths. The maximum share amongst the vehicles in Bulandshahr is of the motorised two wheelers including motorcycles and scooters followed by cars.

Within small cities and towns in India with a population less than 5 lakh, the major role of carrying people is fulfilled by informal public transport (IPT) or para transit. Such systems exist in Bulandshahr as well in the form of e-rickshaws.

The informal public transport is present in most small cities of India and have peculiar characteristics which include non-regularised routes, parking issues, permit issues, fare irregularities, overloading etc. The same kind of problems are arising in Bulandshahr too. These services, if organised, can become a viable and efficient mode of public transport. The absence of proper infrastructure for such systems also lowers their efficiency.
ROAD FATALITIES IN BULANDSHAHR

Road traffic injuries are the eighth leading cause of death and ninth leading cause of overall health loss in India with an estimated 3% loss of GDP. There is an urgent need to study the characteristics of traffic crash patterns so that remedial treatments can be adopted to improve the overall safety scenario.

TRIPP collected the fatality data for the city of Bulandshahr from various police stations, where monthly records are available in the form of FIR’s. FIR data was collected from 2012, 2013, 2014, 2015, 2016 and 2017 (2017 - up to the month of November) within the boundaries of Bulandshahr’s police stations. There were a total of 298 accidents reported in these five years out of which 102 were fatal accidents.

The assessment of the FIR’s revealed that:

- There were a total of 298 accidents reported in the period 2012-2017 out of which 34% accidents resulted in fatalities.

- Pedestrians were the most vulnerable road users with almost counting half of the total number of fatalities. These were followed by motorcycle drivers who also accounted for two thirds of the total number of fatalities.

- Pedestrians were mostly hit by heavy vehicles like buses followed by trucks. Motorcyclists were mostly hit by trucks and cars. A significant share of cases among these two vulnerable groups is where the impacting vehicle was unknown.

- Trucks and Buses are the most common striking vehicles in fatal road traffic crashes of Bulandshahr, with more than one third share amongst the striking vehicles. The striking vehicle is unknown in 21% of the fatal crashes.

- The pedestrians are the majority victims during the
Figure 10: Road Fatalities Accident Map, (2012-17)

Figure 11: Victim, TRIPP 2017

Figure 12: Impacting Vehicle Type, TRIPP 2017
fatal road traffic crashes followed by motorised two wheeler users, thus being the vulnerable groups.

- Pedestrians and motorised two wheeler users are mostly hit by trucks and buses. The heavy goods vehicles had 23% of share amongst the impacting vehicles. These were followed by buses with 18% share whereas in 21% of fatal accidents, the impacting vehicle was unknown.

**Factors Contributing to Road Traffic Crashes** are:

- Vehicles move at a high speed increasing the risk of accidents. Non segregation of traffic leads to high risk to Vulnerable Road Users

- Cyclist accessibility and signage is neglected in the design of road infrastructure

- Lack of proper lighting

- Footpath lack continuity and the design does not follow national/international design guidelines.

- Pedestrian signals are missing at junctions

- The markings for pedestrians are inappropriate

- Standard median design is lacking. This increases the risk for motorised vehicles.

- Lack of well designed parking spaces for para-transit vehicles such as e-rickshaw.

- Encroachments on pedestrian infrastructure by parked vehicles and structures. Lot of obstructions on footpath adds to the difficulty of pedestrians.

- Lack of adequate footpath space and non-uniform width of carriageway

- Highways close to the city with high speed heavy vehicles and motorised two wheelers sharing the highway.

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**Figure 13: Road Traffic Crashes: Victim Vs. Impacting Vehicle Type**

- Heavy goods vehicles
- Unknown
- Motorcycle
- Scooter
- 3 wheeler (goods)
- Van
- Bus
- Medium goods vehicle
- Tractor
- Light goods vehicle

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Road traffic safety is a major concern in India, where the rate of road traffic deaths is five times as high as in some of the best performing countries. Though policy decisions on traffic safety are the prerogative of the state and central government, municipalities can be first responders in redesigning the most dangerous parts of the road network and addressing other determinants of traffic accidents.

The mobility indicators dashboard makes it easy for decision-makers in the city to understand patterns in road accidents. First Information Reports are displayed on a map, with key indicators below. Filters allow the user to refine the information displayed.

A second page of the dashboard displays the city’s performance against the U.N. Sustainable Development Goals. These goals make up a robust framework covering a breadth of human development issues, allowing officials in different countries and focusing on different issues to effectively communicate and work together. Bulandshahr’s progress on road safety towards achieving these targets can be tracked through the second dashboard.

An online, interactive mockup of the Bulandshahr mobility indicators dashboard (populated entirely with real data) demonstrates what decision-makers can do with the tool. The guide below explains how to navigate the functionalities of the mockup.

The dashboard can be accessed online at: bit.ly/2jjOobp

Figure 14: An online, interactive mock-up of the Bulandshahr mobility indicators dashboard. Developed for TRIPP by OpenCities Institute, Community Systems Foundation
02 Issues

DESIGN ISSUES ON STREETS

- **Absence of Pedestrian Paths**: Roads are mostly devoid of any safe infrastructure like footpaths or refuge space. Roads have been asphalted to allow for movement of motorised vehicles.

- **Parking Encroachments**: Heavy encroachment of two wheelers and car parking on pedestrian infrastructure. This makes the pedestrian infrastructure unusable and forces the pedestrians to use the carriageway alongside motorised traffic.

- **Insufficient widths**: Many footpaths are not wide enough to ensure smooth and comfortable walking.

- **Obstructions**: The other obstructions apart from vehicular parking, include encroachments due to extension of abutting property, trees, bus stops and signages on the walking path.

  - Lack of amenities like toilets, kiosks, etc. A few toilets have been built but they are not enough. The toilets itself are built on footpath, causing abrupt discontinuation of pedestrian path. The design of the toilets and making them accessible for all needs to be re-looked into.

  - Lack of designated parking spaces: There are limited designated parking spaces. Most of the on-street parking is unmarked and free of charge.

- **No integration of feeder service**: Auto rickshaws, e-rickshaws, cycle rickshaws ply on roads. However, there is no provision of integrating bus stations for commuter convenience.

- **No provision for safe cycling**: There is a presence of cyclists, passenger cycle rickshaws and goods cycle rickshaws. However, all the above three modes are moving in unsafe conditions in a high speed corridor. With no provision of bicycle infrastructure, cyclists travel with motorised vehicles, risking their lives.

- **Unsafe and inaccessible pedestrian crossing**: Crossing facilities in the city are abysmal. Pedestrians and cyclists then need to cross 4-6 lanes of traffic. The medians lacks refuge island spaces.

- **Lack of universally access infrastructure**: All of...
street infrastructure needs to be universally accessible. The existing bus shelters have been built without any consideration for people with disabilities. Signages, proper lighting, accessible ramps, use of tactile paving, easy boarding and alighting, route informations, etc., should be part of state of the art bus stations.

- **Design of integrated spaces for hawkers/ vendors:** A lot of informal activity is present on the roads. The vendors stand along the road providing service to bus commuters, cyclists and pedestrians. Though they are generally seen as encroacher’s by authorities, their presence also provides security on our roads. The need to integrate them in road design is critical.

- **Lack of planning to integrate service and utilities:** Light poles and power poles come in front of the pedestrian path and road edges. These are obstructions but also indicate a lack of planning so that they can be easily maintained in future without disturbing pedestrians and cyclists. Proper drainage has been not provided. This leads to water-logging and puddling, adding to inconvenience to people on the footpath and road edges.

- **Missing street infrastructure, signs and road marking:** There is a lack of resting places like seats and benches. These not only provide comfort but make the road attractive. Adding street furniture will add to the attractiveness of already existing formal and informal commercial stretches. Signages and marking play a critical role to inform road users.

- **Need for Safe Intersection design:** The current intersections comprise of signalised crossings, un-signalised crossings and roundabouts. However, there are basic flaws in the current geometry. They do not slow the traffic slow down and are not able to assist in safe crossings by pedestrians and cyclists.

- **Missing traffic signals:** The junctions are also unsafe since a lot of traffic signals are absent or are not in a working condition.

- **Signages:** There is lack of road signs for each road user. Also, lack of standardization of signs and non-compliance with signs recommended by Indian Road Congress was observed.

- **Marking:** Only a few pedestrian crossings were painted. There are other types of markings that complement signages and inform road users of the road environment. This is absent.
Community perceptions about mobility problems and issues in the city have been documented through a survey administered in the last two months. A short survey format was designed with 23 key questions about congestion, safety and air pollution issues in Bulandshahr. The questionnaire was distributed amongst students, business community and administrative staff with the help of local NGOs and administrative staff. A total of 420 people were surveyed and majority (63%) respondents were male. 60% of the respondents were students followed by service category with 21% share and business category with 14% share.

The survey respondents were asked on the important issues related to city's traffic in which the three major issues highlighted were traffic congestion, road safety and air pollution. The reasons for the traffic congestion came out to be battery operated three wheelers (e-rickshaws), heavy vehicles and presence of street hawkers. A section in the survey also included questions on climate change and greenhouse gas emissions where around 70% people admitted that climate change is affecting Bulandshahr and 47% people think that motorised vehicles contribute to greenhouse gases.
Agenda 2030 is a plan of action for people, planet and prosperity...determined to take the bold and transformative steps which are urgently needed to shift the world onto a sustainable and resilient path. ...we pledge that no one will be left behind.

The 17 Sustainable Development Goals and 169 targets ... demonstrate the scale and ambition of this new universal Agenda ... seek to realize the human rights of all and to achieve gender equality and the empowerment of all women and girls.

They are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental

People: ... to end poverty and hunger, in all their forms and dimensions, and to ensure that all human beings can fulfil their potential in dignity and equality and in a healthy environment.

Planet: ... to protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations.

Prosperity: ... to ensure that all human beings can enjoy prosperous and fulfilling lives and that economic, social and technological progress occurs in harmony with nature.

Peace: ... to foster peaceful, just and inclusive societies which are free from fear and violence. There can be no sustainable development without peace and no peace without sustainable development.

Partnership: ... to mobilize the means required to implement this Agenda through a revitalised Global Partnership for Sustainable Development, based on a spirit of strengthened global solidarity, focussed in particular on the needs of the poorest and most vulnerable and with the participation of all countries, all stakeholders and all people.

- Preamble, Transforming our world: the 2030 Agenda for Sustainable Development
In 2015, UN General Assembly adopted the Sustainable Development Goals to foster action oriented development towards people, peace and prosperity.

The Sustainable Development Goals are 17 bold yet achievable goals to end extreme poverty, fight inequality and build peaceful societies on a healthy planet; they provide a guiding framework to all countries, developing and developed, to enable national and sub-national governments orient planning, design and implementation to eliminate poverty in all forms and empower communities to become active agents to develop a safe, sustainable and resilient future by 2030.

5 billion people are projected to live in cities by 2030. All cities aim to increase prosperity, promote social inclusion, and enhance resilience and environmental sustainability. The SDGs can strengthen short and long term city planning objectives and outcomes, when aligned with existing planning frameworks and development priorities. They act as a rich tool to support local governments to bridge the gaps between the present scenario and the ambitious target for 2030.

Building on the principle of ‘leaving no one behind’, Agenda 2030 emphasizes on a holistic approach to achieve sustainable development for all.

SDGs are a local agenda, where targets need to be prioritised and adapted at the community level.

SDGs are a collective agenda – implementing the goals will require global cooperation on a scale and intensity that transcends traditional concepts of ‘partnership’.

SDGs are a people’s agenda – civil society is more than NGOs. People must be involved in the design, delivery, monitoring and evaluation of the SDGs on an ongoing basis and will improve effectiveness as well as accountability.

SDGs are universal in nature; they apply to all countries. They are integrated and mutually reinforcing. There are multiple goals that are cross cutting in nature such as SDG 13: Climate Action or SDG 11: Sustainable Cities and Communities, supporting low carbon and people centric approach to development.

Figure 24: 17 Sustainable Development Goals
The genius loci of Indian cities is its vibrancy and diversity, visible in all aspects of urbanity, but especially so within its street life. The present structure of our cities is predominantly high density and mixed land use. This results in short trip lengths and dependence on walking, bicycles and para-transit use such as non-motorised rickshaws, shared auto's and e-rickshaws.

Street vendors bring vibrancy and life to our city streets, in their quest for earning a livelihood through hawking, street merchandise and informal trade. They are also the ones who contribute to sustainable soft mobility modes - walking and cycling.

Apart from the streets of the old and historic parts of most Indian cities, the human-scale of our urban environments has progressively decreased since the 1960's. Enabling the viability and liveability factor in our cities, means creating a sensitive communication between the “built - enclosed; built - open; semi-built - open” urban spaces.

The current structure of our street planning focuses solely on moving vehicles. It ignores the spaces for walking, cycling and affordable public transit infrastructures. People first rather than vehicles will foster safe and accessible mobility for all users.

Key to the people first approach is recognizing that walking is the most universal form of transport. All cyclists, public transit riders and motorists begin their journey as pedestrians and therefore the transit and automobile network can only be as good as the pedestrian network that brings them to other modes of transit (Jeff Risom, in Mohan, D. 2012)

Cross-cutting across other goals, SDG 11 focuses on making cities inclusive, safe, resilient and sustainable. Each of the targets within this goal aims to:

- Ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums;
- Provide access to safe, affordable, accessible and sustainable transport systems for all;
- Enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management
- Protect and safeguard the world’s cultural and natural heritage;
- Reduce the number of deaths and the number of people affected due to disasters;
- Reduce the adverse per capita environmental impact of cities, due to air quality and municipal and other waste management;
- Provide universal access to safe, inclusive and accessible, green and public spaces to all;
- Strengthen national and regional development planning;
- Implement integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change;
- Build sustainable and resilient buildings utilizing local materials.
The transportation system and the way road spaces are allocated in the cities, is a clear indication of a societal attitude and mind-set. Transport planning is clearly car-oriented, with cars having priority on the high speed road stretches, at the intersections which minimize their waiting time, at flyovers that allow them to avoid the congestion, at market places that give them large parking spaces, and the list goes on.

While the authorities may apologize for badly maintained roads, they would never think of apologizing for the broken pedestrian paths, non-existent bicycle lanes and dilapidated bus shelters and the inefficient public transport now in place. Ravi, R. TRIPP Bulletin 2005

Figure 26: 5 advantages if people centric streets
SAFE STREETS ARE COMPLETE STREETS

Sustainable transport needs inclusive streets. Inclusive streets ensure not only safe mobility – reduced risks of traffic crashes – but also reduced street crimes and better social cohesion, and makes public transport, bicycling and walking attractive, and the preferred choice for commuting. Hence, Safe streets are complete streets. They ensure door to door mobility for all road users in a safe and seamless manner. They foster a community spirit since residents use streets to meet, access public spaces and socialize. There is strong evidence that sustainable urban mobility planning raises the quality of life in an urban area (Wefering, et al., 2014).

Safe Streets put pedestrians first. They prioritize vulnerable user groups like pedestrians and cyclists. Any type of streets, any width of streets needs to address the prerequisites of a pedestrian and a cycle. The approach is people centric and not car centric. The multi-dimensional experiences of the pedestrian, cyclist and passenger must all be considered as one, at the ‘eye-level’ of humans in the city.

Safe streets are forgiving in nature. The road environment allows the road users to make ‘mistakes’.

Safe streets are more secure street. Newly emerging research confirms that the presence or fear of violence impedes activity levels and the ability to move outside freely, especially among populations that are more vulnerable to violence such as children, women, people with disabilities, and older adults,(Cohen, et al., 2013). Safe streets are inclusive and provide ‘eyes on street’. Integrating spaces for hawkers and vendors not only provide

Safe streets are for ALL: Design of inclusive streets gives a safe environment to all age groups and segregates population from high speeds and prevents injuries. Safe streets do not discriminate the elderly and the differently-abled.

Safe streets give clean air. The increased dependence on personal transport leads to high emissions. The more people use public transport or just walk and cycle, the cleaner the air.

A complete system of mobility within a city encourages a sense of equality among its citizens. People First Mobility fosters democracy as well as a sense of individual importance (Gehl 2010)
1 Sustainable Safe Traffic System

Congestion continues to get worse as more and more people give up walking, cycling, and using public transport, which are better for the environment. A well functioning road infrastructure must meet the needs of all road users (Tiwari, 2002). The sustainable safe traffic system is based on the five principles on which the vision is based: functionality, homogeneity, predictability, forgivingness, and state awareness (Wegman, et al., 2008).

It focuses on three main points:

- a road environment with an infrastructure adapted to the limitations of the road user: Designing a forgiving road environment is key. The guideline focuses predominantly on this factor.
- Vehicles equipped with technology to simplify the driving task and provided with features that protect vulnerable and other road users
- Road users that are well informed and adequately educated.

2 Social Usability

Streets are not only important for mobility but are vital public spaces of the city. As mentioned earlier, streets are tools for social cohesion. Streets are used by people to meet each other, do outdoor activities and access other public spaces of the city. This is an important component which separates a street from a road. This is where the ‘human factor’ influences. Detailing such as continuity, traffic calming, street furniture, lighting, shade, etc make the street more attractive and encourage usage.

3 Universal Accessibility

The integration of the concept of universal design has been completely missing from our streets. Street design has to be responsive to inclusiveness and accessibility for ALL. Pedestrians, therefore includes everybody i.e. differently-abled people, hawkers and street vendors, people carrying luggage, pregnant women, children, people travelling with infants either in hand or in stroller, etc. Invariably, the physical profile of a pedestrian covers all age groups and gender.
4 Captive Users

Indian cities, with their high population densities, mixed land use and short trips have an environment which naturally encourages walking. Added to that, high rates of poverty make the ownership of any type of vehicle, often even a bicycle, unaffordable.

Even if a vehicle is owned by a household of 4-5 persons, it may typically only be used by one person and the others may resort to other, less expensive means of transport like walking or IPT or Public transport, depending on their trip length. Very few people, who walk in the Indian cities, do so out of choice.

Streets must be returned to pedestrians, not only because pedestrians make up the majority of road users, but also because the efficiency of the overall system, including the performance of motorised vehicles, depends on meeting the demand of “captive pedestrians.”

Travel patterns of people living in informal housing or slums are very different from residents in formal housing. Generally, bicycles and walking account for 50-75% of the commuting trips for those in the informal sector. The formal sector is dependent on buses, cars and two wheelers. This implies that despite high risks and a hostile infrastructure, low cost modes exist because users of these modes do not have any other choice. They are captive users of these modes.
5 Equitable Allocation of Road Space

Urban roads in India have a heterogeneous mix of traffic. These include the pedestrians, slow moving vehicles like bicycles, rickshaws both for passenger and freight movement and fast motorized vehicles like motorcycles, scooters, three wheelers, cars and public transport vehicles. The space occupied by each of these vehicles, accelerations and deceleration characteristics and possible maximum speeds by each user is variable. Therefore space allocation to different vehicles has to be carefully ensured according to their design speed to achieve a smooth and safe flow of traffic.

6 Modal Hierarchy

Pedestrians, non motorized users and the public transport users in urban areas form the basis of sustainable transport systems. Therefore designing a road space for these three user groups in priority is of utmost importance.

Chicago Department Of Transportation has adopted a pedestrian-first modal hierarchy for complete streets and all transportation projects and programs, from scoping to maintenance, will favor pedestrians first. (CDOT, 2012)
Sustainable transport has an impact on several other sectors and SDGs. Without substantial achievement of transport targets, many SDGs risk under achievement. Road Safety and Air Pollution are two key areas while looking at an SDG oriented planning and design approach with Bulandshahr. The main target is to reduce the number of traffic fatalities as well as bring down the air pollution.

A number of interventions are required that SDG can be used as a guiding light. These are:
- Traffic conflict analysis: Understanding road accident crashes at high crash locations
- Monitor air pollution: Collection and review data on air pollution and particulate matter
- Promote Safe Street Design: Design and implement safety principles in streets for all road users; giving priority to pedestrians and cyclists
- Improve Traffic Management: Improve road geometry and design safer intersection design.

For SDG & mobility in Bulandshahr, Target 3.6 and 3.9 have been selected to report on SDG 3: Good Health and Well Being; Target 11.2, 11.6, 11.7 have been identified from SDG11: Sustainable Cities & Communities.

Identified SDG Targets and Indicators

**SDG 3 : GOOD HEALTH & WELL BEING**

**Target 3.6**
By 2030, halve the number of global deaths and injuries from road accidents

**Target 3.9**
By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination

**SDG 11 : SUSTAINABLE CITIES & COMMUNITIES**

**Target 11.2**
By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all

**Target 11.6**
By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

**Target 11.7**
By 2030 provide universal access to safe, inclusive and accessible green and public spaces

Figure 34: Identified SDG Targets and Indicators
Road traffic safety is a major concern in India, where the rate of road traffic deaths is five times as high as in some of the best performing countries. Though policy decisions on traffic safety are the prerogative of the state and central government, municipalities can be first responders in redesigning the most dangerous parts of the road network and addressing other determinants of traffic accidents.

The mobility indicators dashboard makes it easy for decision-makers in the city to understand patterns in road accidents. First Information Reports are displayed on a map, with key indicators below. Filters allow the user to refine the information displayed.

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The dashboard can be accessed online at: bit.ly/2jjOobp
SDGs provide an umbrella framework and guidance to authorities to monitor progress, effectiveness and sustainability of urban transport in their cities. These may have been lacking in many aspects of development or community change.

Initiating work on Sustainable Development goals so as to ‘leave no one behind’ requires developing a baseline and meeting various user groups. A number of discussions were done with various stakeholders through meetings, workshops and consultations. These included District Administration, Municipal Council, Bulandshahr Development Authority (PUDA), Traffic Police, TRIPP IIT Delhi, Researchers, Citizen groups, Vyapar Mandal (Business Union), Local NGO’s, with support from IATSS team.

The framework also assists in setting up a local agenda and identifying goals and targets. This weaves into any long term planning that exists or can support in planning one.

**FRAMEWORK FOR ACTION**

**TARGET 3.6**

Reduce road injuries and deaths

**INPUTS**

- Stake holder consultations and Meetings
- Workshops
- Perception Survey

**ACTIVITIES**

- Data Collection and Analyses
- FIR Data collection from all the police stations inside the city boundary, coding the FIRs, extracting out the crash detail.
- Hotspot Analyses and Design Solutions
- Stakeholder consultation
- Linkages to SDG 3.6

**OUTPUTS**

- Exhibition for Community Participation
- SDG Planning and Design Guideline
- Pilot corridor - street design. Data Dashboard.
- Road safety & vehicular technology interventions
- Forecast for 2030
- Future Roadmap to achieve SDG 3.6

**OUTCOMES**

- Short Term: Reduction of crashes; improved traffic management; Including citizen’s opinions in the local agenda; Enhanced awareness towards equitable allocation of road space; Improving coherence in road design
- Mid Term: Promotion of walkability, connectivity and social cohesion; Integration of street vendors and hawkers, bus shelters, feeder services and utilities
- Long Term: Better Quality of Life; Safer streets and mobility; Better health and well-being; economic vibrancy
Target 3.9
Reduce illnesses and death from hazardous chemicals and pollution

**INPUTS**
- Stake holder consultations and Meetings
- Workshops
- Perception Survey

**ACTIVITIES**
- Data Collection - Installation of monitors
  - Air pollution monitoring
  - Analysis of annual data

**OUTPUTS**
- Exhibition for Community Participation
- Strategies/Recommendations to reduce air pollution

**OUTCOMES**
- Short Term: Monitor air pollution; Including citizen’s opinions in the local agenda; Increased aspiration on why and how to meet SDG goals by 2030
- Mid Term: Improved air quality monitoring and management;
- Long Term: Better Quality of Life; Better health and well-being; Economic vibrancy

Target 11.2
Affordable and sustainable transport systems

**INPUTS**
- Stake holder consultations and Meetings
- Workshops
- Perception Survey

**ACTIVITIES**
- Data Collection and Analyses
  - Survey and Planning of current IPT network
  - Review of city master plans
  - Hotspot Analyses and Design Solutions
  - Stakeholder consultation
  - Linkages to SDG 3.6

**OUTPUTS**
- Exhibition for Community Participation
- SDG Planning and Design Guideline
- Draft Transport Chapter for City Master Plan
- Public Transport Improvement Plan - 2030
- Estimate Ridership Demand & Fleet Requirement
- Finalizing Route Structure and public transport routes

**OUTCOMES**
- Short Term: Introduction of buses; Including citizen’s opinions in the local agenda;
- Mid Term: Promotion of walkability, connectivity and social cohesion
- Long Term: Better Quality of life; Reduced dependency on private transport; Better mobility and accessibility; Better health and well-being; Economic vibrancy;
SDG Oriented Street Design Guideline for Bulandshahr (U.P.)

05 SDG Integrated Master Plan

In the UN SDSN SDG Cities Guide, four basic steps for getting started with SDG implementation in cities has been proposed. These are:

i. **Initiate an inclusive and participatory process**: Raising awareness of the SDGs and engaging stakeholder collaboration to achieve the goals and targets.

ii. **Set the local SDG agenda**: Translating the global SDGs into an ambitious yet realistic agenda that is tailored to the local development context.

iii. **Planning for SDG implementation**: Deploying goal-based planning principles and mechanisms for more sustainable social, economic and environmental outcomes.

iv. **Monitoring and evaluation**: Ensuring that SDG implementation remains on track, and developing local capacity for more responsive and accountable governance.

It is critical to map the stakeholders and engage them through a participatory process. In Bulandshahr, the city administration includes various stakeholders or government institutions who develop and manage the city along its associated urban services. These include the Nagar Palika Parishad (NPP), Bulandshahr Khurja Development Authority, Police Department, State Transport Department, PWD and the District Urban Development Agency.

Feedback from citizens was collected and some suggestions to prepare the local agenda on transport are as follows:

- Bad road design
- Alcohol & Fault of Drivers
- Poor lighting at nights
- Fault of pedestrians
- Over speeding
- Control on e-rickshaws.
- Identification of vending zones.
- There are no designated parking spaces.
- Possibility of e-rickshaws to become the main transport system of the city.
- Fatal crashes on highways.
- Illegal parking of tempos near the bus stops.
- No parking available for customers coming to shops.

A master plan is a blueprint for the future. It is intended to guide the long view of development of any city for a period of 10-20 years.

The Bulandshahr Development Authority had prepared the first master plan in 1993 considering the development between years 1989-2001. A new master
plan for 2021 was prepared in 2005. The next master plan will be developed in the coming years with a long view of 2041 and it would be best to meet the target year by orienting its approach with SDG (mid-term - 2030) and achieving principles of sustainable urban development.

Currently 13.21 % of the total land use falls under traffic and transportation. The current master plan focuses upon:

- Delhi-Anupshahr road, the central road passing through the city carrying both local, regional and passing traffic. It also hosts businesses, sabzi mundi and various other activities which results in high concentration of vehicles. Other major roads are Shikarpur Road, Khurja Road and Gad Mukteshwar Road.

- Only major bus stands and their locations.

- The proposals mentioned in the document focus upon the road network, development of ring road, parking areas, junction redevelopment and introduction of flyovers in the city.

- Also, an improvement in local bus service system, railway overbridges, zonal plans along roads for future has been mentioned.

- Infrastructure such as Parking locations, Bus stand, Motor garage and workshops, Taxi/Tempo/Rickshaw stands, Motor Driving Training Centre, Transport Nagar, Weighing station (for goods vehicles) and Bus depot have been mentioned.

It is critical that Bulandshahr integrates the mandate of sustainable transport in the master plan.

**KEY STAKEHOLDERS: GOVERNMENT**

**BULANDSHAR DEVELOPMENT AUTHORITY (BDA)**
- Flyovers and over bridges development
- Roads widening and developed footpath in past
- Tirri / tempo/ tonga parking and vendor zone development
- Colony development
- Building permission, by laws and land-use charge
- Follow development plan 2021

**STATE TRANSPORT DEPARTMENT**
- (Road Transport Authority)
- District level: Vehicle registration data; E-rickshaw (Tirri) routing

**NAGAR PALIKA PARISHAD (NPPB)**
- Roads (including shoulders and drainage) development and maintenance
- Development of Colony Roads
- Flyovers and over bridges maintenance
- Street lights, Water supply and sewerage
- Vending zones development
- Solid waste management
- Parks and green spaces
- Tirri / Tempo/ Tonga parking and vendor zone management

**POLICE DEPARTMENT**
- District and city level: Traffic Management (many cities), Road accident data (FIR)

**PUBLIC WORKS DEPARTMENT**
- In whole district: Road development and maintenance; majorly district roads outside NPP boundary, member for the district road safety committee

**DISTRICT URBAN DEVELOPMENT AGENCY**
- State Government agency for construction, upgradation and maintenance of roads, buildings and bridges in the state.
BULANSHAHR 2030

E-rickshaw network cover 66% of the city

Figure 37: Role of e-rickshaw as a Para Transit in Bulandshahr
PUBLIC TRANSPORT IMPROVEMENT PLAN

According to mode of travel to place of work data (census, 2011), about 65 per cent of the existing trips in Bulandshahr are within five kilometres distance. More than 15 per cent of the trips to work are more than 10 kilometres trip are supported by bus transport system.

For developing road map to improve public transport system in Bulandshahr aligned to SDG 11.2, 10 minutes of headway for the project has been considered instead 20 minutes as mentioned in SDG 11.2 in the view of providing higher level of public transport services. Higher waiting time leads lower attraction towards public transport system and 10 minutes gives satisfactory waiting time for passengers.

The process followed is as follows:

1. **Existing city road network distribution**: More than 75 per cent of the city road network was covered by local streets and access streets. However, collector roads are covering more than 40 per cent of the road network in both Bulandshahr Proposed Planning Area (BPPA) and Bulandshahr Development Area (BDA), followed by Local Streets and Access Streets.

<table>
<thead>
<tr>
<th>Street Type</th>
<th>Total Street Length in BDA (in Km.)</th>
<th>Total Street Length in BDA (in %)</th>
<th>Road Length in NPPB Boundary (in Km.)</th>
<th>Road Length in NPPB Boundary (in %)</th>
<th>Road Length in PPAB (in km)</th>
<th>Road Length in PPAB (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial Street</td>
<td>8.7</td>
<td>11%</td>
<td>0.0</td>
<td>0%</td>
<td>1.4</td>
<td>2%</td>
</tr>
<tr>
<td>Collector Street</td>
<td>32.8</td>
<td>40%</td>
<td>8.2</td>
<td>23%</td>
<td>25.3</td>
<td>41%</td>
</tr>
<tr>
<td>Local Streets</td>
<td>22.6</td>
<td>28%</td>
<td>12.5</td>
<td>35%</td>
<td>17.3</td>
<td>28%</td>
</tr>
<tr>
<td>Access Street</td>
<td>17.2</td>
<td>21%</td>
<td>14.5</td>
<td>41%</td>
<td>17.3</td>
<td>28%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>81.4</td>
<td>100%</td>
<td>35.2</td>
<td>100%</td>
<td>61.4</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 2: Street Typology, Bulandshahr

Figure 38: Existing Road Network. Source: TRIPP, IIT Delhi

Figure 39: Existing IPT Network. Source: TRIPP, IIT Delhi
2. **Location of trip attraction centers** - More than 40% trip attraction centres are distributed around 12% of access streets in the city. The Maximum number of trip attraction centres are located along the Delhi and Siyana (Anupshahr). The trip attraction centres includes commercial activity centres, educational institutions, government organizations, recreational facilities, tourist sites, etc.

3. **Current Intermediate Para Transit (IPT) operational routes** : The IPT operations are largely serving with 4 seated e-rickshaws. More than 75 percent of the IPT routes either start or end with the Kala Aam Chauraha and it function as a major transport node of the city.

4. **Existing and Proposed Landuse and Density of the city** : The master plan 2021 anticipated that the growth of the city extend to around 34 sq.km from 12.36 sq.km with amalgamation of 10 surrounding villages. The tendency of the city growth was along the transport corridors and proposed ring road.

Based on this analysis, a public transport system for 2030 has been proposed. This includes:

- 23 km of City Bus Service
- 7 km of IPT
- 27 km of Mofussil Bus Service

By 2030, total public transport system will be available over 57 km of overall route length. With the proposed public transport system about 92 percent of the Nagar Palika Parishad (NPP) Bulandhshar and 71 percent of the Bulandshahr Proposed Planning Area (BPPA) came to access to the mode of bus transport system includes city bus, moffusil and IPT services with the distance of 500 meters. With the 1km of buffer area 100 percent of the NPP Bulandshahr and 95 percent of area BPPA coming access to the public transport system.

![Figure 40: Proposed Public Transportation Plan 2030](image-url)
PHASE WISE IMPLEMENTATION

The phase wise implementation of proposed PT is planned in two phases. Each phase scheduled for 5 years of time period - 2025 and 2030.

The public transport system routes being introduced in Phase I is selected on the basis of availability of RoW for introducing public transport systems without much initiatives, maximum coverage of trip attraction centres, current IPT Routes and city boundary limits.

Selection criteria for Phase II is based on connecting trip attraction centres remaining in the phase-one, providing connectivity to city out growth areas, and improving connectivity between the routes.

**Phase I : 2025**

During the Phase I, the proposed public transport system network covering around 35 kilometres of length includes,

- 15km (approx) of City bus service
- 14km (approx) of mofussil bus route, and
- 5km (approx) IPT route.

The implementation of Phase I covers 80% of the municipal council area and 52 percent of the BPPA within 500 metres of buffer area.

**Phase II : 2030**

For the Phase II, the proposed public transport system network providing access around 23 kilometres of length overall, which includes,

- 8km of city bus service,
- 2km of IPT route, and

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Total Length (in Km)</th>
<th>Total Length (in %)</th>
<th>In NPPB Bulandshahr (in Km)</th>
<th>In NPPB Bulandshahr (in %)</th>
<th>In BPPA (in Km)</th>
<th>In BPPA (in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City Bus Service</td>
<td>23</td>
<td>40%</td>
<td>17</td>
<td>53%</td>
<td>22</td>
<td>50%</td>
</tr>
<tr>
<td>IPT</td>
<td>7</td>
<td>12%</td>
<td>5</td>
<td>16%</td>
<td>16</td>
<td>36%</td>
</tr>
<tr>
<td>Mofussil Mini Bus Service</td>
<td>27</td>
<td>47%</td>
<td>10</td>
<td>31%</td>
<td>6</td>
<td>14%</td>
</tr>
<tr>
<td>Total Length</td>
<td>57</td>
<td>100%</td>
<td>32</td>
<td>100%</td>
<td>44</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 3: Proposed Public Transportation Plan 2030

![Figure 41: Proposed Public Transport Coverage (0.5km)](image1)

![Figure 42: Proposed Public Transport Coverage (1 km)](image2)
Large share of the Phase II was about providing transport facility to nearby villages of Bulandshahr with the mofussil service.

In the implementation of Phase II, public transport will be able to covers additional 12 percent of the NPPB and 11 percent of BPPA reaching to additional 40% and 34% in area respectively.

Based on the hotspots derived from the analysis, three areas were identified:

- Khurja Road, Near Upper Canal Road: The stretch is a part of a distributor road and carries mostly the traffic bypassing the city of Bulandshahr.
- Khurja Road, Near Railway Flyover: This stretch is in continuity with above hotspot however it is a part of a sub arterial road.
- Shikarpur Bypass (near Mamman Road Intersection): The street carries bypassing traffic to and from the city.

Average Safety Score observed for the three high crash locations is 27 out of 100 (URSA Toolkit).

Most of the fatalities in this area is due to high speed that needs to be controlled to achieve the desired safety levels. Any highway entering city boundary should be treated as an urban street and the speed and design should be governed by the typology of the street. The cross-section should be based on the design standards. (Refer SDG Oriented Street Design Guideline - Part B: Design).

Appropriate crossing facilities should be designed. At stretches of high speed and high volume of vehicles, crossing facilities could vary from a half subway, full subway and a foot-over bridge. (Refer SDG Oriented Street Design Guideline - Part B: Design).

Instead of providing “hard separation”, “audible markers” should be provided to define the line between the shoulder, where motorcycles usually go on the highways.
Plan city for people, not vehicles.

**MYTHS: ROAD NETWORK**

Wider the Carriageway - Less the Congestion

This is a capacity enhancement measure and creating a more attractive infrastructure for motorised users, while creating hostile environment for pedestrians and cyclists.

**PUBLIC TRANSPORT = BUS**

Erickshaws, auto's and cycle rickshaws cater to the population and act as public transport for small-mid sized cities.

**MYTHS: MOTORISED VEHICLES**

Flyovers will be solve bottlenecks and congestion

Flyovers shift bottlenecks but do not eliminate them. They do not serve the pedestrians, the cyclists and bus users.

More parking will solve congestion

Creating more parking is only a capacity enhancement solution which will serve in the short term. The land used for parking can be designed as quality public spaces that serve everyone.
### MYTHS: DESIGNING FOR CYCLISTS

**Cycle should only be in internal roads.**

India has a high share of current users and they will prefer using the road network which is more direct and faster.

*NMT = Bicycle.*

**NMT also covers tri pedal rickshaws and four wheeled vendor trolleys apart from others used for inclusive mobility.**

**Cycle is used predominantly by men.**

A large number of women of all age groups use the bicycle and rickshaw for work and commutation.

**Separate tracks are required only when volume of cyclists is high.**

Separate cycle tracks are required on all high speed roads more than 30 m ROW to prevent conflict.

**There is no space for cycle infrastructure.**

There is a lot of wasted space on the road. Equitable road space allocation can be easily done according to the classification of road to provide usable and safe cycle infrastructure.

**In metropolitan cities trip lengths are longer. People have to travel longer distances.**

Nearly seventy percent of the trips are shorter than 10 kms regardless of city size. There are about a million cyclists in metropolitan cities like Delhi. The average trip length is about 10km.
MYTHS: PLANNING FOR PEDESTRIANS

Disabled persons are taken care of. They do not need to be alone on the street.

Person with Disabilities are not able to navigate the streets independently, as footpaths do not comply with universal accessible design standards.

There is no space for footpaths due to high volume of cars.

Street edges lack proper thought and design, thereby wasting a lot of space, which if properly designed can provide ample space for footpaths.

Foot-Over Bridges are the best way to cross roads.

At grade crossing is the most comfortable way of crossing for pedestrians.

Street Hawkers create unsafe and chaotic environment.

There are no planned spaces for street hawkers. Hawkers and vendors bring safety and vitality on Indian streets. They are essential for public life.
Bibliography

2. (MoUD), M. o. U. D., 2012. Public Transport Accessibility Toolkint, s.l.: MoUD.
9. IRC11, 1962. IRC: 11, Recommended practice for the design and layout of cycle tracks, New Delhi: IRC.
21. SP:55, I., 2013. SP 55, Indian road Congress, s.l.: IRC.
28. UNEP, I. D., 2012. Toolkit for preparing Low carbon Comprehensive Mobility Plan (LCMP), s.l.: UNEP.