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# URBAN MOBILITY AND APPLICATION OF SUSTAINABLE URBAN TRANSPORT INDEX:

### MONGOLIA

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The Sustainable Urban Transport Index (SUTI) has been developed by UNESCAP to help summarize, track and compare the performance of Asian cities with regard to sustainable urban transport and the related Sustainable Development Goals (SDGs), more specifically target 11.2. This report has been prepared to introduce current urban transport system of Ulaanbaatar, the Capital City of Mongolia as well as collection and analysis of urban transport data for application of SUTI in Ulaanbaatar.

The objective of SUTI is to evaluate the status of urban transportation system in cities. SUTI is a quantitative tool for member States and cities of the region to compare their performance on sustainable urban transport systems and policies with peers. It can help identify additional policies with peers. It can help to identify additional policies and strategies required to improve the urban transportation systems and services. It includes ten indicators in system, economic environmental and social domains. SUTI is also expected to make an assessment of the progress of transportation contribution towards achievement of SDGs.

SUTI has been successfully applied in 15 cities; Colombo, Hanoi, Kathmandu and Greater Jakarta in 2017 and Bandung, Dhaka, Ho Chi Minh City, Surabaya, Surat and Suva in 2018, Bhopal, Khulna, Thimphu, Tehran and Ulaanbaatar in 2019. The cities found the SUTI framework adequate to measure the status and useful in identifying strategies towards sustainable mobility.



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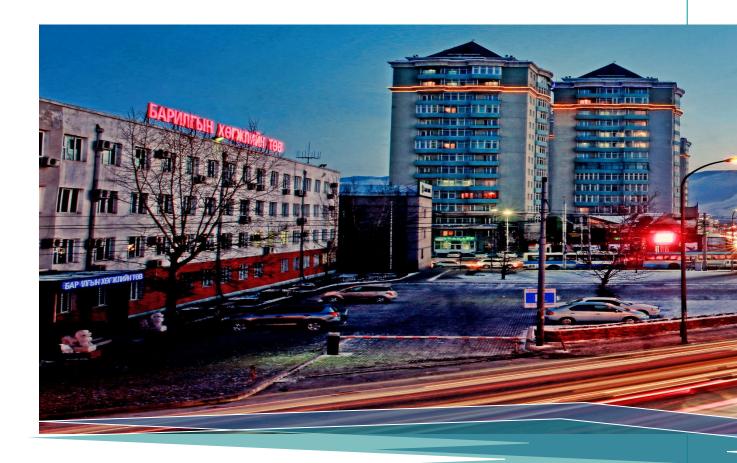
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- Ulaanbaatar City Area: 37,890 km²
- Settlement Area: 35,206 km<sup>2</sup>
- Number of Districts and Horoos: 9 Districts (6 Core Districts & 3 Isolated Districts) &
   152 Horoos
- Altitude: 1,260-1,350 m
- Annual Average Air Temperature: 0oC
- Annual Average Precipitation Rate: 240 mm
- Number of Population in Mongolia for 2018: 3,208,189
- Number of Population in Ulaanbaatar for 2018: 1,447,174





INTRODUCTION
AND URBAN
DEVELOPMENT
IN
ULAANBAATAR

**OBJECTIVES OF THE STUDY** 

OVERVIEW OF ULAANBAATAR

URBAN DEVELOPMENT

URBAN ROAD DEVELOPMENT

URBAN PUBLIC TRANSPORT DEVELOPMENT

**SUMMARY** 



## 1. INTRODUCTION AND URBAN DEVELOPMENT IN ULAANBAATAR

#### **OBJECTIVES OF THE STUDY**

Ulaanbaatar is the capital and the largest city of Mongolia. The city is not a part of any province (aimag). It is the country's industrial, economical, financial, science and technological, cultural and political heart. The city is the center of Mongolia's state road network and connected by the Trans-Mongolian Railway, which connects Trans-Siberian Railway via Naushki in Russia and Chinese Railway system via Jining. The national and municipal governments regulate a system of public and private transit providers, which operate bus lines around the city. There is also an Ulaanbaatar trolleybus system. A secondary transit system of privately owned passenger vans operates alongside these bus lines (majority of them are informal). Additionally, Ulaanbaatar has over 566 taxis officially. (Statistics Department of Ulaanbaatar, 2019).

The objective of this study is to develop a Sustainable Urban Transportation Index (SUTI) for Ulaanbaatar,

Mongolia. This index was developed by United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) to measure, compare and evaluate the performance of sustainable urban transport and related sustainable development goals of Asian cities. The SUTI is a framework of indicators for the assessment of urban transport systems and services in a city. The SUTI is based on ten key indicators representing, transport system, social, economic, and environmental dimensions of sustainable urban transport. It can reflect state of urban transport performance in a city. The SUTI indicators covers elements of planning, access, safety, quality and reliability, affordability, and emissions. The indicators specified in the SUTI will evaluate the transportation system in the capital city, Ulaanbaatar, area and the results will be depicted in the spider diagram.

Results will help in identifying the fields of improvement from the existing situation and thereby equipping the civic body to plan for the betterment of city.

This report includes the following:

- Chapter 1 is an introduction chapter that introduces the objectives of the study, an overview of the city, urban development, urban road network and transport development of Ulaanbaatar including travel demand, traffic congestion and traffic safety.
- Chapter 2 describes data collection approach for

#### **OVERVIEW OF ULAANBAATAR**

**Territory & Administration**: Ulaanbaatar was founded in 1639 as a Buddhist monastic center. Ulaanbaatar is located in north central Mongolia at elevation of 1,200-1,350 meters in valley on the Tuul River at the foot of the mountain Bogd Han.

- SUTI as well as database and data analysis for estimating 10 indicators of Ulaanbaatar.
- Chapter 3 contains overall estimation and its spider diagram of SUTI of Ulaanbaatar, comparisons of SUTIs of Asian Cities.
- Perspectives contain a discussion of the results, and recommendations and suggestions for future urban transport system development of Ulaanbaatar in terms of policies and planning.
- References and annex are included at the end of this report.

Ulaanbaatar Capital Region comprises Ulaanbaatar City and a number of satellite towns and villages. It is the most populous city γe Mongolia with a population of 1.49 million (National Statistical Office of Mongolia, 2019).

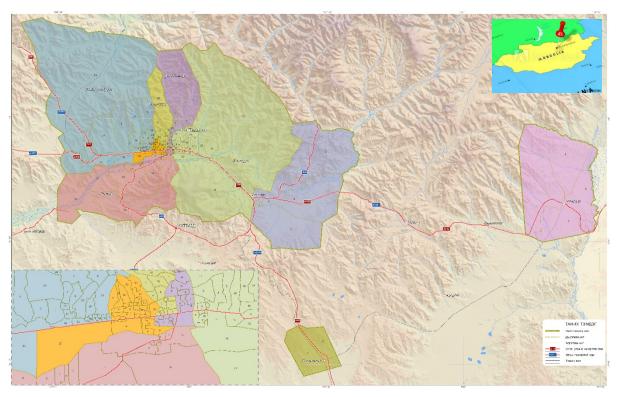


Figure 1-1. Administrative Map of the Capital City
Source: Asian Infrastructure Research Institute

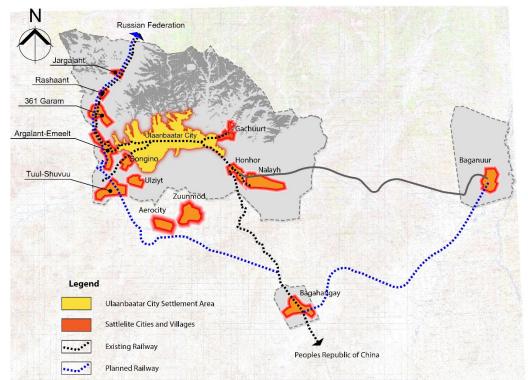
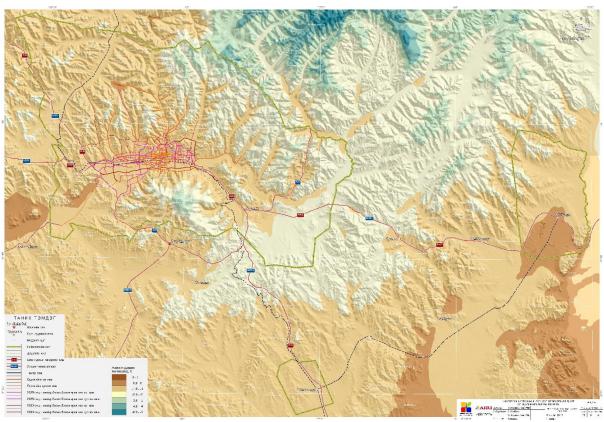


Figure 1-2. Settlement Area, Sub-urban Centers and Satellite Towns
Source: Urban Planning and Design Institute of Ulaanbaatar



**Figure 1-3. Average Annual Air Temperature 1960-2017**Source: Asian Infrastructure Research Institute, Data Source: NSO

Ulaanbaatar the Capital City of Mongolia /UB Region/ has 470 thousand hectares of land area it is divided into 9 districts, which composes of 152 horoos (Figure 1-1). There are 13 sub- urban centers & satellite towns within and/or around UB region (Figure 1-2). The six districts (Bayangol, Bayanzurh, Chingeltey, Han-Uul, Songinohayrhan and Suhbaatar) are in the city center (Ulaanbaatar City) cover an area of 378.9 thousand hectares, of which an area of 35.2 thousand hectares is considered settlement area of the Ulaanbaatar City. The three districts (Bagahangay, Baganuur and Nalaih) are distant from the center and are located over 50-130

km from the city center (Figure 1-2). The study area considered for the SUTI Indicators analysis is the city center or area with core 6 districts.

Climate: The city features 4 distinguished seasons with brief, warm summers, dusty springs, long, bitterly cold and dry winters, and calm autumns. The coldest January temperatures are between -36 and -40 °C (-32.8 and -40.0 °F) with no wind, due to temperature inversion (Figure 1-3 and Figure 1-4). Most of the annual precipitation of 267 millimeters (10.51 in) falls from May to September. Ulaanbaatar is considered the coldest national capital in the world.

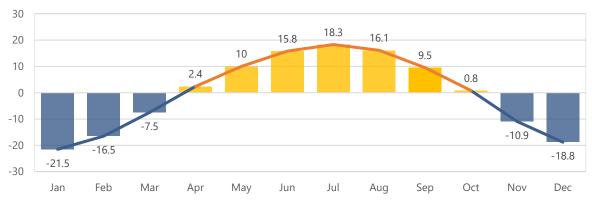


Figure 1-4. Monthly Average Air Temperature of Ulaanbaatar, oC, 1960-2018

Source: National Statistical Office of Mongolia (NSO)

**Population:** Rapid urbanization in Ulaanbaatar occurs disorderly, because people move from other provinces to Ulaanbaatar Capital Region and it results growth in the size of Ulaanbaatar population from 0.59 million (27.2% of the total population of Mongolia) in 1990 to

0.80 million in 2000, 1.24 million in 2010, and 1.49 million (46.1% of the total population of Mongolia) in 2018 (Figure 1-5) (National Statistical Office of Mongolia, 2019)

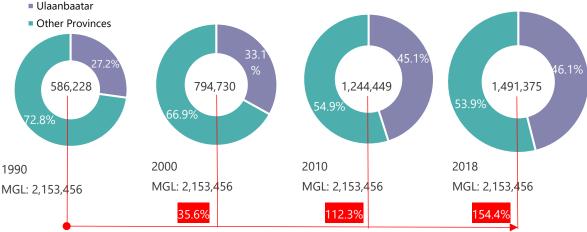


Figure 1-5. Number of Population and Its Growth Rate of Ulaanbaatar Capital City, 1990-2018

Data Source: National Statistical Office of Mongolia (NSO)

Since January of 2017, all internal migration to Ulaanbaatar from the countryside except those people

that require long-term medical treatment and those who purchased apartments are prohibited. As result of this prohibition, in 2018, number of net migration of Ulaanbaatar was only 240 people (Figure 1-6). 95% of the capital city's population reside in the six core districts (Table 1-1).

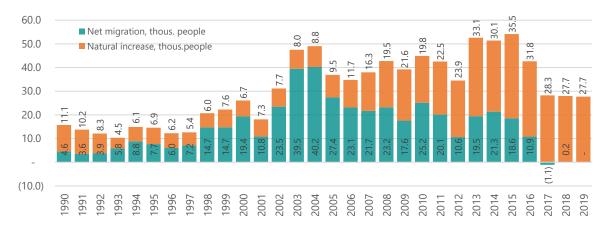


Figure 1-6. Number of Natural Increase and Net Migration of Ulaanbaatar Capital City, 1990-2018

Data Source: National Statistical Office of Mongolia

Table 1-1. Number of Resident Population by Districts, thous. people, 2000-2018

Districts	2000	2010	2015	2016	2017	2018
MONGOLIA	2,374.6	2,653.8	2,990.2	3,063.6	3,131.8	3,186.3
Ulaanbaatar	767.5	1,158.7	1,345.5	1,380.8	1,417.4	1,444.7
Core Urban Districts	720.3	1,096.7	1,277.1	1,311.3	1,347.6	1,373.2
Bayangol	139.9	184.8	205.7	214.3	221.4	226.9
Bayanzurh	148.5	264.1	320.9	327.1	336.9	343.6
Songinohayhan	157.3	252.4	307.2	315.8	322.5	321.2
Suhbaatar	94.7	136.7	137.6	136.6	138.0	145.3
Han-Uul	72.0	111.4	150.9	159.5	169.7	178.9
Chingeltey	107.9	147.3	154.8	158.0	159.1	157.3
Sub-urban Districts	47.2	62.0	68.4	69.5	69.8	71.5
Baganuur	20.5	26.9	28.4	29.0	28.8	29.5
Bagahangay	3.5	3.6	4.1	4.1	4.1	4.4
Nalayh	23.2	31.4	35.8	36.4	36.9	37.6

Source: National Statistical Office of Mongolia

Comparisons on the UB region population pyramid for 2010 and 2018, Ulaanbaatar has transitions from low fertility to high fertility rate as well as high mortality to low mortality rate for older population, which brings an increase of the dependency ratio (Figure 1-7). Compared from 2010 to 2018, the proportion of elderly

people with over 60 years old in the total population increased from 6.0% to 6.8% and the proportion of children with under 20 years old increased from 34.1% to 37.3% (Figure 1-7, Figure1-8) (National Statistical Office of Mongolia, 2019).

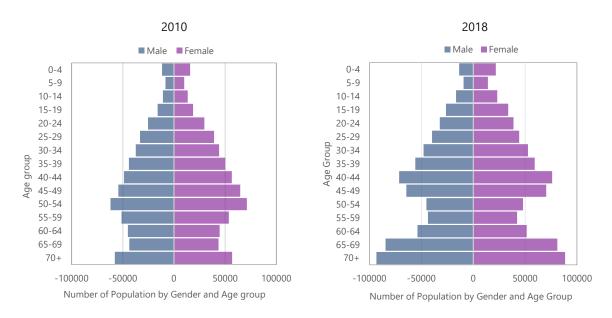


Figure 1-7 Population Pyramid of Ulaanbaatar Capital City, 2010 & 2018

Data Source: National Statistical Office of Mongolia



Figure 1-8. Mongolian Kids at Naadam Festival Source: MONTSAME

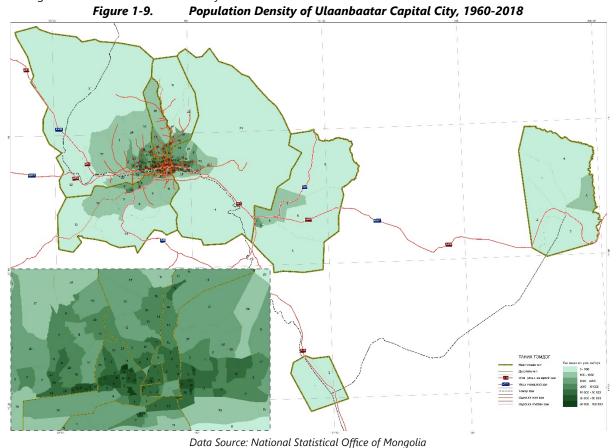
The population density in Ulaanbaatar has climbed from 169.1 people per square kilometer in 2000 to 317.3 people per square kilometer in 2018 while the population density in Mongolia was 2.1 people per square kilometer (Figure 1-9) (National Statistical Office of Mongolia, 2019). Population density of

Ulaanbaatar varies considerably by city center and ger (traditional Mongolian dwelling) areas, where central part of Ulaanbaatar city is more densely populated. Figure 1-9 illustrates map for population density of the Capital City. The most populated area of Ulaanbaatar belongs to constructed area of the city or within the

central Ulaanbaatar area, which creates the monocentric settlement (Figure 1-10 and Figure 1-11).

By 2030, according to the Master Plan of Ulaanbaatar, the projected population of the Capital City will reach to 1.72 million (Urban Design and Planning Institute of Ulaanbaatar, 2018).

The total number of households was 387,453, and increase of (1%) compared of number of households in the previous year. Households in Ulaanbaatar had an average size of 3.72 persons in 2018 (National Statistical Office of Mongolia, 2019).



**GDP:** As the main industrial, trade and business center of Mongolia, Ulaanbaatar produces 66.3% of Mongolia's total gross domestic products (GDP). Since Mongolia adopted its economic reform policy (from central economy to market economy) in the early 1990s, Ulaanbaatar have gained urban development while Ulaanbaatar's economy has created 21.4 trillion tugrug at current price or 8.01 billion USD in 2018 (66.3% of GDP of Mongolia) and kept an average annual growth

rate of 7.94% for 2010-2018 (National Statistical Office of Mongolia, 2019). GDP per capita by regions and provinces is shown in Table 1-2. The city has a strong and vibrant economic base and is a major destination for employment seekers in the country.

Table 1-2. GDP per Capita by Regions and Provinces

Region/Provinces	2016	2017	2018
MONGOLIA	7,910	8,999.1	10,226.9
Western Region	3,740.4	3,900.1	4,512.8
Bayan-Ölgiy	3,115.3	3,253.1	3,612.2
Gobi-Altay	4,392.8	4,663.4	5,589
Zavhan	4,236.7	4,359.5	4,911
Uvs	3,705	3,889.2	4,672
Hovd	3,655.7	3,778.5	4,377
Hangayn Region	5,180.2	6,434.1	6,965.3
Arhangay	3,962.8	4,438.5	4,518.9
Bayanhongor	4,119.4	4,633.2	4,756.9
Bulgan	4,649.7	4,635.4	5,145
Övörhangai	3,584.6	4,009.7	4,322.4
Hövsgöl	3,815.2	3,908.4	4,632.4
Orhon	11,063.6	16,884.2	18,270.2
Central region	5,033.2	5,772	6,224.5
Dornogobi	4,197.8	4,392	5,360.5
Dundgobi	5,041	5,618.8	7,041.4
Ömnögobi	6,463.1	11,050.8	9,762.2
Selenge	5,254.7	5,553.3	6,325.7
Töv	5,592.8	5,450.8	6,272.1
Darhan-Uul	3,921.9	4,061.4	4,157.3
Gobisümber	5,015	4,890.7	5,110.4
Eastern Region	6,394.4	7,267.6	8,028.5
Dornod	8,778.6	10,162.5	10,353.4
Sühbaatar	5,557.6	6,817.8	8,088
Hentiy	4,557.5	4,589.5	5,532.9
Ulaanbaatar	11,519.7	12,940.7	14,957.3

Source: National Statistical Office of Mongolia

#### **URBAN DEVELOPMENT**

Land-Use: Ulaanbaatar has 1.49 million population, which represents 46.1% of the country's total population (3.1 million in 2017), including Ulaanbaatar City (6 districts) reached 1.33 million residents. Since 1990s, Mongolia has experienced intensive urbanization and the population of Ulaanbaatar City has increased by 2.54 times since 1990. This increase in the Ulaanbaatar population is largely due to rural-

urban migration because of underdevelopment of rural areas as well as greater employment, education and healthcare opportunities offered in the capital city.

Dramatic increasing population of the capital city, which cause the expansion of *ger* (traditional Mongolian dwelling) area surrounding the apartment area of Ulaanbaatar City (Figure 1-10). According to the Statistics Department of Ulaanbaatar, 54.4% of

residents, 812,799 people of 221,523 households, live in 10,171.1 hectare *ger* areas in 2018 that characterized by limited or no access to urban engineering infrastructure including heating, water supply, sanitation and paved road, in some cases, electrical

supply, as well as in addition to receiving poor urban services and socioeconomic facilities. In *ger* areas, increasing risks of air, soil and water contamination (Statistics Department of Ulaanbaatar, 2019).

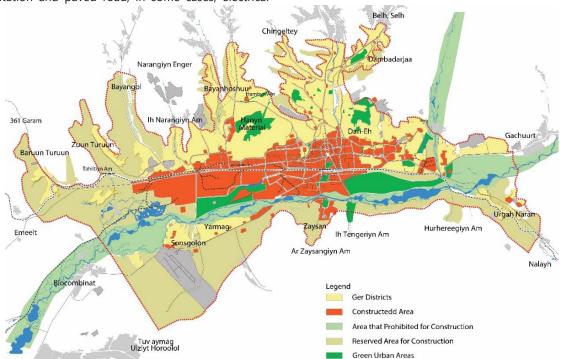


Figure 1-10. Current Land Use Structure of Ulaanbaatar, 2018
Source: MP UB 2020/2030

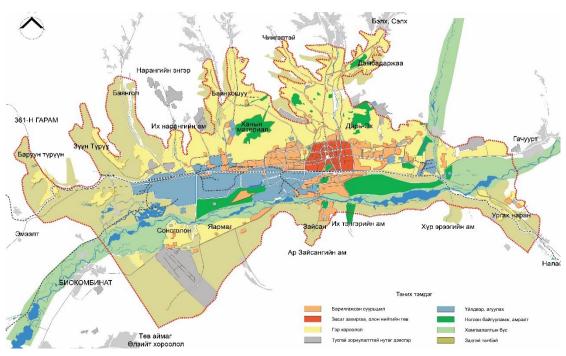


Figure 1-11. Current Land Use Structure of Ulaanbaatar, 2018
Source: MP UB 2020/2030

Table 1-3. Basic Statistics for Constructed and *Ger* Areas

Land Use	Land Area,		Length of Paved				
Туре	hectare	Total	Apartment	Luxury Houses	Houses	Ger	Road Network, km
Constructed Area	6,313.5	175,445	73,526	3,898			555.1
Ger Area	10,171.1	221,523			114,488	104,814	224.1

Source: Statistics Department of Ulaanbaatar

The total of 6,313.5 hectares of constructed area can be classified into three categories based on the building usage types: (i) apartments and public buildings - 3,202.3 ha, (ii) industrial buildings - 2,396.7 ha, and (iii) buildings for engineering infrastructure - 714.5 ha (Table 1-3, Figure 1-11). Most of the municipal government agencies and many international and national organizations, businesses, trade and services organizations, cultural institutions and higher education institutions are located within the city center.

Ulaanbaatar's unplanned increasing population was the most critical issues in its urban development. An increase in population and expansion of the urban area created many challenges in managing urban growth and land use (Figure 1-13). Inappropriate land use creates the centralized settlement or mono-centric settlement (Figure 1-12, 1-13 & 1-14) because of lack of urban engineering infrastructure and receiving poor urban services and socioeconomic facilities. Monocentric settlement with land and capital values declining with distance from the center land and real estate and creates traffic congestion. Travel demand in Ulaanbaatar has increased sharply as a result of the population and vehicular growth and urban expansion.

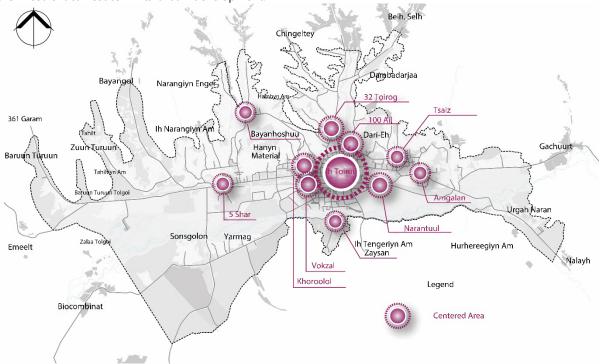


Figure 1-12. Ulaanbaatar – Monocentric City, 2018 Source: MP UB 2020/2030

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Figure 1-13. Ulaanbaatar – Monocentric City, 2018

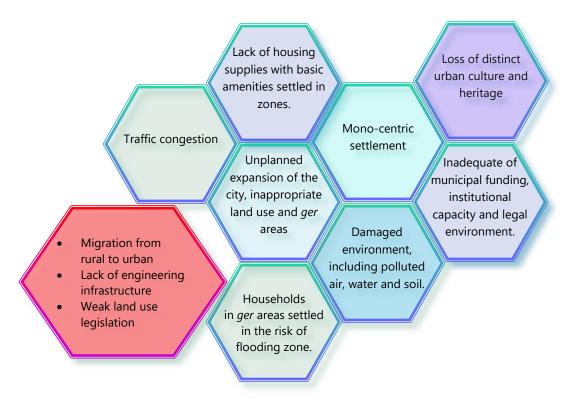


Figure 1-14. Urban Development Challenges of Ulaanbaatar

Since 1954, Ulaanbaatar had six master plans for urban development. To tackle the city's development challenges, the sixth master plan titled "Ulaanbaatar 2020 Master Plan and Development Approaches 2030" (MP UB 2020/2030) was approved by the Parliament of Mongolia in 2013. The vision for development to 2030 of Ulaanbaatar was described as the following as in MP UB 2020/2030:

"Ulaanbaatar will be the **CAPITAL CITY** of Mongolia that respects the **NOMADIC HERITAGE** 

which has endured many centuries, values its

PEOPLE, embraces its GEOGRAPHICAL

CHARACTERISTICS, is ENVIRONMENTALLY

FRIENDLY, has industries and an economy that

are GLOBALLY COMPETITIVE and

TECHNOLOGICALLY ADVANCED, and is A

SMART CITY with a unique Mongolian character."

Development approaches to reach the vision are described in the Master Plan is shown in Figure 1-15.

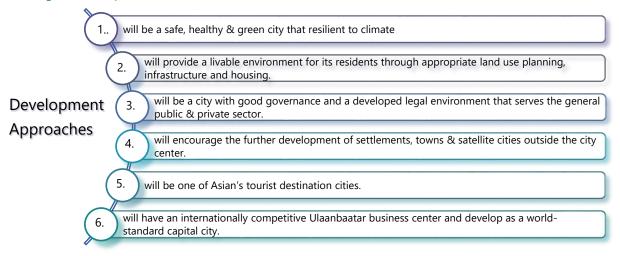


Figure 1-15. Urban Development Approaches of Ulaanbaatar stated in MP UP 2020/2030

Source: MP UB 2020/2030

Unfortunately, so far the proposed actions/activities of the MP UB 2020/2030 implementation has been not adequate and not sufficient to meet the goals and vision of the master plan. During the implementation of the MP UB 2020/2030, the legal environment did not facilitate the urban planning process and system to implement the Master Plan. Several additional factors also contributed Ulaanbaatar's inconsistent urban planning strategy, including insufficient financial investment to implement the plan, and regional and city decision making that was inconsistent with the Master Plan.

The capital city's current structure cannot accommodate the increasing range and scale of development and the development of a multi-centric modern city is proposed in the Master Plan. The MP UB 2020/2030 envisions Ulaanbaatar to grow as the

following broad strategic directions: (i) compact city growth in order to efficiently and equitably deliver urban services; (ii) a poly-centric expansion with two main centers and 6 sub-centers, as well as several satellite centers (Figure 1-16); integration of heat supply distribution with other urban services, particularly transport; implementing *Ger* Areas Redevelopment projects and the *Ger* Area Housing projects.

The new land use zoning system with 7 zones and 20 sub-zones within Ulaanbaatar City is a key strategy of the MP UB 2020/2030, which is a new approach introduced to the urban planning in Ulaanbaatar. The provision of public urban services needs to be increased in proposed new construction, redevelopment *ger* areas (Table 1-4 and Figure 1-17).

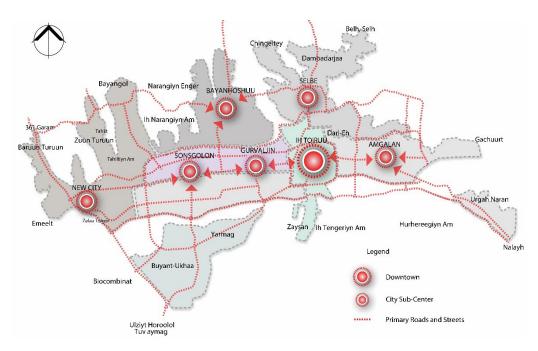


Figure 1-16. Ulaanbaatar – Planned Polycentric City for 2030

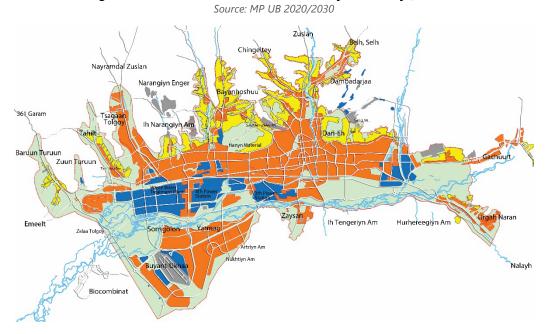


Figure 1-17. Planned Land Use Structure in Ulaanbaatar for 2030

Source: MP UB 2020/2030

 Table 1-4.
 Basic Statistics for Constructed and Ger Areas

Nº	Redevelopment of Ger Areas	Goals for Engineering Infrastructure	Residential Dwelling Types
1	Inner areas (Central)	Connect to central public utility infrastructure	Medium and high density apartment complexes
2	Middle areas	Utilities partially supplied from the central system and/or through an independent utility infrastructure	Medium or low density apartment complexes and/or residential areas
3	Fringe areas	Independent utility infrastructure	Low density private housing

Source: MP UB 2020/2030

Currently, although the total of 2,369.4 hectares of land is the public land for protection or conservation of the road development along the existing road network, the Land Administration and Management Department of Ulaanbaatar issued land for 17,128 legal units, covering area of 627.57 hectares; and in addition, thousands of legal units are settled without permission in this

public land area. Moreover, the total of 23,315 people of 6,753 households in *ger* area settled in the areas with risk of flooding from surface water depth of 0.1% annual chance (Table 1-5 and Figure 1-18). The total of 26,784 people of 1,339 households in *ger* area settled in the areas with risk of flooding from surface water depth of 1% annual chance (Table 1-6 and Figure 1-18).

Table 1-5. Risk Assessment of Flooding from Surface Water Depth of 0.1% Annual Chance of Tuul, Selbe, Dundgol, and Uliastay River Basins

la disetta a		- Tatal			
Indicators	Very High High Medium			Low	Total
Area, hectares	4,007.3	641	631.3	850	6,129
Number of households	1,435	883	1,441	2,994	6,753
Number of population	5,337	3,817	5,173	8,988	23,315
Number of yard	1,104	733	470	1,578	3,885
Number of real estate building	880	814	1,028	3,666	6,388
Number of <i>gers</i>	946	475	726	1,489	3,636

Source: MP UB 2020/2030

Table 1-6. Risk Assessment of Flooding from Surface Water Depth of 1% Annual Chance of Major Dry Riverbeds and Flood Prevention Facilities

Risk Indicators	Floodplain/ Overflow Areas	Floodplain/ Overflow Areas	Zon	Total		
	from Major Dry Riverbeds	from Flood Prevention Facility	High	Medium	Low	
Area, hectares	1,359	510	374	654	841	1,869
Number of households	1,704	4,992	1,339	2,344	3,013	6,696
Number of population	6,816	19,968	5,357	9,374	12,053	26,784
Number of yard	1,373	2,183	711	1,245	1,600	3,556
Number of real estate buildings	883	5,100	1,197	2,094	2,692	5,983
Number of <i>gers</i>	1,247	1,140	477	836	1,074	2,387

Source: MP UB 2020/2030

A road drainage must satisfy two main criteria if it is to be effective throughout its design life: (i) It must allow for a minimum of disturbance of the natural drainage pattern; (ii) It must drain surface and subsurface water away from the roadway and dissipate it in a way that prevents excessive collection of water in unstable areas and subsequent downstream erosion (FAO, 1998). The

current road network in Ulaanbaatar, particularly old streets and roads have less sophisticated or without drainage system. It is necessary clean and maintain these drainage provisions so that they can work properly. Unfortunately, streets and roads in Ulaanbaatar flood easily after a few minutes of a heavy rain, because drainage grills and gratings (e.g. on

gullies) can become blocked very quickly when materials like mud and solid waste are deposited on the road and/or no maintenance for the damaged drainage system and/or improper drainage design in the road. If the proposed action plans for flood prevention of the

Master. Plan UB 2020/2030 and the Long and Medium Term Master Plan for Urban Road Development of Ulaanbaatar implement timely, Ulaanbaatar City will be protected from flood hazards.



Figure 1-18. Ulaanbaatar is in the Flood Risk

Source: Usny Erchim Co.Ltd

Although the MP UB 2020/2030 implementation has been not adequate and not sufficient to meet the goals and vision of the master plan, Ulaanbaatar Municipality

started to draft a Concept for Master Plan Development of Ulaanbaatar for 2040 .

#### URBAN ROAD NETWORK DEVELOPMENT

The urban transport system is highly dependent on the land use character of the city. Economic and social transformations as well as rapid urbanization have brought a greater-than-ever challenge for the urban road transport sector of Ulaanbaatar. Mongolia has developed over the yearsthetransportsystem with large investment in the development of roads and providing the basic connectivity. The city is well connected by paved road to the centers of other provinces and by railway from north to south. Several National roads pass through Ulaanbaatar and having an economic and

business base has resulted in higher volume of traffic entering the city. The city's transportation is predominantly road based. The dependence on individual motorized mode (private taxi) is high due to the absence of an adequate public transport system. Roads and streets are generally narrow, network design and development are not complete. The existing urban transport system will be analyzed by the following components such as I vehicular growth, road network, and public transportation systems.

#### 1.4.1. VEHICULAR GROWTH

**Number of registered vehicles:** Driven by increased economic activities and high urban population growth, motorization has grown rapidly in the past 15 years. The total number of registered vehicles in Mongolia increased 1.6 times between 2012 and 2018 and reached 971 thousand in 2018 from 608 thousand in 2012 (Figure 1-19). In 2012, the number of registered vehicles in Ulaanbaatar was 367,814, of which 72.9% or 258,127 were cars. By 2018, this had increased to 365,819 registered vehicles (1.46 times), of which

70.2% or 282,182 cars (1.54 times) (Table 1-7, Figure 1-20).

In the last five years (from 2014 to 2018), the growth in vehicles and passenger cars have been around 5.6% and 6.6% per year respectively in Ulaanbaatar. In terms of the number and type of vehicles being registered, it is seen that cars lead the growth followed by trucks and special purposed vehicles.

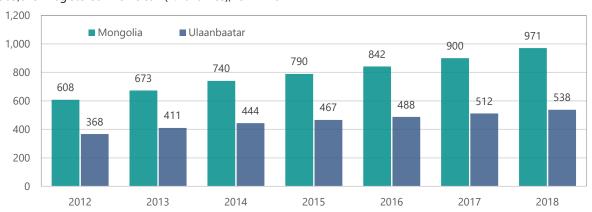


Figure 1-19. Number of Registered Vehicles, thous. vehicles, 2012-2018

Data Source: National Statistical Office of Mongolia

Table 1-7. Number of Registered Vehicles, by type, 2012-2018

Bus         Mongolia         5,584         5,978         6,207         6,474         6,823         6,859         6,507           Ulaanbaatar         4,297         4,570         4,784         4,928         5,055         4,942         4,482           Truck         Mongolia         136,913         55,976         74,011         81,665         88,884         98,668         11,945           Ulaanbaatar         66,792         76,319         84,388         85,208         85,481         87,098         88,710	37.1.1								
Bus           Ulaanbaatar         4,297         4,570         4,784         4,928         5,055         4,942         4,482           Truck         Mongolia         136,913         55,976         74,011         81,665         88,884         98,668         11,945           Ulaanbaatar         66,792         76,319         84,388         85,208         85,481         87,098         88,710           Mongolia         388,888         31,938         72,270         509,287         547,299         586,854         631,43	Vehicle	Types	2012	2013	2014	2015	2016	2017	2018
Ulaanbaatar         4,297         4,570         4,784         4,928         5,055         4,942         4,482           Truck         Mongolia         136,913         55,976         74,011         81,665         88,884         98,668         11,945           Ulaanbaatar         66,792         76,319         84,388         85,208         85,481         87,098         88,710           Mongolia         388,888         31,938         72,270         509,287         547,299         586,854         631,43	Puc	Mongolia	5,584	5,978	6,207	6,474	6,823	6,859	6,501
Ulaanbaatar 66,792 76,319 84,388 85,208 85,481 87,098 88,710  Mongolia 388,888 31,938 72,270 509,287 547,299 586,854 631,43	bus	Ulaanbaatar	4,297	4,570	4,784	4,928	5,055	4,942	4,482
Ulaanbaatar 66,792 76,319 84,388 85,208 85,481 87,098 88,710  Mongolia 388.888 31.938 72,270 509,287 547,299 586.854 631,43	Truck	Mongolia	136,913	55,976	74,011	81,665	88,884	98,668	11,945
Passenger car Mongolia 388,888 31,938 72,270 509,287 547,299 586,854 631,43	Truck	Ulaanbaatar	66,792	76,319	84,388	85,208	85,481	87,098	88,710
Passenger car	Docconger	Mongolia	388,888	31,938	72,270	509,287	547,299	586,854	631,436
	Passenger car	Ulaanbaatar	258,127	289,324	315,611	337,181	356,544	377,071	397,990
	•	Mongolia	25,632	24,852	23,235	22,852	23,013	22,630	21,468
purposed vehicle Ulaanbaatar 15,295 14,877 12,084 11,812 11,952 11,903 10,752		Ulaanbaatar	15,295	14,877	12,084	11,812	11,952	11,903	10,752
Mechanisms Mongolia 7,253 8,434 9,275 9,931 10,612 11,335 12,561	Machaniana	Mongolia	7,253	8,434	9,275	9,931	10,612	11,335	12,561
	iviechanisms	Ulaanbaatar	6,007	6,878	7,418	7,748	8,200	8,599	9,410
Trailer Mongolia 19,435 20,369 21,059 21,039 22,169 25,596 31,043	Tuellen	Mongolia	19,435	20,369	21,059	21,039	22,169	25,596	31,043
	Trailer	Ulaanbaatar	13,374	13,783	14,093	13,835	13,947	15,459	18,734
Mongolia 24,569 25,559 34,388 38,472 42,752 48,203 55,926	Mataravala	Mongolia	24,569	25,559	34,388	38,472	42,752	48,203	55,926
Motorcycle Ulaanbaatar 3,922 4,765 5,415 5,971 6,349 6,935 7,594	iviolorcycle	Ulaanbaatar	3,922	4,765	5,415	5,971	6,349	6,935	7,594
Mongolia 608,274 673,106 740,445 789,720 841,552 900,145 970,88	Total	Mongolia	608,274	673,106	740,445	789,720	841,552	900,145	970,880
Total Ulaanbaatar 367,814 410,516 443,793 466,683 487,528 512,007 537,67	TULAT	Ulaanbaatar	367,814	410,516	443,793	466,683	487,528	512,007	537,672

Data Source: Statistics Department of Ulaanbaatar

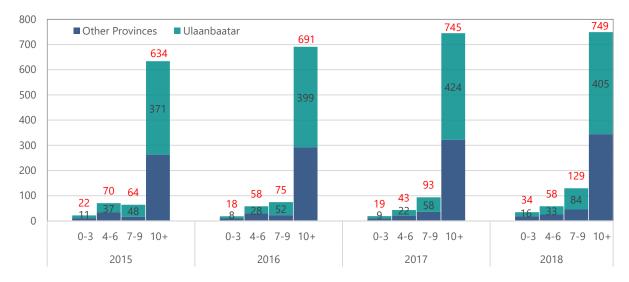


Figure 1-20. Number of Registered Vehicles\*, by age, thous. vehicles, 2015-2018

Source: National Statistical Office of Mongolia

Note: Registered vehicles excluding mechanisms, trailers, & motorcycles

Number Vehicles Passed Technical Inspection: In respect to 2018 from 2010, number of vehicles that passed the technical inspections has increased from 162,710 to 401,725, of which number of cars has increased from 118,573 to 309,812 (increased by 2.47 times) in Ulanbaatar. Number of cars passed the technical inspections per 1000 population has increased to 207 from 95 between 2010 and 2018 in Ulaanbaatar. Compared to 2010, the share of cars has increased from 72.9% to 77.1% while the share of bus has decreased from 5.7% to 2.6% in 2018 (Table 1-8, Figure 1-21). The increasing ownership of cars has not encouraged to use public transport as the main

mode of transport unless public transport system improved dramatically. Growing economy will stimulate private car ownership in the future. In terms of age of the vehicles, on average 73.5% of the total vehicles are over 10 years old between 2014 and 2018.

Approximately 69% of all countries in the world follow the rules of the left-hand steering wheel rule. Despite Mongolia has the rule of the left hand steering wheel, 57.6% of the total vehicles that passed the technical inspection have right hand steering wheel. By 2018, 72.4% of the passenger cars, 13.4% of trucks and 6.3% of buses have the right hand steering wheel.

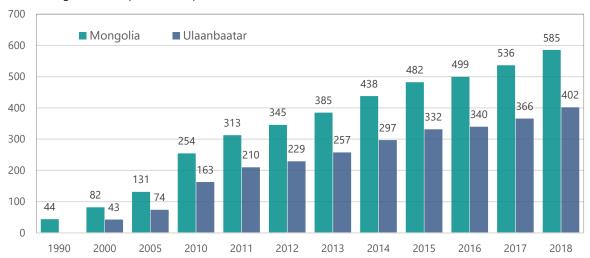


Figure 1-21. Number of Vehicles Passed the Technical Inspections, thous. vehicles, 1990-2018

Data Source: National Statistical Office of Mongolia

Table 1-8. Number of Vehicles Passed the Technical Inspection, by vehicle type, 2012-2018

Vehicle Types	Region	1990	2000	2010	2015	2016	2017	2018
Bus	Mongolia	2,591	8,548	16,366	20,744	18,912	18,550	18,570
bus	Ulaanbaatar			9,304	11,516	9,951	9,924	10,301
Truck	Mongolia	24,400	24,671	61,841	110,024	111,431	120,751	131,573
Truck	Ulaanbaatar			32,344	61,783	61,452	67,699	75,256
Dassanaarsaa	Mongolia	7,962	44,051	172,583	343,288	360,513	388,448	426,065
Passenger car	Ulaanbaatar			118,573	252,582	262,341	282,182	309,812
Special .	Mongolia	8,839	4,423	3,696	7,993	8,296	8,650	9,155
purposed vehicle	Ulaanbaatar			2,486	5,683	5,882	6,014	6,356
Total	Mongolia	43,792	81,693	254,486	482,049	499,152	536,399	585,363
i Olai	Ulaanbaatar		42,509	162,710	331,564	339,626	365,819	401,725

Data Source: National Statistical Office of Mongolia

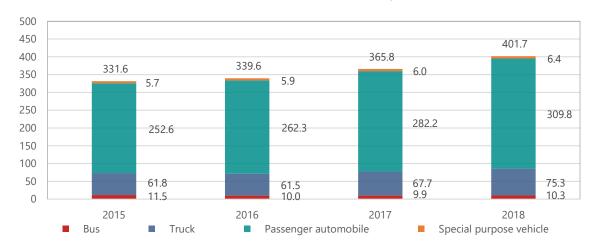


Figure 1-22. Number of Vehicles Passed the Technical Inspections in Ulaanbaatar, by vehicle types, thous. vehicles, 1990-2018

Data Source: National Statistical Office of Mongolia

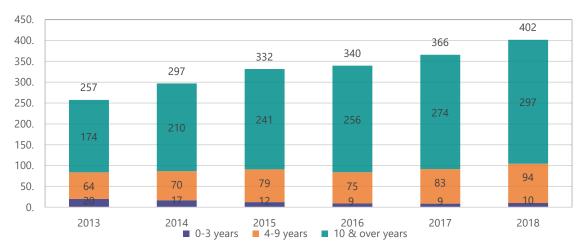


Figure 1-23. Number of Vehicles Passed the Technical Inspections in Ulaanbaatar, by age, thous. vehicles, 1990-2018

Data Source: National Statistical Office of Mongolia

**Number of Imported vehicles:** There are growing demand for imported used cars in Mongolia. According the Mongolian Customs General Administration, Mongolia has imported 59,918 cars /93.6% of the total imported cars/ from Japan, 2,096 cars /3.3% of the total imported cars/ from South

Korea, 930 buses /68.2% of the total imported buses/ from South Korea, 198 buses /14.5% of the total imported buses/ from Russia, and 185 buses /13.6% of the total imported buses/ from Japan in 2018 (Table 1-9).

Table 1-9. Number of Imported Vehicles, by country, by type 2010-2018

Vehicle Types by Country	2010	2011	2012	2013	2014	2015	2016	2017	2018
Motor vehicles for the transport of ten or more persons, including the driver	1,634	2,807	2,432	1,800	1,291	870	964	1,201	1,363
South Korea	1,264	2,227	1,841	1,454	1,002	668	687	823	930
China	9	22	26	62	52	24	43	56	31
Russia	327	500	496	221	189	122	133	215	198
Japan	19	21	28	43	41	32	78	93	185
Others	15	37	41	20	7	24	23	14	19
Motor cars and other motor vehicles principally designed for the transport of persons	26,066	56,805	45,748	44,680	41,246	37,086	37,735	48,870	64,039
USA				457	345	185	239	142	412
South Korea	2,656	10,371	9,069	5,732	2,458	2,568	3,959	2,927	2,096
China	89	128	44	27	19	4	26	76	127
United Kingdom	179	404	247	115	99	94	36	75	112
Russia	212	209	155	140	31	84	65	167	228
Germany	537	1,458	1,096	830	423	248	260	315	722
Japan	22,233	44,011	34,942	37,275	37,783	33,825	33,038	45,050	59,918
Others	160	224	195	104	88	78	112	118	424
Motor vehicles for the transport of goods.	12,221	24,853	22,438	17,995	12,500	7,675	6,836	14,155	22,256
USA	70	137	37	218	83	61	36	125	178
Belarus	14	30	15,449	23	7	12	11	17	11
South Korea	7,656	14,381	2,867	11,783	8,287	5,293	4,809	7,149	10,720
China	2,858	7,246		1,875	1,035	386	323	3,972	6,140
Russia	115	462	386	113	79	128	133	141	242
Thailand	75	92	84	53	84	100	134	308	531
Germany	19	65	159	121	67	78	61	113	140
Sweden	25	95	46	45	41	32	20	142	247
Japan	1,350	2,251	3,087	3,674	2,788	1,537	1,273	2,119	3,931
Others	39	94	323	90	29	48	36	69	116

Data Source: National Statistical Office of Mongolia

### 1.4.2. URBAN ROAD NETWORK DEVELOPMENT

Ulaanbaatar's road network is the main node of the Mongolia road network, which is connecting centers of provinces. The total of 244.8 km international and state roads pass through the territory of Ulaanbaatar, including:

- 64 km of East-West arterial links international road AH32 /AH32 consists of the state roads of A0301 /3.7 km/ and A0501 /50.3 km//,
- 105.6 km of North-South links vertical international road of AH3 /AH3 consists of the state roads of A0401 /52.7 km/ and A0101 /52.9 km/,

- 24.8 km of the state road A0201 for south western direction and
- 30.5 km of the state road A24 for Terelj National

Ulaanbaatar the Capital City of Mongolia /Ulaanbaatar Region/ has 4,700 thousand hectares of land area with 13 sub-urban centers & satellite towns. Distance to sub-urban centers and satellite towns from Ulaanbaatar City is described in the Table 1-10 and is illustrated in Figure 1-24.

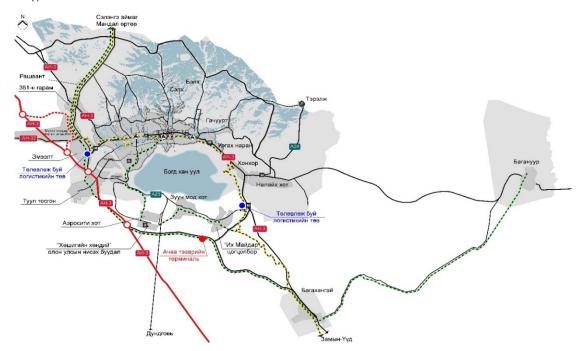


Figure 1-24. International & State Road Network Passes Through Ulaanbaatar, 2019

Source: Long and Medium Term Master Plan for Road Development of the Capital City

Table 1-10. Distance to Sub-Urban Centers & Satellite Towns from Ulaanbaatar City Center, km

Name to Towns	Road Length, km	Name to Towns	Road length, km
Gachuurt	200	Tuul	25
Honhor	240	Bio-Songino	38
Nalayh	350	Argalant-Emeelt	27
Bagahangay	820	Jargalant	53
Baganuur	1300	Terelj	63
Zuunmod	450	361 Garam	35
Uziyt	250	Rashaant	45

Table 1-11. The Length of the Road Network of Ulaanbaatar, 1947-2018

Year	Length of Improved road	Length of Paved Road	Year	Length of Improved road	Length of Paved Road
1947	24	10	2010	464.5	366.4
1960	71.1	39.0	2015	632.1	632.1
1970	184.1	115.2	2016	644.1	644.1
1985	240.3	163.2	2017	870.6	799.2
1990	258.0	191.0	2018	875.7	875.7
2000	344.5	287.4			

Source: Statistics Department of Ulaanbaatar



Figure 1-25. Current Road & Street Network of Ulaanbaatar City, 2017

Source: Long and Medium Term Master Plan for Road Development of the Capital City

Table 1-12. Road & Street Network Classification of Ulaanbaatar, 2017

Nō	Road Classification	Road Length, km
1	First Class Primary Road and Streets	93.6
2	Second Class Primary Road and Streets	55.1
3	First Class Secondary Road and Streets	106.5
4	Second Class Secondary Road & Streets	119.5
5	Residential Roads & Streets	404.5
	Total	779.2

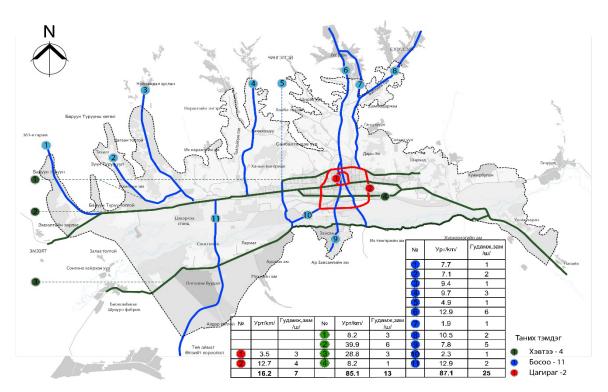


Figure 1-26. Linkage of Primary Road and Streets of Ulaanbaatar, 2017

Table 1-13. The Structure of Primary Road and Streets of Ulaanbaatar, 2017

Nō	Linkage Direction of Primary Road and Streets	Number of Linkage Direction	Number of Streets within the Linkage Direction	Length*, km
1	Links East-West - Horizontal Road	4	25	87.10
2	Links North-South – Vertical Road	8	13	85.10
3	Circle Road	2	7	16.20
	Total	14	45	188.4

Note: \*Length of road is overlapped measurement.

Source: Long and Medium Term Master Plan for Road Development of the Capital City

As 2018, the road network of Ulaanbaatar City within the constructed area of 35,206 hectares was 875.2 km of the paved road (Table 1-11). As 2017, the road network of Ulaanbaatar City was 799.2 km of the paved road, of which 148.6 km of primary road and streets, 226.0 km of secondary road and streets, and 404.6 km of local district streets (Figure 1-25, Table 1-12 and Table 1-13). Urban road infrastructure construction also showed rapid development over the past decade (Table 1-12). However, the growth of urban vehicles has been much faster than that of urban road construction.

Estimation for the road density of Ulaanbaatar, the ratio of the length of the Ulaanbaatar's total paved auto road network to the Ulaanbaatar's constructed land area, is demonstrated in the Figure 1-27. As of 2017, the average road density in Ulaanbaatar City was 2.1 km per square km of land area, with 0-4.1 km/km² road density accounting for 87.7% of the total area of Ulaanbaatar City, 4.2-8.1 km/ km² road density for 5.9%, 8.2-12.1 km/km², road density for 3.2%, 12.2-16.2 km/km² road density for 2.4%, and 16.2-20.2 km/km² road density for 0.8% (Table 1-14 and Figure 1-27).

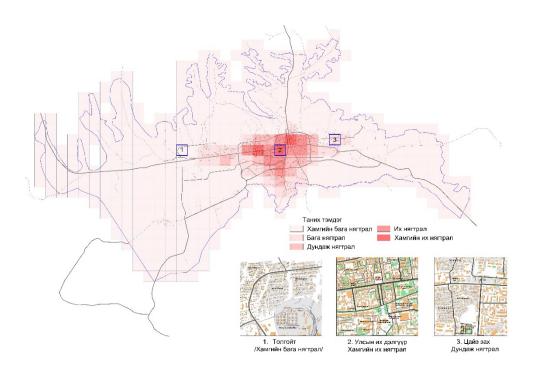


Figure 1-27. Road Density in Ulaanbaatar, 2017

Existing evidence suggested that increasing the supply roads in low road density areas are needed in order to reduce congestion and to reduce overlap of public transport routes (public transport services are available only for paved road). The unbalanced growth of vehicle population and transportation infrastructure is a major contributor to severe traffic congestions in Ulaanbaatar.

In the outlying residential areas of the city or in *ger* districts, that have a population in excess of 876,000, there are only 221.1 km of paved roads, and the rest of them are compacted earth road. The roads are substandard design features with narrow single carriageways and are poorly maintained. Travel on these roads by vehicles is very challenging, so public transport vehicles, water tankers, and other public

service vehicles have difficulty providing services in *ger* areas. Pedestrians and bicyclists unable to travel safely in their community.

Table 1-14. Road Density Classification in Ulaanbaatar City, 2017

Road Density Level	Road Density, km/km <sup>2</sup>	Percentage of Covering Land Area,%
Lowest	0-4.1	87.7
Low	4.2-8.1	5.9
Medium	8.2-12.1	3.2
Higher	12.2-16.2	2.4
Highest	16.3-20.2	0.8
Average	2.1	



Figure 1-28. Roads in Ger Districts of Ulaanbaatar, 2018
Source:MONTSAME



Figure 1-29. New Roads to Ger Districts in Ulaanbaatar, 2018
Source: MONTSAME

#### 1.4.3. TRAVEL DEMAND

Travel Surveys are conducted in 2007 by JICA and in 2016 by ADB. Based on 2007 JICA Travel Survey, the total travel demand consists of 60% of public transport, 35% of passenger cars and 5% of other transport mode (Figure 1-30). Based on 2016 ADB Travel Survey, the total travel demand consists of 51% of public transport, 42% of passenger cars, 5% of taxi, 2% of walking (Figure 1-30).

In 2017, the Traffic Control Center of Ulaanbaatar conducted Household Travel Survey for 53,160 households of six districts of Ulaanbaatar City

to examine overall transport demand and to collect the main source of data for estimating travel demand modeling for Ulaanbaatar City. Based on the survey result, total transportation demand in the city consists of bus and trolleybus (49.2%), passenger cars (39.3%), walking (6.5%), taxi (2.6%), bicycle (1.2%), motorcycle and moped (0.7%), and employee transportation bus (0.6%) (Figure 1-31).

Home-work-home commuting trips were accounted for 52% and school/kindergarten drop off and pick up trips were accounted for 25% of the total trips (Figure 1-32). Traffic congestion become less during the summer or school holidays. The use of bus transport is relatively high regardless of whether or not a household has a car. The use of bicycles, motorcycles, and private buses, such as company or school buses, is not popular.

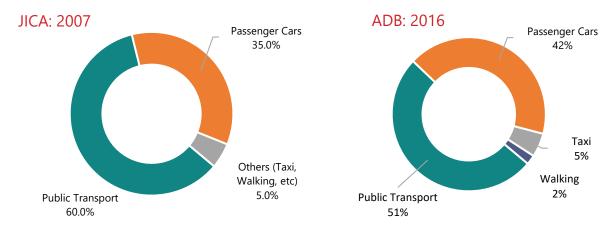


Figure 1-30. Trip Mode Choice by Previous Travel Surveys, 2018

Source: Long and Medium Term Master Plan for Road Development of the Capital City

# UB TFC: 2017 for 53160 Households

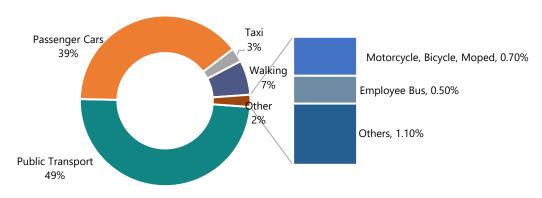


Figure 1-31. Trip Mode Choice of the Travel Demand 53160 Household Survey, 2017

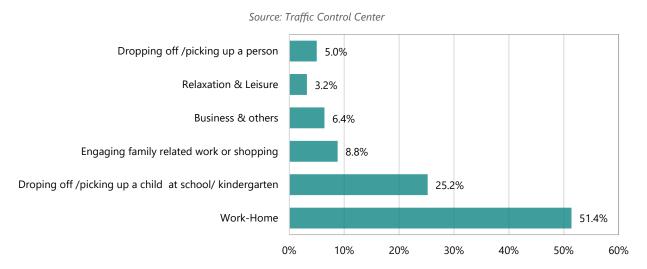


Figure 1-32. Travel Purposes: 53160 Household Survey, 2017
Source: Traffic Control Center

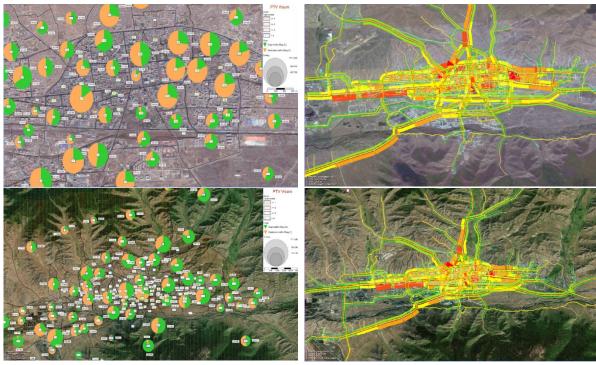


Figure 1-33. In- and Out- Travel from TAZ: 53160 Household Survey, 2017

Traffic data on existing road network, demographic and socioeconomic characteristics, major traffic attracting places' information, and number of vehicles were used to develop the current travel demand model for 2017 using PTV Visum analysis tools (Figure 1-33, Figure 1-34, Table 1-15). The study area is subdivided into 192 traffic analysis zones (TAZs) as shown in Figure 1-34. The TAZs were defined by dividing the administrative units (horoo)

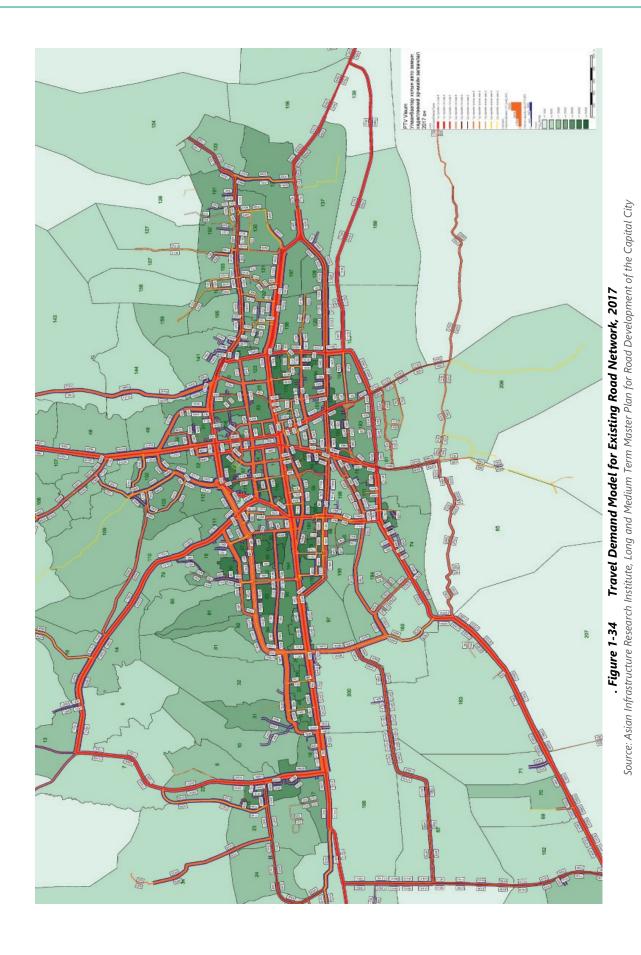
into zones which following certain physical or administrative boundaries, such as roads, rivers, street blocks, etc. In the Figure 1-34, the population density of TAZs are shown in gradient green color from more densely populated (dark green) to sparsely populated (light green). "What would happen future average daily traffic for medium (2025) and long term (2030), if the existing road network will not have any expansion?" The future

travel demand model for 2025 and 2030 using the current road network were developed based on traffic data on existing roads, demographic and socioeconomic forecasts, urban de-velopment plans,

and vehicle fleet forecasts. The results of travel demand model simulations are shown in the Table 1-

Table 1-15. Comparison of Estimated Traffic Volumes
(in the case of no expansion of existing road network of 2017)

Name of Main Streets	Street Features	Model Simulation Year	Est. ADT Range	Est. ADT	Est. VCR Range	Est. Ave. VCR
Enhtayvan	1st class primary road,	2017	20,000-35,000	27,500	1.57-2.75	2.16
Avenue, Moscow	with 3-lane per direction, connecting	2025	20,000-51,000	35,500	1.57-4.00	2.78
Street	East-West	2030	30,000-62,000	46,000	2.35-4.86	3.61
	2nd class primary, road, with 2-lane per	2017	10,000-15,000	12,500	1.00-1.50	1.25
Narny Road	direction, connecting	2025	15,000-20,000	17,500	1.50-1.75	1.62
	East-West (Enhtayvan Ave lower)	2030	18,000-23,000	20,500	1.80-2.30	2.05
Chinggis	1st class primary road,	2017	15,000-22,000	18,500	1.50-2.21	1.85
Avenue, Naadamchid	with 2-3-lane per direction, connecting	2025	19,000-30,000	24,500	3.00-2.45	1.85
Street	Central-Southwest	2030	21,000-33,000	27,000	2.10-3.30	2.70
Nogoon	1st class primary road,	2017	15,000-31,000	23,000	1.50-3.10	2.30
Nuur Street, Chingeltey	with 2-3-lane per direction, connecting	2025	15,000-42,000	28,500	4.20-2.85	2.30
Avenue	North-Central	2030	10,000-44,000	27,000	1.00-4.40	2.70
	1st class primary road,	2017	17,000-23,000	20,000	1.70-2.32	2.00
Huvisgal Road	with 2-3-lane per direction, connecting	2025	25,000-36,000	30,500	3.60-3.05	2.00
	Central-Northwest	2030	25,000-35,000	30,000	2.50-3.50	3.00
Bayanhoshu	1st class primary road,	2017	11,000-26,000	18,500	1.10-2.62	1.85
u Street, Uildverchny	with 2-lane per direction, connecting	2025	13,000-33,000	23,000	1.30-3.30	2.30
Evlel Street	Tolgoyt Street-North	2030	13,000-33,000	23,000	1.30-3.30	2.30
Ard Ayush	2nd class primary road, with 2-lane per	2017	17,800-21,900	19,850	1.78-2.19	1.99
Street, L.Enebish	direction, connecting West-Central	2025	23,700-30,600	27,150	2.06-2.82	1.99
Street	(Enhtayvan Ave upper)	2030	23200-31500	27,350	2.30-3.15	2.74



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Average daily traffic (ADT) is the average number of vehicles that travel on a road during a 24- hour period. Capacity expresses the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point during a given time period under prevailing roadway and traffic conditions. Capacity of roads is expressed in vehicles per day (VPD). Example: The capacity of Ulaanbaatar urban road, 1st class Primary road with three-lane per direction is estimated by traffic engineers to be 12,750 VPD. The Volume-to-Capacity ratio (VCR) measures the level of congestion on a roadway, the volume of daily traffic (ADT) is

divided by the capacity of the roadway (VPD). For instance, for Enhtayvan Avenue & Moscow Street (the only main streets connect East-West in the middle of existing road network): the average volume of traffic on the roadway were 27,500 VPD, then the V/C ratio for that segment would be 27,500/12,750 = 2.16. The VCR ratio makes it possible to estimate the relative level of congestion on a segment of roadway. Traffic engineers have developed the following categories: VCR > 1 = Severe congestion; 0.75 <VCR < 1 Congestion; 0.5 <VCR < 0.75 Moderate congestion, VCR < 0.5 = Low or no congestion.

#### 1.4.4. TRAFFIC CONGESTION AND TRAFFIC SAFETY

Traffic congestion. Some of the major causes of traffic congestion in Ulaanbaatar are the following: (i) Compared to year of 2010, substantial increase (2.25 times) in the number of vehicles on Ulaanbaatar roads in recent 7 years; (ii) The paved road length in Ulaanbaatar has increased by 2.18 times (from 357.4 km to 779.2 km) between 2010-2017, which is not in pace with growing population. Paved road density in Ulaanbaatar is only 2.1 km per square km area; (iii) At the intersections, the VCRs are over 2.0, which leads to the severe congestion with cycle time is over 250 seconds/ vehicle, resulting in average speeds of less than 10 km/hour, in especially in the peak hours (observed traffic count at major intersections of Enhtayvan Ave are shown as example in the Table 1-16,

Figure 1-35); (iv) Increase in the growth of the population in Ulaanbaatar, which includes the growing number of workforce, is another important cause; (v) Ulaanbaatar has mono-centric city with government, business and social activities and services largely found in a one centralized area; (vi) Inadequate public transport system; (viii) Inefficient traffic management; (viii) Poor safety conditions; (ix) Inappropriate enforcement of parking and designation of parking spaces as well as parked vehicles on the roads, sidewalks and pedestrian road; (x) Lack of pedestrian and bicyclists facilities; (xi) Lack of driver discipline; (xii) Last, but not least, ongoing construction in various locations, and poor road conditions all contribute to severe traffic congestion in Ulaanbaatar city.

Table 1-16. Comparison of Estimated Traffic Volumes (in the case of no expansion of existing road network of 2017)

Intersection Location at Enhtayvan Ave	East 4	,	Wres Cer	5	Centra		West 4	•	25 Pharmacy		Sapporo Center	
Indicators	Vol	VCR	Vol	VCR	Vol	VCR	Vol	VCR	Vol	VCR	Vol	VCR
Morning /8:00-9:00/	6,498	2.89	4,924	2.19	6,694	2.98	6,232	2.77	6,456	2.87	7,351	3.27
Day /12:00-13:00/	6,475	2.88	5,062	2.25	6,975	3.10	7,413	3.29	6,970	3.10	7,922	3.52
Evening /17:30-18:30/	6,738	2.99	4,898	2.18	7,119	3.16	6,301	2.80	6,582	2.93	7,741	3.44
Ave. Hourly Traffic	6,570	2.92	4,961	2.20	6,929	3.08	6,649	2.96	6,669	2.96	7,671	3.41

Source: Traffic Control Center



Figure 1-35. Traffic Congestion in Ulaanbaatar, 2018
Source: MONTSAME

More traffic congestion is no doubt aggravating, it is resulting into unnecessary delays and reduction in speed and has resulted into a non-productive activity for most people as when they get stuck in traffic jams. Traffic congestion has also led into high rate of road traffic accidents on the roads, making traveling and driving unsafe in Ulaanbaatar. Traffic congestion has also led to an increase in the number of accidents on the roads. Moreover, traffic jams are increasing operating costs operators in terms of fuel, wear and tear on vehicles, increasing both air and noise pollution, and increasing road rage. The major government approaches to tackle the Ulaanbaatar's traffic congestion problems are the license restriction measures, public transport vehicles are only allowed to travel via the first lane of the major avenue (Enkhtayvan Avenue), the aging fleet of buses is being replaced with more modern and efficient vehicles, etc. In the MP UB Road 2025/2030, promoting non-motorized transport, creating bus rapid transportation, and the congestion

charge zones (CCZ) like the London CCZ are recommended. CCZ fee will be charged on most motor vehicles operating within the CCZ in Central Ulaanbaatar. Enforcement is primarily based on automatic number plate recognition (ANPR).

**Traffic safety.** Ulaanbaatar has a range of serious road traffic safety problems. The trend in road traffic accidents (RTAs) is alarming in Mongolia. In 2018, the total of 29,474 traffic accidents are registered in the nationwide, of which 87.1% or 25,666 traffic accidents accounts for Ulaanbaatar (Table 1-17). While Ulaanbaatar has about 46.1% of the total population and 68.6% of the total vehicles passed technical inspection, and 72.7% of the total passenger cars of Mongolia, Ulaanbaatar accounts for 87.1% of the annual traffic accidents in the country. In 2018, the total of 504 traffic fatalities (140 account for Ulaanbaatar) were reported in nationwide (Traffic Police Authority, 2018).

Table 1-17. Number of Traffic Accidents in Ulaanbaatar, 201	0-2018
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Indicators	2010	2011	2012	2013	2014	2015	2016	2017	2018- MGL	2018-UB
Collision	4,385	13,662	10,177	10,695	22,564	37,717	38,055	32,214	25,176	22,538
Pedestrian hit by a vehicle	2,287	3,044	2,942	3,889	4664	2,653	2,442	2,523	2,519	2,297
Bicyclists hit by a vehicle	2	14	17	25	29	64	126	85	123	108
Real estate hit by a vehicle	129	68	304	331	342	712	552	670	648	526
Car falls off road	59	47	98	129	186	162	127	850	805	149
Passengers fall from a vehicle	16	5	15	39	41	24	33	34	16	7
Animals hit by a vehicle	1	0	4	2	14	55	40	155	93	31
Others	0	5	0	0	12	0	0	60	94	10
Total	6,879	16,845	13,557	15,110	27,852	41,387	41,375	36,591	29,474	25,666

Source: Transportation Police Department



Figure 1-36. Traffic Accidents Against Traffic Safety and Operation of Transport Vehicle, 2017

Source: Transportation Police Department

In terms of the total traffic accidents against traffic safety and operation of transport vehicles by seasons, accidents were happened 15.1% at spring, 32.5% at summer, 34.9% at autumn, 17.5% at winter in winter (Figure 1-36).

Ulaanbaatar has adopted the "3 E's" strategy which operates under the themes of Education, Enforcement and Engineering with others favoring the Safe System Approach, which involves an integration of approaches including Safer Streets (road engineering enhancement, expansion of road, building multilevel

crossings, installing more cameras on the road, installing traffic signals), Safer People (measures in educating the citizens, intoxicated driving intervention), enforcing seatbelt & child restraints, wearing helmets), Safer Vehicle (vehicle safety enhancement), and Safer Speeds (reducing vehicle speeds, speeding enforcement). Road safety audits are needed to use in developing countries like Mongolia in order to reduce road traffic accidents, to encourage the importance of road safety engineering, to increase awareness for the safety needs of all road users, and to improve safety standards and procedures

#### 1.4.5. SUSTAINABLE URBAN ROAD DEVELOPMENT

Future Road Network Development. Integrating road and transport planning with land use in Ulaanbaatar is very challenging, because thousands of legal units (households or establishments) are settled with or without permission in the public area, which protected and/or conserved for the road development along both the existing and the future planned road network. The MP UB 2020/2030 envisions Ulaanbaatar to grow as a poly-centric expansion with two main centers and six sub-centers, as well as several satellite centers (Figure 1-16 and Figure 1-17). Therefore, integrating road and transport planning with distribution of other urban infrastructure services and their planning as well as action plans of Ger Areas Redevelopment projects and the Ger Area Housing projects is essential. The Long- and Medium-term Master Plan for Urban Road Development of the Capital City (MP UB Road 2025/2030) was drafted in 2018 and sets out the main direction for urban road development over the next decades. The MP UB ROAD 2025/2030 states the Ulaanbaatar Urban Road Development Vision 2030 as follows: The MP UB Road 2025/2030 foresees future Ulaanbaatar urban road network to grow as the following strategic directions:

- To plan and to develop urban network based on scientific approaches that lines with transport demand to meet the demand for growing socioeconomic and development opportunities and needs as well as incorporated with urban development and land-use planning;
- To develop comprehensive urban road network with engineering infrastructure (including pedestrian and bicyclist facilities, green development along urban road, parking, bridges, tunnels, bi-level crossing, and etc) that integrated

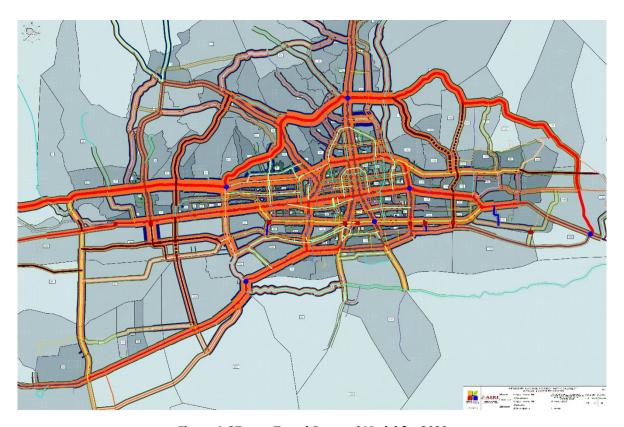
with international standards;

- To provide passenger and freight transport services that are efficient, quality, safe, reliable and compliance with transport demand;
- To provide traffic management system that utilizes to optimize road use and traffic safety;
- (i) To develop a road network that is harmless to human life, health, nature and the environment;
- (M) To develop intelligent road and transport system;
- (vi) To strengthen the capacity building of road and transport sector; and
- (vii) To establish and to improve legal and regulatory environment for implementing MP UB Road 2025/2030.

The future travel demand model for 2025 and 2030 were developed based on predicted traffic data on future road planning, demographic and socioeconomic forecasts, urban development plans, and vehicle fleet forecasts. Planning with respect to road construction takes into account present and future uses, so forecasting results helped to prioritize road construction phase (Figure 1-37 and Figure 1-38).

Based on the travel demand model for 2025 and 2030, future road network planning was developed. In line with the MP UB Road 2025/2030, the urban road network was

779.3 km in 2017, 251 km of road is set to be constructed until 2025 and 283.4 km of road is set to be constructed until 2030. The total urban road network will be 1,030.4 km in 2025 and 1,313.8 km in 2030 (Table 1-18, Figure 1-39 and Figure 1-40).



**Figure 1-37. Travel Demand Model for 2030**Source: AIRI, Long and Medium Term Master Plan for Road Development of the Capital City

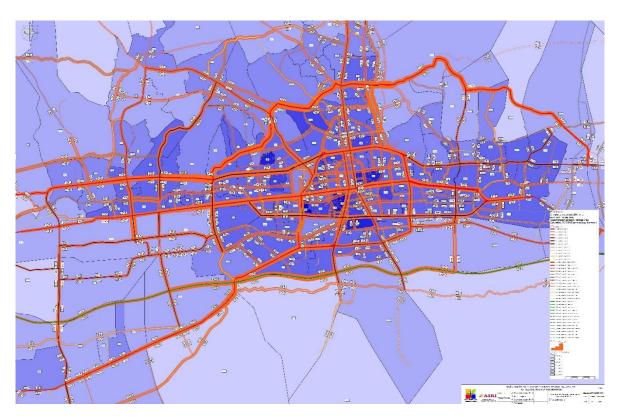


Figure 1-38. Travel Demand Model for 2030

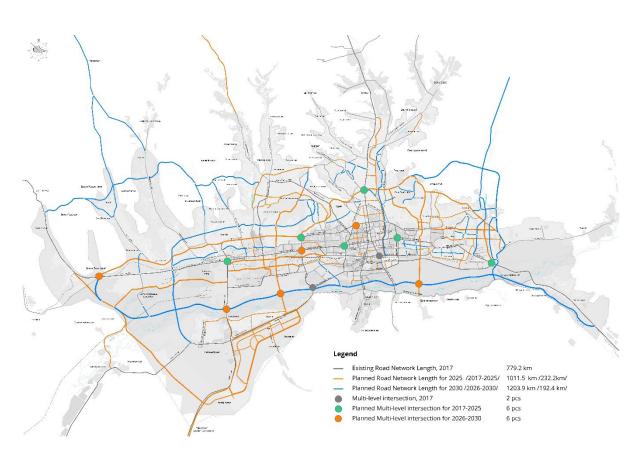


Figure 1-39. Road Network Development, 2017 - 2030

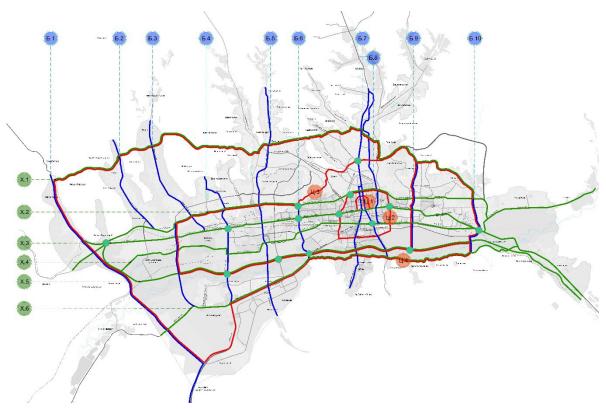


Figure 1-40. Travel Demand Model for 2030

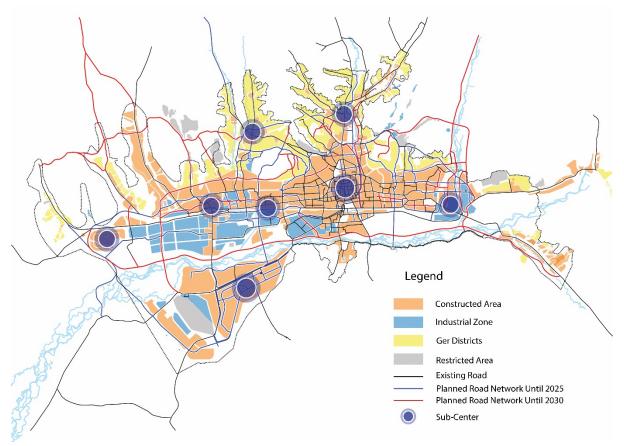
Table 1-18. Future Primary Road Network Development Planning

Mo S	Linkage Direction of Primary Road	Number of Linkage Direction		Number of St the Linkage		Lengtl	ո*, km	
	and Streets	2017	2030	2017	2030	2017	2030	
1	Link East-West-Horizontal Road	4	6	25	28	87.10	193.0	
2	Links North-South – Vertical Road	8	9	13	27	85.10	96.5	
3	Circle Road	2	4	7	25	16.20	143.6	
4	Total	14	19	45	80	188.4	433.1	

Note: \*Length of road is overlapped measurement.

Source: Long and Medium Term Master Plan for Road Development of the Capital City

For future primary road structure, there will be a total 
Future urban road network development planning is



of 433 km arterial road and streets with 193 km of 6 horizontal links road, 96.5 km of 9 vertical links road, and 143.6 km of 4 circle road by 2030 (Figure 1-42 and Table 1-19).

established priority based on fulfilling travel demand, reducing traffic congestion, integrating with polycentric urban development strategy and land-use planning (Table 1-18, from Figure 1-37 to Figure 1-41).

Figure 1-41. Road Network Development Integrating with Urban Development and Land Use Planning, 2025 -2030

Table 1-19. Future Road Network Development Planning Integrating with Urban Development/Land-Use Planning

Indicators		2017			2020/2025			2030		
		Ger Area	Const.A rea	Others	Ger Area	Const.A rea	Others	Ger Area	Const.A rea	Others
Area, hectare		10,140	6,502	18,564	5,442	9,996	19,768	3,883	11,944	15,827
Ε	1st Class Primary Road	18.4	48.0	27.1	18.9	1.7	15.9	0.0	1.9	35.1
Road, km	2nd Class Primary Road	11.5	41.0	2.6	11.7	23.6	3.4	2.1	1.4	14.5
Roa	1st Class Secondary Road	55.6	34.1	16.8	24.2	0.0	34.2	35.7	5.9	47.7
Jo r	2nd Class Secondary Road	66.6	45.7	7.3	28.0	19.5	10.0	31.0	5.0	51.4
Length of	Local District Street	69.0	335.6	0.0		60.0		51.9	0.0	0.0
Le	Total	221.1	504.4	53.8	82.8	104.7	63.6	120.6	14.1	148.7
Roads to be constructed, km						251.1			283.4	
R	Roads to be expanded, km					22.6				
Total Length of Network, km			779.3			1,030.4			1,313.8	

Source: Transportation Police Department

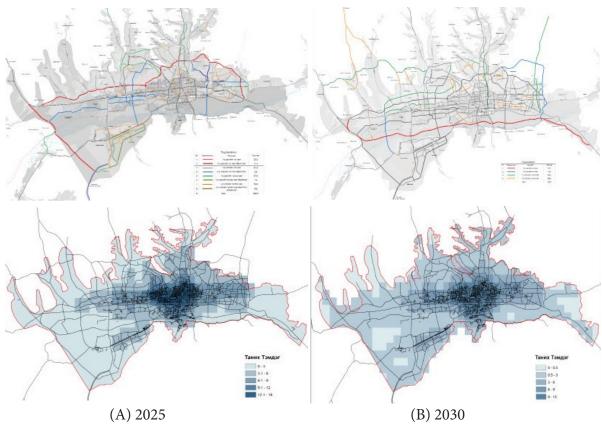


Figure 1-42. Road Network Development Planning and Predicted Road Density, 2025 & 2030

Source: Long and Medium Term Master Plan for Road Development of the Capital City

According to the MPUB 2020/2030, total ger district area of 10,140 hectares will significantly decrease by 4,698 hectares in 2025 and beyond it will decrease to 3,883 hectares in 2030. It will significantly impact By 2030, the average road density in Ulaanbaatar City

livability within communities and gain urban infrastructure services including road and transport (Table 1-18).

will be 2.1 km per square km of land area, with 0-4.1

km/km² road density accounting for 87.23%, 4.2-8.1 km/km² road density for 8.8%, 8.2-12.1 km/km² road density for 3.12%, 12.2-16.2 km/km² road density for 2.55%, and 16.2-20.2 km/km² road density for 0.85% respectively.

Pedestrian and Bicycle Facilities Planning. Urban road and transport planning plays a vital role in achieving sustainable urban transportation. Significant attention was paid to construction of transportation infrastructure such as road and bridges in order to meet the increasing demands for urban infrastructure services and to reduce the congestion. Theoretically increasing road capacity might eventually meet the travel demand, but this is not a cost-effective approach by any means. Because urban road and streets are public spaces that can support multiple activities and functions - not only allow to move motor vehicles, cyclists and pedestrians, but also provide space for parking and loading and provide places to shopping, gather, socialize, and relax. Unfortunately, streets in Ulaanbaatar are substandard with uneven and narrow carriageways, are poorly designed and maintained for pedestrians, cyclists, and transit, as well as less attractive frontage (Figure 1-43). Although walking

and cycling are often the fastest and most efficient way of movement in Ulaanbaatar, pedestrian and bicycle planning/ development has been separate from urban road and transport planning till today.

Table 1-20. Bicycle and Pedestrian Network Planning for 2025 &2030

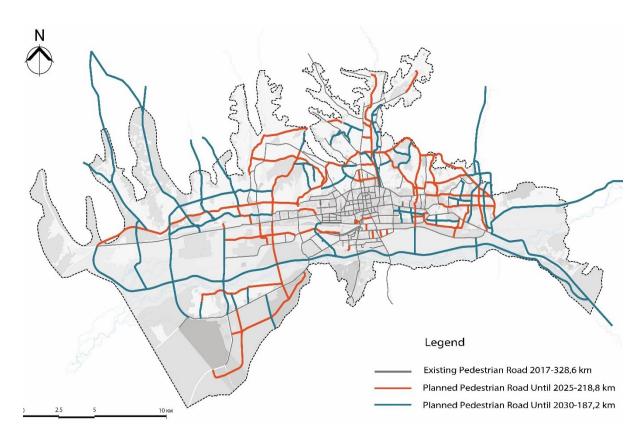
Nº	Notavork Turo	Total Length; km				
ME	Network Type	2017	2025	2030		
1	Pedestrian Network	328.6	729.1	989.5		
2	Bicycle Network	84.6	472.8	686.7		

Source: Long and Medium Term Master Plan for Road Development of the Capital City

As 2017, Ulaanbaatar has the only 84.6 km of bicycle network and 328.6 km of pedestrian network as well. The MPUB Road 2025/2030 recognizes walking and cycling movements are essential for the planning urban road and transport system. According to the master plan, the total length of bicycle network will be increased to 686.7 km and pedestrian network to 989.5 km accordance with international standards by 2030 (Table 1-20, Figure 1-44 and Figure 1-45).



Figure 1-43. Current Conditions of Pedestrian and Bycycle Roads
Source: Long and Medium Term Master Plan for Road Development of the Capital City



**Figure 1-44. Pedestrian Road Development from 2017 to 2030**Source: Long and Medium Term Master Plan for Road Development of the Capital City

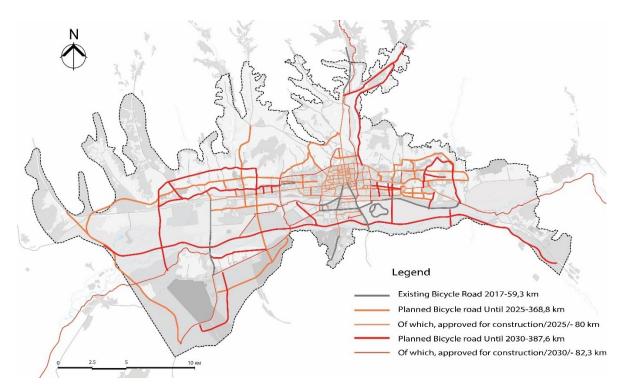


Figure 1-45. Bicycle Road Development from 2017 to 2030

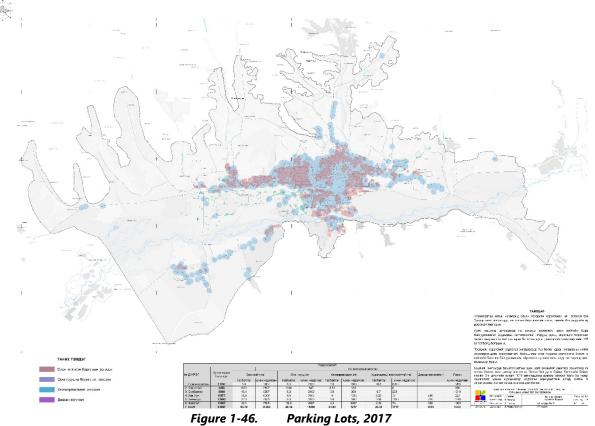
## Parking Planning and Parking Management.

Parking planning and parking management are important and powerful urban mobility tools. As the growth of Ulaanbaatar city and car dependency has led to parking problems resulting in increased traffic congestion, pollution, and overall urban chaos and people aggression. One of the reasons of road congestion is that drivers have nowhere to park. Drivers park wherever they can: in driveways, on footpaths, on curbs, and in front of and behind other cars blocking them in. Vehicle parking on sidewalks and on footpaths has worsened conditions for pedestrians. More paid parking, parking restrictions and enforcements need to be introduced. The MPUB Road 2025/2030 recognizes to deal with the parking fallout and is proposed several parking solutions, including government needs to be prioritized to develop a master plan/action plans to reform parking

and parking management system of Ulaanbaatar.

Urban transport strategy seeks to increase mobility and accessibility by providing a range of modal choices and opportunities that include walking, biking, transit, and automobile as well as parking. In the MPUB Road 2025/2030, parking planning was developed and designed providing a supply of parking to meet minimum requirements, while sufficient for peak demand requirements.

As 2017, although Ulaanbaatar has a total of 358,926 registered vehicles, there are 61,697 parking lot with the total area of 190 hectares (Figure 1-46). A total of 7,538 parking lots are proposed to be constructed by public-private- partnership by 2025 and 15,590 parking lots by 2030. Table 1-21 shows parking planning or supply of parking for 2025 & 2030 in detail (Table 1-21, Figure 1-48 and Figure 1-49).



Source: Long and Medium Term Master Plan for Road Development of the Capital City



Table 1-21. Parking Planning for 2025 - 2030

Parking Location		No of District Units		Total area, m2		Parking Capacity					
		2025	2030	2025	2030	2025	2030	Land Use Types			
ing	Apartments and Public Service Places	8	25	38,853	122,040	1,439	4,520	Utilizing open space areas of large			
oark	Sub Centers	3		33,448		1,239		commercial centers			
or pa	Improved ger housing		10		30,240		1,120	and public services			
Outdoor parking Lots	Industry		4		41,121		1,523	<ul><li>places including</li><li>hospitals and</li></ul>			
Õ	Total	11	39	72,301	193,401	2,678	7,163	schools			
nd ts	Apartments and Public Service Places	11	20	43,453	126,480	1,478	4,216	Underground			
Underground Parking Lots	Dedicated Underground Parking Area	9	5	28,188	35,850	1,044	1,195	parking/garages below open spaces			
Jnde	Industry		1		2,240		83	of apartments and			
	Total	20	26	71,641	164,570	2,522	5,494	playground			
Multilevel Parking	Apartments and Public Service Places	6	13	37,084	69,540	1,238	2,318	Multilevel parking			
	Sub Centers	4	3	29,700	18,450	1,434	615	above (upto 7 levels) and/or below			
Mult	Total	10	16	66,784	87,990	2,672	2,933	(upto 4 levels)			
_	Grand Total			210,726	445,961	7,538	15,590	ground			

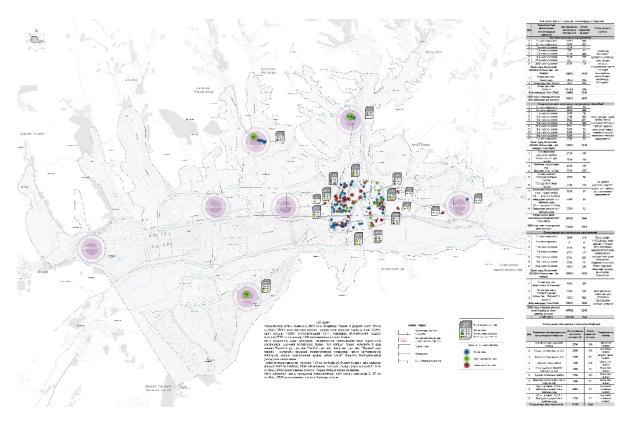


Figure 1-48. Parking Development Planning for until 2025

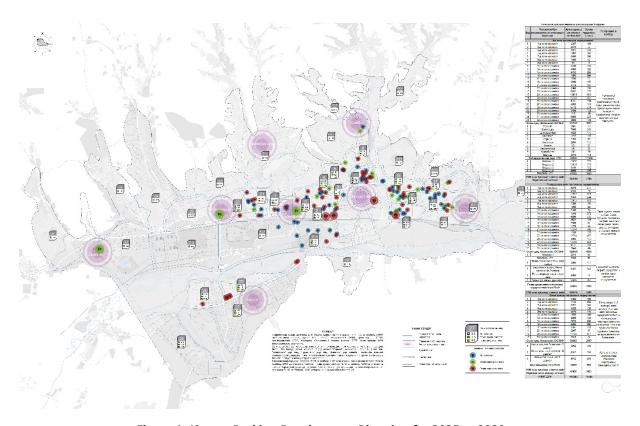
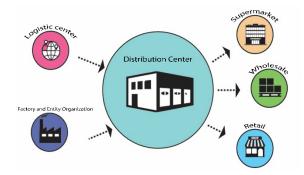


Figure 1-49. Parking Development Planning for 2025 to 2030

City Logistics. City Logistics aims to reduce the troubles associated to freight transportation in urban areas while supporting the economic and social development of the cities and optimize urban transportation systems. The fundamental idea is to view individual stakeholders and decisions as components of an integrated logistics system. This implies the coordination of shippers, carriers, and movements as well as the consolidation of loads of several customers and carriers into the same environment-friendly vehicles. One of the reasons for increasing traffic congestion is that city logistics are not very well developed and does not have any integrated logistics system in Ulaanbaatar. Moreover, a Regional Logistics Center established in Zamyn-Uud soum of Dornogobi aimag and is going into operation 2019.

A key component of Ulaanbaatar's road and transport plans to expand its logistics networks by two logistics centers, located in the west and the east of Ulaanbaatar and as well as nine distribution centers (Figure 1-50). Also, the New Ulaanbaatar International Airport Logistics Center, located about 60 km of Ulaanbaatar will become in addition to integration of the logistics system. According to the MPUB Road 2025/2030, logistics centers and distribution centers will be connected by a total of 87.3 km network of road with a specific lane for heavy duty freight transportation (Figure 1-51).



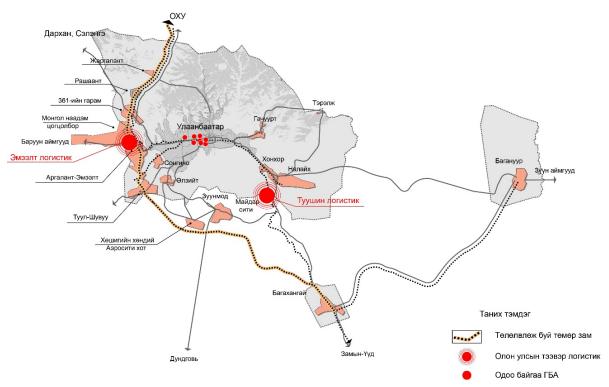


Figure 1-50. Future Logistics Planning

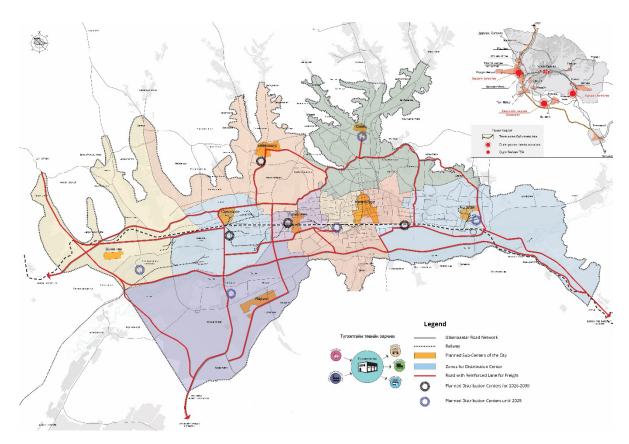


Figure 1-51. Distribution Centers Planning for 2017-2025

# URBAN PUBLIC TRANSPORT DEVELOPMENT

## 1.5.1. CURRENT PUBLIC TRANSPORT SYSTEM

**Public transport.** Given the rapid growth in private vehicles, road improvements cannot solve Ulaanbaatar's urban transport problems. Public transport services are closely related to the daily life of the urban public. A good quality public transport system is needed in order to avoid serious traffic congestion with negative impacts on economic vitality and quality of life.

The Travel Demand Household Survey from 53,160 households was conducted by the Traffic Control Center of Ulaanbaatar in 2017. According to the survey results, about 39.3% of the total urban traffic accounts for public transport, 49.2% for car, 2.7% for taxi, and

6.5% for walking in Ulaanbaatar at present (Figure 1-31).

There are 34 bus companies operating 1,171 variety vehicles including 88.6% of large sized bus, 1.7% of articulated bus, 4.5% of medium sized bus, 0.9% of minibus, 4.3% of trolleybus and 48.3% of taxi to meet with the people's public transport demand (Table 1-22). There are 972 variety vehicles are operating in daily services including 89.7% of large sized bus, 1.6% of articulated bus, 4.2% of medium sized bus, 1.0% of minibus, 3.4% of trolleybus and 58.2% of taxi to meet with the people's daily public transport demand (Figure 1-53).



Figure 1-52. Main Public Transport Mode Autobus

Source: Asian Infrastructure Research Institute

Table 1-22. Number of Entities Engaged with Public Transportation Services

Inc	dicators	1992	1994	1999	2004	2009	2010	2015	2016	2017	2018
	Bus	3	3	3	3	2	2				
Public	Trolleybus	1	1	1	1	1	1	1	1	1	1
	Bus	0	0	11	17	23	23	19	18	18	15
Private	Trolleybus							1	1	1	1
Sm	all Sized Bus	0	0	46	71	55	47	15	9	8	6
	Taxi	1	3	4	57	21	22	17	12	11	10
-	Total	5	7	65	149	102	95	53	41	39	34

Source: Public Transport Department of Ulaanbaatar

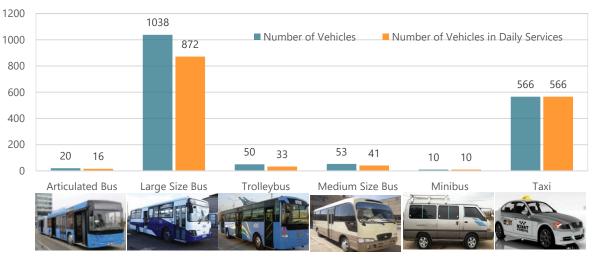
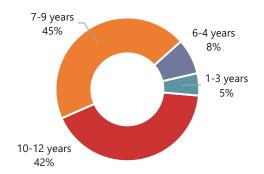


Figure 1-53. Types of Vehicles in Public Transport, 2018

Source: Public Transport Department of Ulaanbaatar

In terms of the age of vehicles in public transport services, 42% of 10-12 years, 45% of 7-9 years, 8% of 6-4 years, 5% of 1-3 years old today (Figure 1-54). New vehicles are, on average, more energy efficient than the older vehicles, and improvement of will decrease greenhouse gas emission. 86% of the public transport vehicles are imported from South Korea, specifically 42% are produced by Hyundai and 44% are produced by Daewoo companies (Figure 1-55).



**Figure 1-54. Age of Bus & Trolleybus, 2018** Source: Public Transport Department of Ulaanbaatar

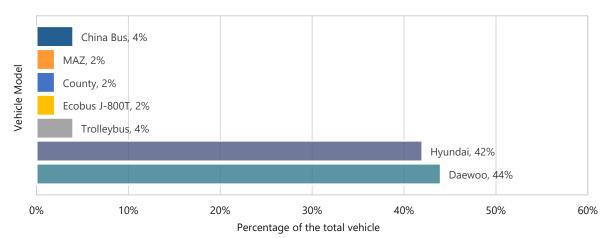


Figure 1-55. Bus Operating in Public Transport Services by Vehicle Models, 2018
Source: Public Transport Department of Ulaanbaatar

Invented by Mongolian engineers, 20 J-800T buses with the engine of Euro – 4 started public transportation services in Ulaanbaatar since November 2015 (Figure 1-56).

Mongolia has imported 10 electric buses from China for transportation in Ulaanbaatar in order to reduce air pollution. The electric buses began operation since 20 January, 2020 on three months' trails. According to officials, the buses can handle -50 and -60 Celsius temperatures and can be recharged after 15-20 minutes. The buses have 36 seats and run 200 km when fully charged.



Figure 1-56. 20 J-800T Buses with the Engine of Euro-48 Invented by Mongolian Engineers

Source: MONTSAME

Public transport network has six types of 126 routes including 76 main routes, 15 feeder routes, 17 express routes, 3 camp routes, 14 sub-urban routes and 1 night routes in 2018 (from Figure 1-57 to Figure 1-60). Total length of routes were 3,735 km in 2018, which is increased by 39 km from previous year (Figure 1-58). Public transport routes are overlapping significantly, which affect to traffic congestion due to a lack of paved urban network (Figure 1-61 and Figure 1-62).

Average public bus speed is 11.35 km/hour in weekdays and 15.66 km/hour in weekend (Figure 1-60). For urban, this speed indicator is too low. Through betterment project of the road, the speed will be improved (Table 1-23, from Figure 1-60 to Figure 1-66).



**Figure 1-57. Types of Public Transport Routes, 2018**Source: Public Transport Department of Ulaanbaatar

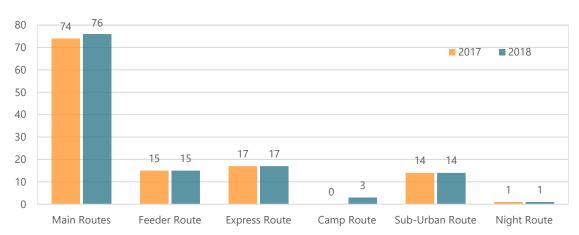
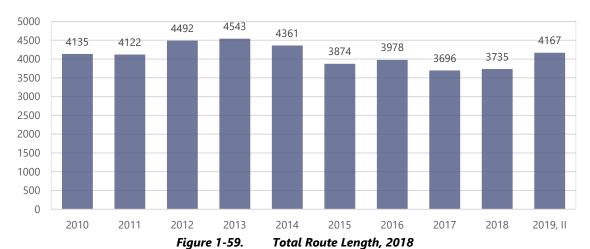


Figure 1-58. Number of Routes by Routes Types, 2018

Source: Public Transport Department of Ulaanbaatar



Source: Public Transport Department of Ulaanbaatar

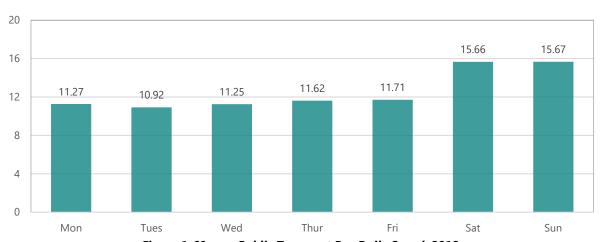


Figure 1-60. Public Transport Bus Daily Speed, 2018

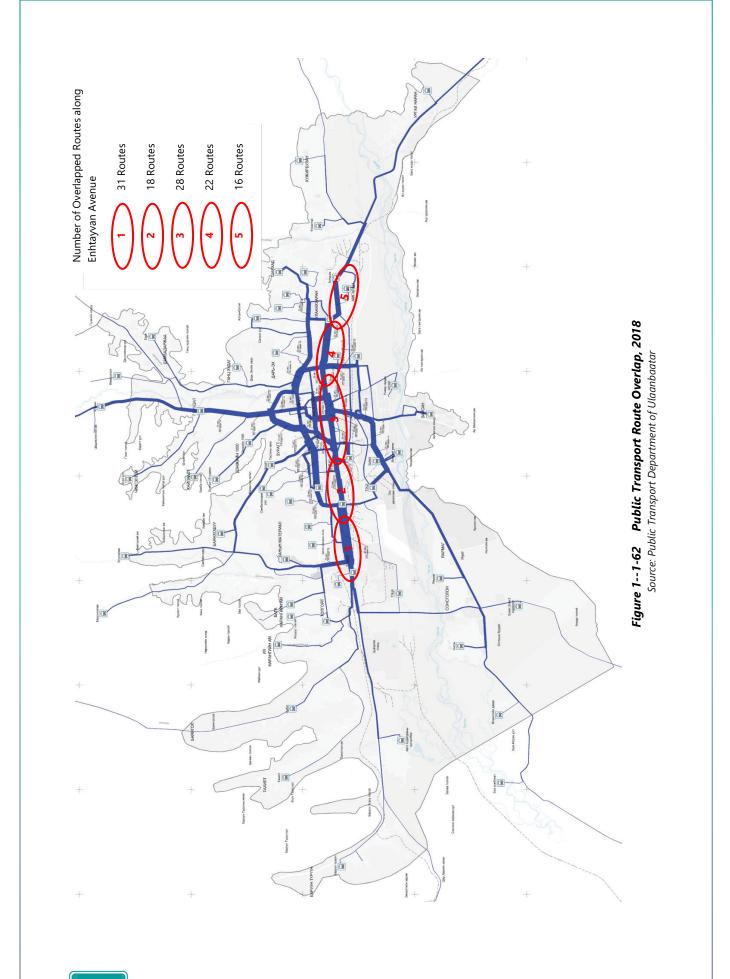
Source: Public Transport Department of Ulaanbaatar

Table 1-23. Public Transport Bus Average Daily Speed by Weekdays

Public Transport Bus by Types	2017	2018
Large sized bus (within the city)	8.2	8.1
Large sized bus (sub-urban area)	28.7	29.7
Trolleybus	9.7	9.7
Articulated Bus	6.9	6.9
Medium sized bus (within the city)	13.3	13.3
Medium sized bus (sub-urban city)	41.6	40.4
Small sized bus	29.3	40.8



**Figure 1-61. Public Transport Bus Congestion, 2018**Source: Public Transport Department of Ulaanbaatar



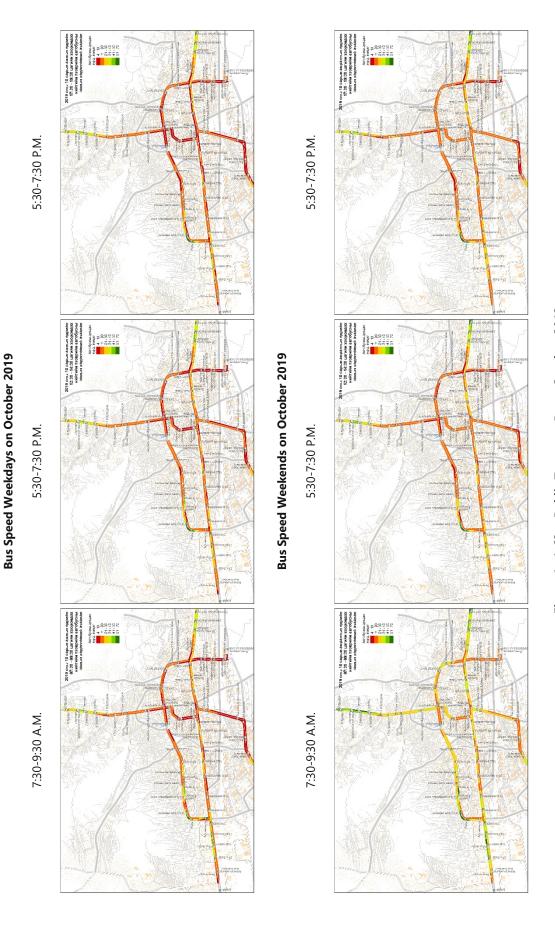
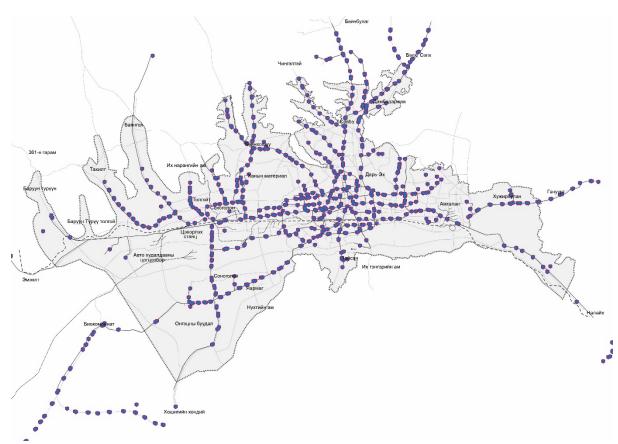


Figure 1--1-63 Public Transport Route Overlap, 2018
Source: Asian Infrastructure research Institute; Data Source: Public Transport Department of Ulaanbaatar



**Figure 1-64. Public Transport Bus Stops, 2018**Data Source: Public Transport Department of Ulaanbaatar



Figure 1-65. Over Fourteen PT Bus Routes at MUBIS Bus Stop, 2018

Source: Asian Infrastructure Research Institute

In 2018, 178.7 million passengers carried by public transport and public passenger turnover accounted for 607.6-million-person. km (Figure 1-65, Figure 1-66). Every day, over 650-750 thousand passenger trips are made through different public transport services in Ulaanbaatar. On average, daily riderships are over 618 thousand in weekdays and over 350 thousand in weekends (Figure 1-67). Based on public transportation statistic of 2018, 49.6 % of the riders are adults, 14.5% are children, 35.9% are riders who receive free of charge services for public transport

including seniors (19.6%), disabilities (7.6%), students (5.1%) after their quote finish, they ride as adults), police officers on duty (0.3%), and donors (0.1%) (Figure 1-69). Public transport fare is shown in Table 1-24. Maps for boarding, transferring and exiting passengers are shown in Figure 1-70, Figure 1-71 and Figure 1-72 respectively. Commuting journeys to and from work within Ulaanbaatar has reached 2.3 million trips per day, with 30.6% of total commuters walking, 24.2% driving, 9.2% taking a taxi, 33.4% riding public transport, and 2.6% using other modes of transport.

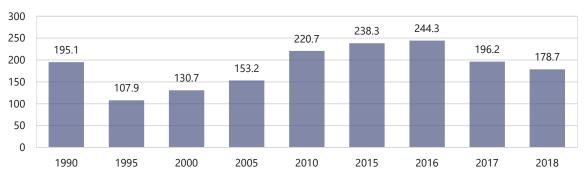


Figure 1-66. Carried Passengers by Public Transport, million people, 2018

Source: Statistics Department of Ulaanbaatar

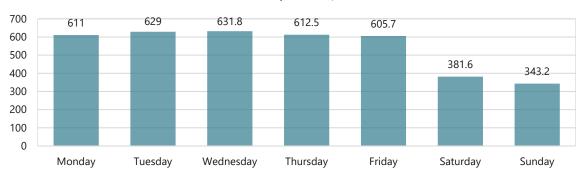


Figure 1-67. Daily Ridership, thousand people 2018

Source: Public Transport Department of Ulaanbaatar

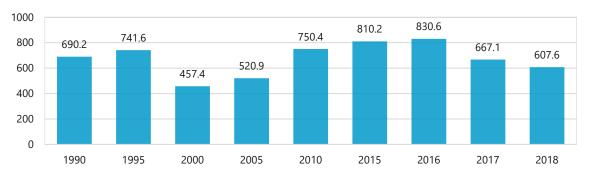


Figure 1-68. Passenger Turnover, million people.km, 2018

Source: Statistics Department of Ulaanbaatar65

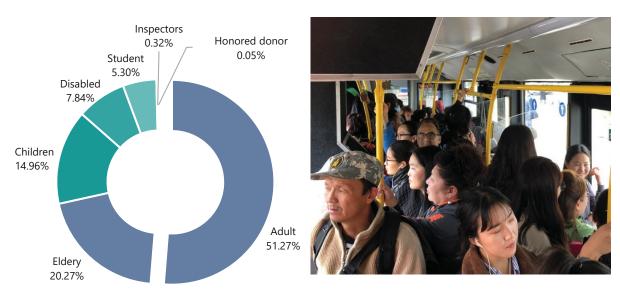


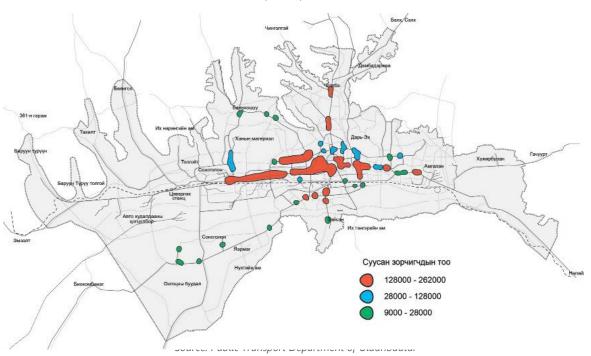
Figure 1-69. Public Transport Ridership Types, 2018

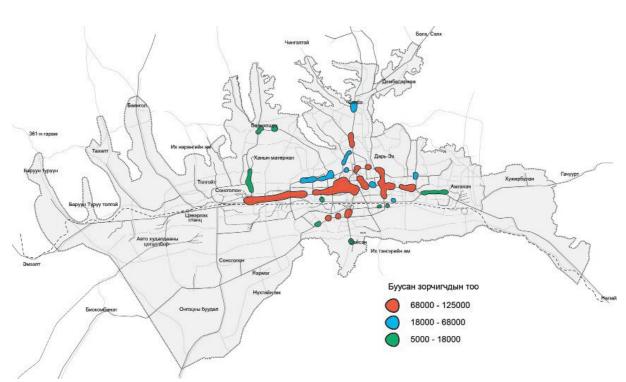
Source: Public Transport Department of Ulaanbaatar

 Table 1-24.
 Number of Entities Engaged with Public Transportation Services

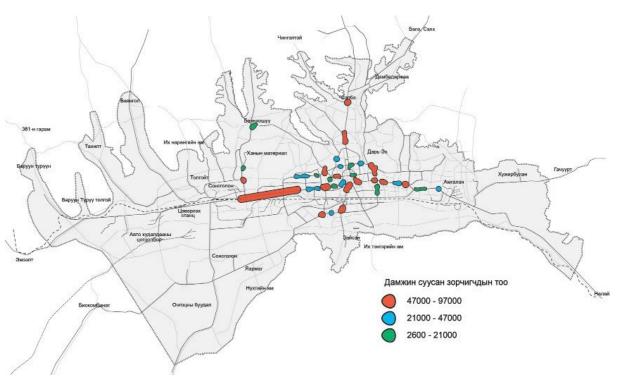
Doute Types	Vahisla Timas	Fare Amount, MNT		
Route Types	Vehicle Types	Adult	Child	
Main Davita	Bus	500	200	
Main Route	Trolleybus	300	100	
Feeder Route	Small/ Medium Sized Bus	500	200	
Express Route	Small/ Medium Sized Bus	500-1,300	200	
Sub-urban Route	Bus (Price depends on the distance)	500-2,300	200-1,200	
Taxi (per 1km)		1000		

Source: Public Transport Department of Ulaanbaatar





**Figure 1-71. Exiting Passengers, 2018**Source: Public Transport Department of Ulaanbaatar



**Figure 1-72. Transferring Passengers, 2018**Source: Public Transport Department of Ulaanbaatar

Since 2000, the role of private bus companies that operate large buses and micro-buses has increased considerably. The performance of public transport has been hampered by the growing problems of traffic congestion and by inefficient public transport policies; lack of coordination among the urban development and public transport regulatory agencies exacerbate the situation. These factors contribute to economic inefficiency due to increased trip times, excessive fuel use, and health problems due to poor air quality, which all serve to reduce residents' quality of life and have a negative impact on the economic growth of the city. The public transport system is struggling with service quality and technical, financial, and institutional challenges.

In the case of public transport operation in 2018, operators' revenue can be derived from the following sources: 37% are from fare revenue, 40% are from reimbursement of the difference between cost and revenue, 23% are subsidies from the Municipal Budget (Figure 1-73). Fare revenue and subsidies from Municipal budget information are shown in Figures of 1-74, 1-75 and 1-76.

Under the scope of developing Intelligent Transport

System in the capital city, "Ulaanbaatar Smart Card" LLC has been implementing "Electronic payment system, BIS and BMS" project since 2015. Total 1,300 bus installed GPS devise, card reader and CCTV. Total card charger 524 point is working whole city (Figure 1-77 and Figure 1-78). New IST 10 standards was built in public transport system. Public transport tariffs do not fully cover the costs of the operators and about 40.0% of passengers are subsidized by the municipal budget.

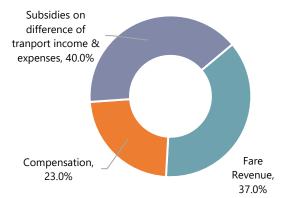
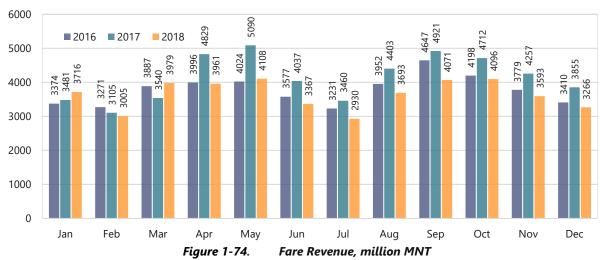


Figure 1-73. Public Transport Revenue Structure

Source: Public Transport Department of Ulaanbaatar



Source: Public Transport Department of Ulaanbaatar

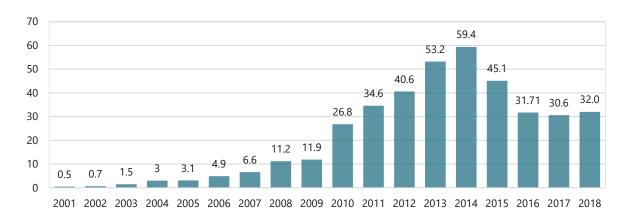


Figure 1-75. Total Subsidies from Local Budget for Free Public Transport, billion MNT
Source: Public Transport Department of Ulaanbaatar

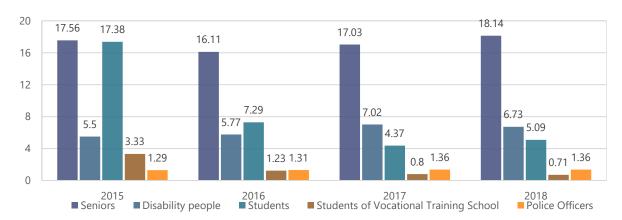


Figure 1-76. Total Subsidies on Free Public Transport by Passenger Types, billion MNT
Source: Public Transport Department of Ulaanbaatar

**Traffic management.** On-street parking is not appropriately managed and often interrupt traffic flows. Number of plate restriction reduce 20% of the cars off the road on working days. Although in poor

condition in traffic management overall, the existing traffic signal system is functioning and controlling traffic (Figure 1-83).

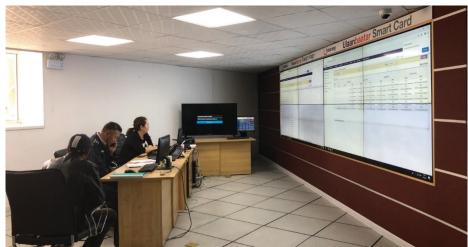


Figure 1-77. Ulaanbaatar Public Transport and U Money Smart Card Monitoring System ,2018

Source: Public Transport Department of Ulaanbaatar



**Figure 1-78. Public Transport - U Money Smart Card System, 2018**Source: Public Transport Department of Ulaanbaatar

#### 1.5.2. FUTURE PUBLIC TRANSPORT SYSTEM CONCEPTS

It is predicted that by 2030, the capital city population will reach 1.7 million. The government wants mass transit transportation that is dedicated to significantly reduce passenger travel time, providing more time for productive economic activities, improving the quality of life. The new urban transport system will prioritize clean and efficient public transport, and better traffic

and road safety. The current public transport bus routes are shown in Figure 1-80. Current public transport routes are overlapped in main roads and avenues. So far, there are several proposals for future public transport system. From Figure 1-85 to Figure 1-90 show several proposed plans for future public transport system.



Figure 1-79. Traffic Control Center of Ulaanbaatar, 2018

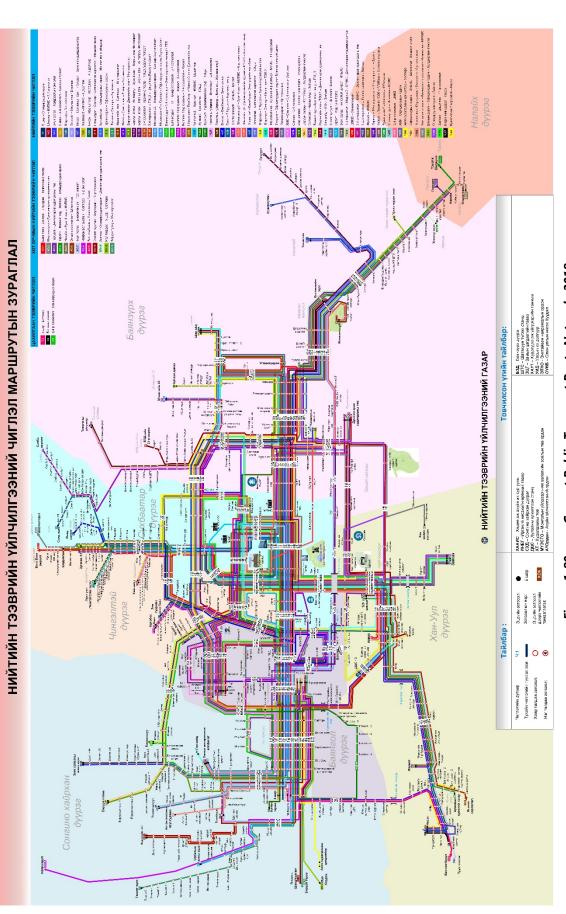


Figure 1-80 Current Public Transport Route Network, 2018

Source: Public Transport Department of Ulaanbaatar

Rapid Transit (BRT). Urban Transport Development Project (UBTD) in Mongolia funded by Asian Development Bank (ADB), which includes the research study on the establishment of BRT system in Ulaanbaatar, was conducted between 2009-2016. Within the scope of this research study, a total of 43.8 km of BRT network will be established including 13.6 km BRT lane on Enhtayvan Avenue, 8.4 km BRT lane on Ih Toyruu, 7.8 km BRT lane on the north vertical road through 7 Buudal, and 14.0 km BRT lane on the vertical road toward the airport (Figure 1-81). It is planned to be implemented by jointly with the Government of Mongolia and ADB in stages from 2017 until 2021, pursuant to a detailed design completed in late 2016.

It seems a BRT Concept Design or BRT Preliminary Design study was never completed after the initial limited concept design study in 2011, meaning that by 2017 the project had no firm foundation and was not yet sufficiently defined for the engineering design to start. Key decisions on corridors, vehicles and operations had not yet been finalized. There had been multiple sporadic inputs by consultant teams working on various aspects related to BRT, but no overall BRT Concept Design. A Project Implementation Unit was formed in 2017, but was unfortunately unable to use the long periods of inactivity during bid preparation and other 'down times' to proceed with much-needed additional planning and design work.

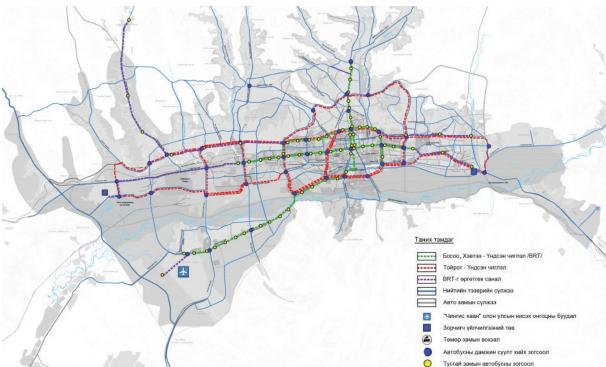


Figure 1-81. Proposed Ulaanbaatar Metro Lines from Feasibility Study done by Soosong Engineering and Seoul Metro Companies, 2011

Source: Public Transport Department of Ulaanbaatar

**Ulaanbaatar Metro Project.** A feasibility study for Metro construction in Ulaanbaatar City was conducted by a Soosong Engineering and Seoul Metro companies group in 2011. The following two lines were planned to construct: (i) East- West line runs along Enhtayvan Avenue from Amgalan in the east to Emeelt (new town area) in the west, totaling 28.38 km in length with 21 stations. (ii) North-South line runs from 7 Buudal to Buyant-Uhaa Airport, totaling 20.6 km in length with

12 stations (Figure 1-82)

A study on metro development, as a part of the UBTD project, was conducted in 2013 - 2014 with non-refundable aid of the Japan International Cooperation Agency (JICA). Even though the report was discussed at the Citizens' Representative Khural and approved by the National Security Council and the Japanese Government decided to issue USD 600 million soft loan, the project was stalled due to economic capacity

and financial capabilities of the country. The east-west line runs along Enhtayvan Avenue from Officers' Palace in the east to Sonsgolon Bridge in the west, totaling 17.7 km in length with 14 stations. Of this 17.7km, 6.6 km is underground in the section running through the central area of UB City, 11.1 km is elevated on both sides of the underground section (Figure 1-83.)

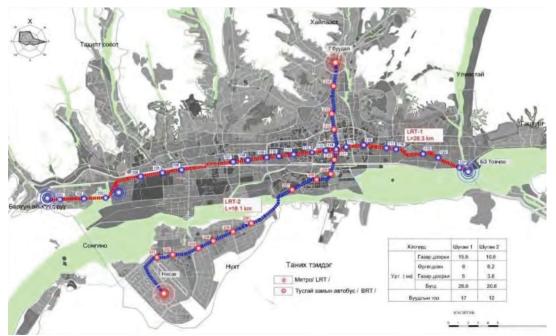


Figure 1-82. Proposed Ulaanbaatar Metro Lines from Feasibility Study done by Soosong Engineering and Seoul Metro Companies, 2011

Source: Public Transport Department of Ulaanbaatar

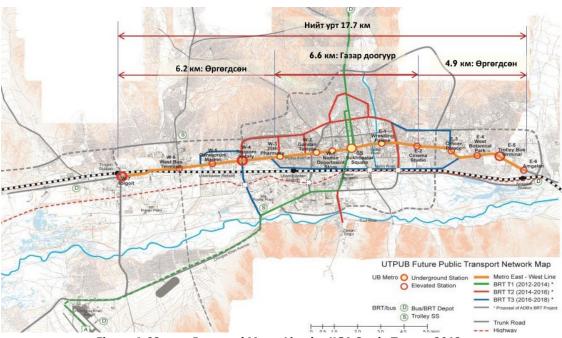


Figure 1-83. Proposed Metro Line by JICA Study Teams ,2013

Source: Public Transport Department of Ulaanbaatar

**Ulaanbaatar Tram Project.** A prefeasibility study for Ulaanbaatar Tram Project was conducted by a Maximall Co Ltd and AsianInfrastructure research Institute between 2017 and 2021. The following three lines were planned to construct in the intial stage: (i) East- West line runs along Enhtayvan Avenue from Amgalan in the east to 5 Shar in the west, totaling 15.0

km in length with 25 stations; (ii) East- West line runs along Narny Road runs from Amgalan to 5 Shar, totaling 15 km in length with 23 stations; (iii) Nalayh line runs from Amgalan to Nalayh connecting Ulaanbaatar core districts to Nalayh district (isolated district), totaling 28.5 km in length with 17 stations. (Figure 1-84).

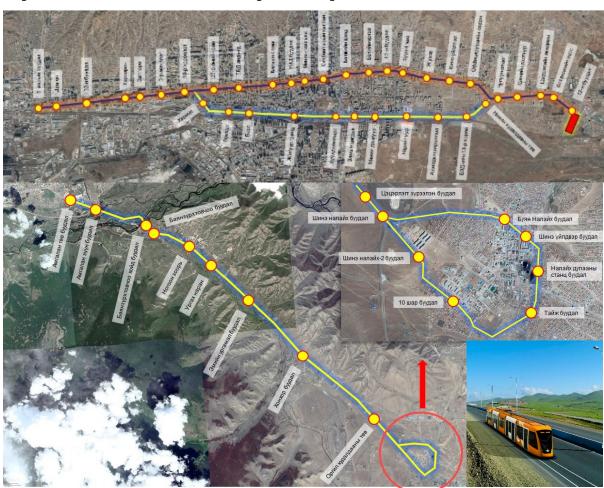


Figure 1-84. Proposed Ulaanbaatar Tram Lines

Other proposals for future public transport development. There are several project proposals including cable car system, rubber tired tram system or Skyway LRT introducing to the urban public transport development.

**Cable car.** The total estimated cost of the cable car project is 60.7 million euro or about 180 billion MNT. The Feasibility Study for this project will be completed in 2020-2021 and will be funded by a soft loan from the French Government. The following two lines are proposed (Figure 1-85):

North Line: 4.9 km of cable road with three stops

- from Bayanhoshuu through Hanyn Material to III/IV Micro district. The cable car will have 157 cabins and its estimated travel time is 16 minutes.
- South Line: 2.9 km of cable road with three stops from Zaysan through Bogd Khan Museum to Bayangol Hotel. The cable car will have 78 cabins and its estimated travel time is 8 minutes.

Cable car system's estimated hourly capacity is 3,000 passengers to carry. Daily riderships are estimated 3,000 and 22,000 passengers respectively (Figure 1-85)

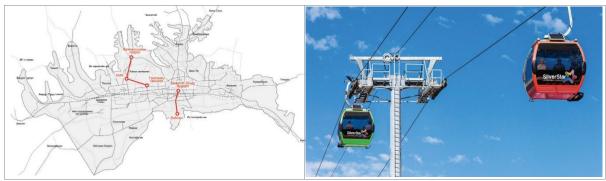
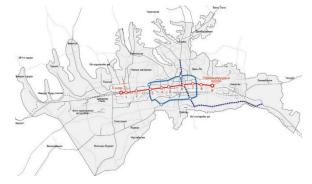


Figure 1-85. Proposed Cable Car Lines, 2019
Data Source: Public Transport Department of Ulaanbaatar

**Rubber-tyred Tram Line.** According to the Engineering Feasibility Study of Rubber-tyred Tram in Ulaabaatar, the total length of planned skyway tram line network is 107.6 km with four lines (Figure 1-90). Of which, 12.6 km of one horizontal - Line 1 (from in east to in west along the Enhtayvan Avenue) with 11 stations, 20.2 km of vertical -Line 2 with 12 stations, 55.0 km of vertical -Line 3 with 5 stations, and 20 km of one ring -Line 4 with 2 stations. The total investment of the project in short term is 1.8982 billion RMB, and the technical and economic indicators are 150.6 million RMB/km of the main line. Of which, (i) the engineering cost is 1.1882 billion RMB accounting for 71.12% of the total investment; (ii) the other expenses of engineering construction are 156.9 million RMB accounting for 9.43% of the total investment; (iii) the budget reserve is 134.5 million RMB accounting for 8.06% of the total investment; and (iv) the professional fees are 191.3 million RMB accounting for 11.39% of the total investment. The transportation cost of

equipment is not included in the above investment

Figure 1-86. Proposed Rubber-tyred Tram Line, 2018



Source: Public Transport Department of Ulaanbaatar

So far, any of these proposals did not become a solid solution for the modernization of Ulaanbaatar public transport system. Cable car is not a mass rapid transit system and it is more suitable for high mountain range. What type of a mass rapid transit do really need

for Ulaanbaatar? BRT or Metro or Rubber-tyred Tram or Modern Tram system? Which one? What we know is Ulaanbaatar needs optimal mass rapid transit system with an introduction of modern intelligent transport system technologies.

### **SUMMARY**

City Characteristics. Ulaanbaatar is Mongolia's the most populous city with a population of 1.49 million (National Statistical Office of Mongolia, 2018), which is 46 percent of the total population of Mongolia. Ulaanbaatar the Capital City of Mongolia /UB Region/ has 470 thousand hectares of land area it is divided into 9 districts, of which 6 districts (Bayangol, Bayanzurh, Chingeltey, Han-Uul, Songinohayrhan and Suhbaatar) are core districts of the city. The 95 percent of the total capital population reside in the core six districts (Figure 1-3). The core six districts cover an area of 378.9 thousand hectares, of which an area of 35.2 thousand hectares is considered settlement area of the Ulaanbaatar City. The study area considered for the SUTI analysis is the city center or area with core six districts.

**Urbanization.** Rapid urbanization in Ulaanbaatar occurs disorderly, because people move from other provinces to Ulaanbaatar Capital Region. It results Ulaanbaatar population growth from 0.59 million (27.2% of the total population of Mongolia) in 1990 to 0.80 million in 2000, 1.24 million in 2010, and 1.49 million (46.1% of the total population of Mongolia) in 2018. The population density in Ulaanbaatar has climbed from 169.1 people per square kilometer in 2000 to 317.3 people per square kilometer in 2018 while the population density in Mongolia was 2.1 people per square kilometer Statistical Office of Mongolia, 2018).

Dramatic increasing population of the capital city, which cause the expansion of *ger* (traditional Mongolian dwelling) area surrounding the apartment area of Ulaanbaatar City. According to the Statistics Department of Ulaanbaatar, 54.4% of Ulaanbaatar residents, 812,799 people of 221,523 households, live in 10,171.1 hectare *ger* areas in 2018 that characterized

by limited or no access to urban engineering infrastructure including heating, water supply, sanitation and paved road, in some cases, electrical supply, as well as in addition to receiving poor urban services and socioeconomic facilities (Figure 1-10).

Economy. Ulaanbaatar is the main industrial, trade and business center of Mongolia, Ulaanbaatar produces 66.3% of Mongolia's total gross domestic products (GDP). Since Mongolia adopted its economic reform policy (from central economy to market economy) in the early 1990s, Ulaanbaatar have gained urban development while Ulaanbaatar's economy has created 21.4 trillion tugrug at current price or 8.01 billion USD in 2018 (66.3% of GDP of Mongolia) and kept an average annual growth rate of 7.94% for 2010-2018 (National Statistical Office of Mongolia, 2019). The city has a strong and vibrant economic base and is a major destination for employment seekers in the country.

Urban Road Network and Transport. Driven by increased economic activities and high urban population growth, motorization has grown rapidly in the past 15 years. The total number of registered vehicles in Mongolia increased 1.6 times between 2012 and 2018 and reached 971 thousand in 2018 from 608 thousand in 2012. Ulaanbaatar's road network is the main node of the Mongolia road network, which is connecting centers of provinces. The total of 244.8 km international and state roads pass through the territory of Ulaanbaatar. As 2017, the road network of Ulaanbaatar City within the constructed area of 35,206 hectares was 779.2 km of the paved road, of which 148.6 km of primary road and streets, 226.0 km of secondary road and streets, and 404.6 km of local district streets (Figure 1-25). Urban road infrastructure construction also showed rapid development over the

past decade. However, the growth of urban vehicles has been much faster than that of urban road construction.

Number of vehicles. Driven by increased economic activities and high urban population growth, motorization has grown rapidly in the past 15 years. The total number of registered vehicles in Mongolia increased 1.6 times between 2012 and 2018 and reached 971 thousand in 2018 from 608 thousand in 2012 (Figure 1-19). In terms of age of the vehicles, on average 73.5% of the total vehicles are over 10 years old between 2014 and 2018. The increasing ownership of cars has not encouraged to use public transport as the main mode of transport unless public transport system improved dramatically. Despite Mongolia has the rule of the left hand steering wheel, 57.6% of the total vehicles that passed the technical inspection have right hand steering wheel, which has significant negative impact on the traffic safety.

**Public Transport System.** In 2017, the Traffic Control Center of Ulaanbaatar conducted Household Travel Survey for 53,160 households of six core districts of Ulaanbaatar City to examine overall transport demand and to collect the main source of data for estimating travel demand modeling for Ulaanbaatar City. Based on the survey result, total transportation demand in the city consists of car (49.2%), bus and trolleybus (39.3%), walking (6.5%), taxi (2.6%), bicycle (1.2%), motorcycle

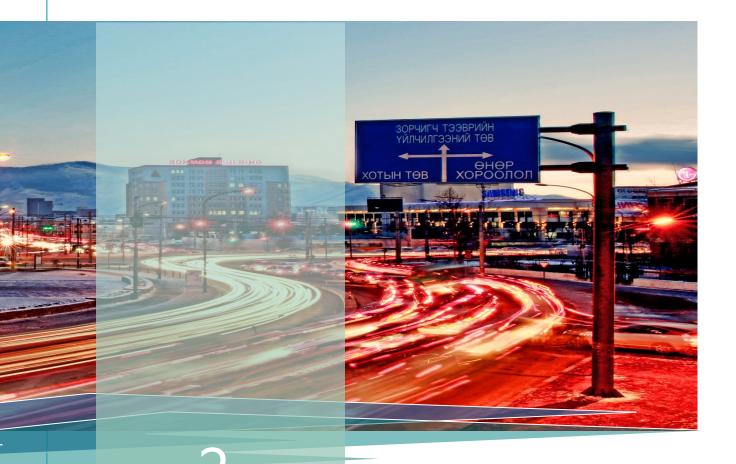
and moped (0.7%), and employee transportation bus (0.6%). There are 34 bus companies operating 1,171 variety vehicles including 88.6% of large sized bus, 1.7% of articulated bus, 4.5% of medium sized bus, 0.9% of minibus, 4.3 % of trolleybus and 48.3% of taxi to meet with the people's public transport demand. Public transport network has six types of 126 routes including 76 main routes, 15 feeder routes, 17 express routes, 3 camp routes, 14 sub-urban routes and 1 night routes in 2018. Total of routes were 3,735 km in 2018, which is increased by 39 km from previous year (Figure 1-59). Public transport routes are overlapping significantly, which affect to traffic congestion due to a lack of paved urban network.

The Ulaanbaatar City Administration is committed to decreasing air-pollution in the Mongolian capital; replacing the old diesel buses is a step in that direction.

Under the scope of developing Intelligent Transport System in the capital city, "Ulaanbaatar Smart Card" LLC has been implementing "Electronic payment system, BIS and BMS" project since 2015. Total 1,300 bus installed GPS devise, card reader and CCTV. Total card charger 524 point is working whole city. New IST 10 standards was built in public transport system. Public transport tariffs do not fully cover the costs of the operators and about 40.0% of passengers are subsidized by the municipal budget.



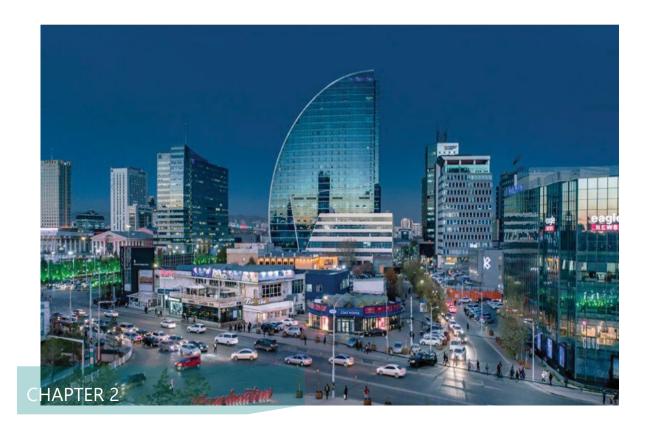
3011 FOR ULAANDAATAK	US
Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes50.	00
Modal share of active and public transport in commuting57.	16
Convenient access to public transport service81.	42
Public transport quality and reliability39.	46
Traffic fatalities per 100000 inhibitions20.	98
Affordability - travel costs as part of income44.	25
Operational costs of the public transport systems74.	85
Investment in public transportation systems1.7	6
Air quality (PM10)37.	29
Greenhouse gas emissions from transport57.	60



DATA
COLLECTION
APPROACHES,
DATABASE AND
DATA
ANALSYSIS FOR
10 INDICATORS

INTRO	DU	JCT	ION
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DATA COLLECTION APPROACHES, DATABASE AND DATA
ANALYSIS FOR TEN INDICATORS



# 2. DATA COLLECTION APPROACH, DATABASE AND DATA ANALYSIS FOR SUTI

### 2.1. INTRODUCTION



The Sustainable Urban Transport Index (SUTI) had been developed by UNESCAP to summarize, track and compare the performance of Asian cities in respect to sustainable urban transport and the related Sustainable Development Goals (SDGs). The objective of SUTI is to evaluate the status of urban transportation system in cities. SUTI is identified to be a periodically ongoing process wherein data is collected for comparative purposes, enabling the cities to identify the deficiencies thereby to set targets and identify good practices cum lessons in the field of transport. Data collection for

different indicators to develop SUTI comprises of field data collection, data collection from appropriate authorities and reviewing different relevant data sources. Some indicators can be dealt together and can be developed from a single data source, thus initial step will be to identify the indicators having possible common data sources. Based on the defined methodology by SUTI, data for each indicator is then analyzed.

# 2.2. DATA COLLECTION APPROACH, DATABASE AND DATA ANALYSIS FOR TEN INDICATORS

The Ten SUTI Indicators' Descriptions. SUTI is a quantitative tool for member States and cities of the region to compare their performance on sustainable urban transport systems and policies with peers. It can help identify additional policies with peers. It can help to identify additional policies and strategies required to improve the urban transportation systems and services. SUTI calculation is based on the following ten indicators.

- Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes
- 2) Modal share of active and public transport in commuting
- 3) Convenient access to public transport service
- 4) Public transport quality and reliability
- 5) Traffic fatalities per 100.000 inhabitants
- 6) Affordability travel costs as share of income
- 7) Operational costs of the public transport system
- 8) Investment in public transportation systems
- 9) Air quality (PM10)
- 10) Greenhouse gas emissions from transport

SUTI includes ten indicators in system, economic environmental and social domains. SUTI is also expected to make an assessment of the progress of transportation contribution towards achievement of SDGs. Descriptions, data collection approach and procedure, data source and its related information for each indicator of SUTI that are shown in from Table 2-1 and to Table 2-25.

Basic general terms and definitions. The SUTI uses mostly standard international definitions, formats, units etc. Some general basic terms used are shown in below:

"Indicator: a variable selected to represent a key property of a system or a wider phenomenon of interest. A SUTI indicator is one of ten variables selected to represent sustainable urban transport.

Index: a type of indicator that consists of two or more indicators that each measure distinct system characteristics in separate units that are normalized and aggregated.

SUTI: Sustainable Urban Transport Index. SUTI is an index based on normalization, equal weighting, and aggregation of the ten SUTI indicators.

Value: the number to be entered for each variable (indicator) in the SUTI data sheet.

Data: The numerical units used to calculate or derive values for the SUTI indicators. Data will originate in various sources and methods (measurements, surveys, observations, calculations, etc.).

City: The 'city' is the named geographical area and administrative unit that is responsible for filling in the data sheet. It is important that all indicators refer to the same geographical area and same administrative unit. If this differs across indicators it should be noted in the data sheet (see below.)

Numbers are metric and generally use SI units; Points '.' are used as decimal marks in the text and the data sheet. Commas ',' are 1,000 separators) (Sustainable Urban Transport Index Data Collection Guideline of UNESCAP)

# 2.2.1 SUTI-1: Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes

### Descriptions, Data Collection Approach, Procedure and Data Source's

Indicator 1 is analyzed based on the recent transportation plan which covers walking networks,

cycling networks, intermodal transfer facilities and public transport. Descriptions, data collection approach and procedure and data source and its information for indicator 1 that are shown in from Table 2-1

Table 2-1. Descriptions, Data Collection Approach, Procedure and Data Source of Indicator 1
According to Expected Required Effort

Indicators	Descriptions and Definitions
SUTI 1	Extent to which transport plans cover public transport, intermodal facilities and infrastructure
	for active modes
Description	This indicator must be produced by undertaking a manual document review of the City's most
	recent transport plan, and score it with a set of criteria defined for this indicator. This review
	involves designating an expert or a small expert team to read and score the plan according
	to the criteria. Time, manpower and independence, should be secured for this process.
Relevance	According to sustainable urban transport policy and research it is an essential element in urban
	sustainable transport planning to provide for alternatives to motorized individual transport.
	This involves especially public transport, walking, and cycling and includes both networks and
	nodes/interchange facilities. Urban transport plans should support these modes explicitly
	and directly by incorporating goals, strategies, physical facilities, services, etc. for them.
	The indicator refers directly to SDG target 11.2 "By 2030, provide access to safe, affordable,
	accessible and sustainable transport systems for all". It is also relevant for SDG target 9.1
	"Develop quality, reliable, sustainable and resilient infrastructure".
Definition	The extent to which the city's most current comprehensive transport or master plan covers
	the four aspects I) walking networks, II) cycling networks, III) intermodal transfer facilities and
	IV) expansion of public transport modes by adopting low emission vehicles, in particular
	electric vehicles, to decarbonize urban mobility.
Unit	The extent of coverage is calculated and measured on an ordinal scale from 0 to 16. First, the
	extent of the coverage in the urban transport plan for each of the four defined aspects I – IV,
	is reviewed and scored on a 5-step scale:
	0) No coverage of the aspect (it is basically ignored)
	1) Limited coverage of the aspect (only minor initiatives)
	2) Middle coverage of the aspect (some typical initiatives)
	3) Extensive coverage of the aspect (several strong initiatives)
	4) Leading coverage of the aspect (ambitious, comprehensive, pioneering initiatives)
	The scores for all four aspects are then added together to provide the overall score (IS(0-4)
	+ IIS(0-4) $+$ IIIS(0-4) $+$ IVS(0-4)), where S(0-4) is score 0-4 for each aspect).
Min and	The lowest possible total score is 0 (=the case that none of the four aspects are covered at
Max values	all). The highest possible total score is 16 (=the case that a city is a regional leader in all four
	aspects)
Ulaanbaatar	The recent transport plan that is used to derive the indicator 1 for the city of Ulaanbaatar are:
	1. "Ulaanbaatar 2020 Master Plan and Development Approaches 2030" (MP UB

	2020/2030) was approved by t	the Parliament of Mongolia in 2013. The vision for				
		baatar was described as the following as in MP UB				
	2020/2030: "Ulaanbaatar will b	e the CAPITAL CITY of Mongolia that respects the				
	NOMADIC HERITAGE which has	endured many centuries, values its PEOPLE, embraces				
		STICS, is ENVIRONMENTALLY FRIENDLY, has industries				
	_	GLOBALLY COMPETITIVE and TECHNOLOGICALLY				
		Y with a unique Mongolian character."				
	_	laster Plan for Urban Road Development of the Capital				
		was drafted in 2018. It focuses on the aspects of road				
		n cycling networks and some aspects of public				
	,	oals and but not secured funding. The MP UB Road				
	, , ,	by the Municipal Board. The vision put forth under the				
	master plan for Ulaanbaatar region's road development for the year 2030 is					
	"Comprehensive urban road no	etwork for sustainable development, providing and				
	managing quality, safe, adequate, environmentally friendly and smart urban road					
	network that meets the future tr	ansport demand".				
Data source	Aspects	Data Source				
for	1. Walking Network	Section 3. & Section 4. of MPUB Road 2025/2030				
Ulaanbaatar	2. Cycling network	Section 3. & Section 4. of MPUB Road 2025/2030				
	3. Intermodal Transfer Facilities	Section 3. & Section 4. of MPUB Road 2025/2030				
	4. Public Transport	Section 3. & Section 4. of MPUB Road 2025/2030				
Year of data	2017					
Comments	The score is based on UBMP2020/2030 and UBMP Road 2025/2030. Scoring /Evaluation					

Source for terms and definitions: SUTI Data Collection Guideline of UNESCAP

conducted by 3 people team chaired by Dr. Eldev-Ochir

### Data Analysis.

The indicator 1 analyses the extent to which the recent transport plans for the city cover public transport, intermodal facilities and infrastructure for active modes. The aspects considered for indicator 1 include Walking networks, Cycling networks, Intermodal transfer facilities and public transport. Each aspect is to

be ranked on a scale of 4, with 4 indicating the best in Table 2-2. The Long - and Medium- term Master Plan for Urban Road Development of the Capital City (MP UB Road 2025/2030) was drafted in 2018 and sets out the main direction for urban road development over the next decades

Table 2-2. Strategic Directions and Key Objectives of the Long-and Medium-term Master Plan for Urban Road development of Ulaanbaatar

	Urban Road development of Ulaanbaatar					
Nō	Strategic Directions	Key Objectives				
1	To plan and to develop urban network based on scientific approaches that lines with transport demand to meet the demand for growing socioeconomic and development opportunities and needs as well as incorporated with urban development and land-use planning;	In view of the future mobility challenges, improvements in the street network are proposed to ensure connectivity, enhance accessibility and improve the efficiency. The plan proposal aids in completing the network, improving hierarchy and adding primary and secondary road and street network based on scientific approach.  Road network planning should support and align with city's urban development plan.				
2	To develop comprehensive urban road network with engineering infrastructure (including pedestrian and bicyclist facilities, green development along urban road, parking, bridges, tunnels, bi-level crossing, and etc) that integrated with international standards;	It is proposed that all roads & streets will be developed with engineering infrastructure that meet international standards. The Integrated Multi-Modal Transport System aims to providing connectivity across all the transport modes of Ulaanbaatar including public transport, cycling and walking. Developing cycling and pedestrian road network plan focuses on providing basic infrastructural elements such as lane markings for bicycle tracks along all public transit routes and new footpaths cum widening of existing ones. Improving and enhancing parking management system in Ulaanbaatar. Ensures compliance with standard specifications for road and bridge construction process.				
3	To provide passenger and freight transport services that are efficient, quality, safe, reliable and compliance with transport demand;	Transit Oriented Development (TOD) is proposed to have a sustainable alternative to low density sprawl which is due to use of private automobiles that results in long commutes, more cars, higher congestion and higher pollution. To integrate the public transport system in Ulaanbaatar, specific provisions in City Bus system and BRT system. Although there are several proposals for utilization of Metro, Tram, Rubber-tyred LRT and Cable Car in the public transportation system, no acknowledge in the MP UB Road 2025/2030 as well as the city's authorities do not have concrete solution for modernization of public transport infrastructure system.  Proposed reinforced freight lane for specified road for freight traffic, 2 logistic parks and 7 distribution centers proposed to help reduce freight vehicle intrusion into the city, Entry-Exit restrictions for freight vehicles (HCVs and MCVs), Parking regulations and Provisioning for farm to market. City logistics aims provide services contributing to efficiently managing the movements of freight in cities and providing innovative responses to customer demands. City logistics intends freight distribution can take place in urban areas as well as the strategies that can improve its overall efficiency while mitigating externalities such congestion and emissions.				

4	To provide traffic management system that utilizes to optimize road use and traffic safety;	As part of the mobility management measures proposed, accident management is one of the key focus of the plan. The components of safety and security includes design improvement junction signalization, setting up of speed limits for the city as per hierarchy of roads and accident monitoring cell which is GIS based accident management cell and traffic control system which would look at monitor and analyses the accident occurrences as well as traffic. Proposed improvement of road maintenance management system by appropriate planning, timing and execution of work zone operations in order to improve efficiency, safety, and cost of the maintenance works.
5	To develop a road network that is harmless to human life, health, nature and the environment;	It is proposed roadway design that will be integrated transportation functionality and ecological sustainability. An environmental approach will be used throughout the planning, design, and the construction. The result is a highway that will benefit transportation, the ecosystem, urban growth, public health and surrounding communities. The components of TOD include improving walkability in transit area thereby encouraging the use of public transport.
6	To develop intelligent road and transport system;	Intelligent transport systems such as Automated Fare Collection, Automatic Vehicle Location System, Passenger Information System, Vehicle Scheduling and Dispatch System, Depot and Incidence Management System etc. will act as the backbone for efficient functioning of the system.
7	To strengthen the capacity building of road and transport sector; and	In order to strengthen the institutional system and capacity building of road and transport sector, it is important to strengthen and expand existing bonds with the government, research institutions, public and private organizations, business organizations and companies, both nationally and internationally.
8	To establish and to improve legal and regulatory environment for implementing MP UB Road 2025/2030.	Laws and regulations are key implementation mechanisms for translating major urban road and transport policy objectives into action through the setting of standards and requirements and the use of sanctions and incentives to exert leverage over the urban development and road and transport systems (and its participants). Proposed to make some changes and/or amendments to the existing 18 laws and 20 regulations and norms and standards in order to implement the MP UB Road 2025/2030.

Source: MP UB Road 2025/2030

Table 2-3. Indicator 1- Score Card

		Table 2-3.	Indicator 1- Score Ca			
Score	2.5	2.5	_	2		
Explanation summary	UB Road MP 2025/2030 is still not approved yet. Implementation	process may become an issue due to budget and politics	Vague goal, little designation seen in plan, small or unclear budget	Although some budget is secured, implementing process is inefficient due to political impacts/influences. There is an urgent need of Master plan for Public Transport Development.	Comments	Score is based on UB MP 2020/2030. Scoring conducted by 3 people team chaired by Dr. Eldev-ochir.
Allocating funding, specifying budgets, securing finance for facilities	A plan states required investment cost for building and maintenances for pedestrian and	cycling road networks until 2030 by annually. Even though budget is not secured.	lt has no/limited efforts and on budget	A plan states required investment cost.	Com	is based on UB MP 202 3 people team chair
Designating infrastructure facilities & measures for each aspect in the plan.	A transport plan designated measures to be built as shown on	maps, listed in tables. The plan has strong effort and extensive coverage.	The extent of the designation is not clear as well as the details.	The extent of the designation is not clear as well as the details.		Score
visions for each aspects	Goals are strong and very ambitious. Pedestrian road network will be increased from 328.6 km to 547.4 km by 2025 (an increase of 66.58%) and to 734.6km by 2030 (an increase of 123% compared to 2018).	Goals are strong and very ambitious. Cycling road network will be increased from 59.3 km to 368.8 km by 2025 (an increase of 6.21 times) and to 387.6km by 2030 (an increase of 6.54 times compared to 2018).	Although the plan is included expansion of the walking, cycling network, and public transport network system, there is not clear goals for building intermodal terminals and/ or connecting intermodal transfer facilities. Unclear public transport development plan has impacted to plan building intermodal transfer facilities.	There is not any master plan for public transport development. There are several PT development concepts.	Year	2017
Stating clear goals & visions for each	Goals are strong and Pedestrian road network will 328.6 km to 547.4 km by 20 66.58%) and to 734.6km by of 123% compared to 2018).	Goals are strong and verroad network will be increa 368.8 km by 2025 (an incand to 387.6km by 2030 times compared to 2018).	Although the plan is included expansic walking, cycling network, and public to network system, there is not clear gbuilding intermodal terminals a connecting intermodal transfer Unclear public transport development impacted to plan building intermodal facilities.	There is not any matransport development developments.	Score	œ
Aspects	Walking Network	Cycling Network	Intermodal Transfer Facilities	Public transport	Aspects	Sum Score for Indicator 1

### 2.2.2 SUTI-2: Modal share of active and public transport in commuting

### Descriptions, Data Collection Approach, Procedure and Data Source.

The indicator 2 analyses the modal share of active and public transport modes. Modal share is an important component in developing sustainable transport within a city or region. In recent years, many cities have set modal share targets for balanced and sustainable transport modes, particularly 30% of non-motorized

(cycling and walking) and 30% of public transport. These goals reflect a desire for a modal shift, or a change between modes, and usually encompasses an increase in the proportion of trips made using sustainable modes. Descriptions, data collection approach and procedure and data source and its information for indicator 2 that are shown in from Table 2-4.

Table 2-4. Descriptions, Data Collection Approach, Procedure and Data Source of Indicator 2

According to Expected Required Effort

	According to expected Required Errort
Indicators	Descriptions and Definitions
SUTI 2	Modal share of active and public transport in commuting
Description	This "modal share" indicator is of interest in many cities, but definitions vary, and data can be a
	problem. In case no data exist, or existing ones are outdated (e.g. 10 years old or more) the city
	will need to derive new data on transport volumes (trips) per mode. This may involve conducting
	some form of a travel survey, or using other methods. This can be a major task.
Relevance	To monitor the modal split is a useful indicator in providing for more sustainable urban transport
	solutions. The indicator refers to SDG target 11.2 "By 2030, provide access to safe, affordable,
	accessible and sustainable transport systems for all". Active and public transport may be
	considered as more sustainable transport compared to individual motorized transport.
	Therefore, the indicator has a focus on increasing the share of these modes. The modal split is
	most critical for commuting (travel to and from work), as this travel puts the most stress on the
	urban transport system and the environment. Therefore, the indicator has its focus on
	commuting. The definition for this indicator is drawn from the ISO 37120 standard set of
	indicators developed by the Global City Indicators Program (GCIP 2015).
Definition	Percentage of commuting trips using active and public travel modes (= using a travel mode to
	and from work and education other than a personal motorized vehicle).
	"Active transport" means cycling and walking. It does NOT include mopeds or other motorized
	two-wheelers.
	"Public transport" includes public bus, BRT, tram, rail, scheduled ferry, informal public
	transportation modes (fixed route and accessible to all) which act as proxy public transportation.
	These services may include mini bus, Chakda or tuk tuk. These should not be confused with auto
	rickshaw or taxies that act as hail service and providing door to door connectivity, the same
	should be excluded.
	"Personal motorized vehicle" therefore means passenger car, motorcycle, scooter, moped, taxi,
	and motorized para-transit/auto-rickshaw etc.,
Unit	Percentage of trips for commuters not by personal motorized vehicle.
Min and	The lowest value is 10%; the highest value is 90%.
Max values	
Ulaanbaatar	The data required for the indicator 2 were considered based on the Travel Demand Household
	Survey done as a part of the Master Plan for Long and Medium term Urban Road Development
	of the Capital City. It is conducted by the Traffic Control Center of Ulaanbaatar. 53,160

	households were surveyed within Travel Demand Household Survey and trip diary of the survey gave the trip information of the people of Ulaanbaatar. The educational and work trips as per				
	the modes were retrieved and found the trip rates. Based on the retrieved da	ta the modal share			
	of active and public transport was calculated to derive the results of the indic	ator.			
Data source	Mode	Trip rate			
for	1. Public Transport /Bus Trolleybus, Medium sized bus/Minibus/	0.395			
Ulaanbaatar	2. Active Transport	0.075			
	3. Individual Motorized Transport	0.487			
	4. Taxi	0.013			
	5. Informail Taxi	0.010			
	6. Motorcycle/Moped	0.007			
	TOTAL	1.000			
Year of data	2017				
Comments	Estimated modal share for commuting (work and education) travel purposes only.				

Source for terms and definitions: SUTI Data Collection Guideline of UNESCAP

#### **Data Analysis**

The indicator 2 analyses the modal share of active and public transport modes. The active modes include the cycling and walking trips, whereas the public transport includes the formal modes and their trips like bus and trolleybus. Taxi and informal taxi services do not include in the public transport services. The minimum and maximum values for this indicator are 10 and 90 percent respectively (Table 2-4). Figure 2-1shows trip mode choice on passenger cars vs public transport.

Figure 2-1. Trip Mode Choice: Public Transport Vs Passenger cars



Travel demand data is a necessary basis for urban mobility planning, but especially in developing and emerging economies data availability is often weak or non-existing. Fortunately, Traffic Control Center of Ulaanbaatar conducted 53,610 household travel demand surveys (within Ulaanbaatar City) for the Long

and Medium term Master Plan for Urban Road Development of the Capital City. The trip rate of each mode for educational and work trips is retrieved from the survey data and thereby calculated the share of active and public transport modes of commuting trips (Table 2-5 and Figure 2-2).

Table 2-5. Trips for Commuting (Work and Education)

Travel Mode	Education Travel	Trip Rate for Education	Work	Trip Rate for Work	Average Trip Rate for Work & Education	Modal Share for Education & Work
Bus/Trolleybus	26,876	0.5663	13,397	0.386	0.476	47.61%
Passenger car	17,880	0.3768	16,900	0.487	0.432	43.18%
Taxi	33	0.0007	893	0.026	0.013	1.32%
Informal taxi	230	0.0048	350	0.01	0.007	0.75%
Medium sized bus	113	0.0024	206	0.006	0.004	0.42%
Minibus/Van	113	0.0024	121	0.003	0.003	0.29%
Cycle	82	0.0017	378	0.011	0.006	0.63%
Walk	2,128	0.0448	2,233	0.064	0.055	5.46%
Motorcycle/ Moped		0	240	0.007	0.003	0.35%
TOTAL	47,455	1.0000	34,718	1.000	1.000	100%

Data Source: Travel Demand Household Survey

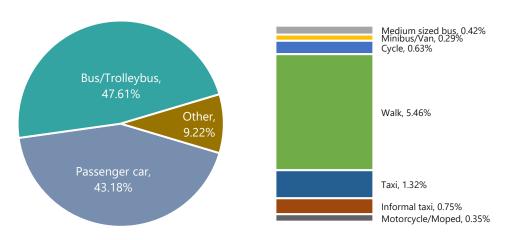


Figure 2-2. Model Share for commuting Travel Purposes, 2017

Source: Travel Demand Survey of Traffic Control Center

Table 2-6. Score Card for Indicator 2

Travel Mode Choice		Travel Purposes Mode Share, %	Commuting Subtotals,%
Scheduled bus and n	ninibus (*)	0.483	
Taxi		0.013	
Ferry			
Public transport (a	ı+b+c)	0.496	0.5
Walking		0.055	
Bicycle		0.006	
Active transport	(e+f)	0.061	0.06
Passenger ca	ır	0.432	
3W - Private	1		
Shared Auto (Informal PT)		0.007	
Motorcycle		0.004	
Institutional Buses and Auto Rickshaws			
Other motorized (trucks,etc)			
Individual motorized (**) (	h+i+j+k+l+m)	0.443	0.44
Total (d+g+r	n)		1
Public and active	(d+g)		0.56
MODAL SHARE OF ACTIVE AND PUBLIC TRANSPORT			55.7
Indicator	Value	Year	Comments
			Data is based on urban travel
Public Transport Mode Choice 55.7		2017	survey 2017 from 53,160
	) - ( - ( - ( - ( - ( - ( - ( - ( - ( -		households

Data Source: Travel Demand Household Survey

The SUTI-2 is derived by considering both active and public transport modes. SUTI-2 value is 55.7 percent, which indicates the modal share of active and public transport for education and work purposes in Ulaanbaatar is 55.7 percent of the total travels (Table 2-6).

Based on the travel demand household survey data analysis, 47.6% of commuting trips used public transport, only 6% used active transport (cycled and walked), 48.7% used individual motorized transport. Reducing travel time of public transit and to attract more passengers during peak hours would be a better strategy for Ulaanbaatar

### 2.2.3 SUTI-3: Convenient access to public transport service

### Descriptions, Data Collection Approach, Procedure and Data Source.

The indicator 3 analyses the convenient access to public transport services. The access to public transport is considered convenient when an officially recognized stop is accessible within a distance of 0.5 km from a reference point such as a home, school, work place, market, etc. Descriptions, data collection approach and procedure and data source and its information for indicator 3 that are shown in from Table 2-7.

Table 2-7. Descriptions, Data Collection Approach, Procedure and Data Source of Indicator 3

According to Expected Required Effort

	According to Expected Required Effort				
Indicators	Descriptions and Definitions				
Indicator 3	Convenient access to public transport service				
Description	This indicator requires the combination of data for the density and frequency of the public				
	transport (PT) service network, and data for the number of citizens living in 500 m buffer				
	zones of main nodes in the network. There are different methods to estimat	e these data as			
	described in section 3.3 but it may require some effort to derive data both for	or PT frequency			
	and population inside the buffer zones.				
Relevance	Access to public transport service is a key requirement for equitable access i	n a sustainable			
	city. Convenient access to sustainable travel modes is the main indicator a	dopted by the			
	United Nations Social and Economic Council and the United Nations Statistic	cal Commission			
	for monitoring SDG target 11.2 "By 2030, provide access to safe, affordable,	accessible and			
	sustainable transport systems for all".				
Definition	Proportion (percentage) of the population that has convenient access to pe	ublic transport,			
	defined as living 500 meters or less from a public transport stop with minim	num 20-minute			
	service. Public transport is a shared passenger transport service available	to the general			
	public, excluding taxis, car pools, hired buses and para-transit (same delimitation as used				
	for public transport in indicator 2. Active transport is not included here). If possible, the				
	measure is measured for the general population as well as for vulnerable groups (women,				
	elderly, and persons with disabilities).				
Unit	Percentage of urban population				
Min and Max	Minimum level is 20%; max level is 100% of the urban population. 100% is hardly realistic				
values	everywhere, but some cities are close to this target.				
Ulaanbaatar	The data used to derive the indicator 3 were involve the bus stops location	GIS data from			
	the Public Transportation Department of Ulaanbaatar and GIS demographic	data from the			
	National Statistical Office of Mongolia. Bus stops map was derived based of	on GIS data for			
	946 bus stops and created 500 m buffer from the bus stops, which creates a	buffer zone for			
	approximately 6 minutes for walking distance bus stops. The total inhabita	ants within the			
	500m buffer of the operational bus stops were analyzed to calculate the	percentage of			
	people having convenient access to the public transportation system.				
Data source for	Aspects	Quantity			
Ulaanbaatar	Population within 500m accessibility of Public Transport	1,147,289			
	Total Population	1,347,598			
Year of data	2018				
Evaluation	Estimated convenient access to public transport services Data is based on	the population			
Procedure	data from National Statistics Office in areas within 500 m of nodes and the	bus stops data			

from the Public Transport Department of the Capital City.

Source for terms and definitions: SUTI Data Collection Guideline of UNESCAP

#### Data Analysis.

This indicator will be monitored by the proportion of the population that has convenient access to public transport. The access to public transport is considered convenient when an officially recognized stop is accessible within a distance of 500 m from a reference point such as a home, school, work place, market, etc. Additional criteria for defining public transport that is convenient include:

- a. Public transport accessible to all special- needs customers, including those who are physically, visually, and/or hearing- impaired, as well as those with temporary disabilities, the elderly, children and other people in vulnerable situations.
- b. Public transport with frequent service during peak travel times
- c. Stops present a safe and comfortable station environment

The indicator 3 requires an estimate of how many inhabitants are living within 500-meter buffer zones

around stations and bus stops with a 6 minutes or more frequent scheduled service interval. The minimum and maximum values for this indicator are 20 and 100 percent respectively (Table 2-7).

The data used for the indicator involve the GIS data for bus locations and population. To arrive at the indicator, buffer zone map within 500 m is prepared in ArcGIS.

Overlapping number of population and households within the 420 -5000 m buffer zone from the operating bus stations were estimated (Figure 2-3, Figure 2-5, Table 2-7 and Table 2-8). Overlapping number of population and households within the 500 m buffer zone from the operating bus stations were estimated (Figure 2-6, Table 2-7). SUTI -3 value is 85.12, which indicates 85.12 percent of the total population has convenient access to public transport services within 500 m buffer zone or approximately 6 min distance zone from the operating bus stations.



Figure 2-3. At Bus Station, 2018
Source: N News

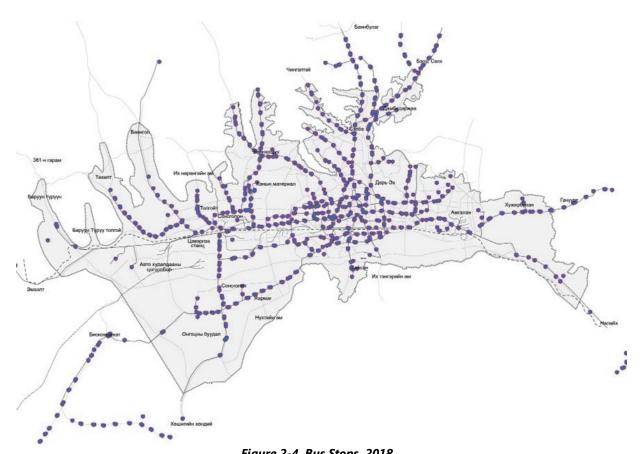


Figure 2-4. Bus Stops, 2018
Source: Public Transport Department of Ulaanbaatar

Table 2-8. Number of Bus Stops, 2015-2018-

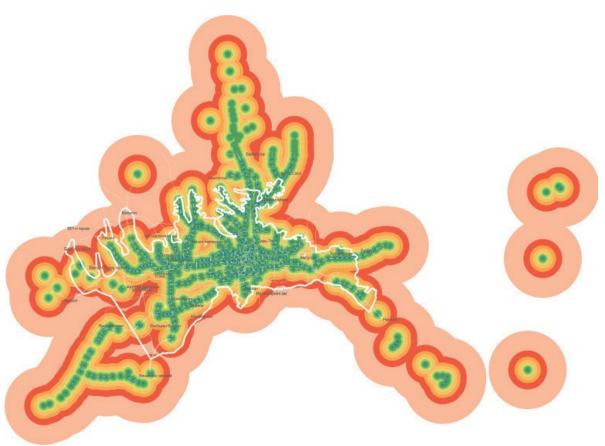
Districts	2015		2016			2017			2018			
	Total	F.S.	I.S.									
Han-Uul	59	9	50	59	9	50	187	9	178	189	9	180
Bayanzurh	190	19	171	189	19	170	209	13	196	216	13	203
Bayangol	76	3	73	76	3	73	51	2	49	52	2	50
Suhbaatar	130	7	123	120	5	115	183	7	176	184	7	177
Chingeltey	103	6	97	72	6	66	83	6	77	87	6	81
Songinohayrhan	195	25	170	195	25	170	216	18	198	218	18	200
Total	753	69	684	711	67	644	931	57	874	946	57	889

Note: F.S. - Final stops, I.S. -Intermediate Stops

Data Source: Public Transportation Department

Table 2-9. Access to Public Transport

Distance from Bus Station, m	Walking minutes	Area, km²	Number of Households within the Area	Number of People Living in the Area	Population Density, inch/ km²	Percentage of the population access to public transport
420	5 min	206.47	280,297	1,069,358	5,179.3	79.40%
500	6 min	249.16	301,007	1,147,289	4,604.7	85.10%
670	5-8 min	126.26	46,564	174,532	1,382.3	13.00%
830	8-10 min	74.18	12,529	47,697	643	3.50%
1250	10-15 min	184.33	12,288	47,004	255	3.50%
1670	15-20 min	168.98	3,299	12,107	71.6	0.90%
2500	20-30 min	301.94	1,447	5,065	16.8	0.40%
5000	30-60 min	829.63	736	1,986	2.4	0.10%



**Figure 2-5. Multi-Level Buffer Zone from Bus Stops, 2018**Source: Asian Infrastructure Research Institute

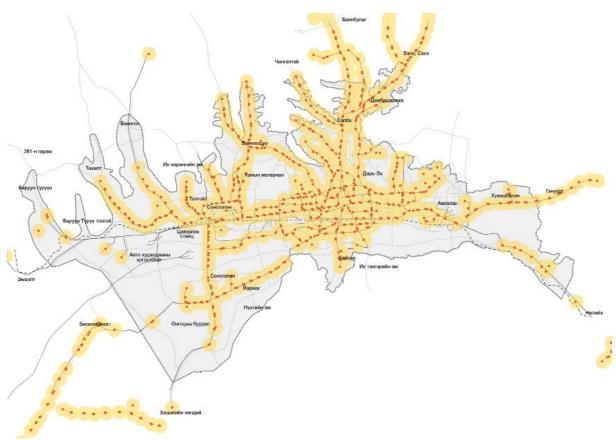


Figure 2-6. Buffer Zone within 500m from Bus Stops, 2018
Source: Asian Infrastructure Research Institute

Table 2-10. Score Card for Indicator 4

Number of Operating Bus Stops	Coverage area within a radius of 500m, km <sup>2</sup>			Population Density, inch/ km²	Number of Inhabitants		
946	249.16			4,604.7	1,147,289		
	1,347,598						
Per	Percentage within 500 m buffer						
Indicator	Indicator Value Year Commer						
Convenient access to public transport services	85.14	2018	Data is based on the population data from National Statistics  Office in areas within 500 m of nodes and the bus stops data from the Public Transport Department of the Capital City.				

Data Source: Public Transportation Department of Ulaanbaatar and National Statistical office of Mongolia

### 2.2.4 INDICATOR-4: Public transport quality and reliability

### Descriptions, Data Collection Approach, Procedure and Data Source.

The indicator 4 analyses public transport and reliability. Descriptions, data collection approach and procedure and data source and its information for indicator 3 that are shown in from Table 2-10. Service quality, customer satisfaction and reliability of public transport

operations have a key role in attracting new passengers from private cars to the public transport as well as improvement of quality services. Reliability is an important quality characteristic in urban public transport. Both passengers and operators benefit from enhanced service reliability by decreased and predictable travel times, and by lower operating costs, respectively.

Table 2-11. Descriptions, Data Collection Approach, Procedure and Data Source of Indicator 4
According to Expected Required Effort

Indicators	Descriptions and Definitions
Indicator 4	Public transport quality and reliability
	This indicator is based on measuring the satisfaction of public transport users with the quality
	and reliability of public transport service. Any existing survey results may need to be updated,
Description	adjusted or re-interpreted to match the format defined in this guidance. If no survey exists, a
	basic survey has to be prepared and conducted within a short time. This involves some practical
	survey work
	The indicator is relevant in support of SDG target 11.2 "By 2030, provide access to safe,
	affordable, accessible and sustainable transport systems for all" and SDG target 9.1 "Develop
	quality, reliable, sustainable and resilient infrastructure".
	Providing high quality service in urban public transport (PT) is essential for attracting passengers
	and limiting individual motorized transport in the long term. High share in public transport
Relevance	modes supports urban sustainability including the economy.
Relevance	Both objective and subjective indicators can be used to measure PT quality and reliability. The
	user's positive subjective experience of the service is critical for people's desire to choose public
	transport. Monitoring the subjective user satisfaction is therefore becoming a widespread
	approach among urban public transport companies in the world using satisfaction surveys.
	Reliability and predictability are important aspects of the perceived quality of the public
	transport system.
Definition	The degree to which passengers of the public transport system are satisfied with the quality of
Deminion	service while using the different modes of public transport
Unit	Overall share of satisfied customers as percentage of all public transport users (%) based on a
Offic	survey.
Min and Max	30% is the expected minimum, 95% the expected maximum
values	
	To derive the indicator 4, the data were used from the Public Transport User Satisfaction Survey
	which is conducted by Asian Infrastructure Research Institute and Mongolian University of
Ulaanbaatar	Science and Technology. In the user satisfaction survey, the 8 specific dimensions specified in
	the SUTI were considered: frequency of the service, punctuality (delay), comfort and cleanliness
	of buses, safety of vehicle and driving, convenience of stops/stations, availability of information,
	personnel courtesy, and fare level. 383 people participated in the survey and provided a scale

of 7 included either satisfied or dissatisfied to the 8 dimensions specified in the SUTI-4. A sample of 383 public transport users were conducted with 59.4% of women, 58.1% of 25-34 age group composition. All age groups were tried to incorporate within the sample. The survey with proportionate samples were conducted at major boarding bus stations. The time of survey were at peak hours of 8-1 am and 5-8 pm, 40% of off-peak hour samples were also included. The survey was done at both station and on board.

	,							
	Dimension	Dissatisfied	Neutral	Satisfied	Responses	Percentage of satisfaction		
	Frequency of the service	66	86	230	382	60.21%		
	Punctuality (delay)	99	89	194	382	50.79%		
	Comfort and cleanliness of vehicles	94	79	210	383	54.83%		
Data source for Ulaanbaatar	Safety of vehicles	129	65	189	383	49.35%		
	Convenience of stops/stations	46	98	238	382	62.30%		
	Availability of information	132	67	183	382	47.91%		
	Personnel courtesy	135	65	181	381	47.51%		
	Fare level	38	68	277	383	72.32%		
	Total Responses	739	617	1,702	3,058	55.66%		
Year of data		2017						
Evaluation Procedure	Estimated modal share for commuting (work and education) travel purposes only.							

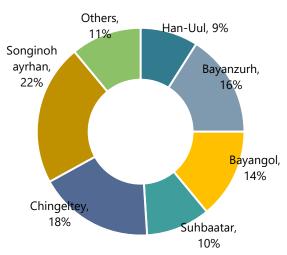
Source for terms and definitions: SUTI Data Collection Guideline of UNESCAP

#### Data Analysis.

Indicator 4 measures the degree to which passengers of the public transport system are satisfied with the quality of service while using the different modes of public transport.

Although Public Transport Department of Ulaanbaatar have some survey results for complains of public transport services, it did not conduct surveys for reliability and quality of services. In order to modernize and evaluate the public transport services, the department should be conduct survey in every year. Because of the lack of data availability, small sized Public Transport User Satisfaction Survey was conducted accordance with SUTI Data Collection Guideline.

Sample size of the survey was 383 people, of which 22% of the participants were residents of Songinohayrhan with the highest rate and the lowest rate being 9% from Han-Uul district. Nevertheless, 11% were from other provinces (Figure 2-7). As shown in Figure 2-8, 9% of the participants were children, 20.0% were 18- 24 age group, 75.5% were working age range (among them 26.1% of the total participants were 25-34 age group), 15.5% were seniors with above 60 age range. Figure 2-9 and 2-10 show survey participants by education level and passenger types respectively. Based on the survey results, 49.05% of the participants were satisfied, 21.23% were neutral and 29.7% were dissatisfied for urban public transport reliability and quality services.



**Figure 2-7. Survey Participants by Districts**Data Source: Asian Infrastructure Research Institute

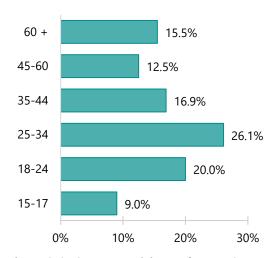


Figure 2-8. Survey Participants by Age Group
Data Source: Asian Infrastructure Research Institute

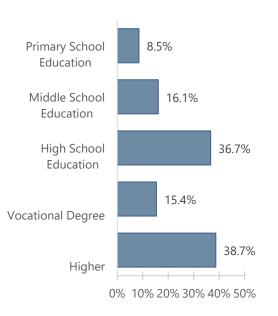


Figure 2-9. Survey Participants by Education Level

Data Source: Asian Infrastructure Research Institute

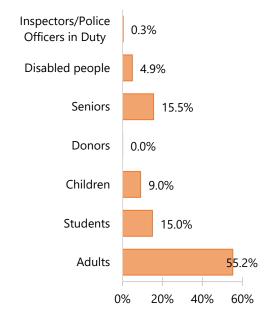


Figure 2-10. Survey Participants by Passenger Types

Data Source: Asian Infrastructure Research Institute

	D:		٠ ما			٠	J				
Variables	Dissatisfied		Neutral S	atisfied	1	RESP	AV	Satis-	Dissatis-		
	Very		Partly		Very		Partly		Score	faction	faction
Dimension	1	2	3	4	5	6	7				
Frequency of the service	7	13	46	86	142	80	8	382	4.61	60.21%	17.3%
Punctuality (delay)*	11	16	72	89	121	48	25	382	4.41	50.79%	25.9%
Comfort and cleanliness of vehicles	9	24	61	79	133	59	18	383	4.44	54.83%	24.5%
Safety of vehicles	24	37	68	65	111	63	15	383	4.18	49.35%	33.7%
Convenience of stops/stations	7	18	21	98	118	110	10	382	4.76	62.30%	12.0%
Availability of information	20	50	62	67	139	33	11	382	9.74	47.91%	34.6%
Personnel courtesy	34	43	58	65	110	53	18	381	4.06	47.51%	35.4%
Fare level	2	4	32	68	111	101	65	383	5.21	72.32%	9.9%
TOTAL	114	205	420	617	985	547	170	3058	4.46	55.65%	24.2%
Indicator			Value		Year		Comments				
Public transport quality and reliability			55.6	5%	2	019	Based		action surve n bus lines.	y on three	

Table 2-12. Score Card for Indicator 4

### 2.2.5 INDICATOR-5: Traffic fatalities per 100.000 inhabitants

### Descriptions, Data Collection Approach, Procedure and Data Source.

The indicator 5 analyses traffic safety of the road. Descriptions, data collection approach and procedure and data source and its information for indicator 5 that are shown in from Table 2-13.

Indicator 5 measures Fatalities in traffic (road, rail, etc.) in the urban areas per 100000 inhabitants. As defined by the WHO, a death counts as related to a traffic accident if it occurs within 30 days after the accident. The strategic objective of Mongolian National Road Safety Program 2012-2020 was to reduce the road

traffic deaths and injuries by more than 50 percent in 2012-2020 through taking actions in the following areas including road safety management, safer road design, safer vehicles, safer road users and post-crash care. This program aims to reduce the negative impacts of road traffic accidents by ensuring the development of inter-sectoral cooperation and integrating the security of People-Vehicle- Road-Environment system. It identifies 20 indicators for its implementation. By the end of 2018, the implementation percentage of the total indicators were 54% (Ministry of Road and Transport Development of Mongolia, 2018).

Table 2-13. Descriptions, Data Collection Approach, Procedure and Data Source of Indicator 5
According to Expected Required Effort

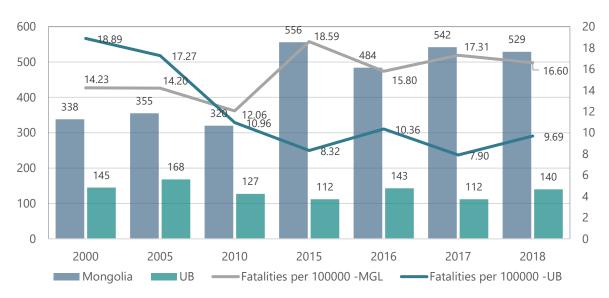
Indicators	Descriptions and Definitions					
Indicator 5	Traffic fatalities per 100.000 inhabitants					
Description	Traffic fatality numbers can usually be found in official statistics or police records. Limited effort.					
	Traffic accidents are a leading	cause of death among younger population groups in some				
	countries and are therefore a critical element in public health. The number of fatalities also					
Relevance	indirectly indicates the (far more	frequently occurring) injuries, as well as substantial health and				
Relevance	material costs. Almost half of all	traffic fatalities occur in cities. The indicator 5 is the same as				
	the main one adopted for mon	itoring SDG target 3.6 'By 2020, halve the number of global				
	deaths and injuries from road tra	affic accidents.				
Definition	Fatalities in traffic (road; rail, etc.	) in the urban areas per 100.000 inhabitants. As defined by the				
Delinition	WHO, a death counts as related t	to a traffic accident if it occurs within 30 days after the accident.				
Unit	Number of persons killed per 100,000 inhabitants					
	The minimum level is set to 35 fa	atal accidents per year while the max is 0 per year.				
Min and Max	While zero may not seem as an	immediately realistic level to achieve, it is increasingly used as				
values	a long-term goal among transp	ort authorities around the world and therefore a meaningful				
	lower yardstick.					
	The responsibility of gathering	g the accident related data vests in the Transport Police				
	Department, Ulaanbaatar city. Th	ne accident data is retrieved from the annual bulletin prepared				
Ulaanbaatar	by the transport police departme	ent. Based on the accident data which involves the minor, major				
	accidents and fatal accident data	a, the fatality data for the latest year 2018 was retrieved to find				
	the fatalities per lakh population.					
Data source	Variables	Quantity				
for	Fatalities	140				
Ulaanbaatar	Total Population 1,444,669					
Year of data	2018					
Evaluation Procedure	Estimated modal share for commuting (work and education) travel purposes only.					

Source for terms and definitions: SUTI Data Collection Guideline of UNESCAP

#### Data Analysis.

According to the Traffic Police Department of Ulaanbaatar, in 2018 a total of 529 people, including 73 children with 0-19 age range, died as a result of traffic accidents in Mongolia. Of which 140 traffic fatalities were recorded in Ulaanbaatar, which means 9.68 deaths/100000 population (Figure 2-11). Based on traffic accident data, in 2018, 28.2% of the fatal accident occur due to careless driving, 26.6% were due to drunken driving, 18.5 % were due to over speeding, and

26.7% were due to other causes in Mongolia (Figure 2-12). According to the WHO data published in 2017 Road Traffic Accidents Deaths in Mongolia reached 616 or 3.29% of total deaths. The age adjusted death rate is 20.89 per 100,000 of population ranks Mongolia #75 in the world. Death rate from road traffic accident in Ulaanbaatar, per 100,000 inhabitants per year, SUTI-5, was 7.9 in 2018 (Table 2-14).



**Figure 2-11. Number of Traffic Fatalities, 2000-2018**Data Source: Traffic Police Department

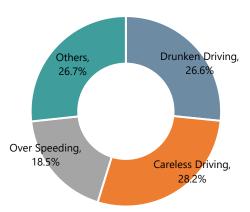


Figure 2-12. Traffic Fatalities by Reasons in Mongolia, 2018

Data Source: Traffic Police Department

Varia	bles	Dissatisfied		
Road tra	ansport	140		
Railway t	ranspor	t		
Tra	ım			
Ferryl	ooats			
Oth	ner			
TO	AL	140		
Inhab	itants	1,444,669		
Fatalities / 1	00000 ii	nch	9.69	
Indicator	Value	Year	Comments	
Traffic			Based on official	
fatalities per			statistics from Traffic	
100000	9.7	2018	Police Department and	
inhabitants			National Statistics	
iiiiabitaiits			Office of Mongolia.	

Table 2-14. Score Card for Indicator 5

### 2.2.6 INDICATOR-6: Affordability-travel costs as share of income

### Descriptions, Data Collection Approach, Procedure and Data Source.

The indicator 6 analyses Affordability – travel costs as share of income. Descriptions, data collection approach and procedure and data source and its information for

indicator6 that are shown in from Table 2-15. This indicator should determine whether public transport is too expensive in a given city and therefore that should be done about it. What is considered "affordable"? SUTI-6 defines that if affordability index is less than 35% of the minimum standard of living of the city.

Table 2-15. Descriptions, Data Collection Approach, Procedure and Data Source of Indicator 6
According to Expected Required Effort

Indicators	Descriptions and Definitions						
Indicator 6	Affordability – travel costs as share of income						
Description	The indicator needs data on costs for a monthly pass or similar to t	the PT network as well as					
Description	statistical data on income for segments of the population. At best it r	equires limited effort					
	Transport costs represent a significant share of the household budget, especially for low income						
	households. High travel costs can also increase the costs of labor to	business. Affordability is a					
Relevance	commonly recognized feature of a sustainable transport system. The	indicator will be helpful in					
	support of the SDG target 11.2 "By 2030, provide access to safe, a	affordable, accessible and					
	sustainable transport systems for all".						
Definition	Cost of a monthly network-wide public transport ticket covering al	I main modes in the city,					
Bennicion	compared to mean monthly income for the poorest quartile of the po	opulation of the city.					
Unit	Percentage of monthly income for the poorest quartile of the population of the city.						
Min and Max	The minimum (worst) value is 35 percent of income to uses public transport. The maximum						
values	(best) value is 3.5 percent						
	The indicator 6 involves the collection of two data: 1. Costs of using public transport, 2. Average						
	Monthly income of the poorest quartile of the population. The cost of using public transport						
	was retrieved from the number of ridership, monthly fare revenue of public transport operating						
	companies and ticket prices. It was then estimated monthly cost for	public transportation per					
Ulaanbaatar	person based on ridership types.						
The monthly income data is retrieved from the minimum substance level of pop							
	capita per month from the National Statistics Office of Mongolia.	It is to give the average					
	monthly income of the poorest quartile of the population. The rati	o of the public transport					
	monthly cost to the average monthly income of the poorest quartile	of the population give the					
	result for the indicator 6.						
Data source	Factors	Amount /USD/					
for	Monthly Cost per Adult for Public Transport	15.58					
Ulaanbaatar	Minimum Subsistence Level of Population, per capita per month	74.10					
Year of data	2017						
Evaluation Procedure	Estimated affordability – travel costs as share of income						

Source for terms and definitions: SUTI Data Collection Guideline of UNESCAP

### Data Analysis.

Indicator 6 measures cost of a monthly network-wide public transport ticket covering all main modes in the

city, compared to mean monthly income for the poorest quartile of the population of the city.

Ulaanbaatar, as in cities of many other developing countries, the affordability of public transport to a three particular social groups with limited financial resources, students, retired people, and disability people has received special attention with free ridership, rather than the affordability to the poor as a social group or to the working poor. Moreover, donors and inspectors and/or police officers in duty ride free for public

transport. Public Transport Fare for children is kept low. Promotional discount cards are available. Estimated the costs of using public transport using the ridership of public transport bus data by passenger's type, fare revenue, fare price and the average monthly income of the poorest part of the population. Estimation details are described in the head of tables (from Table 2-16 to Table 2-18).

The SUTI-6 for Ulaanbaatar is 21.10, which means public transport is quite affordable (Table 2-19).



Figure 2-13. U Money Payment System in Public Transport Bus, 2018

Table 2-16. Public Transport Ridership /thous. passengers/ and Fare Revenue /thous. MNT/, 2018

	Total		:	Ridersh promotic	Ridership with promotional card*			Free Ridership	ship		Total Fare Revenue, MNT
Month	Ridership	Adults	Children	Adults	Children	Students	Donors	Seniors	Disabilities	Police Officers in Duty	
Jan	14,037.15	7,800.28	2,011.39	338.17	76.17	0.21	7.41	2,643.07	1,103.58	56.88	3,609,784.70
Feb	12,768.61	6,039.50	1,987.12	270.86	111.12	1,061.42	6.48	2,308.88	940.44	42.79	2,898,706.40
Mar	16,962.10	8,092.37	2,629.65	391.6	157.2	1,274.77	7.93	3,112.26	1,239.83	5.95	3,858,626.50
Apr	17,112.72	8,063.23	2,611.69	417.16	161.1	1,271.46	7.62	3,262.77	1,262.57	55.13	3,833,536.20
May	17,655.12	8,408.52	2,520.25	462.52	168.08	1,231.13	2.72	3,483.50	1,319.48	58.93	3,972,418.20
Jun	14,030.84	7,059.13	1,722.85	329.46	82.08	739.98	5.89	2,913.24	1,130.82	47.38	3,259,985.30
luſ	11,514.41	6,246.06	1,347.54	271.97	43.49	0.05	6.44	2,546.75	1,013.84	38.27	2,840,567.70
Aug	14,134.16	7,789.22	1,851.72	333.36	49.15	ı	7.68	2,906.25	1,154.47	42.3	3,596,440.80
Sep	15,977.14	8,142.07	2,719.65	405.35	105.82	349.3	7.38	3,066.43	1,142.94	38.22	3,937,022.40
Oct	17,130.76	8,273.22	2,597.82	463.61	124.57	1,009.31	8.17	3,382.53	1,225.14	46.4	3,955,253.70
Nov	15,423.26	7,281.11	2,222.94	427.39	109.86	1,161.88	8	3,045.08	1,122.13	44.88	3,453,446.20
Dec	14,223.34	6,615.04	1,977.95	402.43	106.77	1,176.16	7.94	2,828.78	1,073.22	35.08	3,129,421.80
Total	180,969.61	89,809.73	26,200.56	4,513.86	1,295.41	9,275.67	83.66	35,499.54	13,728.44	562.75	42,345,209.90
Atores * Adores	is also the in the second seco	tion law and bush	al danahin ha								

Note: \* Monthly promotional card for unlimited ridership

Price: Adult 25,000 MNT, Child 8000MNT per month

Source: Public Transportation Department of Ulaanbaatar

Table 2-17. Public Transport Fare Paid Ridership /thous. passengers/ and Fare Revenue /thous. MNT/, 2018

			Lico (2007)	Ridership with promotional	promotional	Revenue fro	Revenue from Promotional Card, MNT	I Card, MNT	Revenue from	
Month	Total	Kidersnip Keg	Kiderstiip Kegular Fare Pald	card*	*p.	Adults	Children	Total	Regular Fare	Total Fare
		Adults	Children	Adults	Children	/5*25000/	/0008*9/	/4+8/	/11-9/	, , , , , , , , , , , , , , , , , , ,
_	2	3	4	5	9	7	8	6	10	11
Jan	14,037.15	7,800.28	2,011.39	338.17	76.17	8,454.30	609.37	9,063.67	3,600,721.03	3,609,784.70
Feb	12,768.61	6,039.50	1,987.12	270.86	111.12	6,771.38	988.96	7,660.34	2,891,046.07	2,898,706.40
Mar	16,962.10	8,092.37	2,629.65	391.6	157.2	9,790.05	1,257.59	11,047.64	3,847,578.86	3,858,626.50
Apr	17,112.72	8,063.23	2,611.69	417.16	161.1	10,428.88	1,288.76	11,717.64	3,821,818.57	3,833,536.20
Мау	17,655.12	8,408.52	2,520.25	462.52	168.08	11,562.95	1,344.62	12,907.57	3,959,510.63	3,972,418.20
Jun	14,030.84	7,059.13	1,722.85	329.46	82.08	8,236.53	99.959	8,893.19	3,251,092.11	3,259,985.30
Jul	11,514.41	6,246.06	1,347.54	271.97	43.49	6,799.25	347.95	7,147.20	2,833,420.50	2,840,567.70
Aug	14,134.16	7,789.22	1,851.72	333.36	49.15	8,334.03	393.23	8,727.26	3,587,713.54	3,596,440.80
Sep	15,977.14	8,142.07	2,719.65	405.35	105.82	10,133.75	846.59	10,980.34	3,926,042.06	3,937,022.40
Oct	17,130.76	8,273.22	2,597.82	463.61	124.57	11,590.23	996.54	12,586.77	3,942,666.93	3,955,253.70
Nov	15,423.26	7,281.11	2,222.94	427.39	109.86	10,684.63	878.86	11,563.48	3,441,882.72	3,453,446.20
Dec	14,223.34	6,615.04	1,977.95	402.43	106.77	10,060.65	854.13	10,914.78	3,118,507.02	3,129,421.80
Total	180,969.61	89,809.73	26,200.56	4,513.86	1,295.41	112,846.60	10,363.27	123,209.87	42,222,000.03	42,345,209.90
N/oto	Acreto L. march	and a second sec	١-	00 10 17 7	JOO FILAD LIVE C	At a con TIMPACCOO PIND TIMPACCOOTC TIMPA COOTC	7:			

Note: \* Monthly promotional card for unlimited ridership Price: Adult 25,000 MNT, Child 8000MNT per month

Source: Public Transportation Department of Ulaanbaatar

Table 2-18. Public Transport Fare Paid Ridership /thous. passengers/ and Fare Revenue /thous. MNT/, 2018

Month	Total Number of Adult Passengers Who Regular Fare	Total Regular Fare revenue	Cost per Ride for Regular Transport Fare	Monthly Cost with Regular Fare per Person	Promotional Fare Paid Adult	Monthly Cost for Promotional Fare per Person	Weighted Monthly Cost for PT per person
	/thous.people/	/thous.MNT/	/MNT/	/MNT/	/thous.people/	/MNT/	/MNT/
				/3:5/		/25,000+8,000/	/(4*5+6*7):(2+6)/
_	2	3	4	5	9	7	80
Jan	7,800.28	3,600,721.03	461.61	41,545.30	338.17	33,000.00	41,190.22
Feb	6,039.50	2,891,046.07	478.69	43,082.07	270.86	33,000.00	42,649.33
Mar	8,092.37	3,847,578.86	475.46	42,791.19	391.6	33,000.00	42,339.25
Apr	8,063.23	3,821,818.57	473.98	42,658.30	417.16	33,000.00	42,183.20
Мау	8,408.52	3,959,510.63	470.89	42,380.36	462.52	33,000.00	41,891.29
Jun	7,059.13	3,251,092.11	460.55	41,449.61	329.46	33,000.00	41,072.84
Jul	6,246.06	2,833,420.50	453.63	40,827.00	271.97	33,000.00	40,500.41
Aug	7,789.22	3,587,713.54	460.6	41,454.01	333.36	33,000.00	41,107.04
Sep	8,142.07	3,926,042.06	482.19	43,397.32	405.35	33,000.00	42,904.24
Oct	8,273.22	3,942,666.93	476.56	42,890.19	463.61	33,000.00	42,365.38
Nov	7,281.11	3,441,882.72	472.71	42,544.27	427.39	33,000.00	42,015.11
Dec	6,615.04	3,118,507.02	471.43	42,428.44	402.43	33,000.00	41,887.76
Annual	89,809.73	42,222,000.03	470.13	42,311.45	4,513.86	33,000.00	41,842.17
Accimation	24:02:						

Assumptions:

Source: Public Transportation Department of Ulaanbaatar

<sup>\*</sup> Adults pay the public transport fare both own and children.

<sup>\*\*</sup> Average daily ride for public transport is 3 times. Monthly cost with regular fare =  $\cos t$  per ride\*3\*30 days

<sup>\*\*\*</sup> Monthly cost per promotional fare adult is 33000MNT =25000MNT per adult +8000 MNT per child

<sup>\*\*\*\*</sup>Weighted average of monthly cost per person with regular fare and promotional fare.

Table 2-19	Seems Care	d for Indicator	_
1 ania /- 14	SCORELAN	a tor indicator i	_

Variable	Value/MNT/	Value /USD/ (1 USD=2686 MNT)
		(1 03D=2000 MINT)
Monthly Cost per Adult for Public Transport	41 042 17	15.50
(Bus & Trolleybus) /MNT/	41,842.17	15.58
Minimum Subsistence Level of Population, per capita per month	198,600	74.1
Affordability - costs as share of income	21.10%	21.10%
Indicator	Value	Year
Affordability-costs as share of income	21.10	2018



Figure 2-14. Promoting Sustainable Urban Development, 2018
Data Source: UNESCAP

# 2.2.7 INDICATOR-7: Operational costs of the public transport system

# Descriptions, Data Collection Approach, Procedure and Data Source.

The indicator 7 analyses operational costs of the public transport system. Descriptions, data collection approach and procedure and data source and its information for indicator 7 that are shown in from Table 2-20.

Transport costs and revenue are monetary measures of what the public transport agency incurs for providing transportation services. In order to promote public transport use in Ulaanbaatar, it is tried to maintain low fares, in spite of fare subsidies being provided to public transport operating companies. There 18 companies run urban bus, trolleybus services, of which 2 companies are state-owned enterprises.

Table 2-20. Descriptions, Data Collection Approach, Procedure and Data Source of Indicator 7
According to Expected Required Effort

Indicators	Descriptions and Definitions	
Indicator 7	Operational costs of the public transport system	
Description	This needs to be derived from the accounting reports and It may be necessary for some cities to consult Public individual operators to request the data, which will require	Transport Authority or company or
Relevance	The operational costs of the public transport system are provide affordable, efficient and competitive transport operational costs are compared to the revenue generate sustainability of the public transport service.  The indicator relates to SDG target 11.2 "By 2030, provide and sustainable transport systems for all".	re critical for the ability of a city to ort services. In this indicator the ed from fares to reflect the financial
Definition	Ratio of fare revenue to operating costs for public transp	ort systems ('Fare box ratio')
Unit	Percentage of operational costs recovered by fares	
Min and Max values	Min value is that only 22% of cost is recovered. Max is r (more than 100% and above) reflects a good financial sur to 22%, indicates financial unsustainable with a need for central government.	stainability. Very low numbers, close
Ulaanbaatar	The data to derive the indicator 7 require the data of fare transport system thereby to calculate the fare box recovers of 18 different public transport operators were reto Department of Ulaanbaatar. The fare revenue consists of the difference of cost and income. Market shares of the boridership and fare revenue from the Public Transport Department.	ery ratio. The revenue and expenses rieved from the Public Transport fare revenue and reimbursement on us services are based on the data for
Data source	Factors	Amount /mln.USD/
for	Fare box revenues	32.96
Ulaanbaatar	Operating expenses	41.51
Year of data	2018	
Evaluation Procedure	Estimated operational costs of the public transport system	m.

Source for terms and definitions: SUTI Data Collection Guideline of UNESCAP

### Data Analysis.

Indicator 7 measures ratio of fare revenue to operating costs for public transport systems. Information on revenue and cost of public transport bus operation companies are derived from their annual balance sheets data. In the case of public transport operation in 2018, operators' revenue can be derived from the following sources: 37% are from fare revenue, 40% are from reimbursement of the difference between cost and revenue, 23% are subsidies from the Municipal

Budget (Figure 1-77). Income and expenditures of public bus operating companies are shown in Table 2-21. Market shares of public bus operating companies are estimated based the ridership and revenue data. SUTI-7 is estimated as 80.38% based on market share,

revenue and expenditure data, which means public bus operating companies do not have massive financial

losses to operating public transportation services (Table 2-22).



Figure 2-15. Riding Public Transport Bus, 2018



Figure 2-16. At Bus Station, 2018

Table 2-21 Income and Expenditures of Public Bus Operating Companies

				Revenue			Expenses	
OI Z	Name of Companies	Total Revenue	Fare Revenue	Subsidies	Reimbursement on the difference of cost & income	Total	Transportation Costs	Other operating costs
		/mln. MNT/	/mln. MNT/	/mln. MNT/	/mln. MNT/	/mln. MNT/	/mln. MNT/	/mln. MNT/
_	ZTN	37,340.64	11,761.88	7,975.05	16,733.26	43,870.79	36,492.97	7,377.82
2	Gbus	1,929.57	596.78	392.22	787.22	2,044.63	1,889.53	155.1
c	Myaralzaa	4,270.47	1,575.37	746.68	1,890.23	3,629.14	2,546.68	1,082.46
4	S&A	1,126.72	228.18	151.64	746.9	1,172.40	898.55	273.85
2	Autobus Negdel	2,682.77	82.696	804.57	905.77	2,727.60	2,591.72	135.89
9	ErdemT rans	20,089.84	7,363.17	4,078.37	8,648.30	19,752.52	16,177.58	3,574.95
7	Trans bus	4,418.55	1,342.75	1,022.29	1,767.78	4,499.26	4,021.09	478.17
∞	Emsid	4,578.83	1,407.92	1,124.22	1,646.21	4,577.94	4,070.38	507.56
6	Auto Terminal	3,428.93	1,090.76	729.66	1,404.87	3,423.96	2,856.85	567.11
10	Blue bus	3,960.00	1,339.20	1,045.18	1,339.43	4,090.73	3,875.70	215.03
=	Sutain Buyant	8,346.78	2,636.43	5,475.68	1	8,298.04	7,128.67	1,169.37
12	Dyuts	1,694.28	539.38	335.49	818.74	1,806.55	1,683.14	123.41
13	AzS ervice	558.54	207.26	351.29	1	564.16	519.68	44.48
7	Saikhan Ireedui	1,793.62	570.86	502.4	720.36	2,022.60	1,766.61	255.99
15	Zorchigch Teever-III	3,388.35	704.42	587.62	1,778.75	4,295.80	3,487.69	808.11
16	Atibus	6,528.71	1,515.43	1,016.94	1,971.05	7,001.00	5,975.99	1,025.01
17	Tenuun-Ogoo	16,737.03	4,838.07	3,388.10	6,005.00	17,662.74	13,154.66	4,508.08
18	Tenuun-Ogoo 3	3,522.51	1,128.07	832.74	1,561.70	3,818.07	2,361.73	1,456.34
	TOTAL	126,396.13	39,815.70	30,560.12	48,725.57	135,257.94	111,499.22	23,758.71
			Course: Dublic T	Cacitottograph	Cource: Dublic Transportation Department of Illoanbaatar			

Source: Public Transportation Department of Ulaanbaatar

Table 2-22. Score Card for Indicator 7

Name of Companies	Market Share, %	Fare Revenue Reimbursement,m In. MNT	Transportation Costs, mln.MNT	Revenue Cost Ratio (FR+Reim)/TC	Fare Box Ratio,
1. ZTN	22.94%	28,495.14	36,492.97	0.7808	17.91
2. Gbus	1.31%	1,384.00	1,889.53	0.7325	0.96
3. Myaralzaa	2.59%	3,465.60	2,546.68	1.3608	3.53
4. S & A	1.47%	975.08	898.55	1.0852	1.60
5. Autobus Negdel	2.38%	1,875.55	2,591.72	0.7237	1.72
6. Erdem Trans	17.69%	16,011.47	16,177.58	0.9897	17.51
7. Transbus	4.08%	3,110.53	4,021.09	0.7736	3.16
8. Emsid	3.51%	3,054.13	4,070.38	0.7503	2.63
9. Auto Terminal	2.52%	2,495.63	2,856.85	0.8736	2.20
10. Bluebus	3.09%	2,678.63	3,875.70	0.6911	2.13
11. Sutain Buyant	6.57%	2,636.43	7,128.67	0.3698	2.43
12. Dyuts	2.41%	1,358.12	1,683.14	0.8069	1.95
13. Az Service	0.71%	207.26	519.68	0.3988	0.28
14. Saikhan Ireedui	1.22%	1,291.22	1,766.61	0.7309	0.89
15. ZorchigchTeever-III	8.61%	2,483.17	3,487.69	0.7120	6.13
16. Atibus	5.03%	3,486.48	5,975.99	0.5834	2.94
17. Tenuun-Ogoo	10.75%	10,843.07	13,154.66	0.8243	8.86
18. Tenuun-Ogoo 3	3.12%	2,689.77	2,361.73	1.1389	3.55
TOTAL		88,541.27	111,499.22		80.38
Indicator	Value	Year		Comments	
Operational costs of the public transport system	80.38%	2018		rom the Public Tr nent of the Capit	•

## 2.2.8 INDICATOR-8: Investment in public transportation systems

# Descriptions, Data Collection Approach, Procedure and Data Source.

The indicator 8 analyses Investment in public transportation systems. Descriptions, data collection approach and procedure and data source

and its information for indicator 8 that are shown in from Table 2-23. Investment in public transportation is crucial to improving the quality of life and economic vitality of our cities it creates jobs, provides access to jobs and supports jobs in many other industry sectors helping to stimulate economic growth.

Table 2-23. Descriptions, Data Collection Approach, Procedure and Data Source of Indicator 8
According to Expected Required Effort

Indicators	Descriptions and Definitions
Indicator 8	Investment in public transportation systems
	The indicator uses data on total transport sector investments and within that the investments in
Description	active and public transport systems. This needs to be derived from the accounting reports and
Description	data from local, provincial and national governments, and the private sector. This will require some
	effort.
	Investment in public transport is a relevant indicator to monitor efforts to promote sustainable
	urban mobility and to help shift passengers from individual to public modes. In general, it is
Relevance	considered more sustainable to direct investments towards public transport rather than only
	incremental extensions of the road network for individual transport. Relates to SDG target 11.2 "By
	2030, provide access to safe, affordable, accessible and sustainable transport systems for all".
	The share of all transport investments made in the city that is directed to public transport in the
	total transport investments.
	Public transport investments include investments in development of Scheduled bus and minibus
	services, BRT, train, metro and tram, ferry services. The investments on acquisition of fleet and
	development of infrastructure including ITS. This also includes investments on development of
Definition	pedestrian and NMT infrastructure. Other transport investments include investments in
Deminion	development of roads, bridges, flyovers and such other infrastructure serving mixed traffic. These
	investments may be from local, provincial or national government, private sector or through non-
	governmental organizations. The investments are likely to vary from year to year in a pattern that
	may be sensitive to the profile of individual projects. The value is therefore averaged over a period
	of five years. Only actual and not budgeted investments are to be taken into account while
	calculating the indicator.
Unit	Percentage of transport investment spending (running five-year average).
	Min value is 0 used for public transport; max value is 50%. The Min-Max is informed by data from
Min and	the UITP 'Millennium Cities Database' (UITP 2001). In this database values from 12 to 85% occur.
Max values	However, these are annual values that are likely to even out when observed as average over five
Triax values	years. In some years a city may dedicate more than 50% of all its transport investments to public
	transport but within a five-year average this would more rarely be the case.
	The data required for indicator 8 is the public transport investments in the respective city for the
	last 5 years. The public transport investments were retrieved from the budget documents of the
	Ulaanbaatar Municipality/Ulaanbaatar City Budget, whereby of the total transport investments and
Ulaanbaatar	the public transport investments were retrieved for the latest 5 years. The public transport
	investments from the municipality budget include expenditure on road pockets for public
	transport bus. The share of the public transport investments of the total investments specified in
	the budget give the result for the indicator 8.

Source for terms and definitions: SUTI Data Collection Guideline of UNESCAP

### Data Analysis.

Indicator 8 measures the share of all transport investment made in the city that is directed to public transport in the total transport investment. Although the investment in road and transport sector is quite high amount. There are almost no investments in public transport sector except construction of road pockets for

public transport bus stops (Figure 2-17, Figure 2-18). Bus operating companies receive subsidies and reimbursement for their operational cost and this accounts around 20 percent of the total current expenditure of the Capital City (Table 2-24).

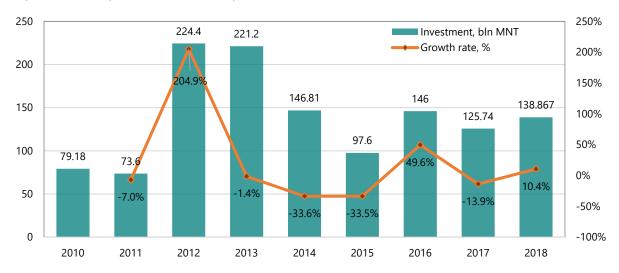


Figure 2-17. Road & Transport Investment by State and UB Local Government Budget of the Capital City, bln MNT, 2010-2018

Data Source: Statistics Department of Ulaanbaatar

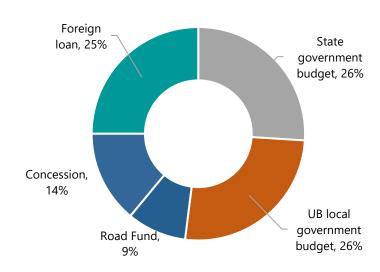


Figure 2-18. Road & Transport Investment by Investment Source, %, 2018
Data Source: Statistics Department of Ulaanbaatar

Table 2-24. Road and Transport Investment in Ulaanbaatar by expense type, 2013-2017.

Inv	estment Type	2013	2014	2015	2016	2017
D. d. L.	New construction	80.0	249.5	-	-	-
Bridge	Maintenance	591.7	-	492.6	470.0	1,000.0
D I	New construction	2,743.5	1,280.0	2,112.9	2,113.6	12,086.7
Road	Maintenance	1,467.6	15,613.1	12,944.9	24,836.0	10,311.5
	Road signs	960.0	1,314.8	1,735.9	1,991.3	2,479.7
Road dra	ainage maintenance	149.9	3,170.9	392.3	740.3	1,000.0
	or road pockets for public sport bus stops	-	208.0	90.0	292.3	300.0
	Parking	-	-	-	310.3	-
	Road patch	2,000.1	-	-	-	1,421.5
	Gravel road	47.5	-	-	-	-
Roa	adblocks works	811.4	-	-	-	650.5
Ro	oad pavement	1,168.5	-	-	-	-
Road c	drainage well filter	200.0	-	-	-	-
Underpass/	Underground crossing	80.0	305.1	-	-	-
Со	ntrol Cameras	-	-	2,015.7	-	997.4
	Others	5,140.6	1,996.1	1,375.7	1,522.5	2,875.6
	Total	15,440.9	24,137.7	21,160.0	32,276.2	33,122.9

Source: Public Transport Department of Ulaanbaatar

There are several initiatives for investing public transport system, including metro, BRT, Rubber- Tyred LRT, and cable car plans. However, none of these plans are become reality yet. There is a definitely urgent need for investing in mass transit system toward building

sustainable city. Perhaps, modern Tram-LRT system may be a solution. So far almost no investment for public transport system, therefore SUTI-8 is become 0.88% based on the road and transport investment in Ulaanbaatar data for 2013-2017 (Table 2-25).

Table 2-25. Score Card for Indicator 8

Variables	2014	2015	2016	2017	2018	Total	Average
Public Transport Facility /bln. MNT/ from	0.208	0.090	0.2922	0.300	0.600	1.4902	0.298
State & Local Budget							
Total Road & Transport Investment of the	146.0	97.0	146.0	125.74	134.867	649.61	
Capital City /bln. MNT/							
Total Road & Transport Investment of the						168.90	33.78
Capital City from State & Local Budget (26%							
of the total investment) /bln. MNT/							
SHARE OF TRANSPORT STATE & LOCAL							0.88
BUDGET INVESTMENT SPENDING							
Indicator	Value	Year			Commen	its	
Public Transport Investment	0.88%	2018	Bas	ed on UB	Local Gov	ernment l	Budget
				Spendir	ng Data In	formation	١.

## 2.2.9 INDICATOR-9: Air quality (PM 10)

**Descriptions, Data Collection Approach, Procedure and Data Source.** The indicator 9 analyses air quality of the city. Descriptions, data collection approach and procedure and data source and its information for

indicator 9 that are shown in from Table 2-26. Air quality remains one of the major environmental problems. Mongolia needs well- enforced air pollution legislation for cars, trucks, and diesel machines.

Table 2-26. Descriptions, Data Collection Approach, Procedure and Data Source of Indicator 9
According to Expected Required Effort

Indicators	Descriptions and Definitions
Indicator 9	Air quality (PM10)
Description	The indicator uses population weighted air quality monitoring data reported to national agency or WHO. May need conversion from PM2.5 data if PM10 not available. Should require limited effort.
Relevance	Air pollution including particulate matter (PM) poses health risks for humans. More than 80% of people living in urban areas that monitor air pollution are exposed to air quality levels that exceed the World Health Organization limit values. Particulate matter has been adopted by the United Nations Social and Economic Council and the UN Statistical Commission as indicator to monitor SDG 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'. Traffic is a major source of air pollution in cities causing significant health problems as well as impairing visibility and affecting ecosystems and agriculture. Motor vehicles are among the main contributors to PM pollution. The UN Habitat mentions PM concentrations as a useful indicator for estimating effects of sustainable transport policies in cities.
Definition	Annual mean levels of fine particulate matter (PM10) in the air (population weighted) compared to the health threshold. [for PM2.5 as alternative]
Unit	Micrograms per cubic meter (μg/m3).
Min and Max values	Min value (worst) is 150; max value (best) is 10 (for PM10)
Ulaanbaatar	<ul> <li>The data needed to derive the indicator 9 is the air quality information within the Ulaanbaatar city. In Ulaanbaatar, there are 12 air monitoring stations. The locations of air monitoring automatic stations are provided in GIS. PM10 monthly data for 2018 is collected by National Agency Metrology and the Environmental Monitoring. The values are averaged by estimate of population exposed per city area. The following procedure is used to estimate the result of indicator 9:</li> <li>Estimate yearly PM10 Index at each station.</li> <li>Estimate population percentage in each horoo area /the smallest administration unit of UB city/.</li> <li>Evaluate the interpolation at ArcGIS and create a PM 10 interpolation raster map.</li> <li>Evaluate the interpolation of population percentage data from horoo center and produce a population interpolation map.</li> <li>Multiply PM10 index and population maps and get result of the population weighted concentration of PM10.</li> <li>Estimate mean of population weighted air pollution (PM10) concentration and get Air Quality (PM10) SUTI Index</li> </ul>

	The PM10 values and the population covered	within its reach data were then weighted to						
	derive the result of indicator 9.							
	Mode	PM Annual Average						
	UB-Station 1	144						
	UB-Station 2	118						
	IUB-Station 3	173						
	UB-Station 4	124						
Data source	UB-Station 5	162						
for	UB-Station 6	108						
Ulaanbaatar	UB-Station 7	131						
	UB-Station 8	95						
	UB-Station 9	122						
	UB-Station 10	97						
	UB-Station 11	127						
	UB-Station 12	121						
Year of data	2018							
Comments	Data for monitoring stations managed by National	Agency Metrology and the Environmental						
Comments	Monitoring. The values are averaged by estimate of	Monitoring. The values are averaged by estimate of population exposed per city area.						

Source for terms and definitions: SUTI Data Collection Guideline of UNESCAP

## Data Analysis.

Air pollution is a major environmental risk to health. By reducing air pollution levels, countries can reduce the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma. Indicator 9 measures annual mean levels of fine particulate matter (PM10) in the air (population weighed) compared to the health threshold. Monthly PM10 measurements are collected

from 12 automatic air monitoring stations in Ulaanbaatar (Table 2-27). Figure 2-19 and Figure 2-20 show raster map for population percentage in each horoo (smallest administrative unit of Ulaanbaatar) and air pollution in Ulaanbaatar. SUTI-9, mean of population weighted air pollution (PM10) concentration is estimated as 97.8% using ArcGIS tools (Figure 2-21 and Table 2-28).

Table 2-27. PM10 by Air Monitoring Stations

Station Number	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	PM10 yearly
UB-1	144												144
UB-2	214	177	140	95	93	69	65	66	85	126	135	155	118
UB-3	398	316	136	105	132	73	34	43	55	113	236	426	172
UB-4	189	179	136	93	105	72	42	56	81	123	180	231	124
UB-5	346	216	140	120	143	93	57	73	102	158	207	284	162
UB-6	134	124	102	97	154	74	37	44	57	109	194	176	108
UB-7	228	184	139	123	154	0	0	0	92	161	244	248	131
UB-8	108	112	102	82	154	65	36	50	51	91	147	142	95
UB-9	160	136	102	112	154	83	38	37	63	127	240	210	122
UB-10	240	105	34	78	83	48	11	26	60	135	191	154	97
UB-11	198	177	117	106	106	68	38	49	71	128	229	232	127
UB-12	164	157	143	118	139	75	41	58	68	122	192	177	121

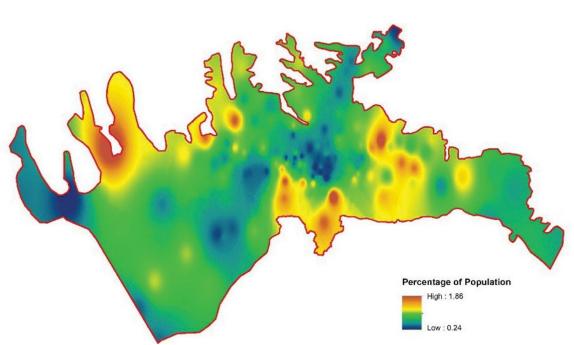
Source: National Agency Metrology

Data Source:

Percentage of Population

Low: 0.24

National Statistical Office of Mongolia



**Figure 2-20. Air Quality (PM10)** Data Source: National Agency Metrology

Population weighted Concentration
Air Quality Index (PM10)

Population weighted Concentration
Air Quality index (PM10)

High: 234.2

Mean: 97.8

Low: 29.3

Data Source: National Agency Metrology

Table 2-28. Score Card for Indicator 9

Indicator	Value	Year	Comments
Air Quality (PM10)	97.8	2018	Data for monitoring stations managed by National Agency Metrology and the Environmental Monitoring. The values are averaged by
(PIVITO)			estimate of population exposed per city area.

## 2.2.10 INDICATOR-10: Greenhouse gas emissions from transpor

# Descriptions, Data Collection Approach, Procedure and Data Source

The indicator 10 analyses Greenhouse gas emissions from transport. Descriptions, data collection approach and procedure and data source and its information for indicator 10 that are shown in from Table 2-29. Emissions of CO2 are from burning oil, coal and gas for

energy use, burning wood and waste materials, and from industrial processes such as cement production. In Ulaanbaatar, greenhouse gas emissions from transportation primarily come from burning fossil fuel for our cars, trucks, trains and planes. Over 90 percent of the fuel used for transportation is petroleum based, which includes primarily gasoline and diesel.

Table 2-29. Descriptions, Data Collection Approach, Procedure and Data Source of Indicator 10
According to Expected Required Effort

Indicators	Descriptions and Definitions							
Indicator 10	Greenhouse gas emissions from to	ransport						
Description	If an account or estimate of the emissions of CO <sub>2</sub> from transport in the city is not available, a figure has to be calculated using emission factors and data for traffic volumes (vehicle kilometers) for all emitting modes, or indirectly from gasoline and diesel sales. Collecting and compiling this information could be one of the most time & effort consuming tasks of all.							
Relevance	Man-made emissions of CO <sub>2</sub> and other greenhouse gasses are causing global warming and climate change. Transport contributes worldwide to around one quarter of the global energy related CO <sub>2</sub> emissions. A major proportion of this contribution is emitted in cities. The indicator Is highly relevant for SDG 13 'Take urgent action to combat climate change and its impacts', even if this goal does not directly specify GHG targets for the urban level.							
Definition	CO <sub>2</sub> equivalent emissions from tra	nsport by urban residents p	per annum per capita.					
Unit	Ton CO <sub>2</sub> equivalent emitted/capit	a/year						
Min and Max values	Min. value (worst) is 2.5 ton; Max value (best) is 0							
Ulaanbaatar	greenhouse gas emissions were	calculated based on estim	ouse gas emissions within the city. The nate of fuel consumption by types of node. Top down calculation based on sions from transport.					
	Vehicle by engine type	Number of vehicles	Consumption per year , tons					
	Gasoline/petrol	1,741,245	313,430.1					
Data source	Diesel	101,266	252,518.3					
for	Dual fuel engine	115,004	80851.1					
Ulaanbaatar	Gas	14,030						
	Total Fuel		384,281.2					
	Total Diesel		252,518.3					
Year of data	2018							
Comments	Based on estimate of fuel consum per traffic mode.		nd average national emission factors					

Source for terms and definitions: SUTI Data Collection Guideline of UNESCAP

### Data Analysis.

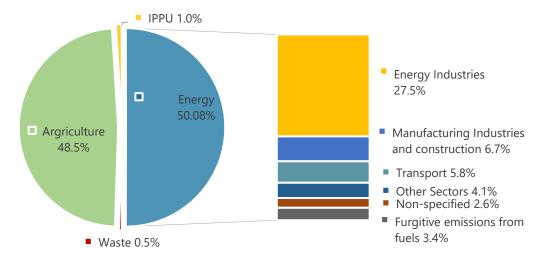
 $CO_2$  emissions from transport (% of total fuel combustion) in Mongolia was 11.57 as of 2014. Its highest value over the past 30 years was 12.98 in 1990, while its lowest value was 8.65 in 1995 (Table 2-30). Figure 2-22 shows greenhouse emission from energy sector in Mongolia by sub-sectors. Indicator 10 measures  $CO_2$  equivalent emission from transport by

urban residents per annum per capita. Estimation for fuel and diesel consumption is showed in Table 2-31. SUTI-10, transportation emission per capita of Ulaanbaatar, is estimated as 1.17 based on the number of vehicles by engine types data and their petroleum consumption estimation (Table 2-32).

Table 2-30. GHG Emissions from the Energy Sector by Source Categories, GG CO2E

Categories	Emissions	1990	1995	2000	2005	2010	2014
From Indiana	Gg	5,209.46	5,374.38	5,126.45	6,201.15	7,110.12	9,474.70
Energy Industries	%	46.97%	60.25%	68.09%	63.68%	53.75%	54.87%
Manufacturing	Gg	2,535.38	1,792.04	571.47	716.3	1,888.93	2,313.48
Industries & Construction	%	22.86%	20.09%	7.59%	7.36%	14.28%	13.40%
Tuesday	Gg	1,439.66	771.75	935.12	1,108.73	1,400.58	1,997.25
Transport	%	12.98%	8.65%	12.42%	11.39%	10.59%	11.57%
Otherwarder	Gg	1,164.36	468.85	646.36	1,221.03	1,690.48	1,422.37
Other sectors	%	10.50%	5.26%	8.59%	12.54%	12.78%	8.24%
Non specified	Gg	611.38	421.83	148.07	333.48	456.93	903.37
Non-specified	%	5.51%	4.73%	1.97%	3.42%	3.45%	5.23%
Fugitive emissions	Gg	130.91	91.8	101.42	157.6	680.31	1,156.62
from fuels (coal, oil)	%	1.18%	1.03%	1.35%	1.62%	5.14%	6.70%
Energy Total	Gg	11,091.15	8,920.65	7,528.89	9,738.29	13,227.35	17,267.79
Energy Total	%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Source: Third National Communication of Mongolia



**Figure 2-22. GHG Emissions from Transport**Data Source: National Statistical Office of Mongolia

Table 2-31. Estimating Fuel & Diesel Consumption, 2018

Engine Types		Passenger car	Truck	Bus	Special purposed	Total
	Number of vehicles	163,647	5,463	1,923	392	171,425
Fuel	Fuel consumption per year, tons	2	2	4	1	
	Total Fuel Consumption, tons	294,565	11,472	6,923	470	313,430
	Number of vehicles	17,993	69,237	8,098	5,938	101,266
Diesel	Diesel consumption per year, tons	2	3	4	2	
	Total Diesel Consumption, tons	39,585	173,093	29,153	10,688	252,518
5 1	Number of vehicles	114,656	232	101	15	115,004
Dual Engine	Fuel consumption per year, tons	1	1	3	1	
Fuel	Total Fuel Consumption, tons	80,259	278	303	11	80,851
Gas	Number of vehicles	13,516	324	179	11	14,030
Total fuel consumption						394,281
Тс	tal diesel consumption, tons					252,518

Vehicle Data Source: National Statistical Office of Mongolia

Table 2-32. Score Card for Indicator 10

Fuel type	Consumption	CO <sub>2</sub> -factor	Emission	Population	Emission	
r der type	tons	kg/l	tons/year	Topulation	per.capita	
Gasoline/Petrol	394281.2	2.27	895,609.75			
Diesel	252518.3	2.676	675,738.97			
TOTAL			1,571,348.72	1347598	1.17	
Indica	tor	Value	Year	Comr	nents	
				Based on estimate of fuel consumption		
Greenhouse gas e	missions from	1.17	2018	by types of vehicles and average		
transp	ort	1.17	2010	national emission factors per traffic		
				mo	de.	



**Figure 2-23. GHG Emissions from Transport**Data Source: Third National Communication of Mongolia



# **SUTI –Asian Cities**

1)	Greater Jakarta, Indonesia: 57.8
2)	Thimphu, Butan: 54.5
3)	Suva, Fiji:53.5
4)	Tehran, Iran: 50.5
5)	Kathmandu, Nepal:47.8
6)	Dakha, Bangladesh:45.3
7)	Ulaanbaatar, Mongolia:39.05
8)	Colombo, Sri Lanka: 32.6

9)	Hanoi, Vietnam:	29.7
10)	Bhopal:	61.1
11)	Bandung:	54.3
12)	Surabaya:	53.3
13)	Khulna:	49.0
14)	Surat:	47.9
15)	Ho Chi Minh:	40.1



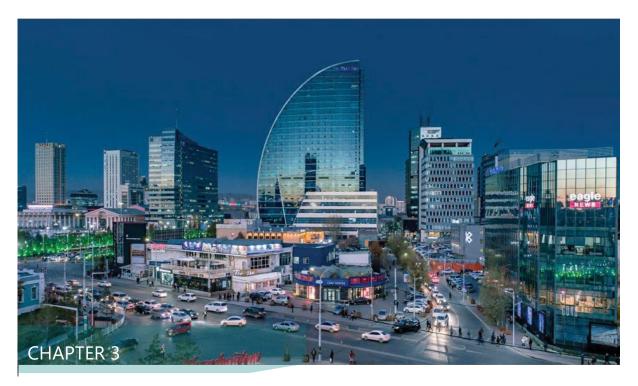


SUTIS FOR
ULAANBAATAR
AND ASIAN
CITIES

**ULAANBAATAR SUTI** 

COMPARISONS WITH ASIAN CITIES

**CONCLUSIONS & RECOMMENDATIONS** 



# 3. ULAANBAATAR & ASIAN CITIES' SUTIS

## 3.1. SUTI - ULAANBAATAR

The Sustainable Urban Transport Index (SUTI) had been developed by UN ESCAP to summarize, track and compare the performance of Asian cities in respect to sustainable urban transport and the related Sustainable Development Goals (SDGs). SUTI is identified to be a periodically ongoing process wherein data is collected for comparative purposes, enabling the cities to identify the deficiencies thereby to set targets and identify good practices cum lessons in the field of transport.

Data collection for different indicators to develop SUTI comprises of field data collection, data collection from appropriate authorities and reviewing different relevant data sources. Some indicators can be dealt together and can be developed from a single data source, thus initial step will be to identify the indicators having possible common data sources. Based on the defined methodology by SUTI, data for each indicator is then analyzed. SUTI index provides a quantitative

analysis on existing transportation situation. SUTI-Ulaanbaatar is estimated as 39.09. The SUTI indicators articulate the following for the city of Ulaanbaatar.

- City's vision towards urban road sustainable development is very well articulated in its Medium and Long Term Road Development Master Plan. However, the master plan for public transportation does not exist. More focus is needed to implement the master plan successdfully.
- Over 55.7 percent of active and public transport ridership. Current efforts of Ulaanbaatar City to promote public transport through Umoney system and real time information on web, etc.
- 3. Convenient access to public transport service index is estimated as 85.14%, which means Ulaanbaatar PT system coverage both in population and area is high.

Table 3-1. Ulaanbaatar SUTI- Score Card

Nō	Indicators	Natural Units	Weight	Min	Max	UB Value	Normalization	Year
1	Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes	0-16 scale	0.1	0	16	8.00	50.00	2018
2	Modal share of active and public transport in commuting	% of trips/ mode	0.1	10	90	55.7	57.16	2017
3	Convenient access to public transport service	% of population	0.1	20	100	85.14	81.42	2018
4	Public transport quality and reliability	% satisfied	0.1	30	95	49.05	39.46	2018
5	Traffic fatalities per 100000 inhibitions	No. of fatalities	0.1	0	10	9.69	72.31	2018
6	Affordability-travel costs as part of income	% of income	0.1	35	3.5	21.06	44.25	2018
7	Operational costs of the public transport systems	Cost recovery ratio	0.1	22	100	80.38	74.85	2018
8	Investment in public transportation systems	% of total investment	0.1	0	50	0.88	1.76	2018
9	Air quality (PM10)	μ/m3	0.1	150	10	97.80	37.29	2018
10	Greenhouse gas emissions from transport	tons/ Capita/year	0.1	2.75	0	1.17	57.60	2018
	SUTI						39.09	

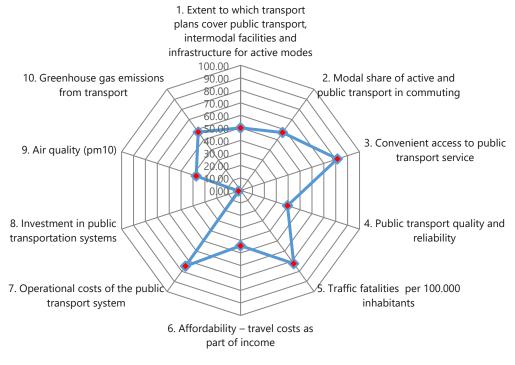


Figure 3-1. SUTI Spider Diagram for Ulaanbaatar

- 4. People of Ulaanbaatar, in general find the public transport system need to be improved in quality and reliability. This indicator is important factor to attract new riders to the transit system and to decrease traffic congestion.
- 5. Fatality rate is high compared to other Asian capital cities. National Road Safety Program aims to bring down traffic related fatalities and injuries through management and educational measures including introduction of technology are underway. In 2018, traffic fatality rate is increased to 140 in Ulaanbaatar.
- 6. The fares set at an affordable level.
- 7. Operational cost recovery is not fully covered but it is pretty well, because bus operating companies receive subsidies and reimbursement money from the city's budget. Ulaanbaatar is making efforts to build transit market. Recovery levels are likely to increase with increase in ridership.
- The city needs renovation and modernization in public transport system. There is not any major investment in public transport and active mobility.
- 9. More than 800,000 residents live in *ger* districts. They burn raw coal and other flammable materials to keep warm and cook during the six-month-long cold seasons. Therefore, during winter air pollution was very badly in the Capita City. Since May of

- 2019, the Government resolution to ban the consumption of raw coal and replace it with refined coal, in the capital city. This has tremendous change in air quality during winter of 2020. But this improvement is not included in our data analysis. Nowadays, high levels of PM10 and NOx are become from transport sector.
- 10. GHG emissions from the transport sector is relatively high, because 69% of the total number vehicle passed the inspection has petroleum based engine and 74% are have over age of 10 years. Efforts are underway to introduce electric public transport bus in the city.

SUTI -Ulaanbaatar estimated as 39.09. Based on the SUTI Ulaanbaatar estimation results, in order to build sustainable urban public transport system, there are an urgent need (i) to invest in environmentally friendly mass rapid transit, (ii)to improve public transport quality and reliability services, (iii) to continue National Road Safety Program through implementing national educational, engineering, and enforcement programs emphasizing on decreasing traffic related death and injuries, (iv) to develop high taxation policy on importing petroleum used vehicles with age of over 10 years in order to improve air quality and decrease GHG emissions from the transportation section .



## 3.2. COMPARISONS WITH ASIAN CITIES

The Sustainable Urban Transport Index (SUTI) had been developed by UN ESCAP to summarize, track and compare the performance of Asian cities in respect to sustainable urban transport and the related Sustainable Development Goals (SDGs). SUTI is identified to be a periodically ongoing process wherein data is collected for comparative purposes, enabling the cities to identify the deficiencies thereby to set targets and identify good practices cum lessons in the field of transport.

Data collection for different indicators to develop SUTI comprises of field data collection, data collection from appropriate authorities and reviewing different relevant data sources.

Some indicators can be dealt together and can be developed from a single data source, thus initial step will be to identify the indicators having possible common data sources. Based on the defined methodology by SUTI, data for each indicator is then analyzed.

SUTI has been successfully applied in 15 cities; Colombo, Hanoi, Kathmandu and Greater Jakarta in 2017, Bandung, Dhaka, Ho Chi Minh City, Surabaya, Surat and Suva in 2018, and Bhopal, Khulna, Thimphu, Tehran and Ulaanbaatar in 2019 (Table 3-2). The cities found the SUTI framework adequate to measure the status and useful in identifying strategies towards sustainable mobility.



Table 3-2. SUTI Comparisons with Asian Capital Cities

Nº	Indicator	Ulaanb aatar	Jakarta	Hanoi	Colomb o,	Kathma ndu,	Thimph u,	Dhaka	Tehran	Suva
1	Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes	50.00	75	43.75	68.75	43.75	68.75	50	68.75	37.5
2	Modal share of active and public transport in commuting	57.16	35.11	0.81	81.81	74.71	33.5	96.39	34.28	57.5
3	Convenient access to public transport service	81.42	46.88	50.0	30	81.25	40.96	45.63	91.54	50
4	Public transport quality and reliability	39.46	49.25	76.87	0.15	5.12	51.57	12.15	49.24	30.77
5	Traffic fatalities per 100000 inhibitions	72.31	94.43	77.87	57.34	81.91	38.89	95.31	26.06	72.57
6	Affordability-travel costs as part of income	44.25	67.9	92.98	70.41	75.87	73.02	60.7	102.20	57.14
7	Operational costs of the public transport systems	74.85	28.35	19.57	46.93	52.55	44.09	34.14	29.67	50.98
8	Investment in public transportation systems	1.76	100	3.93	49.6	35.68	60.26	100	42.00	50
9	Air quality (PM10)	37.29	53.57	28.24	74.29	44.29	78.36	9.04	55.64	78.57
10	Greenhouse gas emissions from transport	57.60	71.27	88.16	77.09	88.73	79.8	94.18	55.42	75.64
	SUTI	39.09	57.8	26.8	32.6	47.8	54.5	46.3	50.5	53.9

#### **GREATER JAKARTA, INDONESIA**

Greater Jakarta is urban agglomeration which covers six cities of Jakarta, Bogor, Depok, Tangerang, Bekasi, Tangerang Selatan, and three regencies including Bekasi, Tangerang and Bogor. The population has reached ±30 million and density is 4,461 person/km². In 2017, Jakarta has two kinds of rapid transit system: Trans Jakarta BRT, Commuter Rail (KRL). Both of the system only serve the trunk network. The North to South corridor of MRT Jakarta with 16 km length and 42 km of elevated LRT track was commissioned in 2019.

Comparison to other Asian Capital Cities, Greater Jakarta has the highest SUTI overall score as well as the highest scores on SUTI-1 and SUTI-8. The Greater Jakarta has ambitious citywide mass transit development plan with actual investment including Airport Railway and Elevated BRT 13rd Corridor Jakarta (Tendean- Ciledug) in 2017, LRT Jabodetabek (Cawang-Cibubur) and LRT DKI Jakarta (Gading Nias Velodrome) in 2018, LRT Jabodetabek (Cawang Bekasi Timur and Cawang – Dukuh Atas) and MRT (Lebak Bulus – Bundaran HI) in 2019 (Prayudyanto, Muhammad Nanang; Thohir, Muiz, 2017).

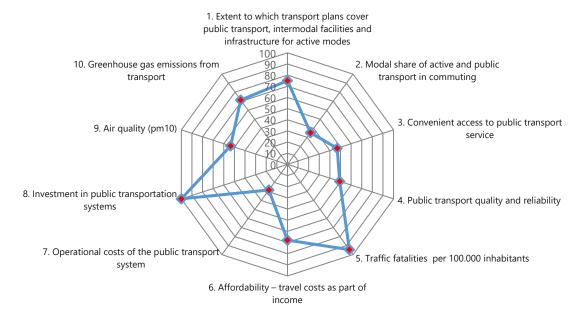


Figure 3-2. SUTI - Greater Jakarta: 57.8
Source: SUTI Mobility Assessment Report Greater Jakarta

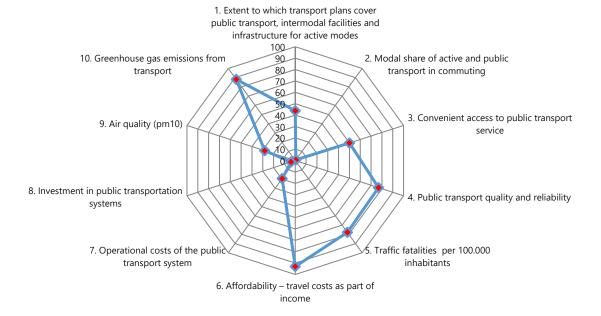


Figure 3-3. Mass Public Transit in Greater Jakarta

HANOI, VIETNAM

Hà Nội City comprises 30 urban/suburban districts, with 584 precincts and towns; and gathers almost all administration and working agencies at Central level. Hanoi City owns a natural land area of 3,324.5 square kilometers, and population of 7,667,399 persons; Its average population density is 2,306 persons per 1 sq. km, but unevenly distributed (highest concentration of 41,602 persons per sq.km is in the inner city); the

urbanization reaches to 49.2 percent. Based on SUTI-Hanoi, the city has high rates of public transport quality and reliability, affordability, greenhouse gas emissions and traffic fatalities, modal share and investment in public transportation are estimated the worst. Transport users mainly travel by individual motorized vehicles, especially motorcycles (Chung, 2017).



**Figure 3-4. SUTI – Hanoi: 26.8** Source: SUTI Mobility Assessment Report Hanoi



Figure 3-5. Public Transport Bus in Hanoi

### **COLOMBO, SRI LANKA**

The study area has been identified as the Western Region (WR) in Sri Lanka including three administrative districts; Colombo, Gam Paha and Kalahari and 33 divisional secretariat divisions. According to the 2012 Census, the population of Western Region was 5.8 million in spread over a 3,684 sq.km of land area. Based on SUTI-Colombo, Western Region province has high rates of

convenient access to public transport services, modal share, active and public transport in commuting, PM10, and greenhouse gas emissions. Public transport quality and reliability is estimated the worst. Not much investment in public transportation and low rate on convenient access to public transport services (De Silva, 2017).

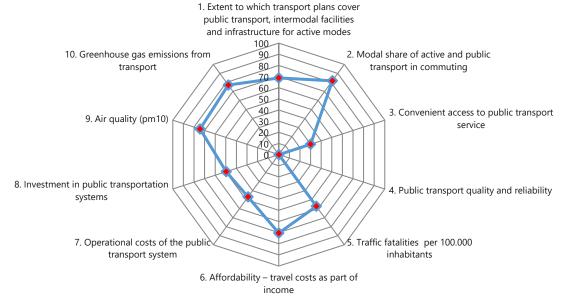


Figure 3-6. SUTI- Colombo: 32.6
Source: SUTI Mobility Assessment Report Colombo



Figure 3-7. Public Transport Bus in Colombo

### KATHMANDU, NEPAL

Kathmandu Valley covers an area of 721.87 sq.km covering parts of Kathmandu (approx. 85%), Lalitpur (approx. 50%) and Bhatpara districts. The total population of Kathmandu Valley in the census year 2011 was 2,517,023 with the annual growth rate of 4.63%. This represents the 9.32% of entire population of country in mere 0.49% area of the country. The major mobility mode of transport in Kathmandu valley is road transport. The city doesn't have metro rail, mono rail,

AGT system and BRT system introduced until now. Kathmandu has high rates of convenient access to public transport services, modal share, traffic fatalities and greenhouse gas emissions. Public transport quality and reliability is estimated the worst. Not much investment in public transportation and low rate on convenient access to public transport services (Khokhali, 2017).

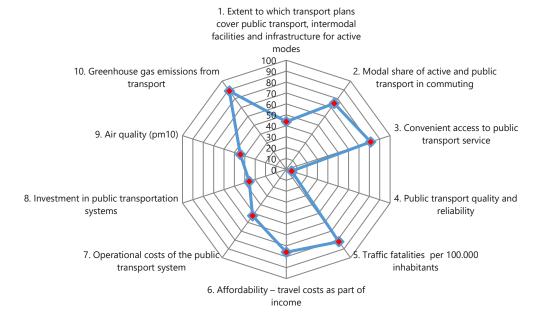


Figure 3-8. SUTI- KATHMANDU: 47.8
Source: SUTI Mobility Assessment Report Kathmandu



Figure 3-9. Public Transport Bus in Kathmandu

### THIMPHU, BUTAN

Bhutan is a small landlocked mountainous country situated between India and China. In 2018, Bhutan's population was 727,145, 62% of its population residing in the rural areas, and the capital city Thimphu alone accounted for 114,551 people, amounting to 15.7% of the total population (RGoB, 2017). Bhutan's development philosophy of Gross National Happiness (GNH) represents an alternative approach to

development, signifying the need to measure development outcomes in terms of happiness. Thimphu has high rates of affordability, PM10, and greenhouse gas emissions and lower rates of modal share, convenient access to public transportations services, and operational costs of the public transport system. Traffic fatalities are one of the major problems (Sanjeev, 2019).

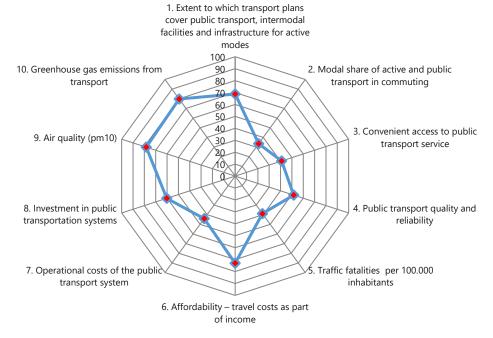


Figure 3-10. SUTI- THIMPHU: 54.5
Source: SUTI Mobility Assessment Report Thimphu



Figure 3-11. Public Transport Bus in THIMPHU

#### **DHAKA, BANGLADESH**

Dhaka, the capital of Bangladesh, is one of the most populous emerging megacities in the world. Dhaka has a population of almost 14.4 million with a density of 47,537.3 per km² (2011). Due to this huge population pressure, Dhaka suffers from various problems like lack of accommodation and other basic facilities, pollution and most importantly lack of efficient transportation system. The overall transportation system in Dhaka city

was found in a moderate condition. Huge investment in public transportation system has been planned and many of the plans are on the working stage (Two mega projects like: MRT and BRT). On the other hand, public transport quality and reliability, affordability of the people, operational cost of public transportation system and air quality are comparatively in critical condition (NOOR-E-ALAM, 2018).

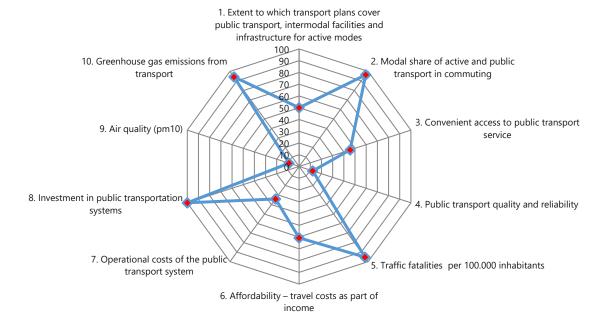


Figure 3-12. SUTI- DHAKA: 46.3 Source: SUTI Mobility Assessment Report Dhaka



#### **TEHRAN, IRAN**

Tehran is the capital city of the Islamic Republic of Iran and the largest city in the country. According to the last population census in 2016, Tehran population was 8.7 million and its population density is 12,100 per square kilometer. Tehran's public transport system includes variety of public transport modes like bus, bus rapid transit (BRT), Metro, Taxi, fixed-route taxi, private taxi and Internet taxi. Based on SUTI estimation, the amount of investment in the

public transport systems and air quality in Tehran are poor. Although Tehran does have an affordable, easy access with fair quality public transportation system, the modal share of public transport of total daily trips in Tehran is low. This means to have a convenient public transport system without increasing the using private cars cost, does not make people to use more public transport instead of their own cars (Mojtehedzadeh, 2019).

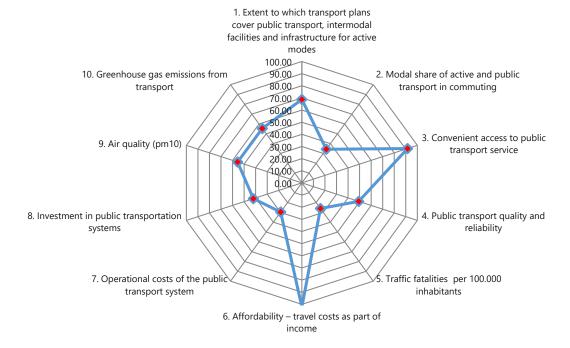


Figure 3-14. SUTI- TEHRAN: 50.5
Source: SUTI Mobility Assessment Report Tehran



Figure 3-15. Public Transport Bus in TEHRAN

### SUVA, FIJI

Fiji, situated in the South Pacific about 4,450 km southwest of Hawaii and 1,770 km north of New Zealand, comprises some 850 islands, of which only about 100 are inhabited. Suva is the capital and largest metropolitan city in Fiji. At the 2017 census, the city of Suva had a population of 93,970 and the population of the Greater Suva urban area was 185,913. Based on the

SUTI result, the Greater Suva Transport Strategy plan should be incorporating has been developed, an integrated urban mobility plan incorporating all modes cover all city council would be necessary. More focus on integrated terminals, facilities for active modes such as walking and cycling is essential (Sustainable Urban Transport Index (SUTI) in The Greater Suva Area, 2018).

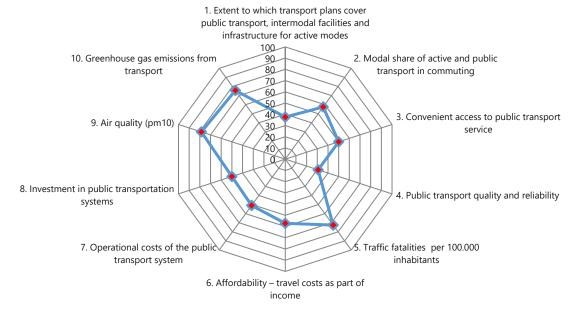


Figure 3-16. SUTI- SUVA: 53.9
Source: SUTI Mobility Assessment Report Suva



Figure 3-17. Public Transport Bus in SUVA

Table 3-3. SUTI Comparisons with Asian Cities

Nō	Indicators	Ho Chi Minh, Vietnam	Bandung, Indonesia	Surabaya, Indonesia	Bhopal, India	Surat, India	Khulna, Banglades h
1	Extent to which transport plans cover public transport, intermodal facilities and infrastructure for active modes	43.75	75	87.5	75	93.75	31.25
2	Modal share of active and public transport in commuting	23.15	11.68	4.94	75	23.71	22.5
3	Convenient access to public transport service	69.71	22.5	90.74	65	90.7	39.48
4	Public transport quality and reliability	18.11	88.72	23.63	80.68	91.85	60.84
5	Traffic fatalities per 100000 inhibitions	76.21	87.54	81.78	6.34	86.9	83.34
6	Affordability travel costs as part of income	92.98	90.48	84.51	98.41	93.42	79.53
7	Operational costs of the public transport systems	15.89	16.73	57.58	100	21.42	30.15
8	Investment public transportation systems	27.00	59.2	100	37.4	65.67	62.38
9	Air quality (PM10)	32.44	71.43	60.03	32.14	36.96	30.71
10	Greenhouse gas emissions from transport	86.28	80.73	99.93	84.14	93.29	97.71
	SUTI	40.1	49.0	54.3	53.3	61.1	47.9

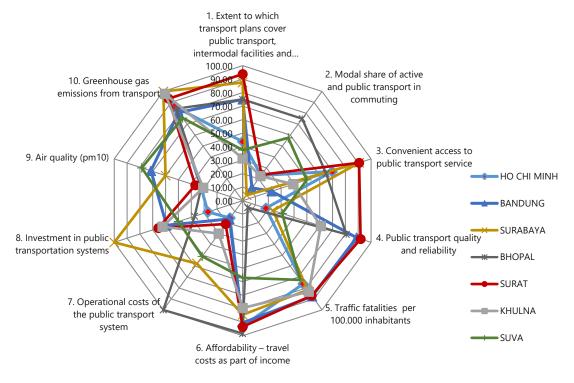


Figure 3-18. SUTIs for Asian Cities

#### HO CHI MINH, VIETNAM

Located in the center of Southeast Asia, abbreviated as HCMC, also known by its former name Saigon. Ho Chi Minh City plays an important role as the transport hub in all fields on roadway, waterway and airway, linking the provinces in the region and also being an international gateway. According to statistics by GSO in 2017, Ho Chi Minh City has a total area of 2,095.6 km² with a population of 8.61 million. It is the most

populous mega city in Vietnam. Based on SUTI estimation, transport users mainly travel by motorcycles; The access to public transport service is relatively good in the central area but poor in the suburbs; Public transport affordability is good, but the quality and reliability and air quality in Ho Chi Minh are poor. Bus operation of HCMC is inefficient (Hai, 2018).

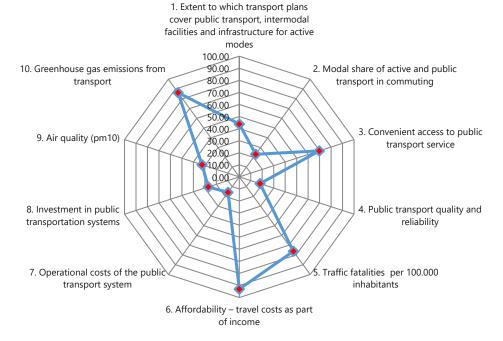


Figure 3-19. SUTI-HO CHI MINH: 40.1

Source: SUTI Mobility Assessment Report Ho-Chi-Minh



Figure 3-20. Public Transport Bus in HO CHI MINH

#### KHULNA, BANGLADESH

Khulna is one of the major divisional cities of Bangladesh. It is the 3rd largest city with a population of 1.5 million after Dhaka and Chattogram situated in the south-western region of the country. Currently the population density is around 32,000 persons/sq.km. The city has one of the oldest systems of transportation in the country and yet not meeting the demand of the city dwellers. The city has no specific transport plan and

no sole transport planning authority to plan and manage the city transportation system and services. Battery operated Easy-Bike holds the largest share of the daily trips in the city though it is not proper public transport by definition. Transport plan, convenient access to transport, investment in transportation systems, and revenue collection are comparatively in critical condition (Kabir, 2019).

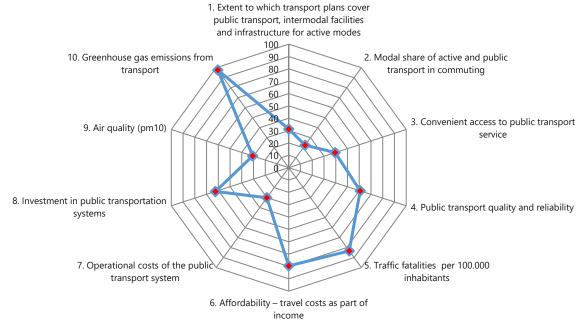


Figure 3-21. SUTI-KHULNA: 47.9
Source: SUTI Mobility Assessment Report Khulna



Figure 3-22. Public Transport Bus in KHULNA

#### **BANDUNG, INDONESIA**

Bandung, the capital of West Java province, located about 180 km (110 mi) southeast of Jakarta, is the third largest city in Indonesia. The total area of Bandung Municipality is 167.31 km<sup>2</sup>. The total area of Bandung Municipality is 167.31 km<sup>2</sup>. Bandung show a good extent to the improvement of public transport system. Modal share of public transport and convenient access to public transport in Bandung is considered low. The

customer satisfaction of the only BRT system is high. Convenient access to public transport service and operational cost of the public transport system are very low. Traveling by public transports in Bandung are affordable. Air quality (PM10) and greenhouse gas emission from transport are in a good condition (Weningtyas, 2018).

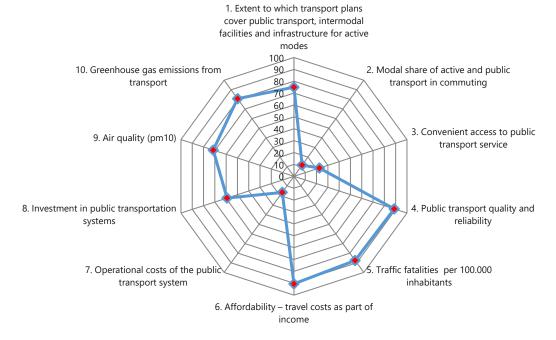


Figure 3-23. SUTI-BANDUNG: 49.0 Source: SUTI Mobility Assessment Report Bandung



Figure 3-24. Public Transport Bus in BANDUNG

#### **SURABAYA, INDONESIA**

Surabaya is located in West Java province, inhabited by more than 3 million people, with area of 350 sq.km. Surabaya is the second biggest city in Indonesia. It attracts 1.5 million people every day as visitors from the conurbation area. Surabaya is the economic Centre of the eastern part of Indonesia. Public Transport is limited. Bicycles are popular only on Sundays. Main terminal of Surabaya is Purabaya bus terminal.

Purabaya is the busiest bus terminal in South East Asia with annual passenger's movement (departure + arrival) of 22 million for intercity buses, and 9 million for city buses. Annual bus movement is 7,76,000 for intercity buses and 3,17,000 for city buses. Indices for modal share of public and active transport and public transport quality and reliability are very low ( (Herijanto, 2018).

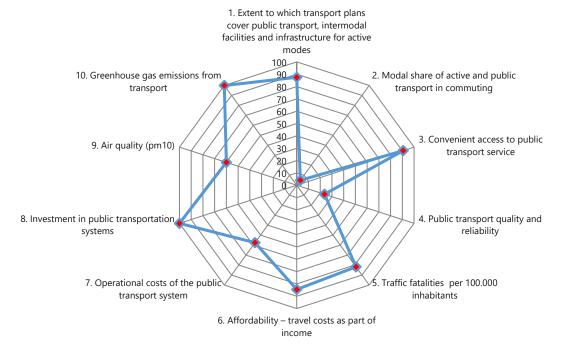


Figure 3-25. SUTI-Surabaya: 54.3
Source: SUTI Mobility Assessment Report Surabaya



Figure 3-26. Public Transport Bus in Suraba

#### **BHOPAL, INDIA**

The study area considered for the SUTI Indicators is the Bhopal Planning Area spanning over 813 sq.km and houses a population of 2.018 million people. Currently in Bhopal the public transport system constitutes of the city bus service and BRTS being operated on the Net Cost Contract (NCC) model by the transit authority. There are presently 287 buses operating on 15 routes. The system is operational on a route length of 401 Km.

People of Bhopal, in general, find the public transport system to be moderately convenient and reliable. The fares are set at an affordable level. High levels of PM10 is on the expected line. GHG emissions from the transport sector is low, because of shorter motorized trips and higher share of active mobility trips (Swamy, 2019).

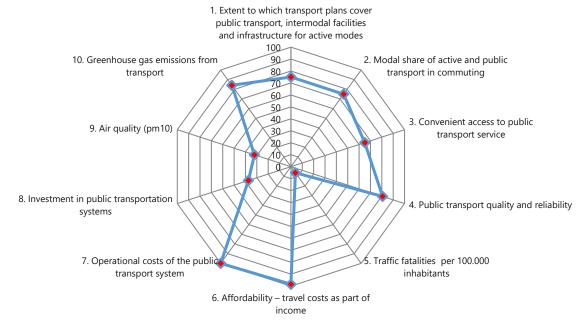


Figure 3-27. SUTI-BHOPAL: 53.3
Source: SUTI Mobility Assessment Report Bhopal



Figure 3-28. Public Transport Bus in BHOPAL

### **SURAT, INDIA**

Surat is India's eighth most populous city with a population of 4.5 million (Census 2011) and second most populous city in the state of Gujarat. Currently in Surat, the city bus services (CBS), bus rapid transit services (BRTS) and high mobility corridor (HMC) are being operated on gross cost basis by Sitilink Ltd a SPV under SMC. City's vision towards sustainability mobility is very well articulated in its Comprehensive

Mobility Plan. Low and rapidly increasing Public Transport Ridership. People of Surat, in general, find the public transport system to be convenient and reliable. Surat is making efforts to build transit market. With the manufacturing as economic base, high levels of PM10 on the expected line (Swamy, 2018)

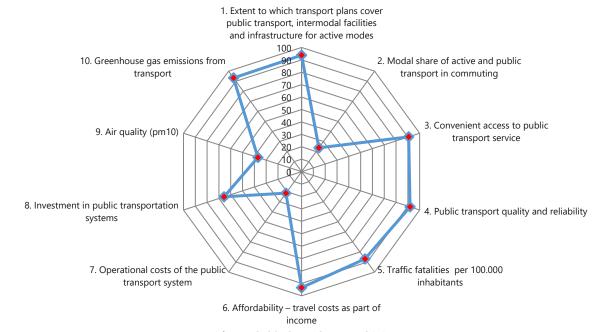


Figure 3-29. SUTI-SURAT: 61.1
Source: SUTI Mobility Assessment Report Surat



Figure 3-30. Public Transport Bus in SURAT

# 4. PERSPECTIVES

SUTI provided new insights into the areas of focus for Ulaanbaatar City. These include:

- Develop a comprehensive urban transport master plan including mass public transport systems, facilities for non-motorized transport, improvement of bus stops and intercity terminals
- Introduction of mass transport systems, and promotional activities along with induction of new fleet and routes towards increasing share of public transport system.
- 3) Increase investment in public transport systems
- 4) Improving road safety
- 5) Initiate measures to improve quality and

- reliability of public transport and develop public transport information system
- 6) Explore alternative operations financing models for meeting the revenue-expenditure gap as the gap is small and currently covered by subsides and unlikely to be covered fully even with increased ridership.
- 7) Improve air quality and GHG emissions from transport, work with related stakeholders to reduce air pollution, PM10, introduce renewable energy and reduce use of coal. Monitor actions for better air quality management.
- 8) Introduce cleaner vehicles both for public transport and para transit.

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