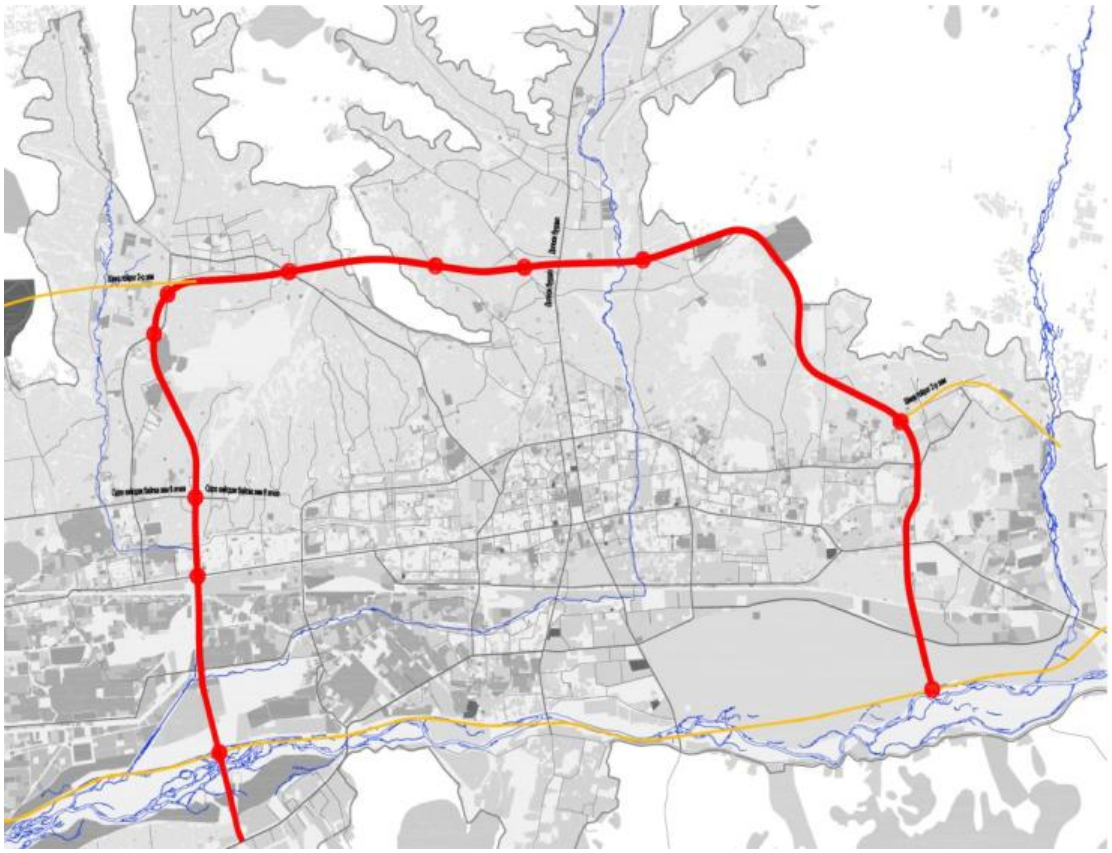
Ulaanbaatar New Ring Road Traffic Modeling and Analysis Report



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1. Research Overview

1.1Basis

In order to implement major upgrades to Ulaanbaatar's public transportation system and road/bridge infrastructure, with the goal of reducing traffic congestion by a specific percentage, the *Economic and Technical Feasibility Study* and *Conceptual Design* consulting services for "Phase I of the First Ring Road" project were completed on January 9, 2025, in accordance with the framework of Contract No. UT2402804435. This initiative was based on Mongolia's *Vision-2050* Long-term Development Policy, the Ulaanbaatar City Master Plan - 2040, *Resolution on the Construction of the "First Ring Road" in Ulaanbaatar* by the Government of Mongolia (2022 No. 476), and Executive Order No. A/720 by the Capital Chief Executive on June 19, 2024.

The implementation of the First Ring Road project has created numerous social and economic demands. For example, in recent years, Ulaanbaatar has seen a dramatic increase in road traffic loading, with the number of registered vehicles growing by 80%, however, the road network has expanded by only 19%, creating a severe insufficiency of road traffic capacity. Currently, approximately 500,000 to 610,000 motor vehicles participate in daily traffic in Ulaanbaatar, twice the road network's capacity (Capital Transport Bureau, 2024). This situation has led to severe citywide traffic congestion, particularly serious during peak hours, where the average speed of vehicles has dropped to 7-13 km/h. The total length of congested road segments reaches 97 kilometers.

In this context, building a new ring road network and dispersing the traffic stream in the city center are key solutions to alleviate congestion. According to a 2022 study by the Japan International Cooperation Agency (JICA), one of the main reasons contributing to Ulaanbaatar's traffic congestion is the insufficient number of connection nodes among roads and the lack of connectivity in the road network. At present, a complete and closed expressway ring road has not yet been formed throughout the city. Arterial road intersections are concentrated in the city center, causing traffic pressure to converge in central urban areas.

1.2 Basic Data Overview

As part of the economic and technical feasibility study and conceptual design for the "First Ring Road" project, research was conducted on urban road traffic flow, travel

speeds, citizens' travel behavior, and public satisfaction in the capital. Key quantitative and qualitative data were collected, including lane arrangements, intersection designs, road speed limit standards, toll collection systems, and investment return for the First Ring Road.

Analysis of Current Road Traffic in Ulaanbaatar: The capital's population has experienced rapid and sustained growth over the past two decades. Between 2014 and 2024, the population grew from 1,362,974 to 1,768,151, representing a 29.73% increase. Over the same period, registered vehicles surged from 443,793 to 796,989, marking a 79.95% rise. Travel speed studies reveal that during peak hours, the average speed on Ulaanbaatar's arterial roads typically falls below 25 km/h, with certain segments dropping to as low as 5 km/h. Traffic flow analysis indicates that during peak hours, most intersections operate at a level of service (LOS) "E" or "F", indicating severe congestion and exceeding capacity. These findings clearly demonstrate that the existing road network is severely underutilized, with traffic loading far exceeding its designed upper limits.

Projected Trends in Ulaanbaatar's Road Traffic: Multiple factors, including uneven population distribution, insufficient road network density, a sharp increase in motor vehicles, low public transport coverage, poor road user discipline, uncoordinated land use planning, and outdated infrastructure, may further exacerbate congestion in the urban road network on the current basis in 2025.

Table 1: Preliminary Estimate of Expected Effect in 2030 Without Traffic Congestion Mitigation Measures

Factor	2030 (Without Mitigation Measures)
Population	2.1 million
Registered motor vehicles	1136187

Note: Without measures such as "road network expansion, high-capacity public transport development, and other transport infrastructure construction", coupled with Ulaanbaatar's expected population growth to 2.1 million by 2030 and an increase in motor vehicle ownership to 1,136,187, traffic congestion is expected to worsen substantially by 2030 if no adjustment is made to the existing road network.

2 Traffic Demand and Necessity for New Ring Road

This section is based on the following documents and data:

Evaluation of the Implementation Effectiveness of the *Ulaanbaatar City Development Master Plan Revision and 2030 Development Trend Assessment*; *Ulaanbaatar City Master Plan - 2040*; and *Shantytown Development Investment Support Project Proposal*.

Background: Following Mongolia's transition from a centrally planned economy to a market economy in 1992, rapid urban migration to Ulaanbaatar led to the growth of "shantytowns" (i.e., informal settlements lacking access to engineered infrastructure). Urban development challenges and planning response: Since 1992, escalating traffic congestion, environmental pollution, and disaster risks, driven by uncontrolled urban migration towards the capital, have seriously violated the right to "a healthy and safe living environment" granted to citizens by the Constitution of Mongolia. These issues stem primarily from Ulaanbaatar's monocentric linear and single-ring radial urban structure.

2.1 Demand and Necessity for Subcenter Development

To build a multi-center urban system, Ulaanbaatar aims to establish 14 urban subcenters. This effort aims to optimize population distribution, reduce traffic congestion, address environmental pollution, and ensure a healthy and safe living environment for residents.

Project road network coverage: The proposed road network connects multiple northern areas with six urban subcenters along two vertical corridors. The specific areas to be connected are Өнөр, **Баянхошуу, Сэлбэ, Чингэлтэй, .Дарь-Эх, and Буянт-Ухаа хот**, spanning a total length of 24.8 kilometers. The New Ring Road project is in line with the long-term policies of the capital city, indicating that it is a high-priority project.

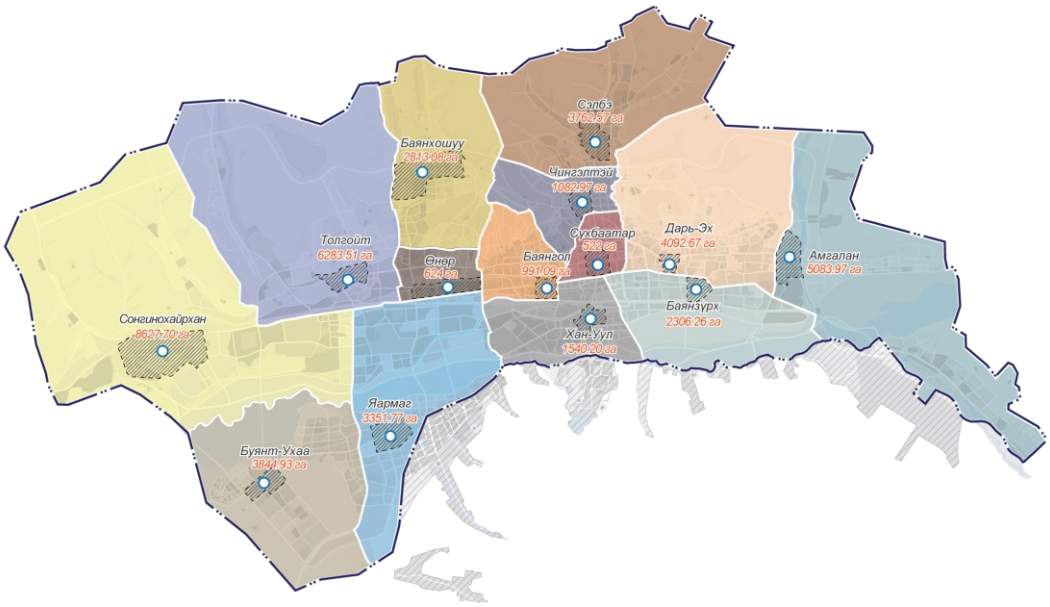

Figure 1: Planning Map of 14 Urban Subcenters

2.2 Demand and Necessity for Road Network Expansion in Ulaanbaatar

(1) Rapid Growth in Traffic Demand: Between 2014 and 2024, both the population and the motor vehicle population in Ulaanbaatar saw significant growth. The vehicle ownership rate increased from 326 to 451 vehicles per 1,000 people, reflecting a continuous rise in transportation demand of the residents, as shown in Table 2.

(2) Inadequate Road Network Capacity: Based on real-time traffic data from Google Maps, traffic congestion in Ulaanbaatar starts during the morning peak, intensifies until the evening peak, and gradually eases during the evening peak, as shown in Figure 2. This trend clearly indicates that the current road network can no longer meet the daily travel demands of the residents.

Table 2 Comparison of Motor Vehicle Quantity and Population Changes in Ulaanbaatar in 2014 and 2024

Year	Registered motor vehicles	Population	Vehicle Ownership Rate (vehicles per 1,000 people)
2014	443793	1362974	326
2024	796989	1768151	451

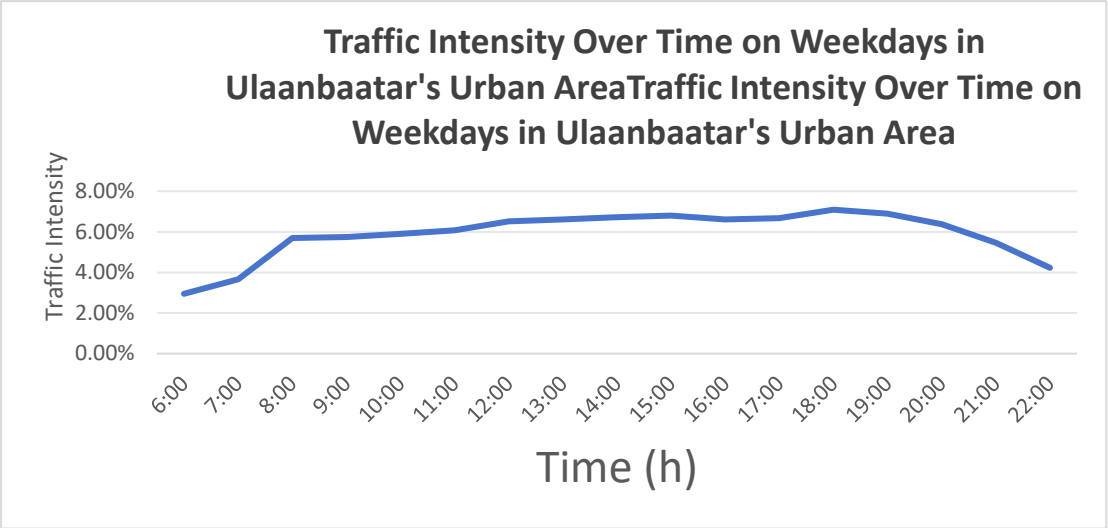

Figure 2: Traffic Intensity Over Time on Weekdays in Ulaanbaatar's Urban Area

3 Traffic Demand Modeling and Methodology for the New Ring Road

Mathematical modeling in transportation policy and planning describes the interaction between transportation infrastructure and traffic loading using mathematical methods, and it also models how the operation of the transportation system is influenced by socio-economic and population statistic indexes. Mathematical modeling is a core component of urban planning activities and provides quantifiable data support for formulating transportation policies based on computational research.

TransCAD, as a GIS-integrated transportation planning software, supports multimodal traffic modeling (e.g., the Four-Stage Method, Logit Model, and ABM). It can handle massive data, perform dynamic road network analysis, optimize bus routes and logistics paths, and share outcomes via cloud services. Its key advantage is the deep integration of GIS with traffic models, providing users with tools for algorithm balancing and parallel computing acceleration.

Table 3 Four-Stage Transportation Planning Modeling Process

Stage	Function Description
Trip Generation	Calculate trip generation and attraction for each zone using the OD matrix (Origin-Destination Matrix)
Trip Distribution	Build a model for the distribution of trips between different zones
Traffic Mode Choice	Analyze the share of different transportation modes (private vehicles, public transportation, walking, etc.)
Traffic Assignment	Assign predicted traffic volumes to the specific road network and assess road capacity

3.1 Construction and Data Integration of Traffic Analysis Zones (TAZ)

A core component of transportation modeling is the Traffic Analysis Zone (TAZ). High-resolution quantitative data for TAZs are essential for traffic modeling computations. TAZ division should be guided by geographic characteristics and road network topology to support regional planning. In this study, Ulaanbaatar is subdivided into 213 TAZs, which are categorized and integrated using the following three key data attributes:

1. Population Statistic Attributes: Resident population density (persons/km^2), age structure (proportion of children, working-age, and elderly populations), and average

vehicles per household.

2. Socioeconomic Attributes: Employment density (jobs/hectare), per capita disposable income (USD/year), and the proportion of key industry sectors (industrial, commercial, and service proportions).

3. Land Use Attributes: Proportion of residential land area, commercial facility density (number of shopping centers and office buildings), and coverage of public service facilities (schools/hospitals/parks).

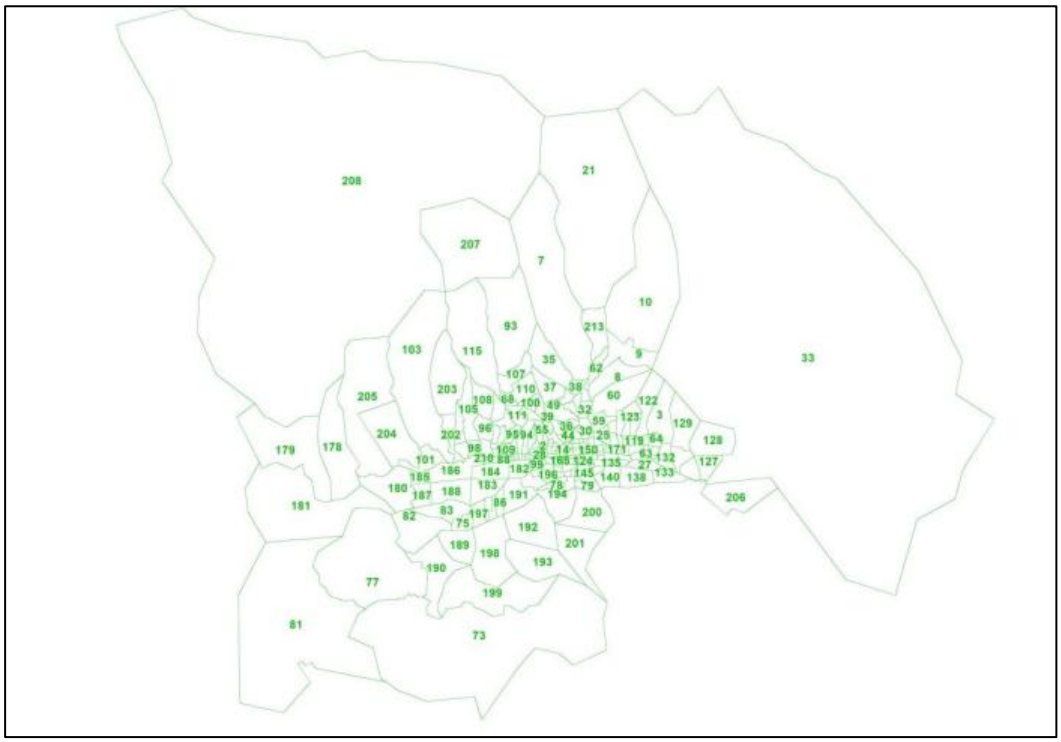

Figure 3 Schematic Diagram of TAZ Division

3.2 Application of TransCAD Software

Using the Four-Stage Transportation Planning Method and the aforementioned key indicators (LOS, VCR, and travel speed), this study quantitatively predicts the current load levels, future traffic demand, and long-term congestion trends for Ulaanbaatar's road network.

3.3 Sources of Basic Research Data

(1) Source of Intersection Traffic Flow Data

For the road traffic flow study in Ulaanbaatar, traffic observations were conducted at 23 intersections. Traffic flow data, recorded at 15-minute intervals from 5:00 AM to 12:00 AM on both weekdays and weekends, were collected for each approach direction

(including vehicle types for left turns, right turns, and straight-through movements). Since most intersections have a LOS of "E" or "F" (oversaturated), the flow values simulated by TransCAD may exceed the actual observed data.

(2) Source of Road Speed Data

To determine travel speeds on Ulaanbaatar's roads, GPS devices were installed to collect actual speed data. Statistics were gathered during the morning peak, midday peak, and evening peak periods on both weekdays and weekends to ensure data comprehensiveness and representativeness.

(3) 2022 and 2025 OD Survey

The 2022 OD survey collected travel data from 15,000 households. In the 6 districts of downtown Ulaanbaatar, there are a total of 394.391 million households, of which 15,000 were sampled for the survey.

The 2025 OD survey collected travel data from 2,600 households. Questionnaires were distributed in 50 traffic communities along or near the new ring road, with 52 questionnaires per community, totaling 2,600 households that completed the questionnaires.

The report "Иргэдийн зорчилт хөдөлгөөний Origin-Destination (OD) матриц боловсруулах өрхийн судалгааны тайлан" provides a comparative analysis of the 2022 OD survey data and the 2025 OD survey data.

(4) Road Capacity Design

Road capacity design was based on the *Beijing Road Capacity Manual*, with appropriate reductions applied in accordance with Ulaanbaatar's actual road operating conditions. The resulting capacity design for Ulaanbaatar's road network is shown in Table 4.

Table 4 Road Capacity Design

Name	Peak Hour Capacity (pcu/h)
One-Way Three-Lane Urban Expressway	4550
One-Way Two-Lane Service Road	1400
Directional Ramp	1200

This study evaluates the current road load status through the following Key Performance Indicators (KPIs):

Table 5 List of Indicator Definitions

Indicator	Definition
VolumePrT	Motor vehicle flow intensity (vehicles/hour)
VolumePuT	Public transport passenger flow intensity (persons/hour)
LOS	LOS (A-F grade, reflecting traffic quality)
VCR	Volume to Capacity Ratio
Travel speed	Average travel speed on road segments (km/hour)

Table 6 Definitions of LOS and VCR

Level of Service (LOS)	VCR Range	Definition	Vehicle Conditions for Road Users
A	0.00 - 0.35	Free-flow: Optimal traffic conditions with minimal vehicle interactions. Vehicles can travel freely, maintaining the design speed, with large spacing between them.	Large vehicle spacing, no queuing, and drivers can change lanes freely.
B	0.35 - 0.58	Stable flow: Light restrictions on traffic flow, with noticeable interactions between vehicles. Traffic efficiency remains high, but overtaking becomes more frequent.	Short queues (2-5 vehicles); drivers need to adjust speed, and comfort decreases slightly.
C	0.58 - 0.75	Critical flow: Traffic flow is significantly constrained, requiring additional measures to ensure safety. Overtaking is difficult, speed decreases, and driver comfort is noticeably reduced.	Continuous queues (5-14 vehicles), fewer lane-change opportunities, speed reduced to 70%-80% of design speed.

Level of Service (LOS)	VCR Range	Definition	Vehicle Conditions for Road Users
D	0.75 - 0.90	Unstable flow: High-density traffic, with severe restrictions on lane changing and turning. Long queues become common, and traffic efficiency drastically declines.	Frequent stop-and-go traffic, overtaking is nearly impossible; speed drops to 50%-60% of design speed, and significant delays occur at intersections.
E	0.90 - 1.00	Forced flow: Road capacity is saturated, and traffic flow becomes extremely unstable. Long queues result in a high risk of intersection blockage.	Speed drops below 30 km/h, the road is constantly congested, and delays account for over 40% of total travel time.
F	>1.00	Breakdown flow: Traffic demand far exceeds road capacity, causing transportation system failure. The probability of accidents surges, and vehicles move in a stop-and-go pattern.	Speed drops below 15 km/h; the road is completely blocked; travel time becomes unpredictable, and emergency vehicles struggle to pass.

4. Current Traffic Load Status of Ulaanbaatar's Road Network

4.1 Vehicle Growth Trend

As of 2024, the total number of registered vehicles in Mongolia reached 1,339,005, with 796,989 of those registered in Ulaanbaatar. Between 2014 and 2024, the number of registered vehicles increased from 443,793 to 796,989, reflecting an average annual growth rate of 7.96%. Additionally, vehicle aging is a prominent issue, with approximately 80% of vehicles with a service life of over 10 years (see Table 7). This suggests a higher risk of negative environmental impacts.

Table 7 Vehicle Age Structure

Vehicle Age Range	Number of Vehicles	Percentage
0-3 years	48,667	6.1%
4-6 years	36,490	4.6%
7-9 years	78,522	9.9%
10 years or above	633,310	79.5%

4.2 Analysis of Current Road Transportation Conditions

To assess the traffic load on Ulaanbaatar's road network, this study conducted a travel survey of 2,600 households along and near the planned ring road, in accordance with international standards. The survey results are as follows:

Breakdown of Trip Purposes: Work commuting accounts for 46.52% of trips, followed by returning home (33.31%), school (2.87%), child pickup (9.43%), taxi driving (0.89%), leisure and recreation (4.13%), and government/medical purposes (2.85%).

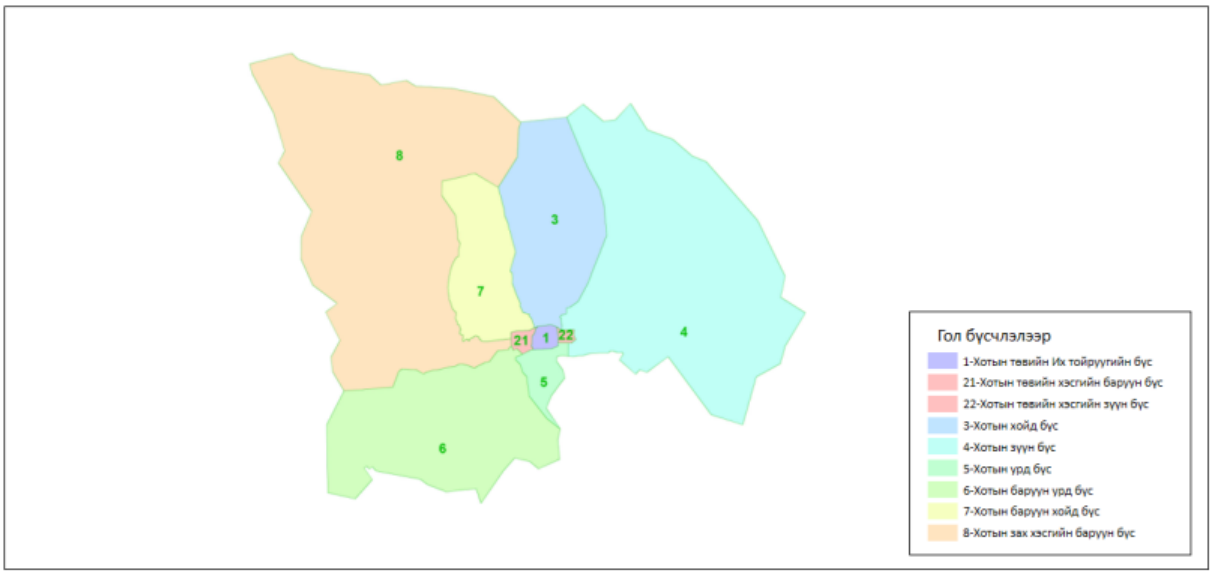

Figure 4 Traffic Zone Division in Ulaanbaatar

Table 8 Morning Peak Traffic Zone Trip Matrix in Ulaanbaatar

Traffic Zones	1	3	4	5	6	7	8	21	22
1	2656	1667	1713	714	282	1748	267	824	553
3	3047	1585	725	1095	457	2100	375	1168	293
4	3256	1512	1339	548	325	1781	203	783	994
5	731	421	241	155	309	754	166	394	108
6	1423	982	608	381	837	1629	563	1265	190
7	2344	3239	1356	703	1281	4626	1075	2432	319
8	177	415	113	117	526	928	694	386	59
21	1301	1479	711	438	424	1558	413	2163	303
22	962	301	644	198	77	358	61	236	139

Table 9 Noon Peak Traffic Zone Trip Matrix in Ulaanbaatar

Traffic Zones	1	3	4	5	6	7	8	21	22
1	4794	2073	1686	1216	500	2621	221	2201	813
3	2283	4041	632	784	583	1164	195	2286	303
4	1994	1146	964	259	309	584	90	687	1082
5	1984	820	88	176	159	1233	100	405	16
6	565	628	206	309	1844	895	383	551	51
7	1601	1845	712	1059	695	4342	981	1962	198

8	306	177	83	152	332	599	742	199	49
21	2286	3499	454	849	413	1393	228	4842	144
22	4794	2073	1686	1216	500	2621	221	2201	813

Table 10 Evening Peak Traffic Zone Trip Matrix in Ulaanbaatar

Traffic Zones	1	3	4	5	6	7	8	21	22
1	4237	2914	1839	849	444	2266	149	1847	331
3	1955	1465	1609	868	431	2703	342	1034	518
4	1457	1847	1167	219	255	1479	114	952	742
5	812	588	137	156	317	683	153	488	54
6	1452	1128	433	379	837	1343	531	1055	104
7	2243	2457	1614	621	1323	4762	1049	1946	435
8	186	405	108	94	540	904	694	200	46
21	1594	1676	708	462	465	2457	560	2257	233
22	302	678	1728	73	51	297	30	160	320

4.3 Traffic Condition Analysis and O-D Matrix

Video monitoring data from 11 key urban intersections during morning and evening peak hours formed the basis for traffic volume measurements. Application of traffic flow continuity theory and lane functional analysis enabled the derivation of entry/exit volumes for non-observed zones. Real-time traffic data from Google Maps was analyzed to evaluate roadway operational conditions in Ulaanbaatar during peak hours. Concurrently, Google Maps data was integrated with ArcGIS to develop structured network models. Spatial analysis through raster-vector overlay delineated congestion distribution patterns across Ulaanbaatar's entire road network, with particular focus on temporal variations along primary north-south and east-west corridors.

4.3.1 Peak Hour Traffic Volumes

During traffic assignment, OD matrix inversion is required to optimize the resident trip matrix. This system survey investigated 16 intersections, with data documented in the Traffic Flow Survey Report. Figure 5 shows the distribution of key intersections,

while Figures 6 to 16 display real-time video footage from 11 critical intersections.

Figure 5 Key Intersection Location

The traffic assignment process incorporated the O-D backcasting approach to calibrate the resident travel matrix. A systematic survey was conducted at 16 signalized intersections, with complete datasets documented in the *Traffic Volume Survey Report*. Figures 6 through 16 present real-time surveillance footage from sampled intersections.

Figure 6 Intersection 1

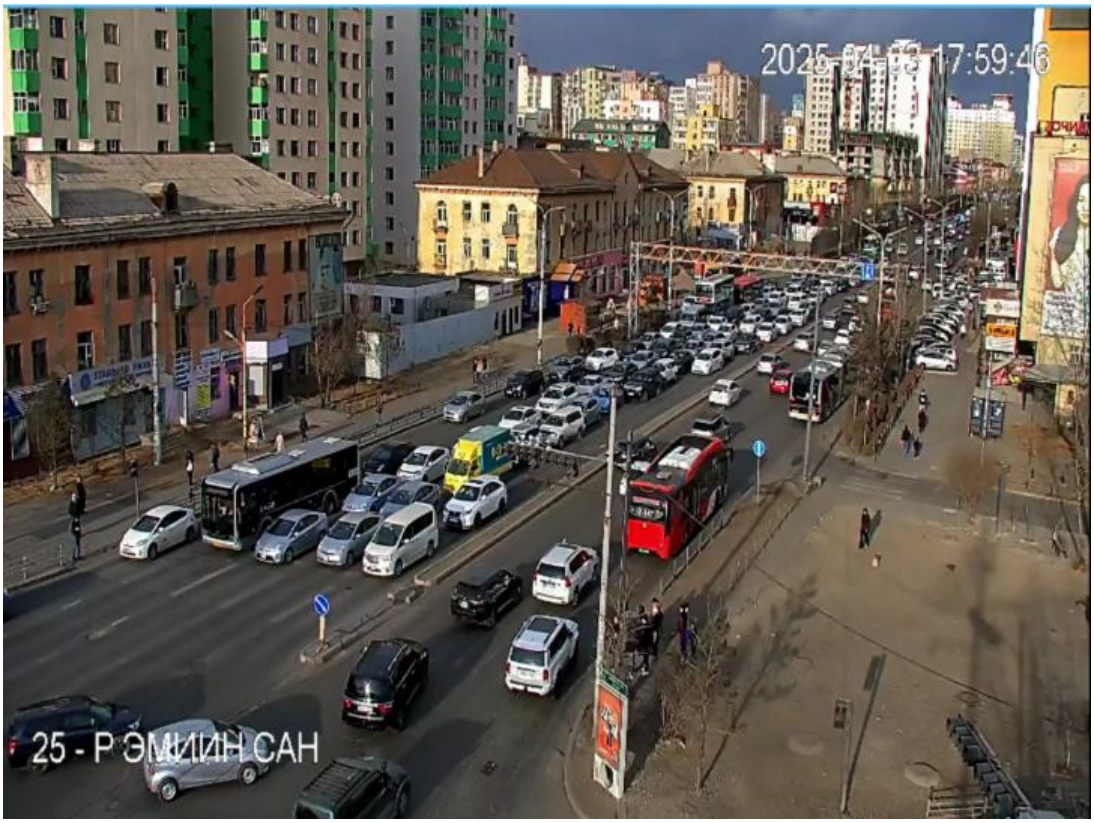

Figure 7 Intersection 2

Figure 8 Intersection 3

Figure 9 Intersection 4

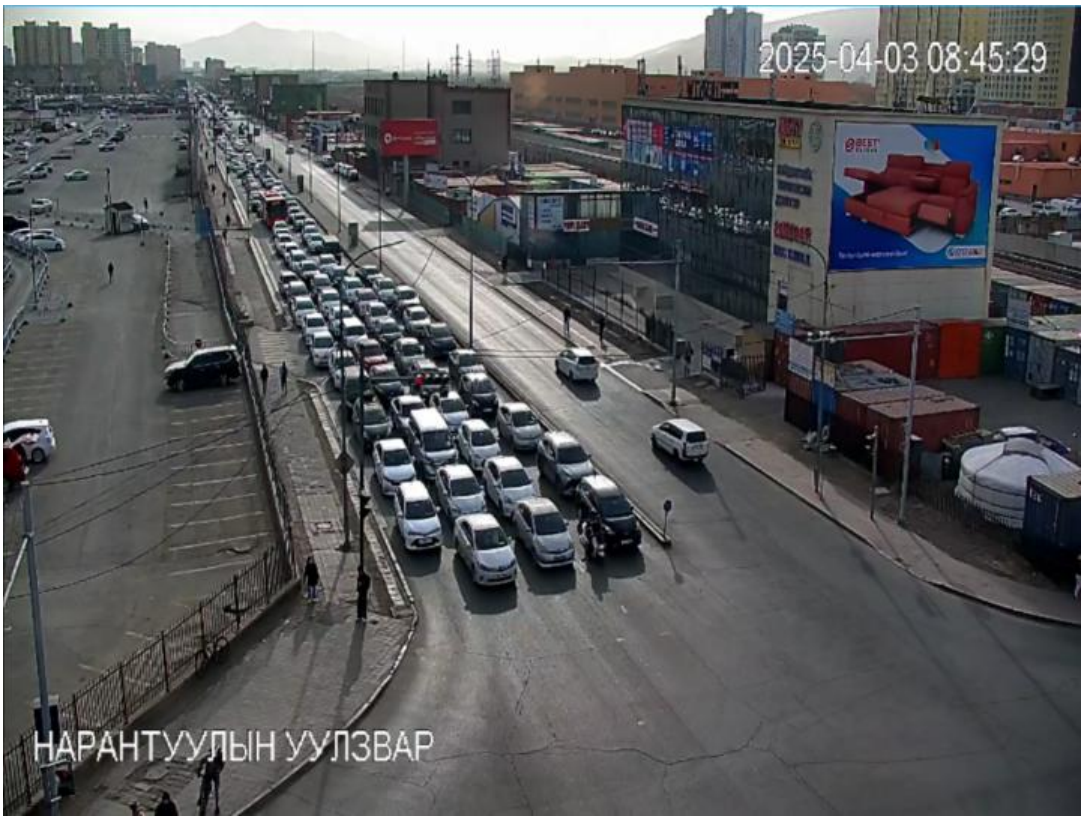

Figure 10 Intersection 5

Figure 11 Intersection 6

Figure 12 Intersection 7

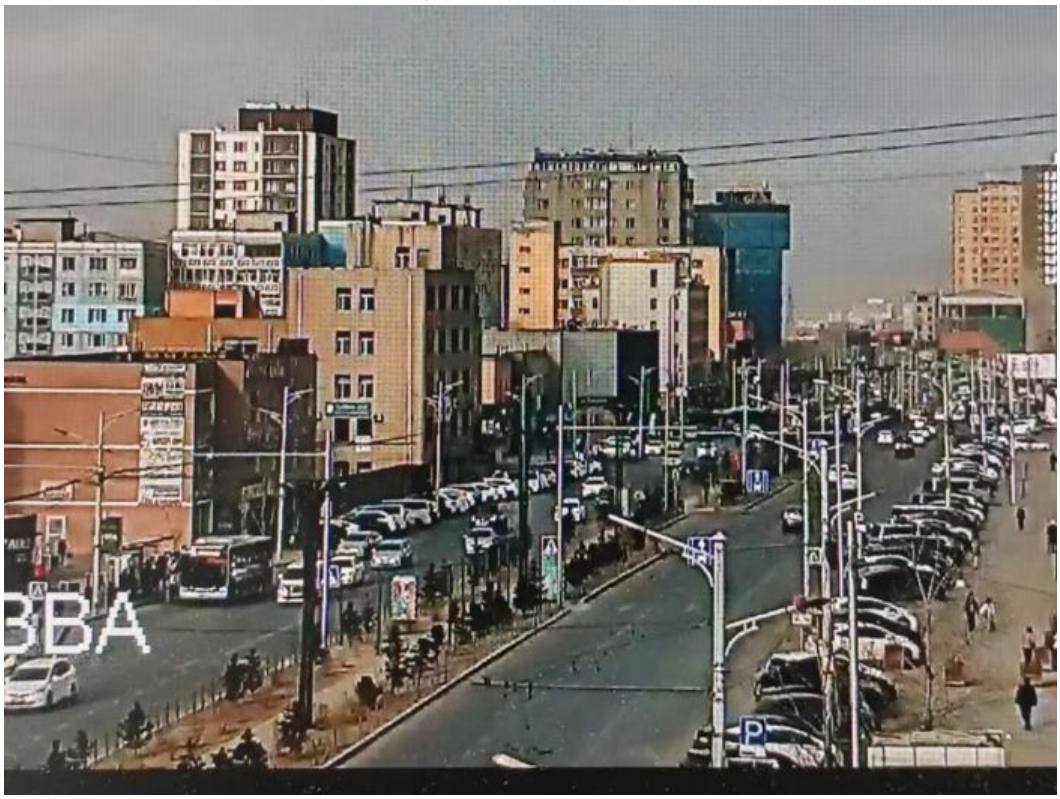

Figure 13 Intersection 8

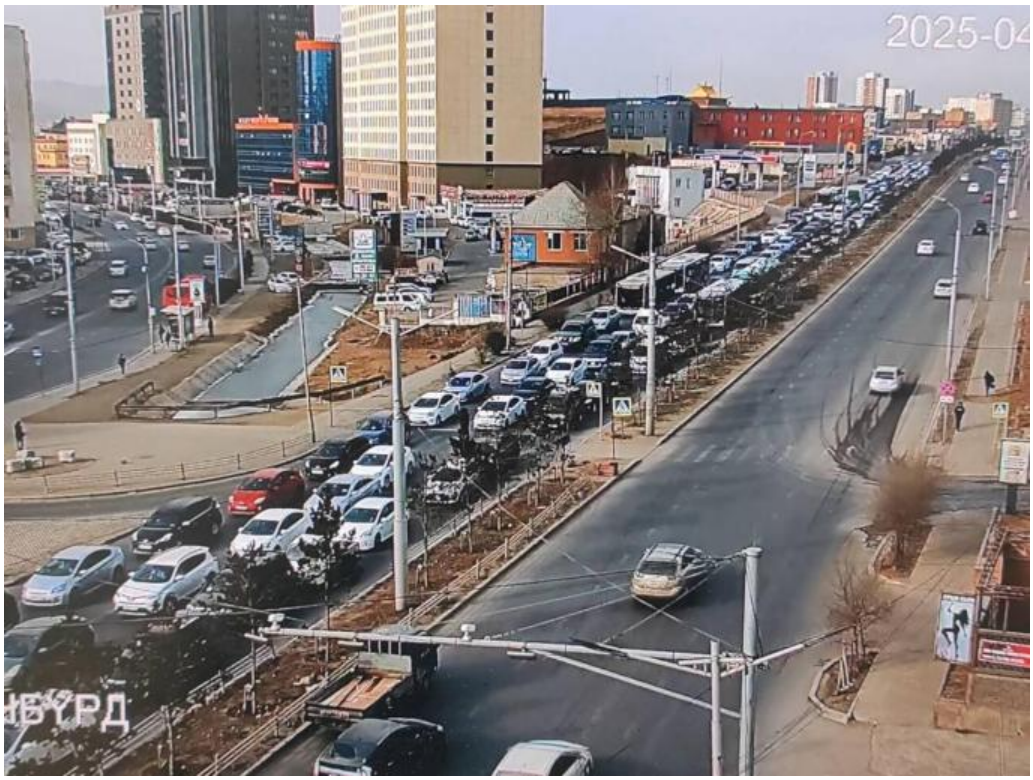

Figure 14 Intersection 9

Figure 15 Intersection 10

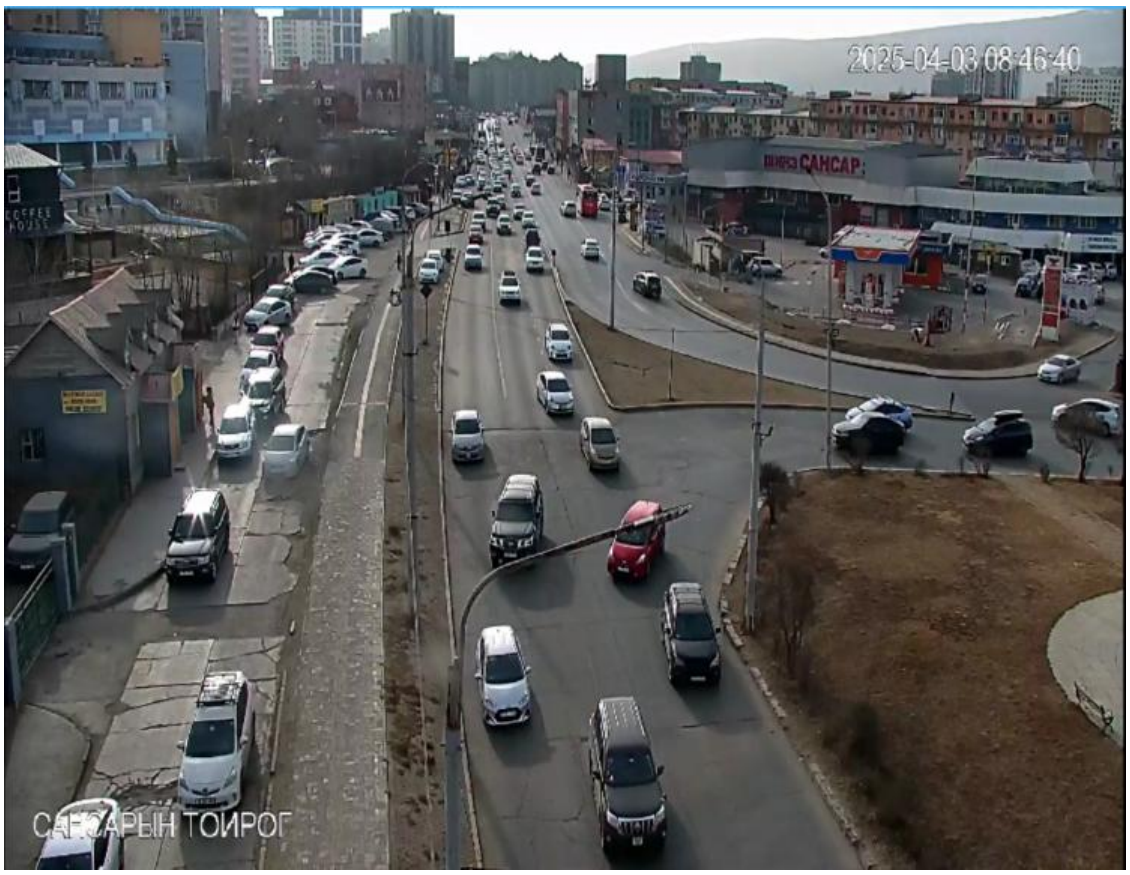

Figure 16 Intersection 11

4.3.2 Morning Peak Hour Analysis

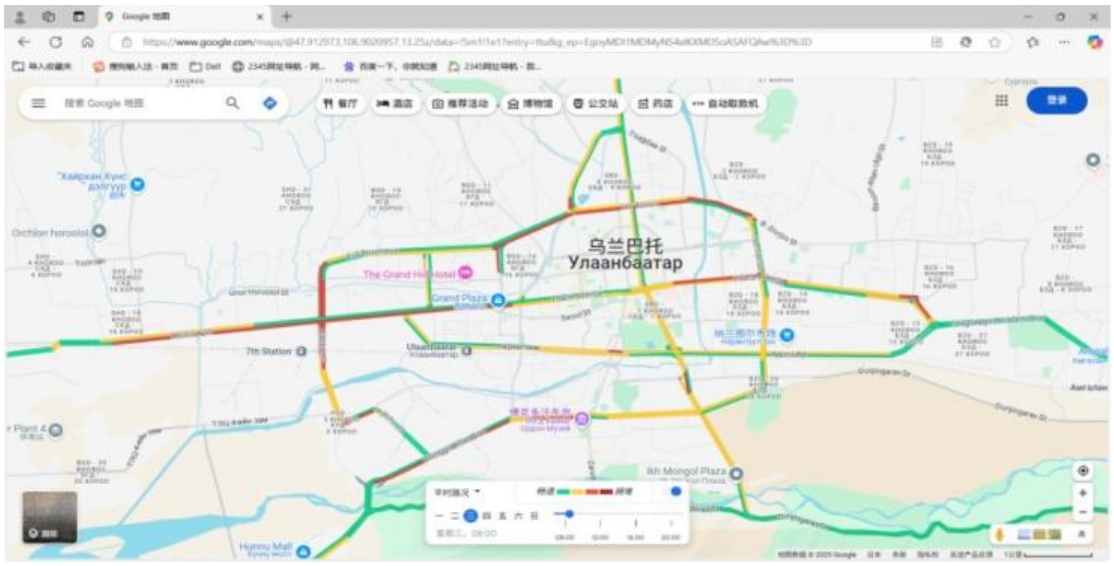

Figure 17 Traffic Congestion During Morning Peak Hour

As illustrated in Figure 17, several key roadways in Ulaanbaatar display red or yellow congestion levels, including the east-west corridors traversing the city center and select north-south arterial routes. All four inbound corridors (eastbound, westbound,

southbound, and northbound) are experiencing severe congestion, with the congestion patterns progressively extending toward the urban core.

During morning peak hours, the dramatic rise in commuter numbers prompts a substantial portion of residents to opt for private vehicles or public transit to reach workplaces, schools and other key destinations, triggering a sudden surge in traffic volume that significantly surpasses the roadway capacity.

4.3.3 Midday Peak Hour Analysis

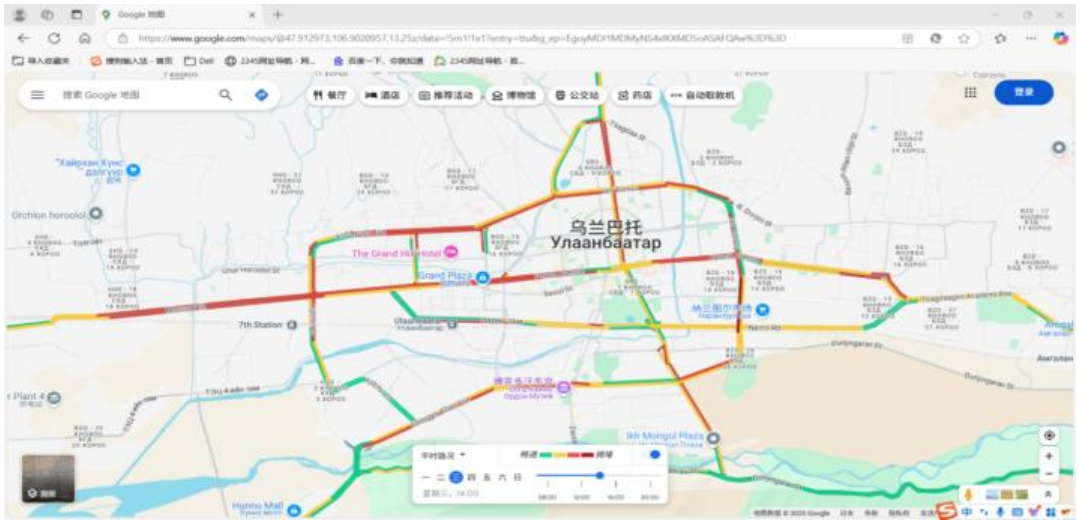

Figure 18: Traffic Congestion During Midday Peak Hour

As illustrated in Figure 18, when compared with morning peak conditions, the midday peak shows a marked increase in severely congested (red) road sections, where travel speeds remain substantially reduced and traffic operations continue to experience significant disruptions.

Weekday commuting and recreational travel exhibit peak demand, with concentrated surges of both pedestrian and vehicular traffic overwhelming road networks. This leads to traffic volumes consistently exceeding designed capacity, causing recurrent congestion patterns.

4.3.4 Evening Peak Hour Analysis

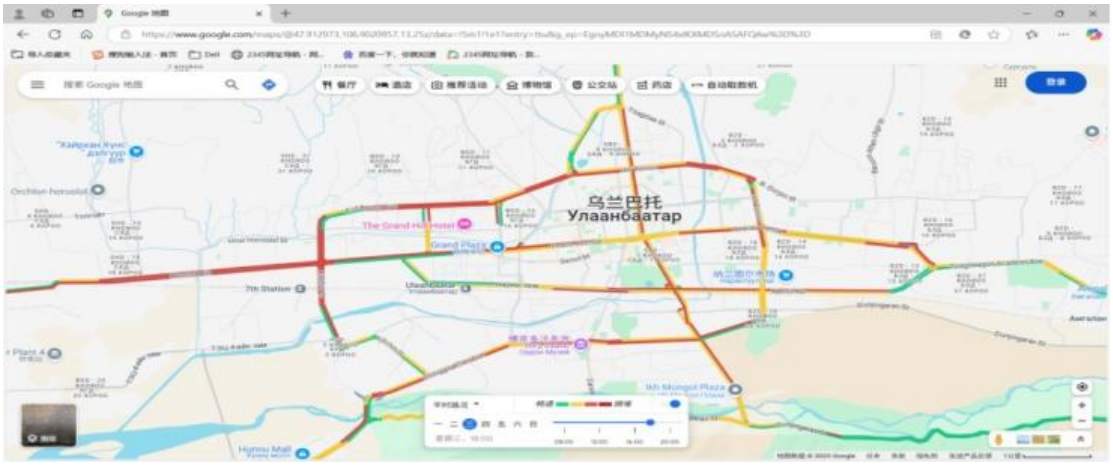

Figure 19: Traffic Congestion During Evening Peak Hour

As illustrated in Figure 19, during the evening peak hours, extensive sections of Ulaanbaatar's urban road network display red or yellow congestion levels, reflecting system-wide traffic congestion. The northern arterial exit corridor exhibits particularly acute congestion conditions.

The evening peak hour witnesses concentrated pedestrian and vehicular flows overwhelming the roadway system, coupled with surging private vehicle travel demands. These combined factors result in traffic volumes consistently surpassing designed roadway capacity, generating critical congestion levels.

4.3.5 Road Segment Congestion Attribute Analysis

This analysis utilizes traffic condition imagery obtained from Google's BigQuery platform, where the blue spectrum layer accentuating roadway characteristics is isolated via multi-band decomposition. The processed data is then used for generating structured network features and centroid elements through ArcGIS geospatial processing. The network dataset then undergoes hierarchical reclassification, with roadway pixels being algorithmically mapped to digital codes, while divergence analysis is applied to resolve classification ambiguities in the reclassification process. The analytical process integrates processed raster data with centroid feature layers through spatial extraction, producing a comprehensive congestion attribute matrix.

This study employs Google Maps traffic snapshots collected at multiple time intervals to generate two analytical outputs: (1) congestion ratio matrices and (2) temporal variation trendlines, facilitating a comprehensive assessment of Ulaanbaatar's urban traffic conditions. Tables 11 through 13 systematically present congestion metrics for: (i) Ulaanbaatar's overall urban road network, (ii) east-west corridors, and (iii) north-south corridors. Table 14 presents the traffic intensity proportion across Ulaanbaatar's

overall road network, east-west corridors, and north-south corridors. Figures 20 through 22 demonstrate temporal variations in congestion levels for Ulaanbaatar's overall roadway system, east-west corridors, and north-south corridors during weekdays. Figures 23 to 25 demonstrate temporal variations in traffic intensity distribution for Ulaanbaatar's overall roadway system, east-west corridors, and north-south corridors during weekdays.

Table 11 Temporal Variation of Congestion Rates in Ulaanbaatar's Overall Roadway System

Color	Green	Yellow	Red and Dark Red
Time	Smooth Traffic	Slow-moving traffic	Congested conditions
6：00	100.00%	0.00%	0.00%
7：00	76.74%	22.34%	0.92%
8：00	29.67%	47.36%	22.97%
9：00	27.91%	49.65%	22.44%
10：00	23.37%	52.99%	23.64%
11：00	17.49%	59.14%	23.37%
12：00	16.20%	46.34%	37.46%
13：00	14.12%	47.45%	38.43%
14：00	15.34%	41.21%	43.45%
15：00	14.98%	39.59%	45.43%
16：00	16.45%	43.05%	40.50%
17：00	16.94%	39.96%	43.10%
18：00	10.46%	38.62%	50.92%
19：00	11.47%	43.48%	45.05%
20：00	17.39%	48.90%	33.71%
21：00	28.15%	58.28%	13.57%
22：00	60.13%	36.39%	3.48%

Table 12 Temporal Variation of Congestion Rates of East-West Corridors in Ulaanbaatar

Color	Green	Yellow	Red and Dark Red
Time	Smooth Traffic	Slow-moving traffic	Congested conditions
6:00	100.00%	0.00%	0.00%
7:00	64.31%	32.75%	2.94%
8:00	28.31%	37.35%	34.34%
9:00	23.20%	49.35%	27.45%
10:00	21.98%	54.75%	23.27%
11:00	16.67%	59.88%	23.45%
12:00	9.60%	36.69%	53.71%
13:00	2.75%	41.76%	55.49%
14:00	4.54%	34.08%	61.38%
15:00	3.72%	38.24%	58.04%

16:00	6.62%	44.73%	48.65%
17:00	13.33%	33.34%	53.33%
18:00	7.88%	38.98%	53.14%
19:00	14.42%	35.51%	50.07%
20:00	19.40%	40.30%	40.30%
21:00	22.57%	71.27%	6.16%
22:00	47.68%	44.48%	7.84%

Table 13 Temporal Variation of Congestion Rates of North-South Corridors in Ulaanbaatar

Color	Green	Yellow	Red and Dark Red
Time	Smooth Traffic	Slow-moving traffic	Congested conditions
6:00	100.00%	0.00%	0.00%
7:00	78.02%	21.98%	0.00%
8:00	22.87%	71.87%	5.26%
9:00	18.46%	67.38%	14.17%
10:00	14.75%	64.30%	20.94%
11:00	7.36%	71.86%	20.78%
12:00	12.00%	50.10%	37.90%
13:00	15.16%	47.88%	36.96%
14:00	11.63%	45.84%	42.54%
15:00	9.78%	36.73%	53.49%
16:00	12.88%	38.95%	48.17%
17:00	10.10%	57.44%	32.46%
18:00	1.82%	47.66%	50.52%
19:00	2.46%	45.12%	52.42%
20:00	9.31%	71.84%	18.85%
21:00	18.06%	74.86%	7.08%
22:00	60.53%	38.32%	1.15%

Table 14 Traffic Intensity Proportion: Overall Roadway System vs. Primary Transport Corridors in Ulaanbaatar

	Overall Roadway System	East-West Corridor	North-South Corridor
Time	Traffic Intensity Proportion	Traffic Intensity Proportion	Traffic Intensity Proportion
6:00	2.95%	2.78%	2.91%
7:00	3.66%	3.86%	3.55%
8:00	5.70%	5.73%	5.31%
9:00	5.74%	5.69%	5.69%
10:00	5.90%	5.60%	6.00%
11:00	6.07%	5.76%	6.21%
12:00	6.52%	6.79%	6.57%
13:00	6.61%	7.04%	6.45%
14:00	6.73%	7.15%	6.72%
15:00	6.79%	7.08%	7.09%

16:00	6.61%	6.74%	6.84%
17:00	6.67%	6.68%	6.47%
18:00	7.09%	6.83%	7.23%
19:00	6.89%	6.56%	7.27%
20:00	6.38%	6.15%	6.10%
21:00	5.47%	5.11%	5.50%
22:00	4.23%	4.46%	4.09%

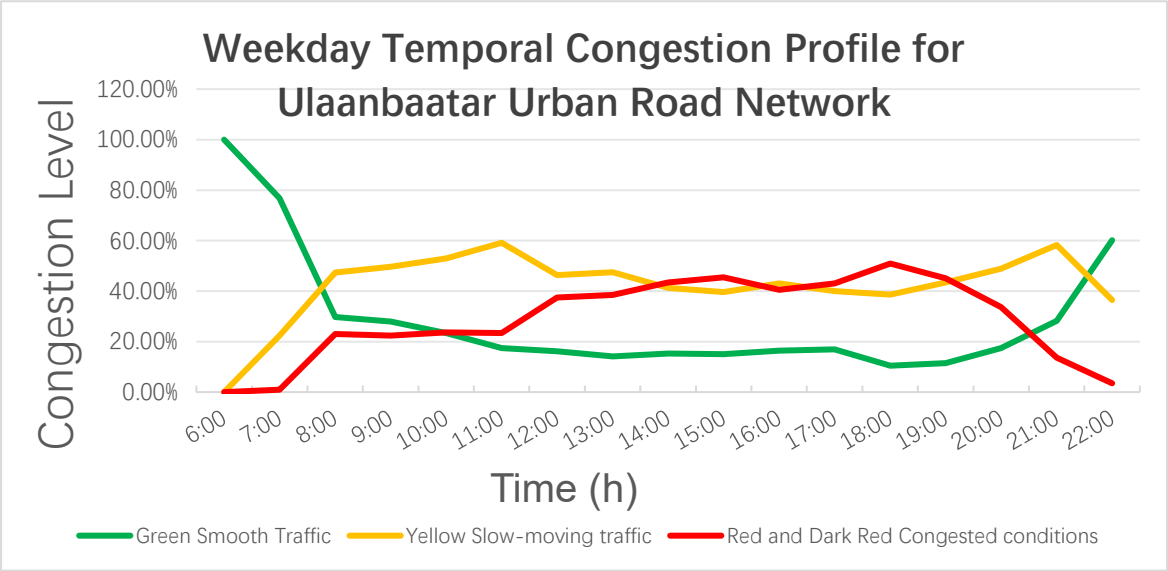

Figure 20 Temporal Citywide Congestion Profile in Ulaanbaatar

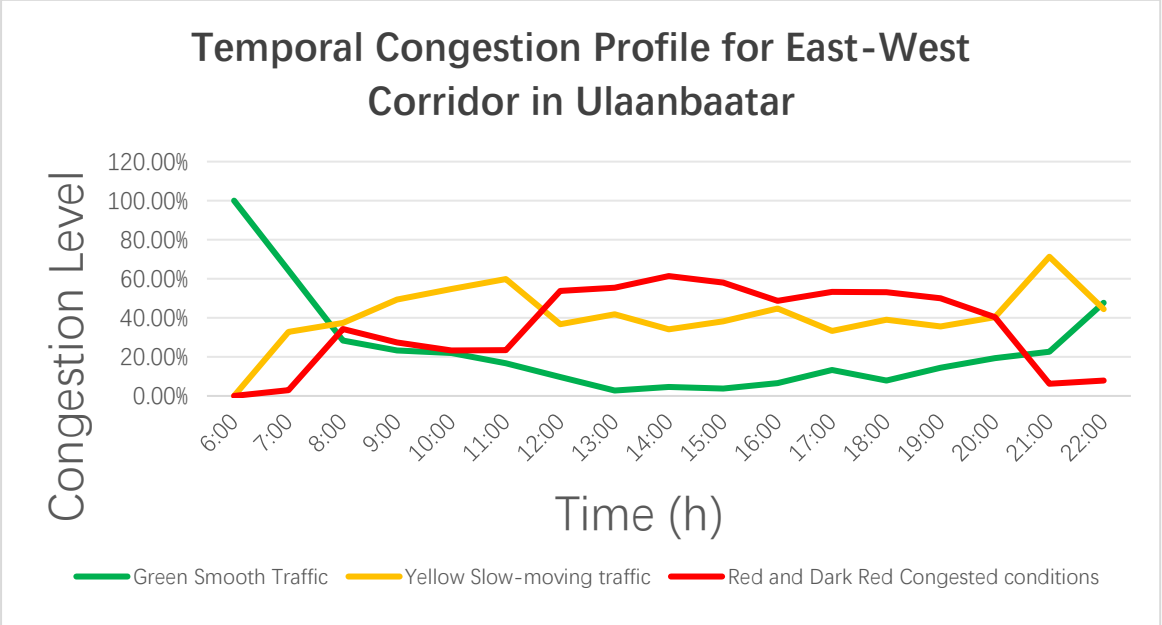

Figure 21 Temporal Congestion Profile for East-West Corridor in Ulaanbaatar

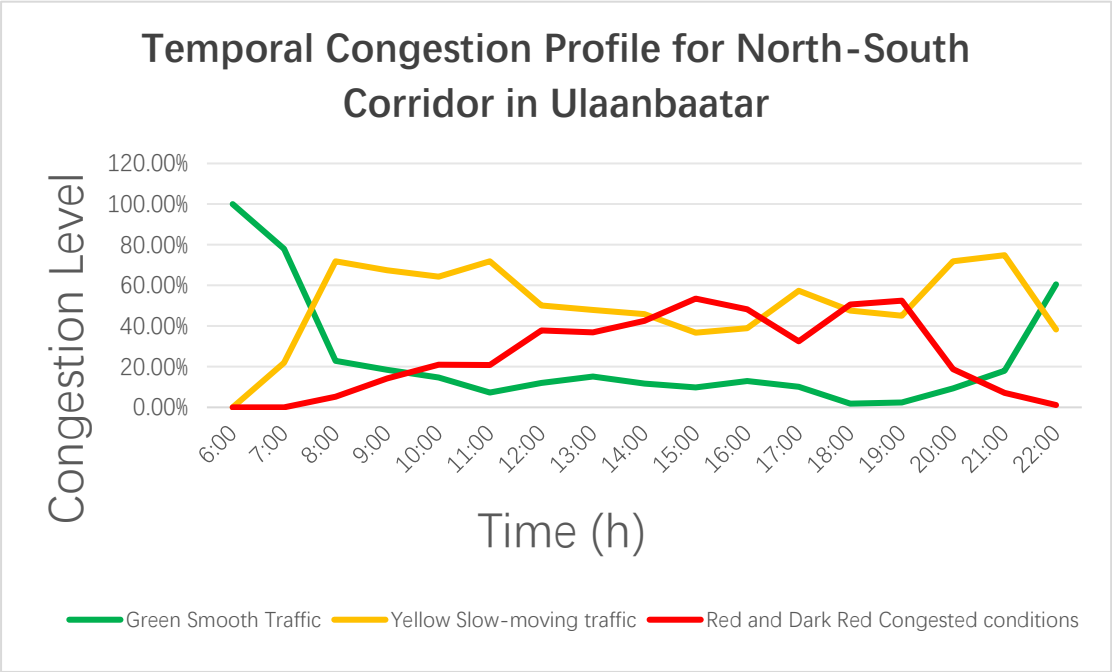

Figure 22 Temporal Congestion Profile for North-South Corridor in Ulaanbaatar

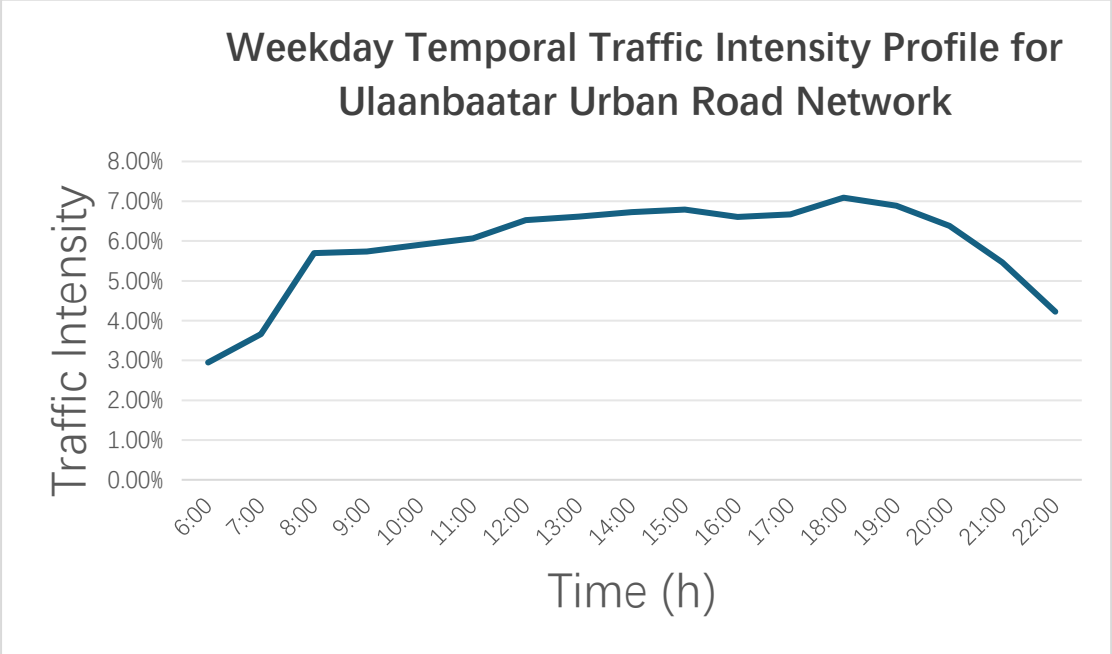

Figure 23 Weekday Traffic Intensity Profile for Ulaanbaatar Urban Road Network

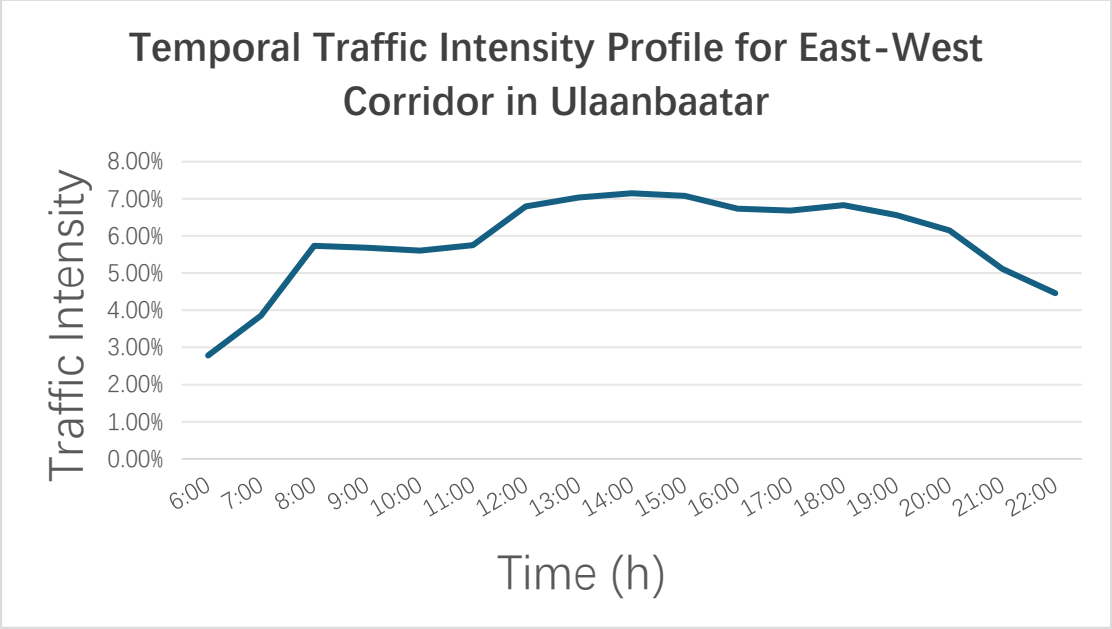

Figure 24 Temporal Traffic Intensity Profile for East-West Corridor in Ulaanbaatar

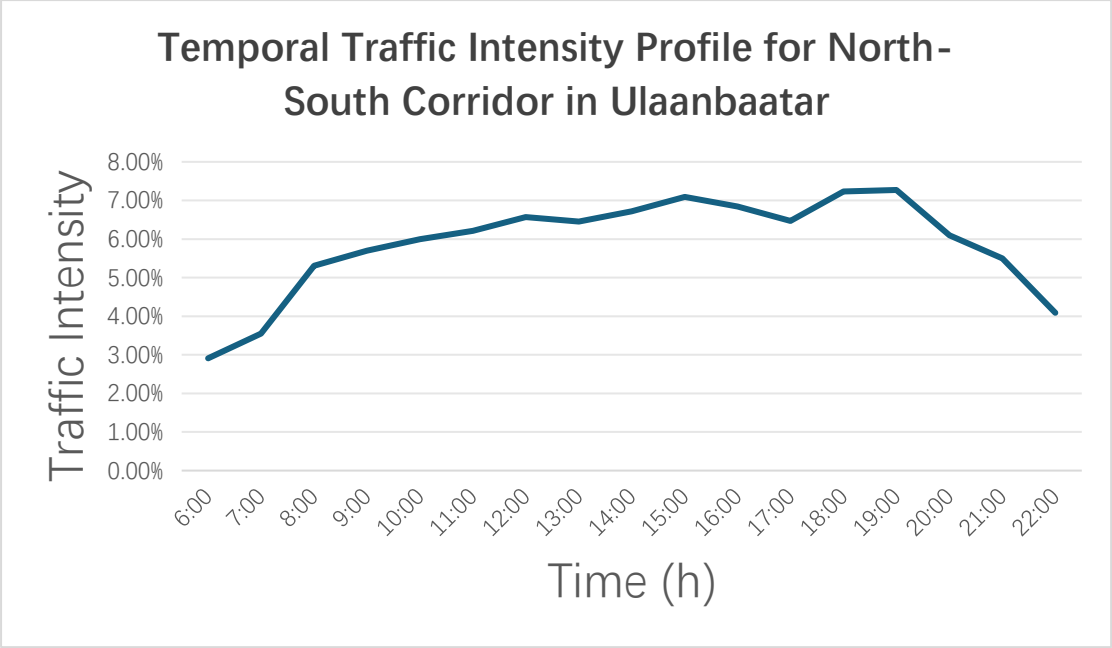

Figure 25 Temporal Traffic Intensity Profile for North-South Corridor in Ulaanbaatar

5. Transportation Mode Distribution in Ulaanbaatar

This study evaluates the level of urban transportation infrastructure development and future traffic demand trends by analyzing the types of transportation modes chosen by residents. The comparison of transportation mode distribution in Ulaanbaatar over the years is as follows:

Table 15 Transportation Mode Structure (Mode Share)

Year and Source of Study	Public Transit	Private Cars	Walking	Taxi	Others
2007 (JICA International Organization Study)	60%	34%	-	-	5%*
2016 (Preliminary Study on Special Bus Routes in Ulaanbaatar)	51%	42%	5%	2%	-
2017 (Capital Road Network Development Plan)	49%	39%	7%	3%	2%
2022 (OD Matrix Survey of 15,000 Households)	34%	48%	12%	3%	3%
2025 (OD Matrix Survey of 2,600 Households)	38%	49%	10%	2%	2%

Notes:

1. 2007 data: The "Others" category (5%) includes taxis and walking (original data were not disaggregated).

2. 2016 data: The "Others" category is unspecified (original data not labeled).

3. 2022 data: The "Others" category (3%) includes bicycles (1%) and other uncategorized modes.

4.2025 data: The "Others" category (2%) includes bicycles (0.07%) and other uncategorized modes.

5. Percentages may have ±1% error due to rounding.

5.1 Trend Analysis

Public transit share: Declined from 60% in 2007 to 38% in 2025 (a 36% reduction);

Private car share: Rose from 34% in 2007 to 49% in 2025 (a 44% increase);

Walking and non-motorized transport: Significantly increased after 2017, reflecting urban expansion and growing demand for short-distance travel.

The comprehensive data shows that over the past 15 years, the proportion of public transit usage in Ulaanbaatar has continued to decline, while private car usage has

significantly increased. To cope with this trend, measures such as strengthening public transit, promoting walking/cycling, and adopting new transportation modes should be implemented.

The road network before and after the implementation of Ulaanbaatar's "New Ring Road" project is shown in the following figures.

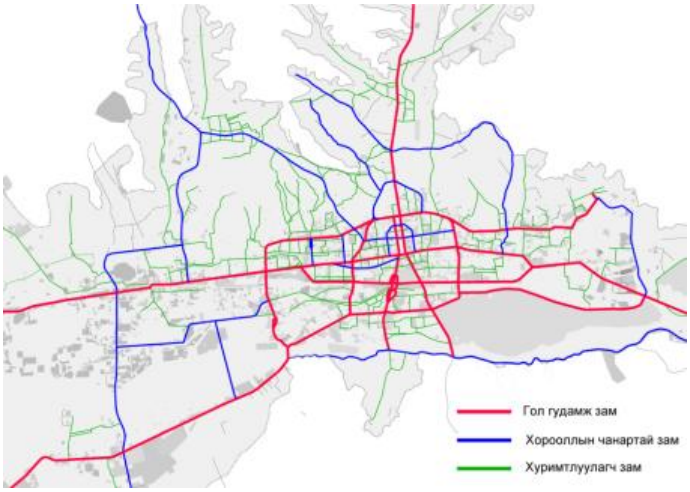

Figure 26 Road Network Prior to Project Implementation

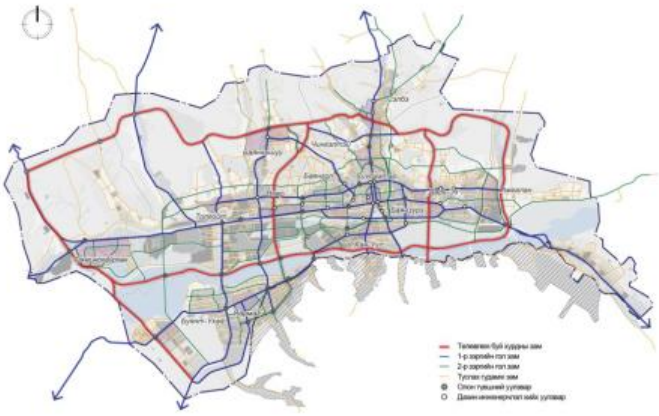

Figure 27 Road Network After Project Implementation

6. Macroscopic Modeling of Traffic Demand for the "New Ring Road" Project

6.1 Software Introduction

TransCAD is a piece of professional transportation Geographic Information System (GIS) software developed by Caliper Corporation in the USA, specifically designed for transportation planning, management, and analysis. As the first comprehensive platform to integrate GIS with transportation models, its core functionality is built around the "Four-Stage Method" for traffic demand forecasting. It also incorporates advanced spatial data processing capabilities, which makes it widely used in urban transportation planning, public transit network optimization, and highway traffic flow forecasting.

(1) Traffic Generation Forecasting

Traffic generation forecasting mainly predicts the trip generation and attraction volumes for each traffic zone in the study area. Regional predictions generally take into account the spatial distribution of traffic generation sources and land use patterns.

This study is based on the 2022 travel survey of 15,119 households. After conducting the 2025 OD survey, the relevant traffic zone data were updated. Growth rates from the 2022 report were applied to estimate the traffic generation and attraction volumes for the planning year, ensuring a balanced distribution.

(2) Traffic Distribution Forecasting

Traffic distribution forecasting converts the trip generation and attraction volumes of each zone into origin-destination (OD) flows between zones. his study used the Furness method, a technique based on the growth rate approach, for traffic distribution forecasting.

(3) Mode Split Forecasting

Mode split forecasting determines the distribution of transportation mode choices for residents in the planning year. Based on the 2022 survey data and supplemented by the 2025 travel survey of 2,600 households, the mode share distribution for various transportation modes was determined.

(4) Traffic Assignment

Traffic assignment refers to the process of assigning the OD matrix obtained earlier to the road network to derive road segment-level traffic flows and other transportation indicators. In this study, the User Equilibrium (UE) method was selected

in the TransCAD simulation software for traffic assignment on Ulaanbaatar's road network.

6.2 Traffic Demand Analysis and Traffic Assignment Results

According to the 2022 survey report, the demographic classification within the TAZs includes the following data: total population, number of households, family members, and age distribution, all of which are reflected in the project's database. The demographic statistics were calculated by zone using the foundational data from the Capital Statistics Bureau. The 6 central districts of Ulaanbaatar cover 1,466,431 residents, divided into 213 zones. Population data were sourced from local administrative committees. Committee 26 is the most populous, with 24,054 residents.

Household Statistics: The model includes a total of 412,527 households across the 6 central districts. The area with the highest number of households is District 26, with 6,930 households.

Household Members: The average household size per committee or zone ranges from 2.5 to 4.6 members.

Age Groups: The population of the 6 central districts is divided into 5 age groups:

Children aged 0-14: 488,284

Youth aged 15-29: 269,020

Adults aged 30-44: 373,683

Seniors aged 45-60: 222,807

Seniors aged over 60: 115,304

A total of 1,469,099 citizens are included in the simulation zones.

Socioeconomic and Land Use Data:

Based on the 2022 OD survey results, this project incorporates the following socioeconomic data: non-working population, employed populations, unemployed populations, total number of students, student distribution by zone, number of motor vehicles, household motor vehicles, employment figures, industrial output, and other relevant indicators.

Land use data includes the following indicators:

Land use types

Residential area, commercial service area, administrative area

Industrial area, daily commercial area

Large commercial center area

Leisure, entertainment areas, and others.

All the above data have been fully entered into the project's information database.

6.3 OD Matrix Calculation Process

The total travel volume of Ulaanbaatar in this report is based on the growth rate from the 2022 OD survey for the years up to 2040, with trend predictions for 2025-2040 applied for the years beyond 2040. The following tables are extracted directly from the 2022 OD report.

This study adopts the base OD matrix from the 2022 dataset. Trip generation and attraction data for certain traffic zones were updated using the 2025 OD survey data. Intersection throughput data was obtained from the provided traffic flow surveys and video data.

By combining the speed study report with real-time traffic visualizations from Google Maps at different time points, it was determined that Ulaanbaatar's road network is currently oversaturated. Specifically, the actual arrival volume is generally greater than the observed throughput. Based on this, the actual vehicle arrival volume at each intersection was estimated.

Using vehicle arrival data for both entry and exit points of intersections during the morning, noon, and evening peak hours, the traffic OD matrix was reverse-engineered to derive the travel matrices for the 2025 peak periods (morning, noon, and evening).

Core Basis:

① Base OD Matrix: Inherited from the 2022 OD survey's travel matrix (based on 15,119 households), which was validated through field surveys and data calibration to accurately reflect current travel distribution patterns.

② Zone Growth Factor Method: Based on the 2022 OD matrix, the travel data for relevant traffic zones was updated in the 2022 OD matrix using the 2025 OD survey data. For the remaining zones, the growth factor method was applied to update the data, ensuring the balance between trip generation and attraction volumes.

③ Trip Distribution Forecasting: The Furness method from the growth rate approach was used for forecasting the trip distribution.

④ Mode Split: Based on the 2022 OD survey data, combined with the 2025 OD survey data, the mode split was determined for various transportation modes, including private cars, buses, walking, and others.

⑤ Traffic Assignment: In TransCAD software, the user equilibrium (UE) method

was applied to assign the 2025 travel matrix to the road network, deriving the traffic volumes and related traffic flow indicators for each road segment.

⑥ Actual Intersection Data: This was based on traffic flow survey data from 23 intersections in Ulaanbaatar and traffic volume monitoring video data of some intersections, which serve as the foundation for the road traffic volume study.

⑦ Actual Road Network Stress Conditions: Based on the road speed study report and real-time Google Maps screenshots, it was confirmed that Ulaanbaatar's overall road network is oversaturated, with actual vehicle arrival volumes generally exceeding the observed throughput.

⑧ Traffic OD Reverse Engineering: Using core data from steps ⑤ and ⑥, the actual arrival volumes at intersections were estimated. Based on the 2025 travel distribution matrix, the OD matrix was reverse-engineered and optimized to more accurately reflect actual travel conditions.

⑦ Long-Term Total Growth Rate: The projected daily car travel volume and compound growth rate from the 2022 OD report for the forecast year were strictly used as anchor points for controlling the total volume, as shown in the table below.

Table 16 Long-Term Forecast

	Unit of Measurement	2022	2025	2022/2025 Growth%	2030	2025/2030 Growth%	2040	2030/2040 Growth%	2044
Daily Traffic Volume									
Total Traffic Volume	Million persons/times	2.8	3.2	14%	3.6	13%	4.1	14%	
Total Car Traffic Volume	Million persons/times	1.8	2.1	17%	2.3	10%	2.6	13%	2.75

Based on the growth rate forecast, the OD matrices for each key year and the expected trend lines are presented below.

Table 17 Morning Peak Matrix for 2028

Traffic Zones	1	3	4	5	6	7	8	21	22
1	2763	1734	1782	743	294	1818	278	857	575
3	3169	1648	754	1139	475	2184	390	1214	305
4	3387	1572	1392	570	338	1852	211	814	1034
5	760	438	251	161	321	784	173	410	112
6	1480	1021	633	396	871	1694	586	1316	197
7	2437	3368	1410	731	1332	4811	1118	2529	331

8	184	432	117	122	547	965	721	401	61
21	1353	1538	740	456	441	1620	430	2249	315
22	1001	313	669	206	80	373	63	246	145

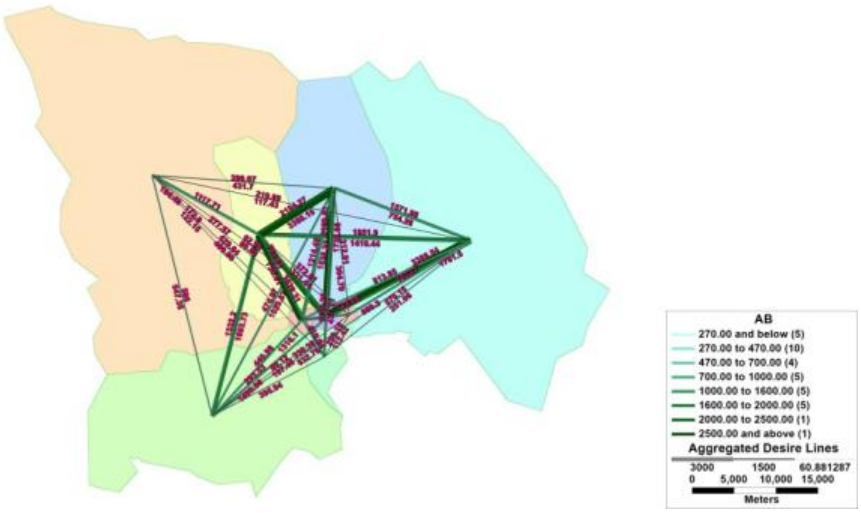

Figure 28 Projected Trend Line for Morning Peak in 2028

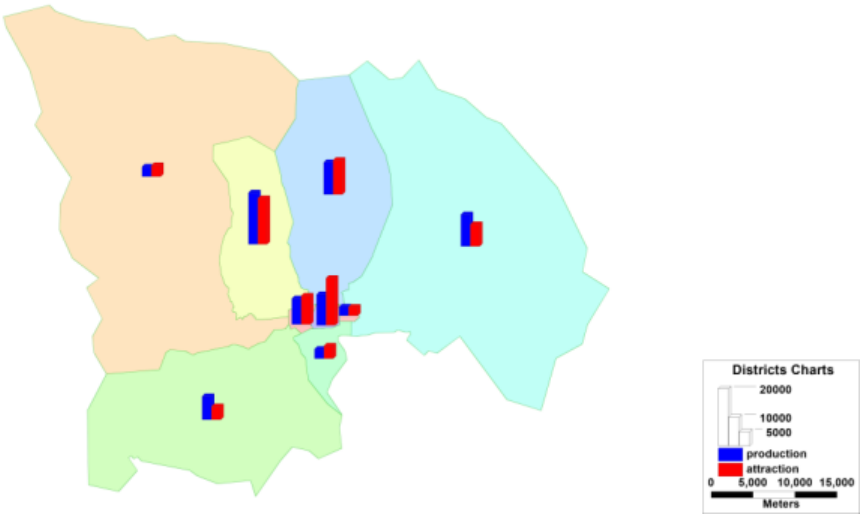

Figure 29 Bar Chart for Morning Peak in 2028

Table 18 Noon Peak Matrix for 2028

Traffic Zones	1	3	4	5	6	7	8	21	22
1	4986	2156	1753	1264	520	2726	230	2289	846
3	2374	4202	657	816	607	1210	203	2377	315
4	2073	1192	1003	270	322	608	94	714	1126
5	2063	853	91	183	165	1282	104	421	16
6	587	653	215	321	1918	931	398	573	53
7	1665	1919	740	1102	723	4516	1020	2041	206
8	318	184	86	158	345	623	771	207	51

21	2377	3639	472	883	429	1449	238	5035	150
22	639	538	721	62	78	165	62	189	581

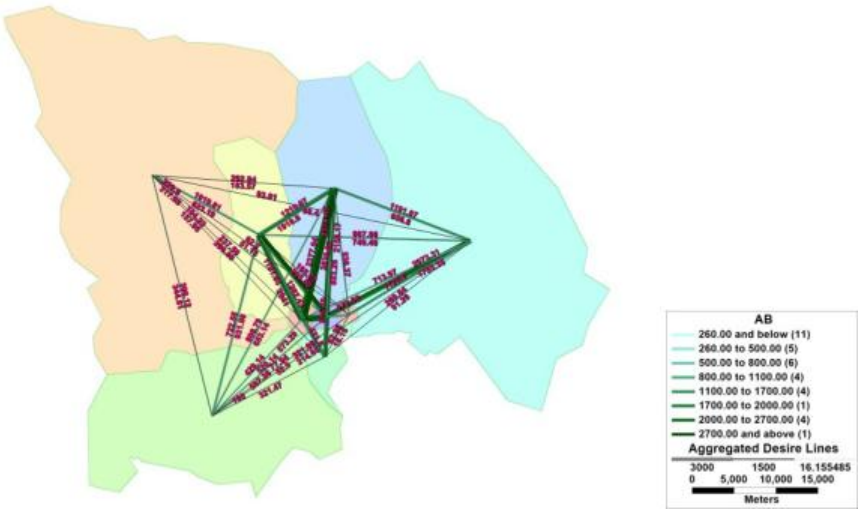

Figure 30 Projected Trend Line for Noon Peak in 2028

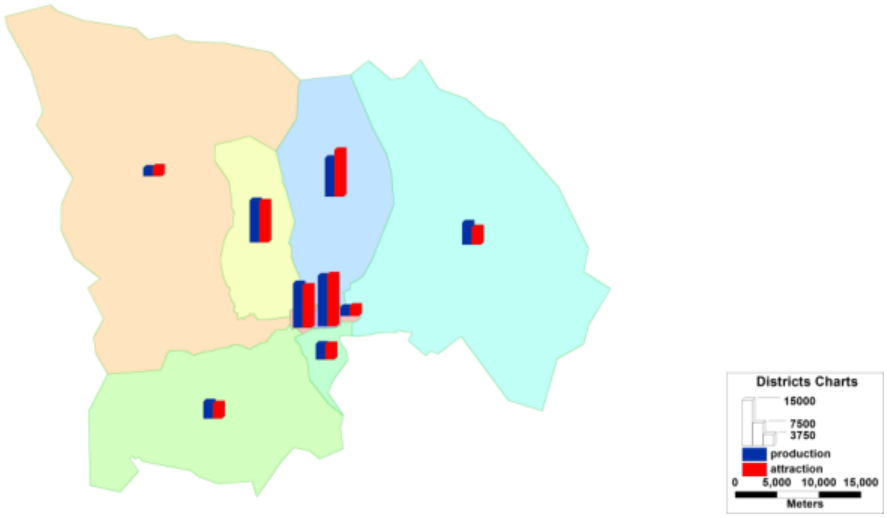

Figure 31 Bar Chart for Noon Peak in 2028

Table 19 Evening Peak Matrix for 2028

Traffic Zones	1	3	4	5	6	7	8	21	22
1	4406	3031	1912	883	462	2356	155	1921	344
3	2033	1524	1673	903	448	2811	355	1075	538
4	1515	1921	1213	228	265	1538	119	990	772
5	845	612	142	162	329	710	159	507	56
6	1510	1173	451	395	871	1397	552	1097	108
7	2332	2556	1678	645	1376	4953	1091	2024	453

8	193	421	113	98	561	940	722	208	48
21	1658	1743	736	481	484	2555	582	2347	242
22	314	705	1798	76	53	309	31	166	333

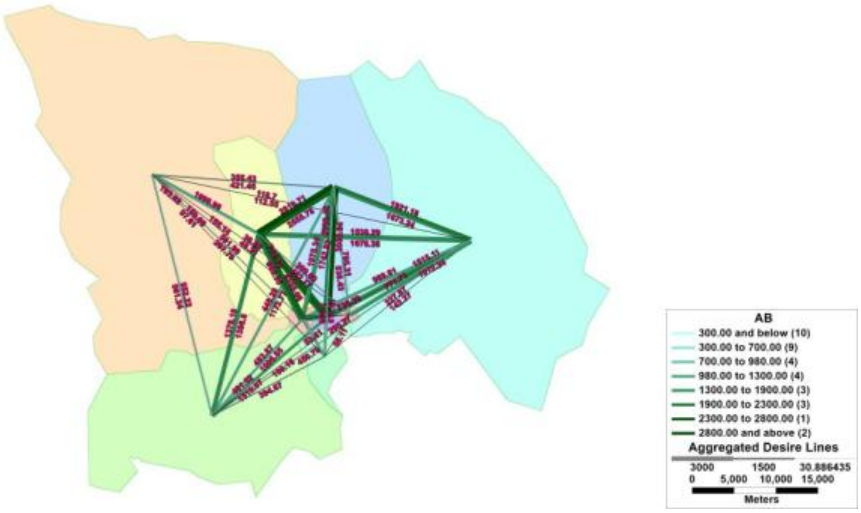

Figure 32 Projected Trend Line for Evening Peak in 2028

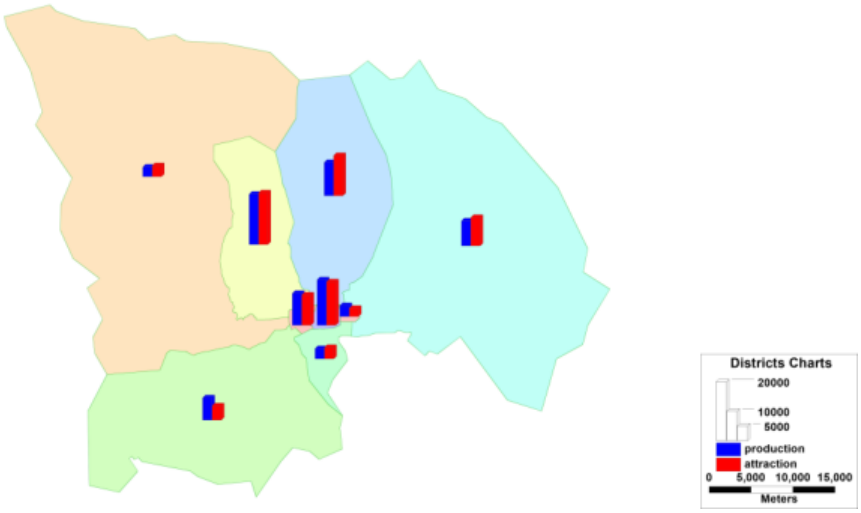

Figure 33 Bar Chart for Evening Peak in 2028

Table 20 Morning Peak Matrix for 2030

Traffic Zones	1	3	4	5	6	7	8	21	22
1	2922	1834	1884	785	310	1923	294	906	608
3	3351	1743	798	1205	502	2310	413	1285	322
4	3582	1663	1473	603	358	1959	223	861	1093
5	804	463	266	170	340	829	183	434	119
6	1565	1080	669	419	921	1791	620	1392	209
7	2578	3562	1492	773	1409	5088	1182	2675	351
8	195	457	124	129	579	1020	763	424	64
21	1431	1627	783	482	466	1714	454	2379	333
22	1058	331	708	218	85	394	67	260	153

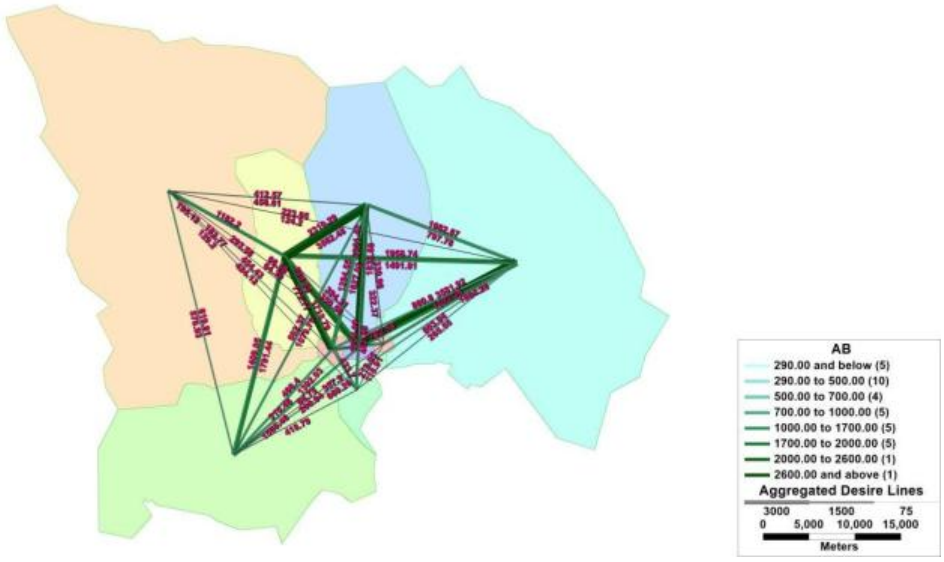

Figure 34 Projected Trend Line for Morning Peak in 2030

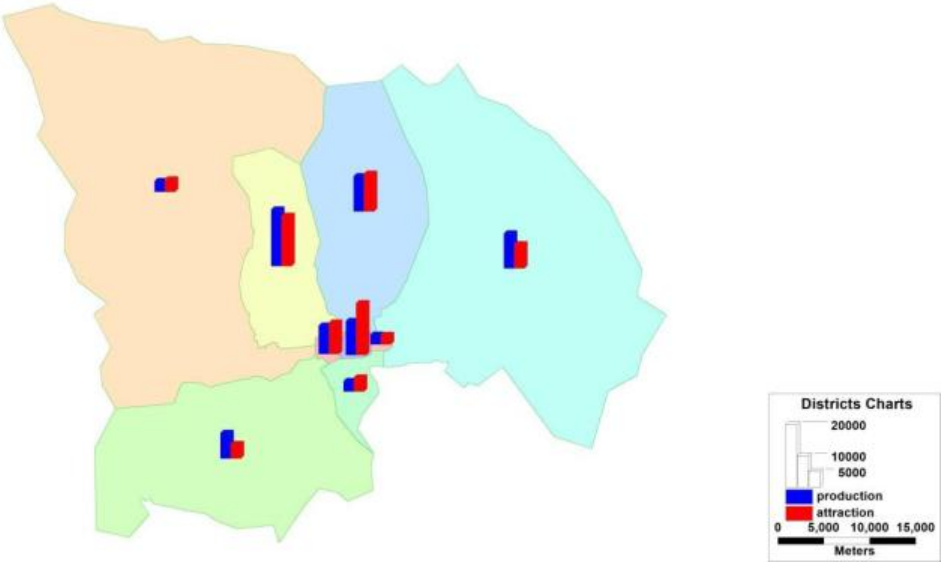

Figure 35 Bar Chart for Morning Peak in 2030

Table 21 Noon Peak Matrix for 2030

Traffic Zones	1	3	4	5	6	7	8	21	22
1	5274	2281	1855	1337	550	2883	243	2421	895
3	2511	4445	695	863	642	1280	215	2514	333
4	2193	1261	1060	285	340	643	99	755	1191
5	2183	902	97	193	175	1356	110	446	17
6	621	691	227	340	2029	985	421	606	56
7	1761	2030	783	1165	764	4776	1079	2159	218
8	336	194	91	167	365	659	816	219	54
21	2514	3849	499	934	454	1533	251	5326	159

22	676	569	763	66	82	175	66	200	615

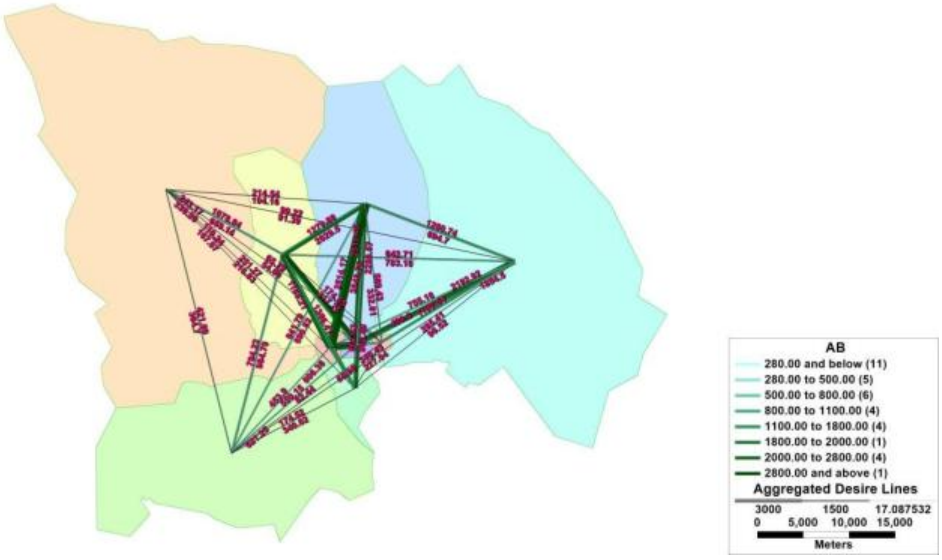

Figure 36 Projected Trend Line for Noon Peak in 2030

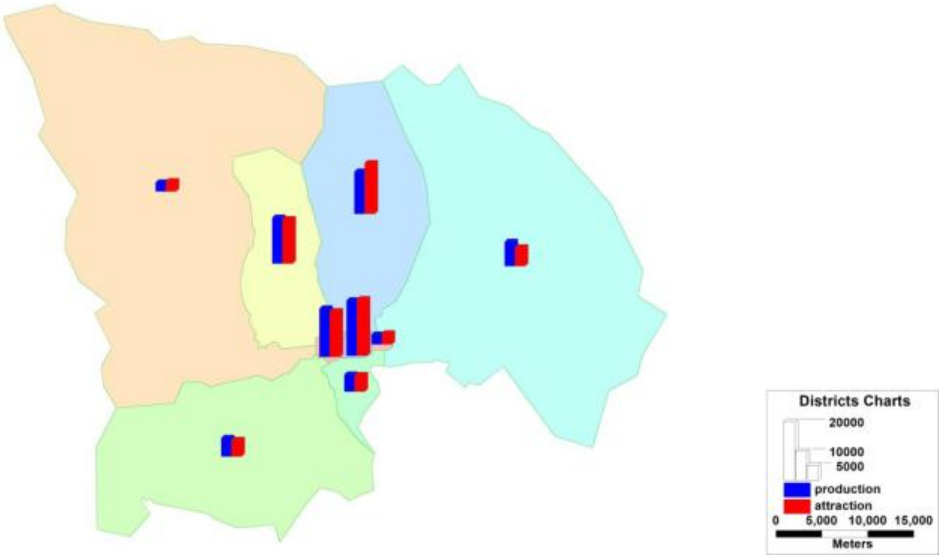

Figure 37 Bar Chart for Noon Peak in 2030

Table 22 Evening Peak Matrix for 2030

Traffic Zones	1	3	4	5	6	7	8	21	22
1	4661	3205	2023	934	488	2492	164	2032	364
3	2151	1612	1770	955	474	2973	376	1137	569
4	1603	2032	1283	241	281	1627	126	1047	816
5	894	647	150	171	348	751	168	537	59
6	1597	1240	477	417	921	1477	584	1160	114
7	2467	2703	1775	683	1456	5239	1154	2140	479
8	204	446	119	103	594	995	764	220	51
21	1753	1843	779	508	512	2702	616	2482	256
22	332	746	1901	81	56	327	33	176	352

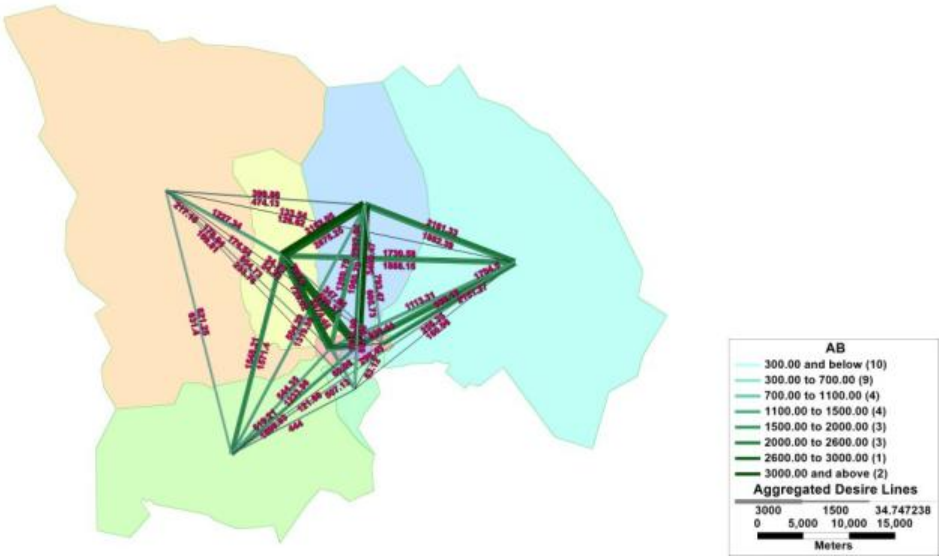

Figure 38 Projected Trend Line for Evening Peak in 2030

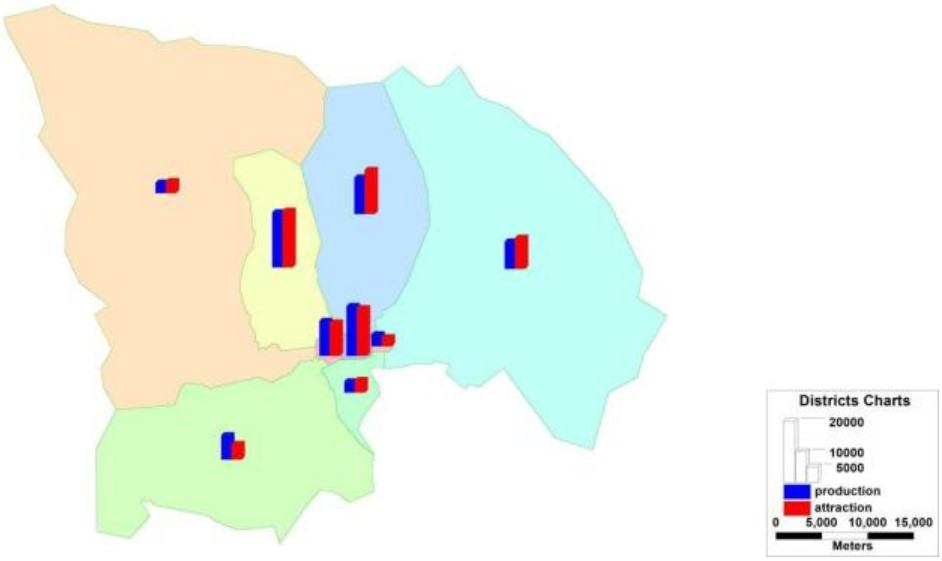

Figure 39 Bar Chart for Evening Peak in 2030

Table 23 Morning Peak Matrix for 2035

Traffic Zones	1	3	4	5	6	7	8	21	22
1	3108	1950	2004	835	330	2045	312	964	647
3	3565	1854	849	1282	534	2457	439	1366	343
4	3810	1768	1567	641	381	2083	237	916	1163
5	855	492	282	181	361	882	194	461	126
6	1665	1148	712	445	979	1905	659	1481	222
7	2742	3789	1587	822	1499	5412	1257	2845	373
8	208	486	132	137	616	1085	811	451	68
21	1522	1731	832	512	496	1823	483	2530	354
22	1126	352	753	232	90	419	71	276	163

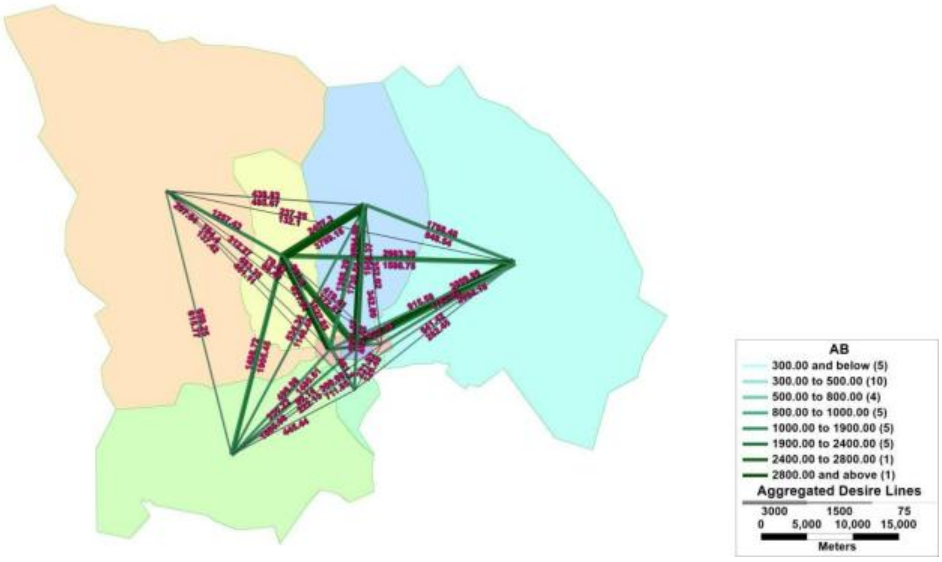

Figure 40 Projected Trend Line for Morning Peak in 2035

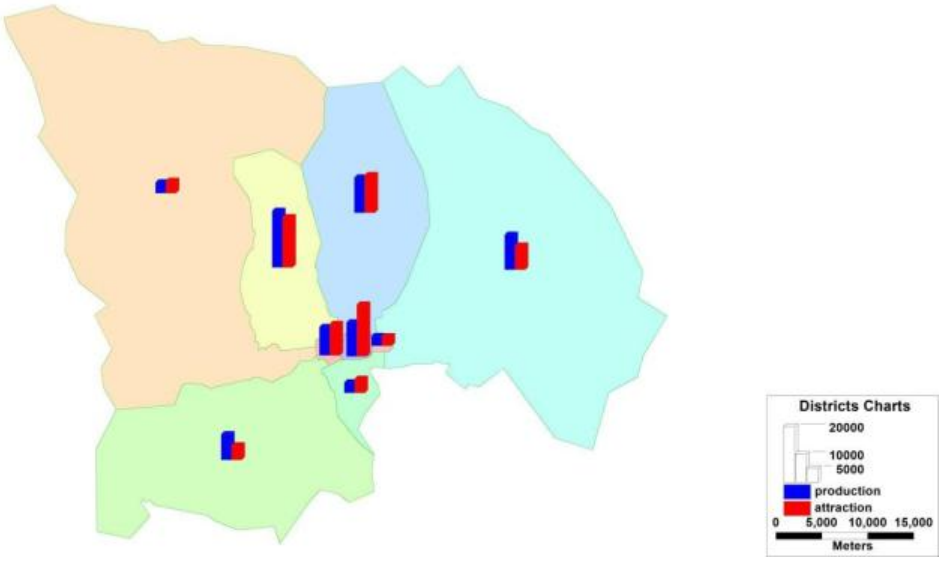

Figure 41 Bar Chart for Morning Peak in 2035

Table 24 Noon Peak Matrix for 2035

Traffic Zones	1	3	4	5	6	7	8	21	22
1	5609	2426	1973	1422	585	3066	259	2575	952
3	2671	4728	739	918	683	1361	228	2674	354
4	2332	1341	1128	304	362	684	106	803	1266
5	2321	960	103	205	186	1443	117	474	18
6	661	735	241	362	2158	1047	448	645	60
7	1873	2159	833	1239	813	5080	1147	2296	232
8	358	207	97	178	388	701	868	233	58

21	2674	4094	531	993	483	1630	267	5665	169
22	719	606	811	70	88	186	70	213	654

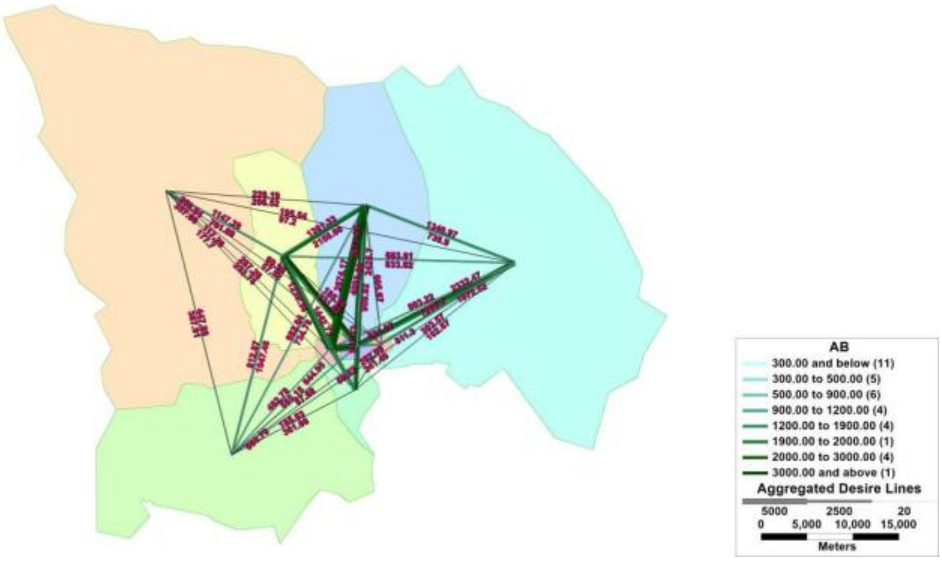

Figure 42 Projected Trend Line for Noon Peak in 2035

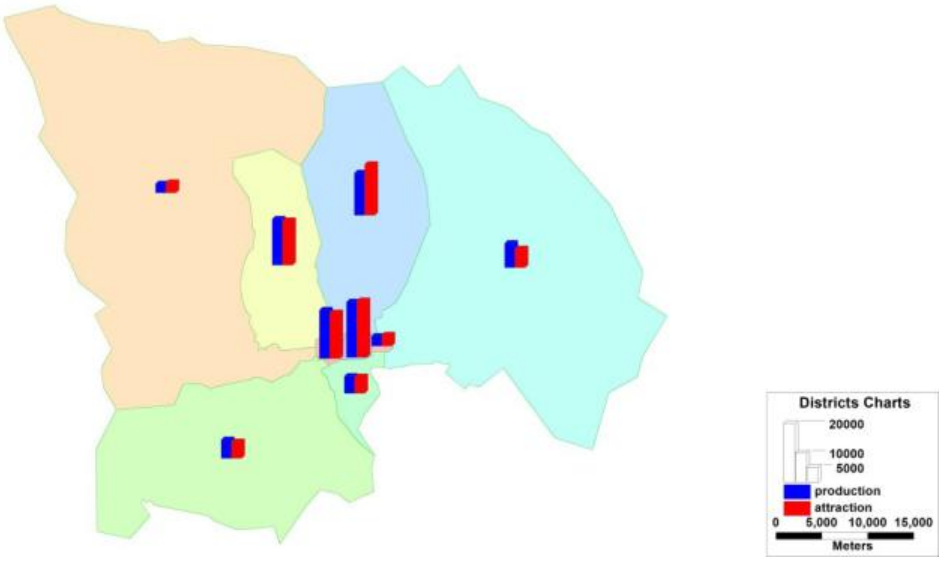

Figure43 Bar Chart for Noon Peak in 2035

Table 25 Evening Peak Matrix for 2035

Traffic Zones	1	3	4	5	6	7	8	21	22
1	4957	3409	2151	993	519	2651	175	2161	387
3	2288	1714	1882	1016	504	3162	400	1210	606
4	1705	2161	1365	256	298	1731	134	1113	868
5	950	688	160	182	370	799	179	571	63
6	1699	1319	507	444	979	1571	621	1234	122
7	2624	2875	1888	726	1548	5572	1227	2277	509
8	217	474	127	110	631	1058	812	234	54
21	1865	1961	828	541	544	2874	655	2640	273

22	353	793	2022	86	60	348	35	187	375

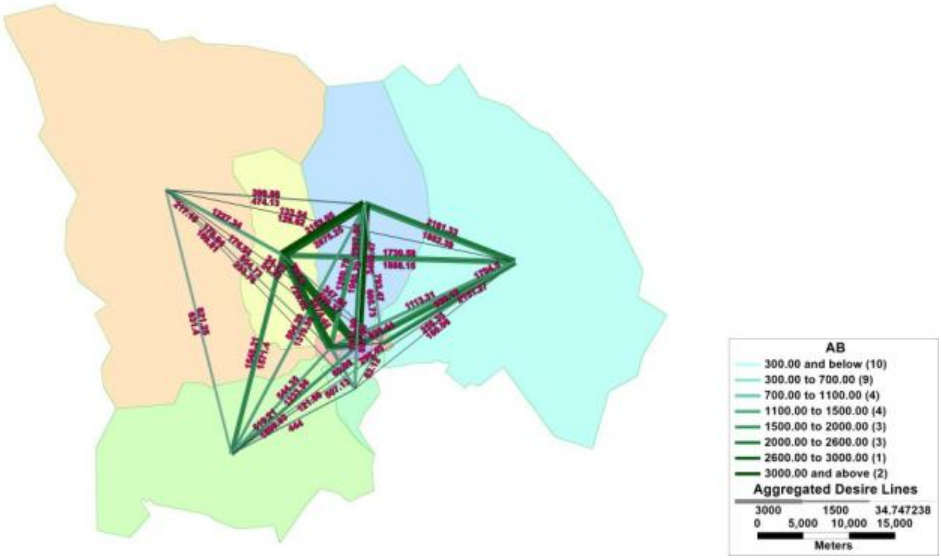

Figure 44 Projected Trend Line for Evening Peak in 2035

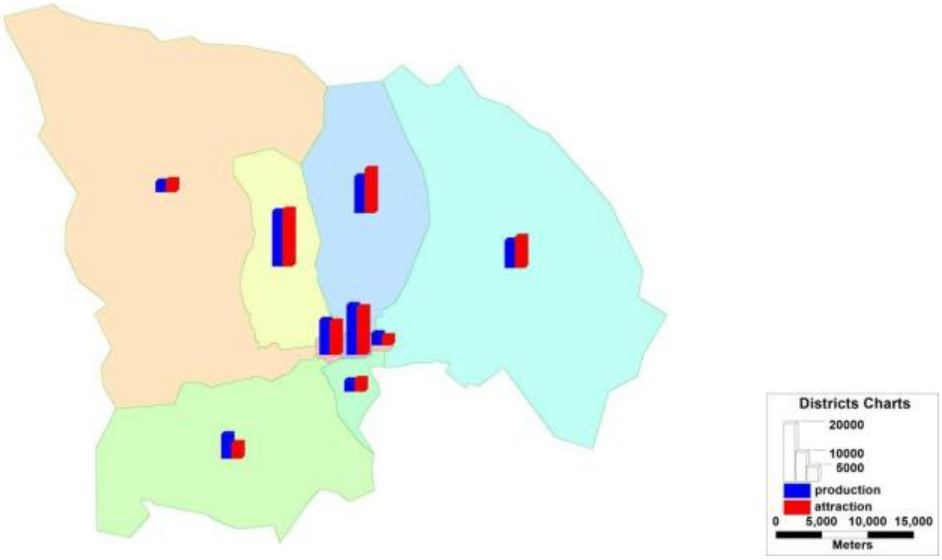

Figure 45 Bar Chart for Evening Peak in 2035

Table 26 Morning Peak Matrix for 2040

Traffic Zones	1	3	4	5	6	7	8	21	22
1	3294	2067	2124	885	350	2167	331	1022	685
3	3778	1965	899	1358	566	2604	465	1448	363
4	4038	1874	1660	680	403	2208	251	970	1232
5	907	522	299	192	383	934	206	489	134
6	1765	1217	754	472	1038	2019	699	1569	235
7	2906	4016	1682	871	1588	5736	1333	3015	395
8	220	515	140	146	653	1150	860	478	73
21	1613	1834	882	543	526	1932	512	2682	376
22	1193	373	798	246	96	444	75	293	172

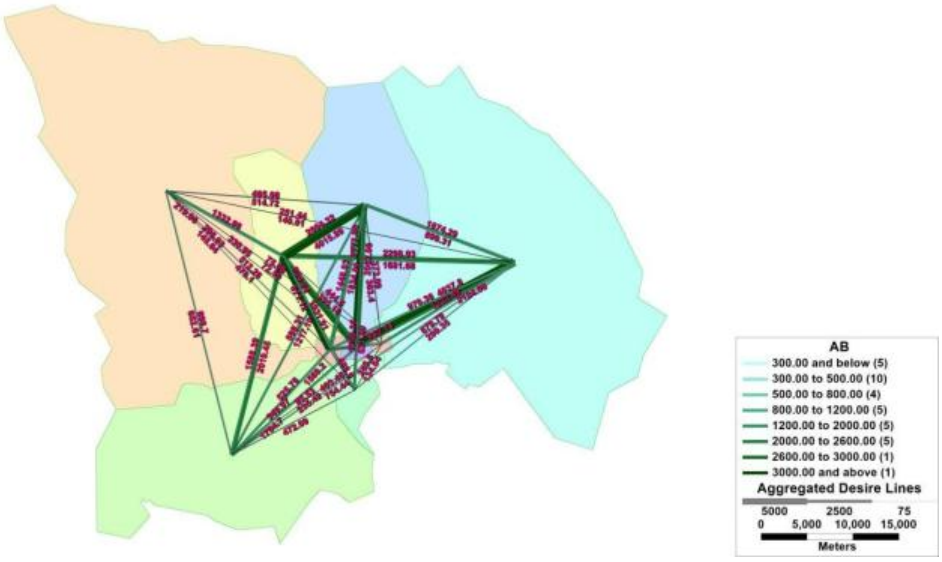

Figure 46 Projected Trend Line for Morning Peak in 2040

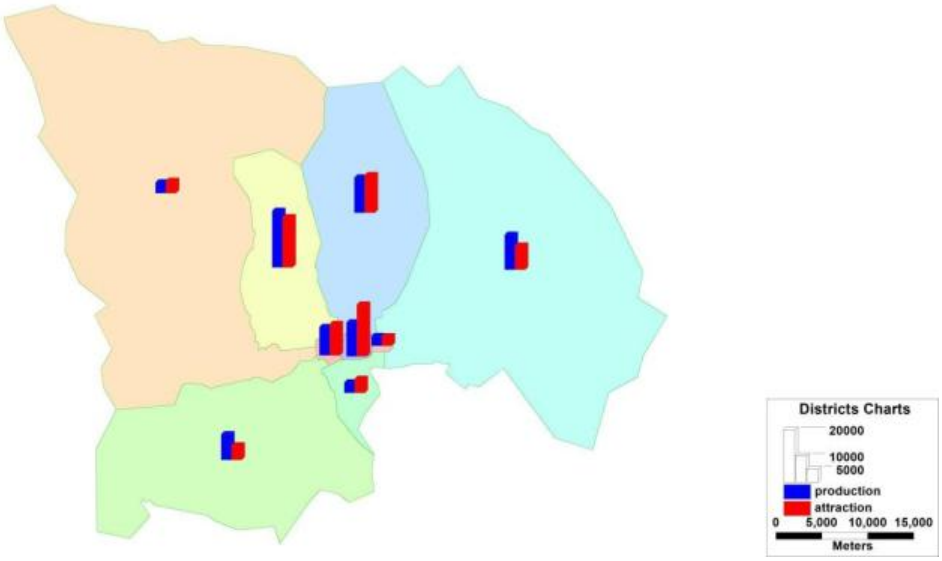

Figure 47 Bar Chart for Morning Peak in 2040

Table 27 Noon Peak Matrix for 2040

Traffic Zones	1	3	4	5	6	7	8	21	22
1	5945	2571	2091	1508	620	3250	274	2730	1009
3	2831	5010	783	973	723	1443	242	2834	375
4	2472	1421	1195	322	384	725	112	851	1342
5	2460	1017	109	218	197	1529	124	503	19
6	700	779	256	383	2287	1110	475	684	63
7	1985	2288	883	1314	861	5384	1216	2433	245
8	379	219	103	188	411	743	920	247	61
21	2834	4339	563	1052	512	1728	283	6004	179
22	762	642	860	74	93	197	74	226	693

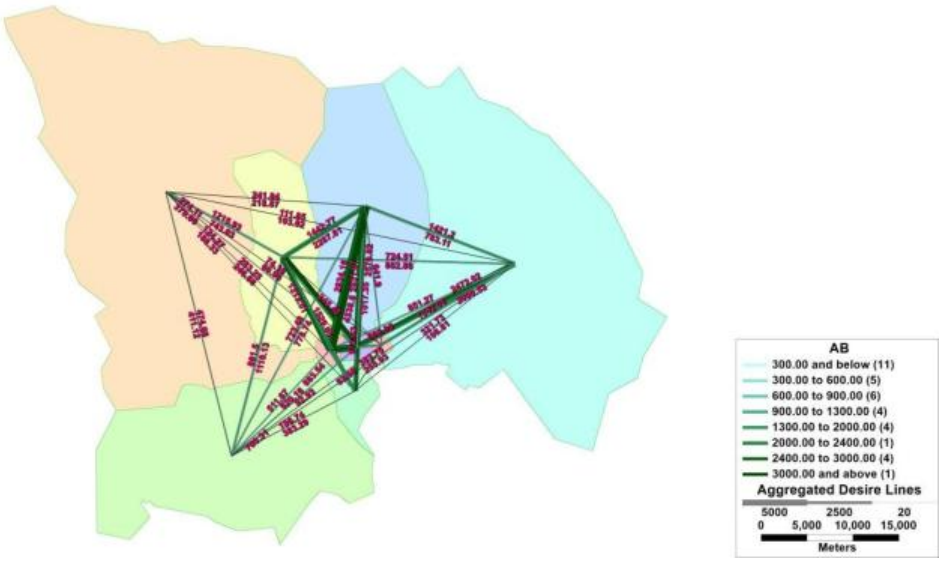

Figure 48 Projected Trend Line for Noon Peak in 2040

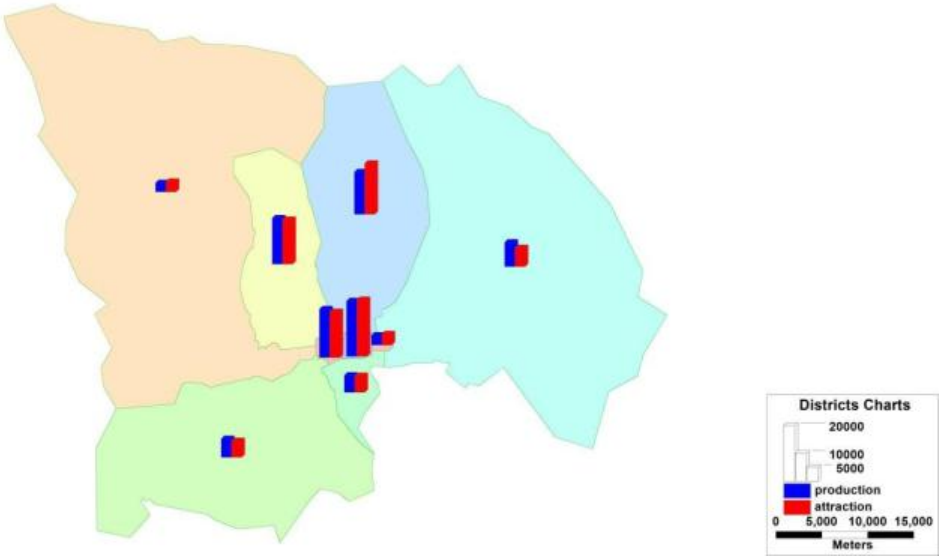

Figure 49 Bar Chart for Noon Peak in 2040

Table 28 Evening Peak Matrix for 2040

Traffic Zones	1	3	4	5	6	7	8	21	22
1	5254	3613	2280	1053	550	2809	185	2291	410
3	2425	1817	1995	1077	534	3351	424	1282	642
4	1806	2291	1446	272	316	1834	142	1180	920
5	1007	729	170	193	393	847	190	605	67
6	1800	1398	537	471	1038	1665	658	1308	129
7	2781	3047	2001	769	1641	5905	1301	2413	540
8	230	503	134	116	669	1121	861	248	57
21	1976	2078	878	573	577	3046	694	2798	289
22	374	841	2143	91	64	368	37	198	397

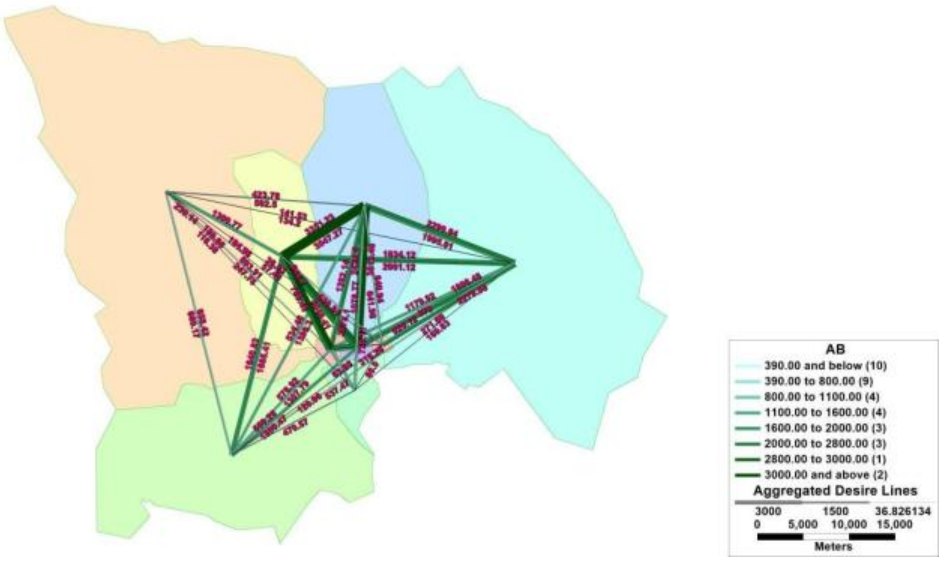

Figure 50 Projected Trend Line for Evening Peak in 2040

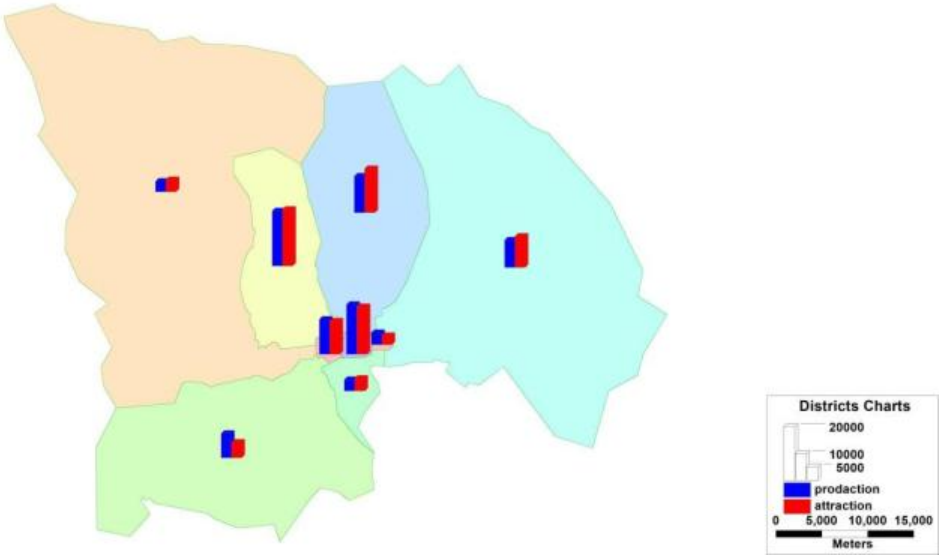

Figure 51 Bar Chart for Evening Peak in 2040

Table 29 Morning Peak Matrix for 2044

Traffic Zones	1	3	4	5	6	7	8	21	22
1	3480	2184	2244	935	370	2290	350	1079	724
3	3991	2076	950	1435	598	2751	491	1530	384
4	4266	1980	1754	718	426	2333	266	1025	1302
5	958	551	316	203	404	987	218	516	142
6	1864	1286	797	499	1097	2133	738	1658	249
7	3070	4243	1777	920	1678	6060	1408	3186	417
8	232	544	148	154	689	1215	909	505	77
21	1704	1938	932	574	555	2041	541	2833	397

22	1260	394	843	260	101	470	79	310	182

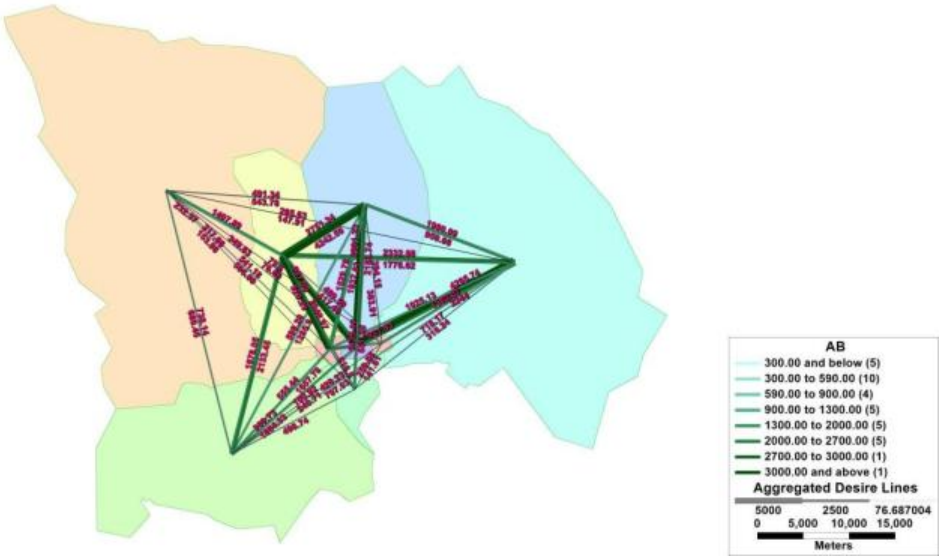

Figure 52 Projected Trend Line for Morning Peak in 2044

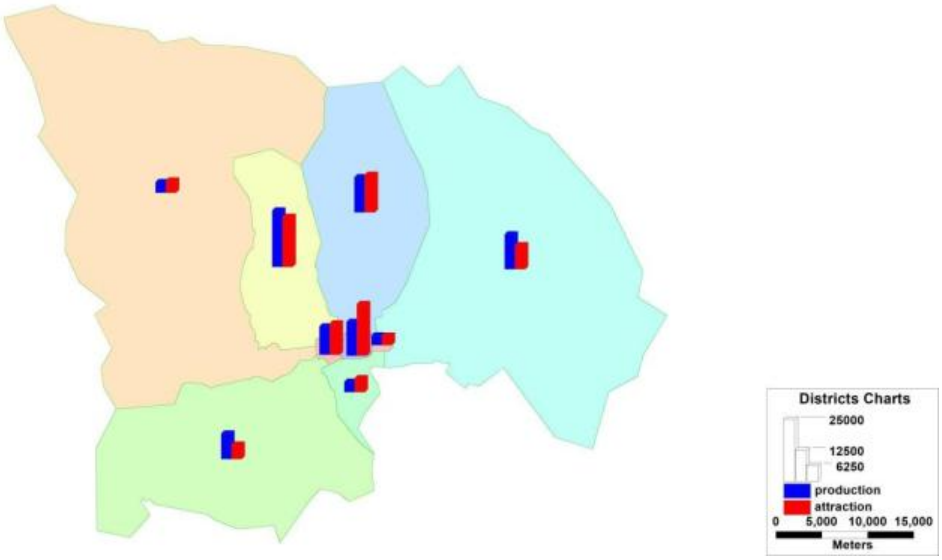

Figure 53 Bar Chart for Morning Peak in 2044

Table 30 Noon Peak Matrix for 2044

Traffic Zones	1	3	4	5	6	7	8	21	22
1	6302	2725	2216	1598	657	3445	291	2893	1069
3	3001	5311	830	1031	767	1529	256	3004	398
4	2620	1506	1267	341	407	768	119	902	1423
5	2608	1078	115	231	209	1621	132	533	20
6	742	825	271	406	2424	1177	503	725	67
7	2105	2425	936	1392	913	5707	1289	2580	260
8	402	232	109	200	436	788	975	261	65
21	3004	4599	597	1116	542	1832	300	6364	190

22	807	680	911	79	99	209	79	239	734

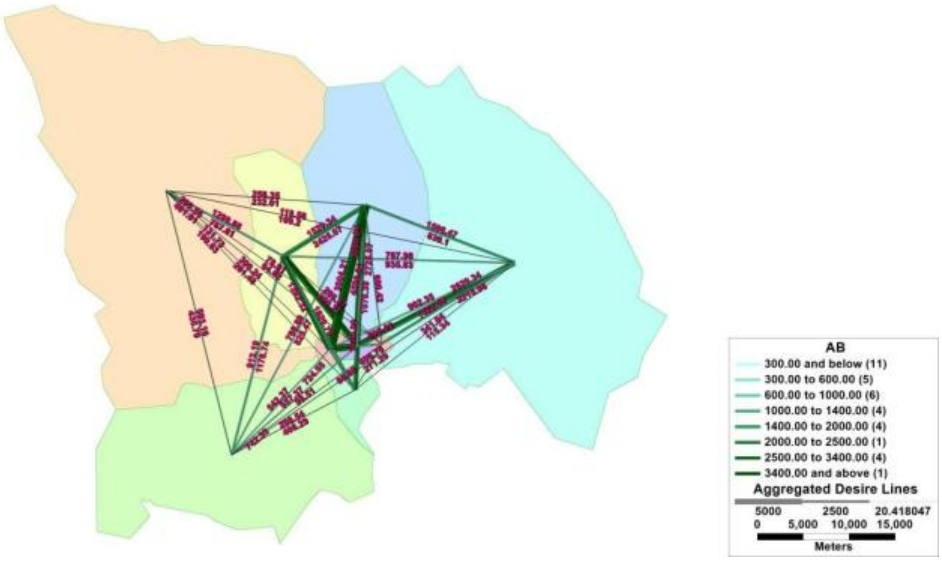

Figure 54 Projected Trend Line for Noon Peak in 2044

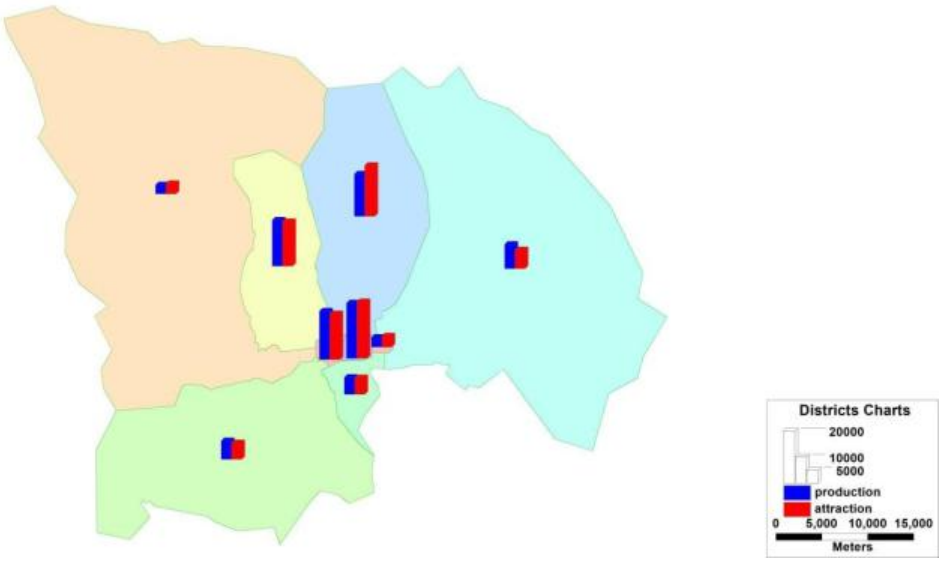

Figure 55 Bar Chart for Noon Peak in 2044

Table 31 Evening Peak Matrix for 2044

Traffic Zones	1	3	4	5	6	7	8	21	22
1	5550	3817	2409	1112	581	2968	195	2420	434
3	2561	1919	2108	1138	565	3540	448	1355	678
4	1908	2420	1528	287	334	1938	150	1247	972
5	1064	770	179	204	415	894	200	639	71
6	1902	1477	568	497	1097	1759	696	1382	136
7	2938	3219	2114	813	1733	6239	1374	2549	570
8	243	531	142	123	707	1185	910	262	61
21	2088	2195	928	605	609	3218	733	2956	305
22	395	888	2264	96	67	389	39	210	420

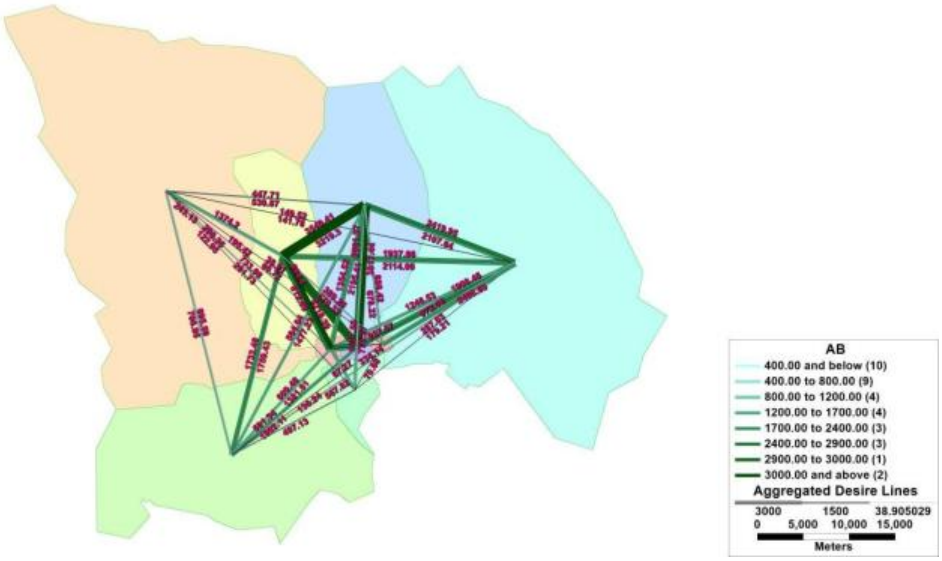

Figure 56 Projected Trend Line for Evening Peak in 2044

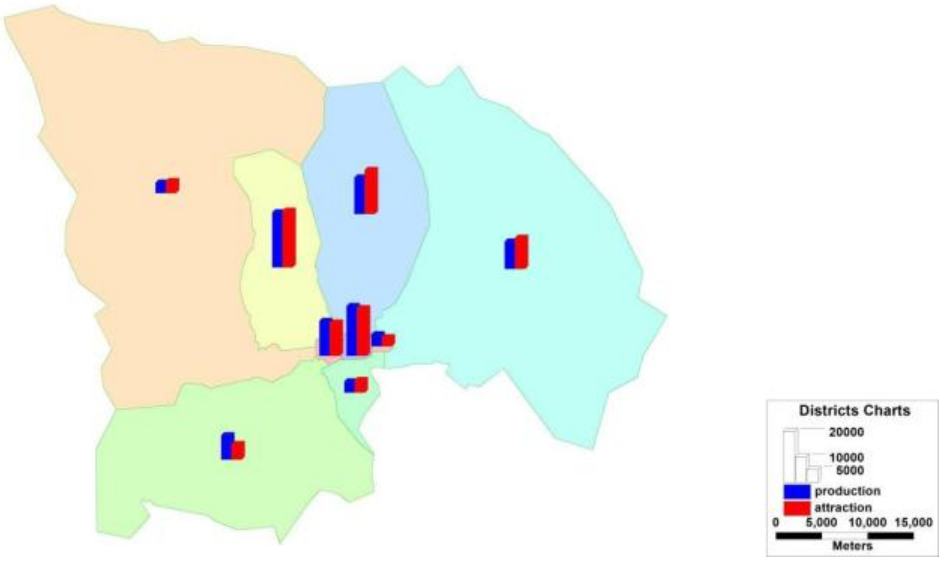

Figure 57 Bar Chart for Evening Peak in 2044

6.4 Traffic Assignment Results

(1) 2025 Traffic Assignment Forecasting

1) Morning peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 58 and 59.

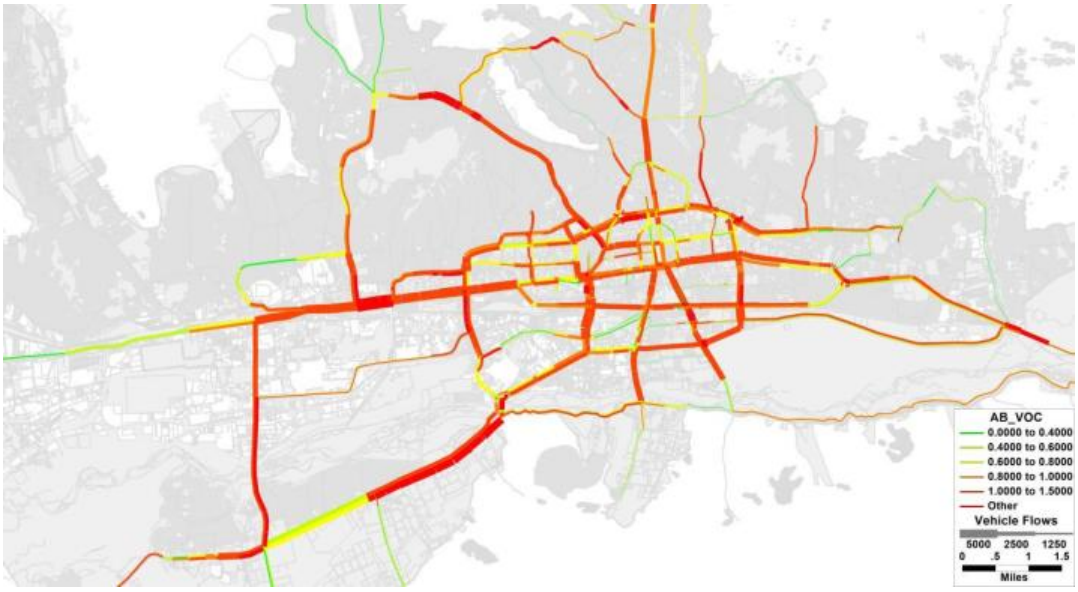

Figure 58 Morning Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2025

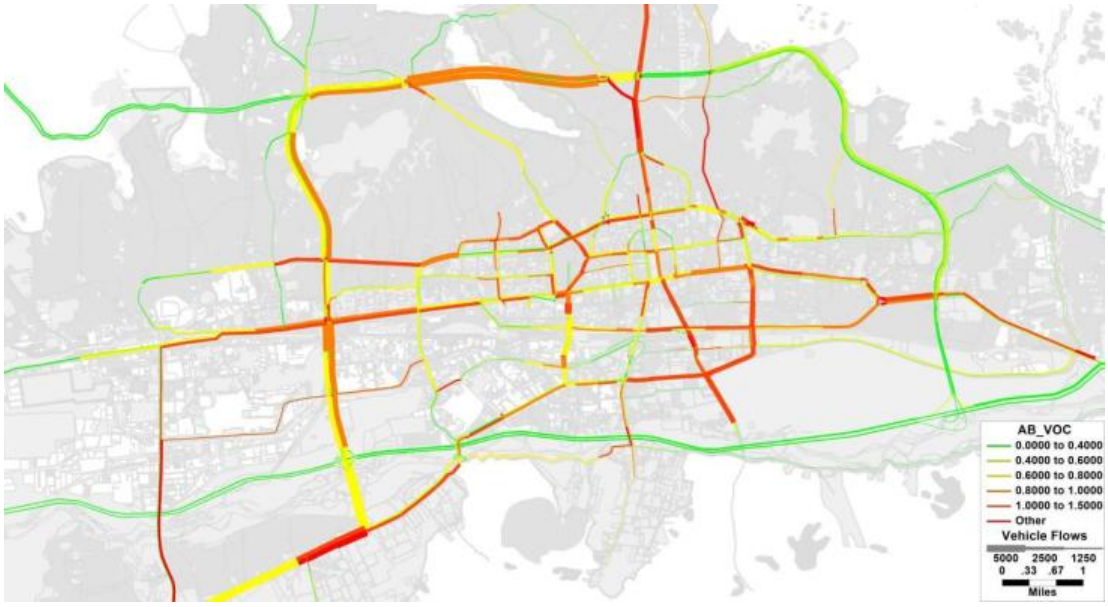

Figure 59 Morning Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2025

2) Noon peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 60 and 61.

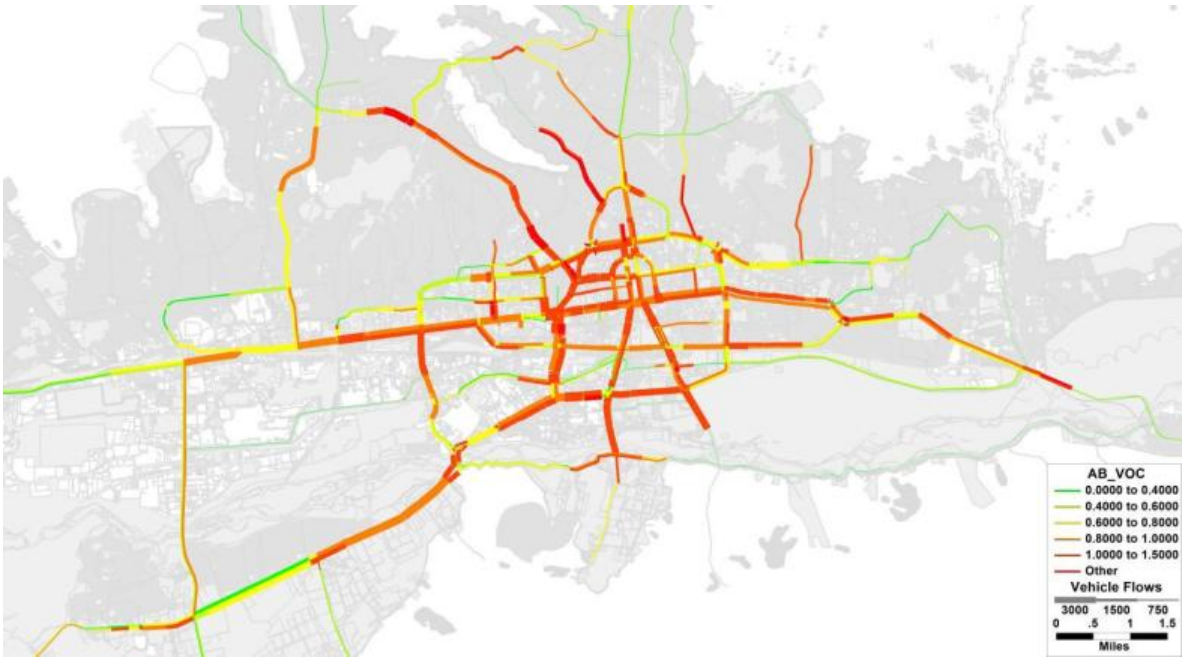

Figure 60 Noon Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2025

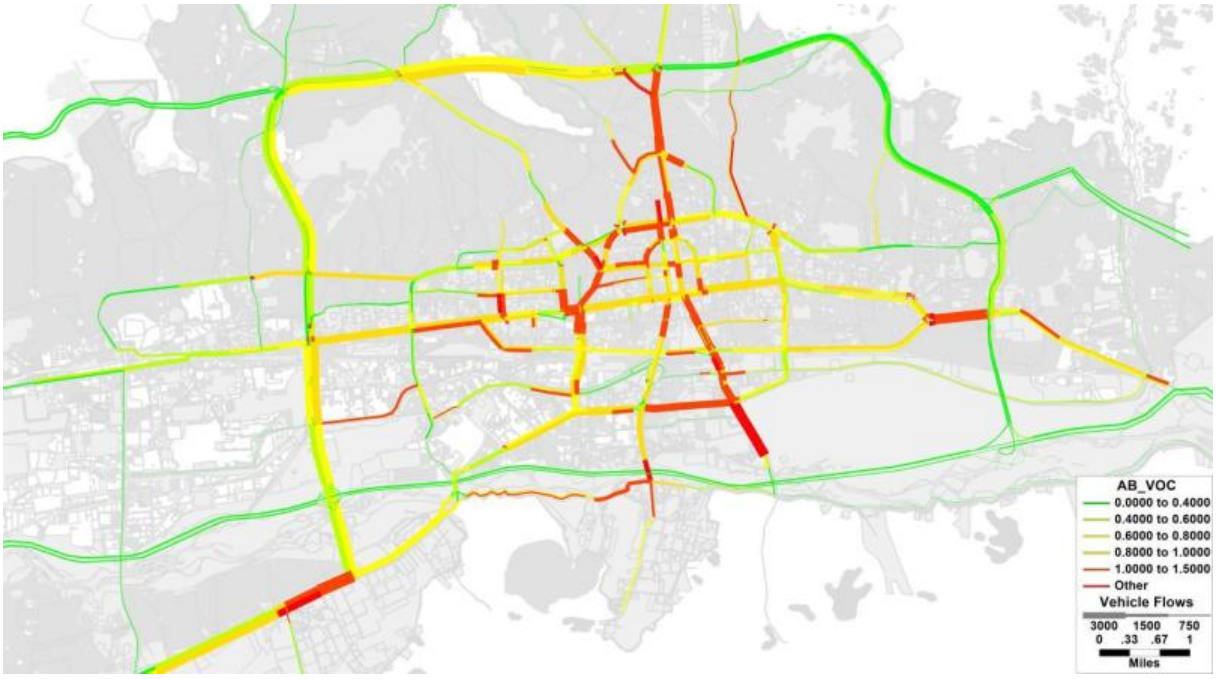

Figure 61 Noon Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2025

3) Evening peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 62 and 63.

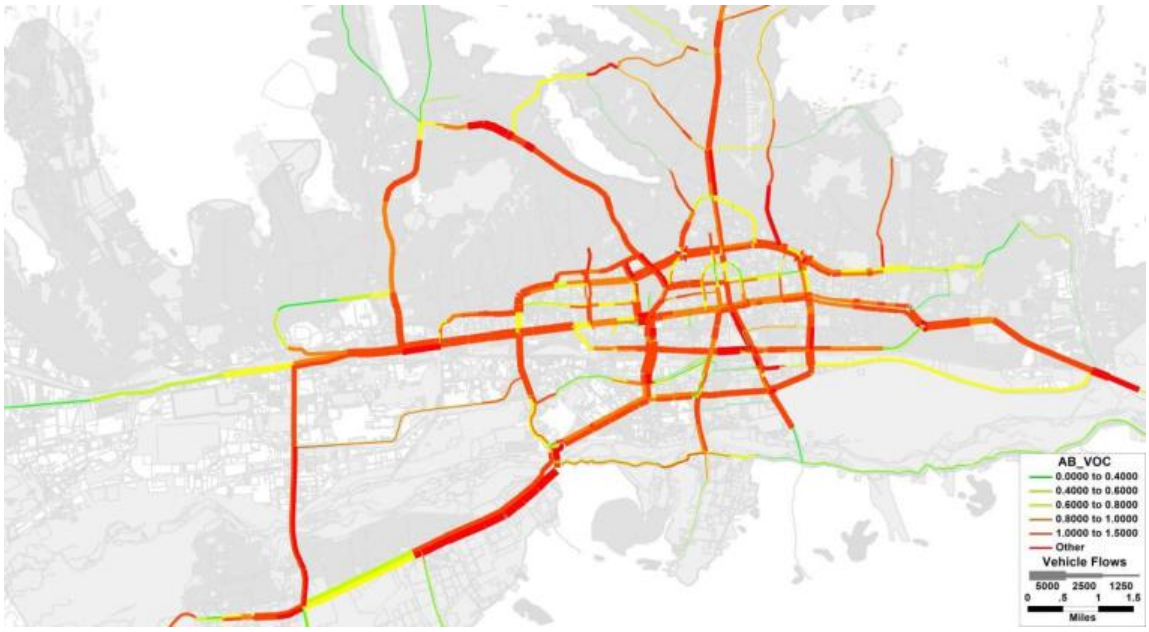

Figure 62 Evening Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2025

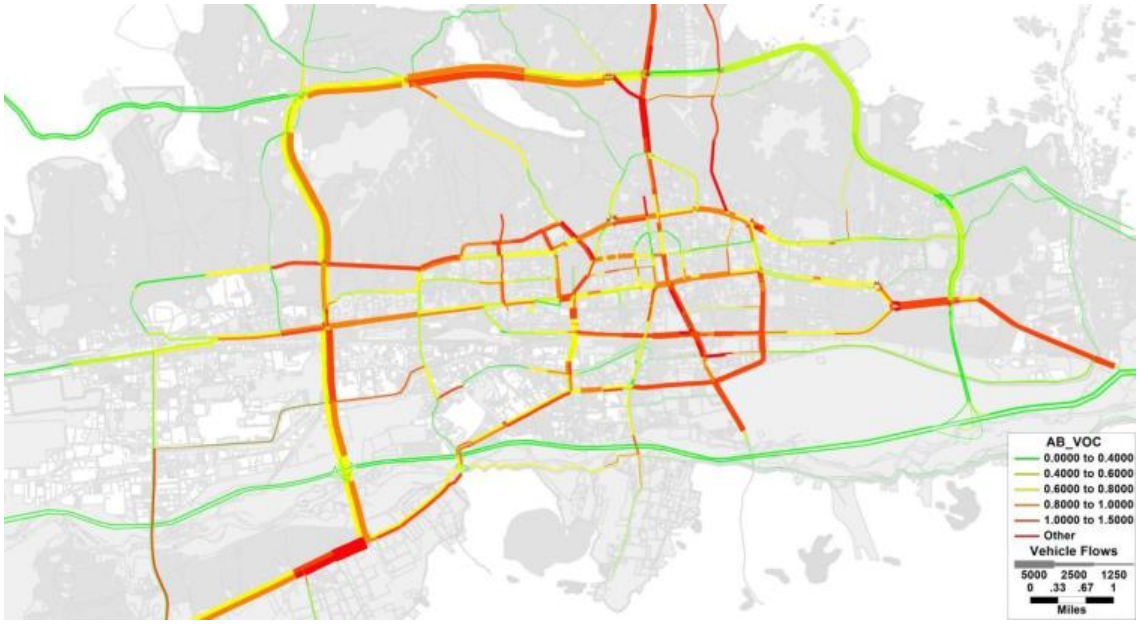

Figure 63 Evening Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2025

6.5 2028 Traffic Assignment Forecasting

Morning peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 64 and 65.

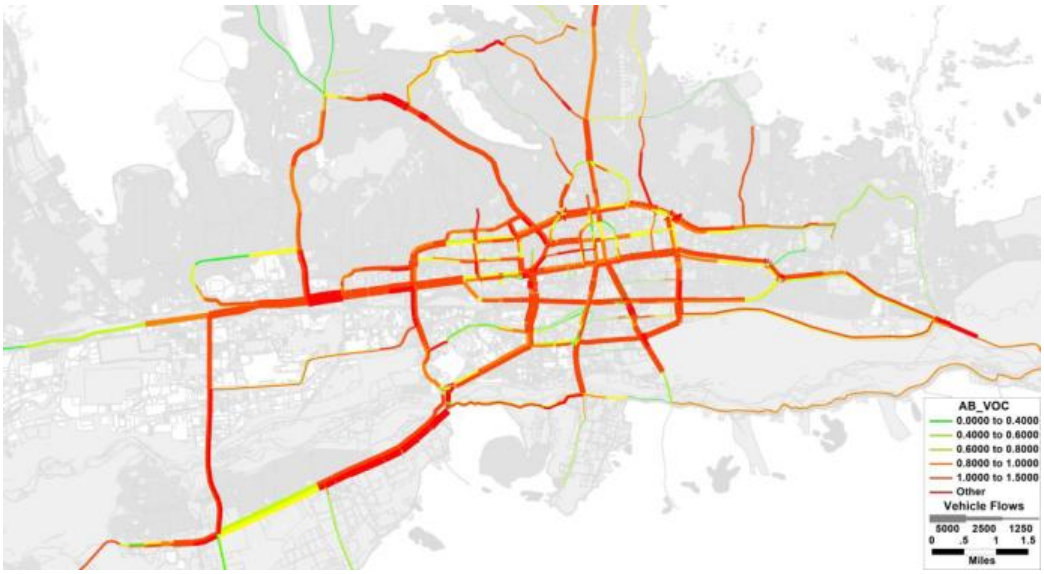

Figure 64 Morning Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2028

Figure 65 Morning Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2028

2) Noon peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 66 and 67.

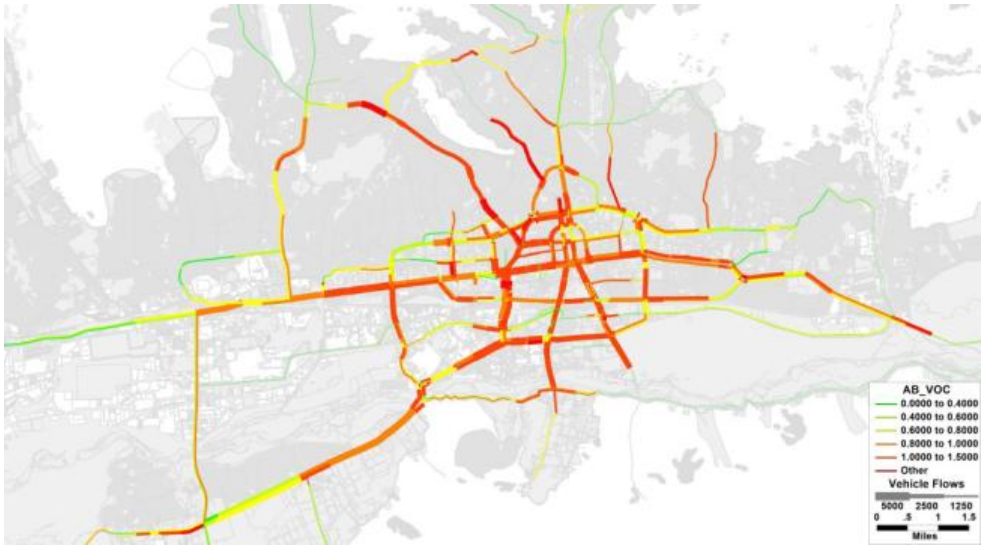

Figure 66 Noon Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2028

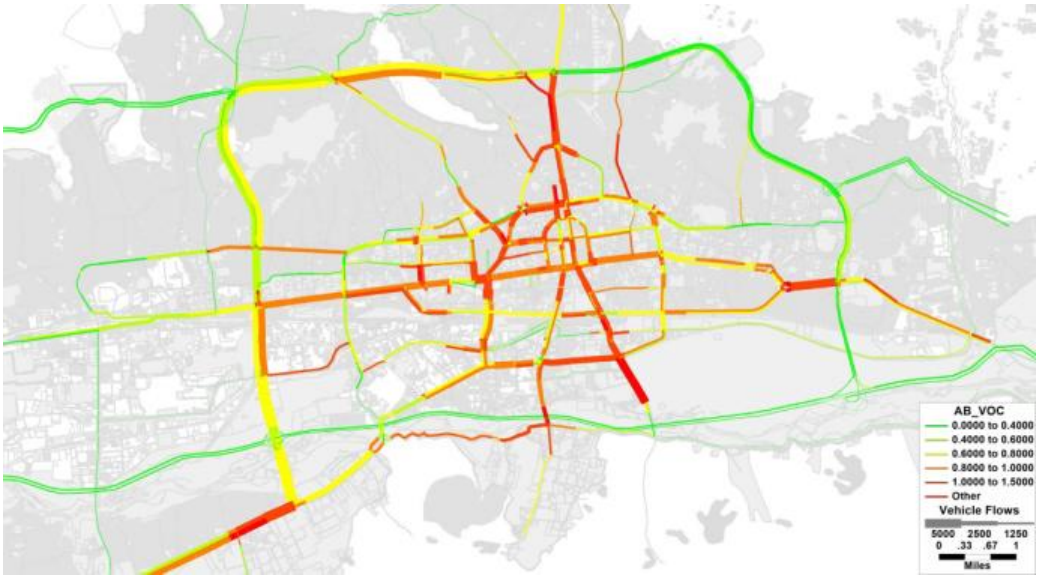

Figure 67 Noon Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2028

3) Evening peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 68 and 69.

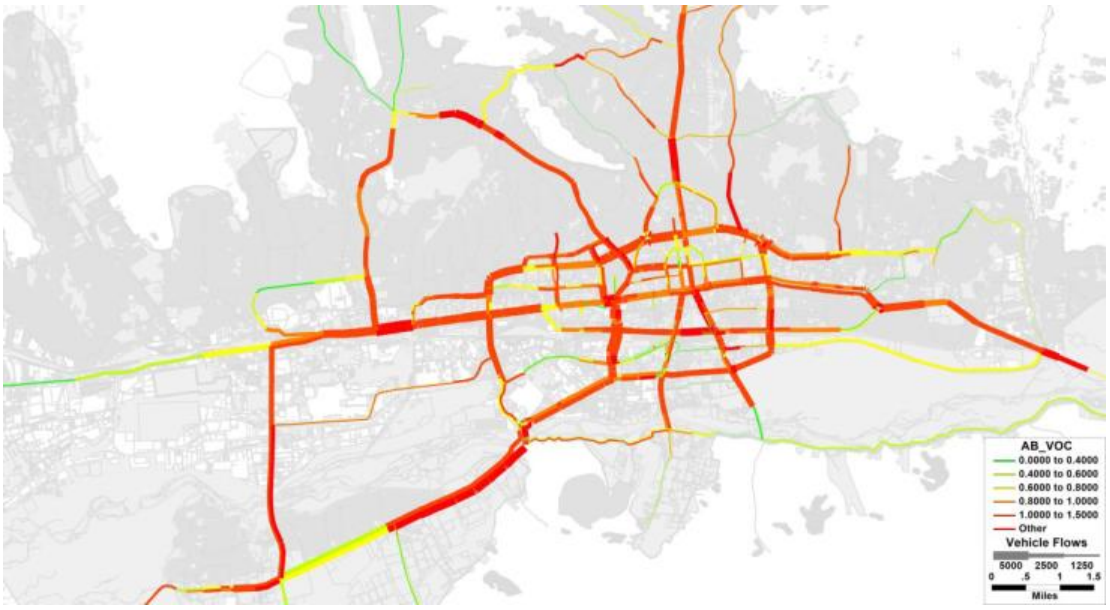

Figure 68 Evening Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2028

Figure 69 Evening Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2028

6.6 2030 Traffic Assignment Forecasting

1) Morning peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 70 and 71.

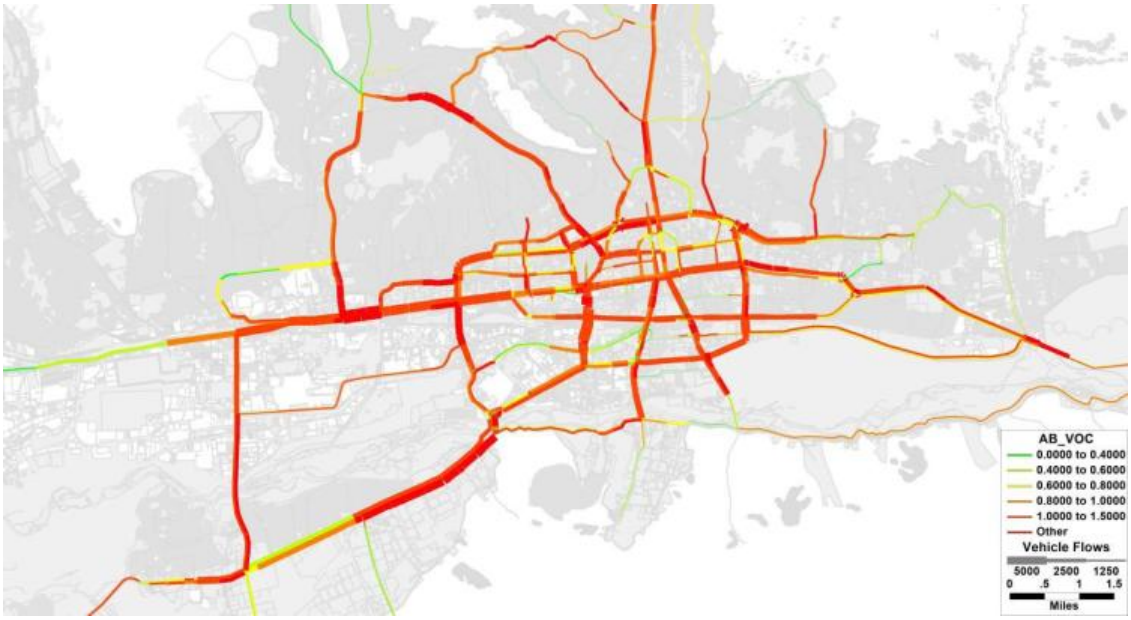

Figure 70 Morning Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2030

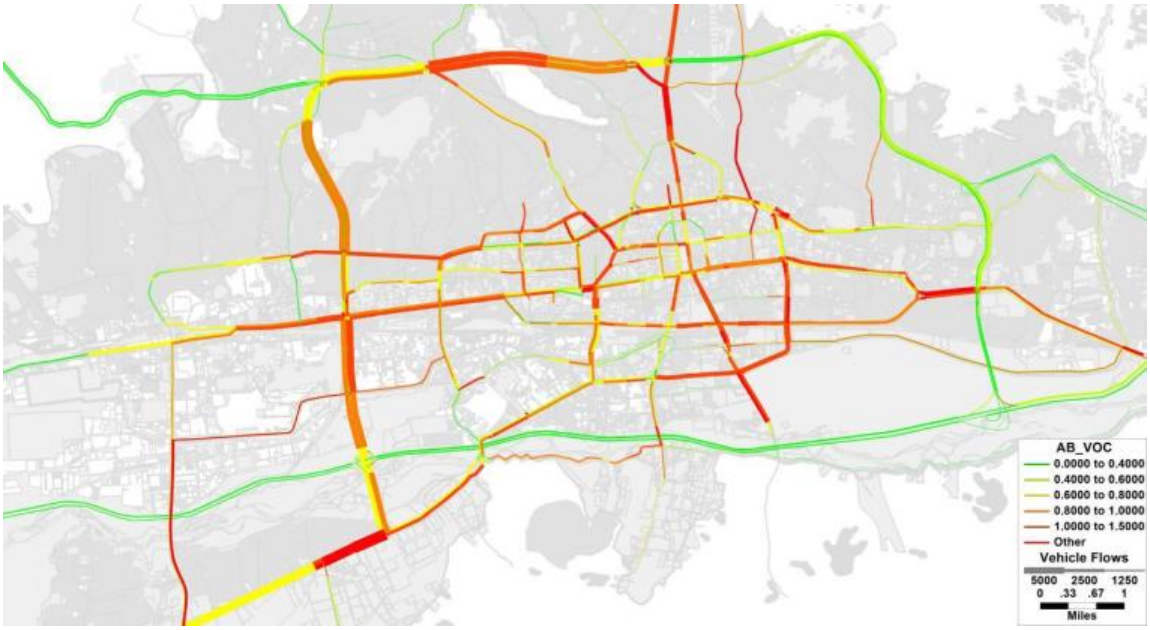

Figure 71 Morning Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2030

2) Noon peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 72 and 73.

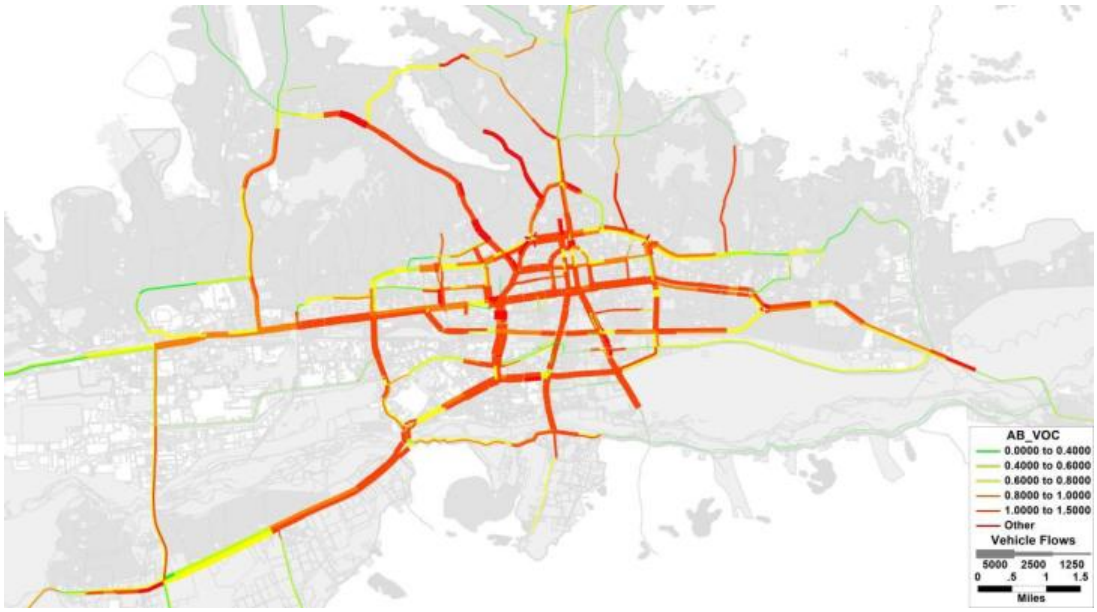

Figure 72 Noon Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2030

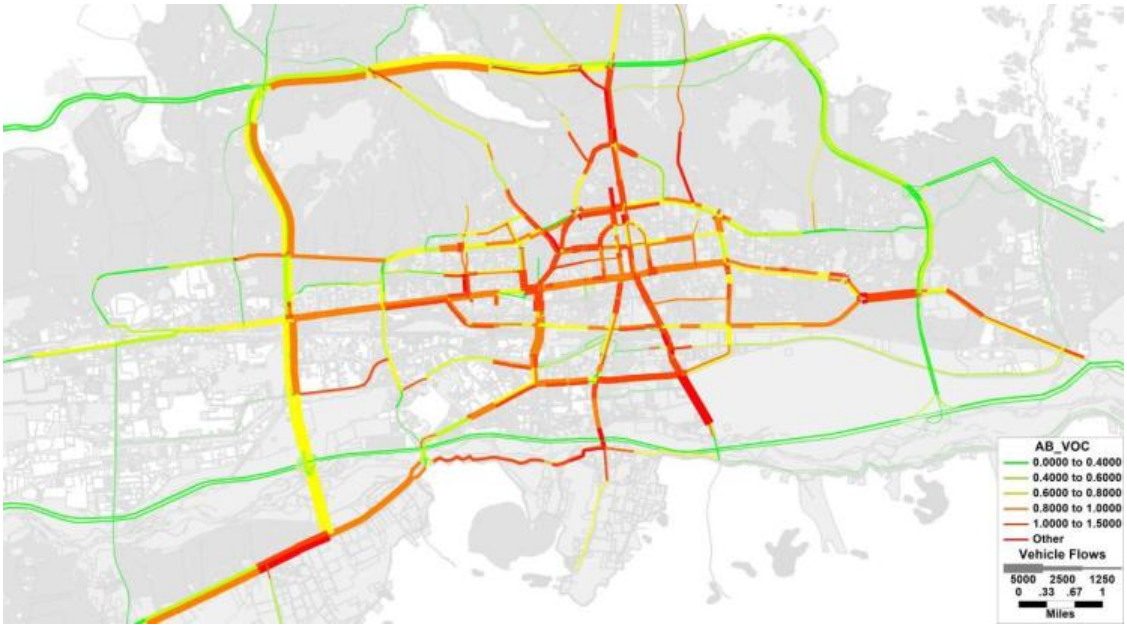

Figure73 Noon Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2030

3) Evening peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures74 and75.

Figure 74 Evening Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2030

Figure 75 Evening Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2030

6.7 2035 Traffic Assignment Forecasting

1) Morning peak traffic assignment for the road network before and after the

implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 76 and 77.

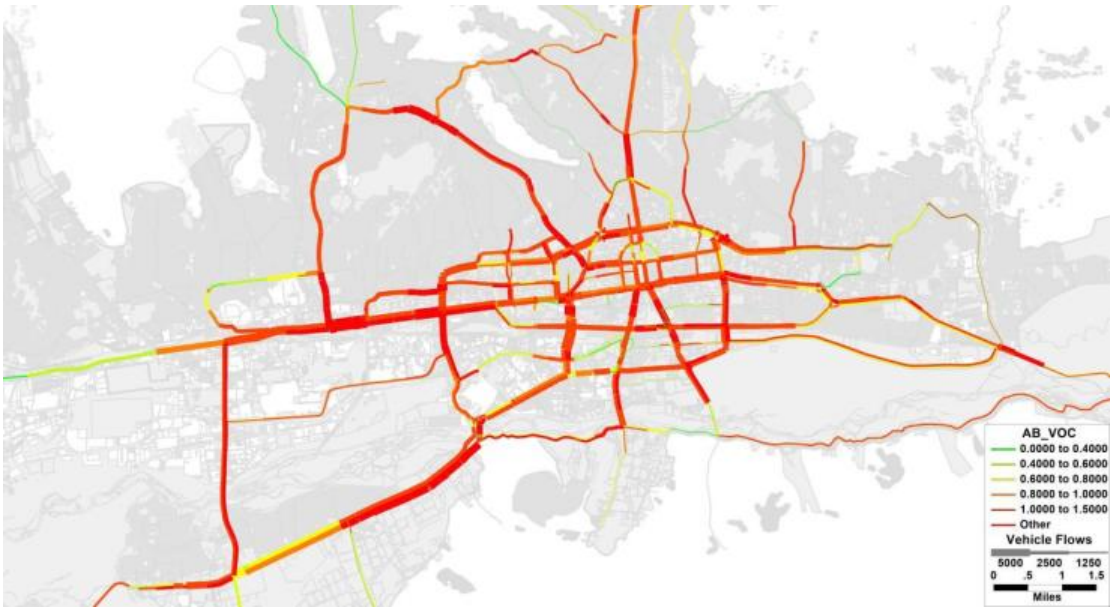

Figure 76 Morning Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2035

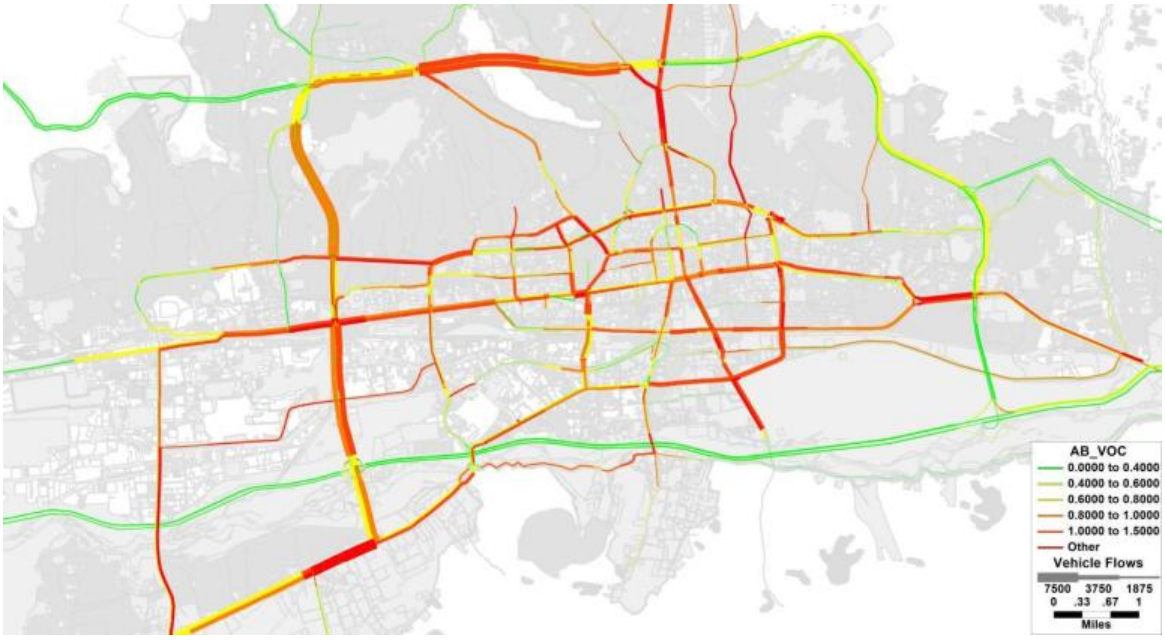

Figure 77 Morning Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2035

2) Noon peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment

maps shown in Figures 78 and 79.

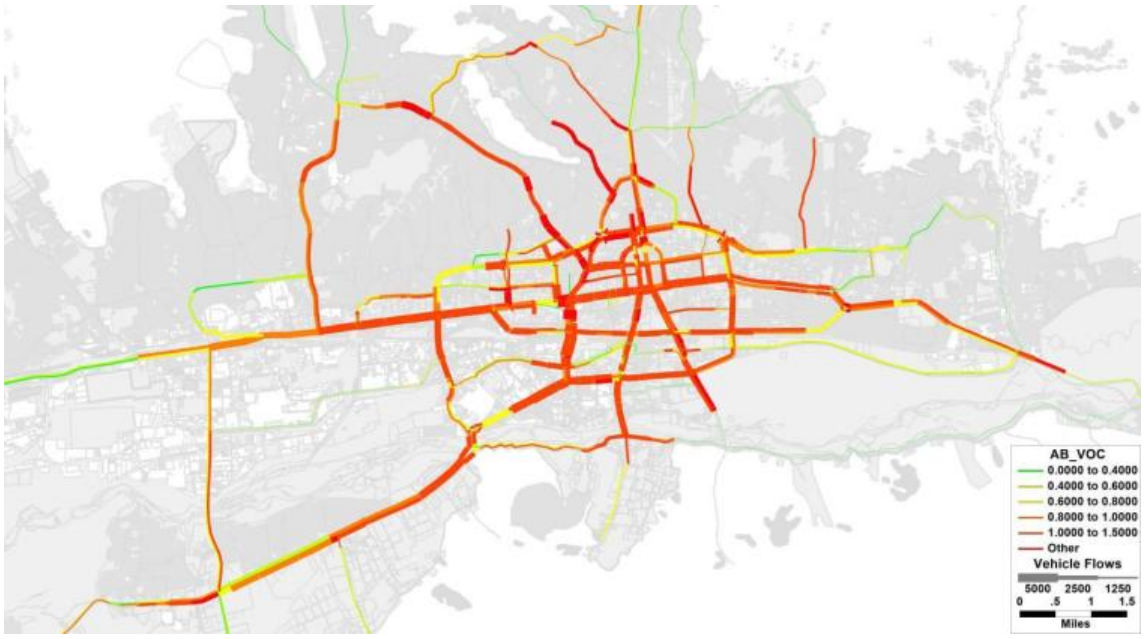

Figure 78 Noon Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2035

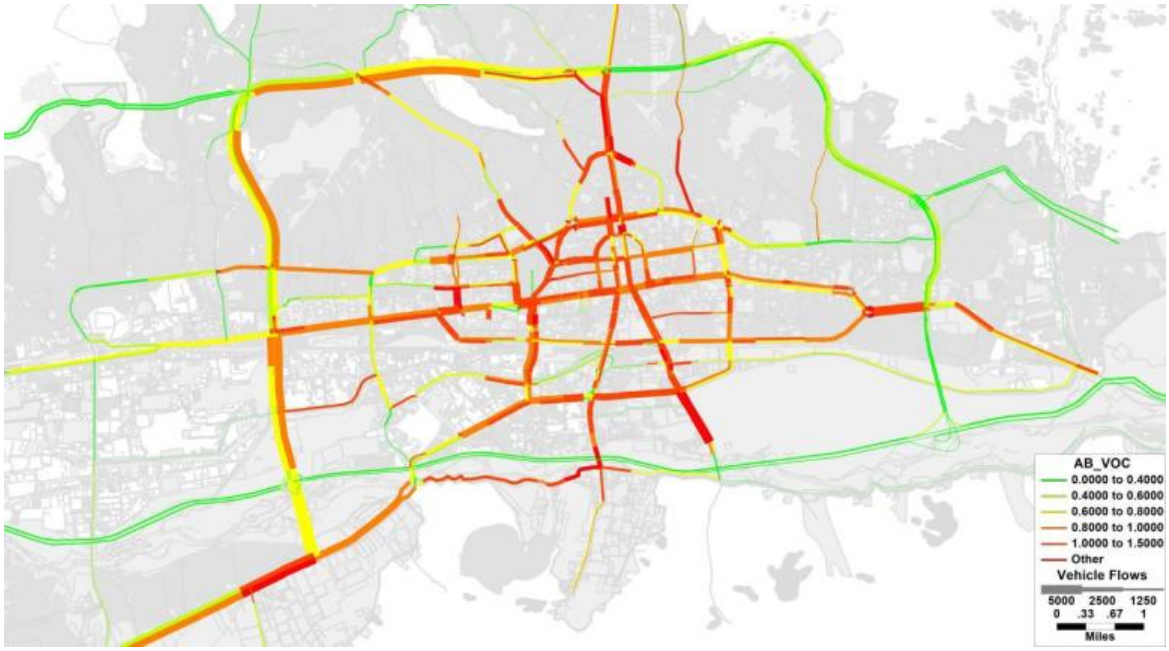

Figure 79 Noon Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2035

3) Evening peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 80 and 81.

Figure 80 Evening Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2035

Figure 81 Evening Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2035

6.8 2040 Traffic Assignment Forecasting

1) Morning peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment

maps shown in Figures 82 and 83.

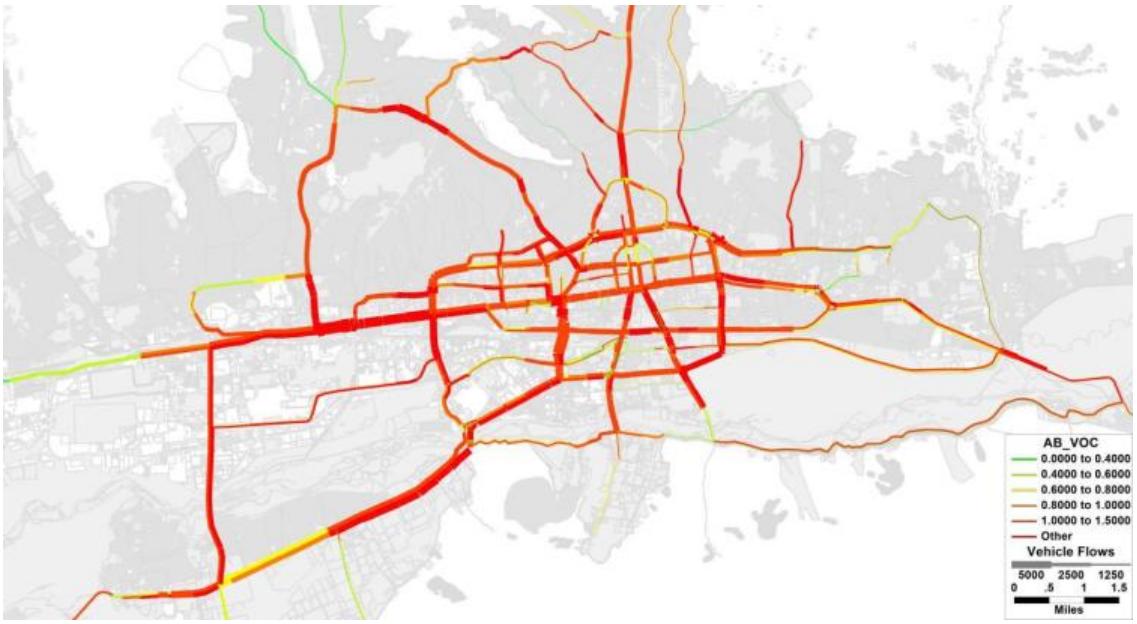

Figure 82 Morning Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2040

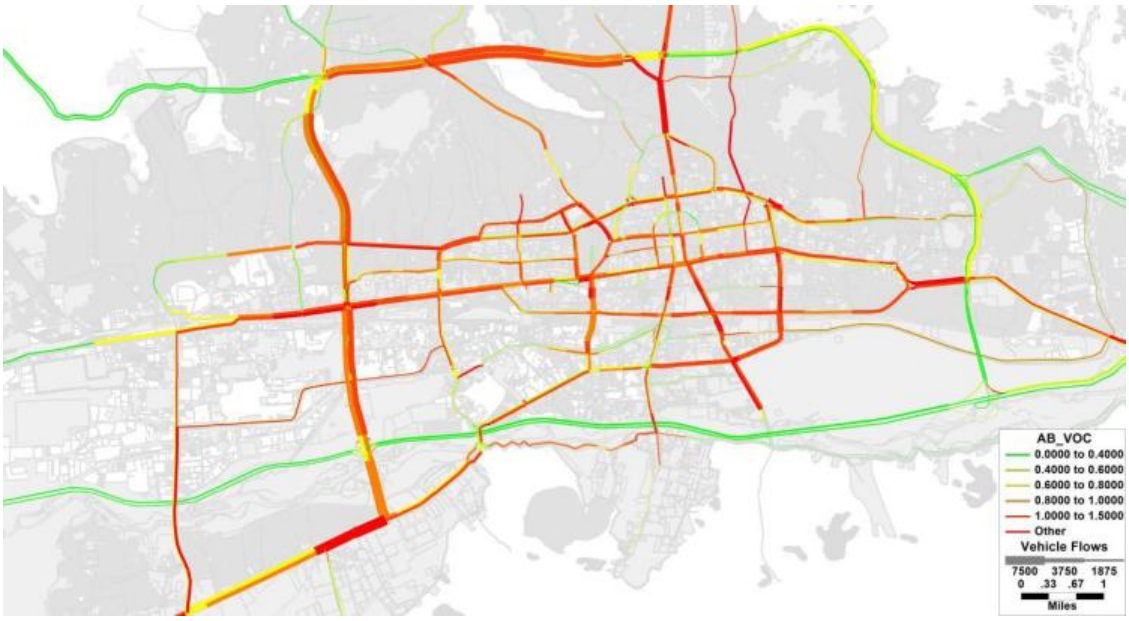

Figure 83 Morning Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2040

2) Noon peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 84 and 85.

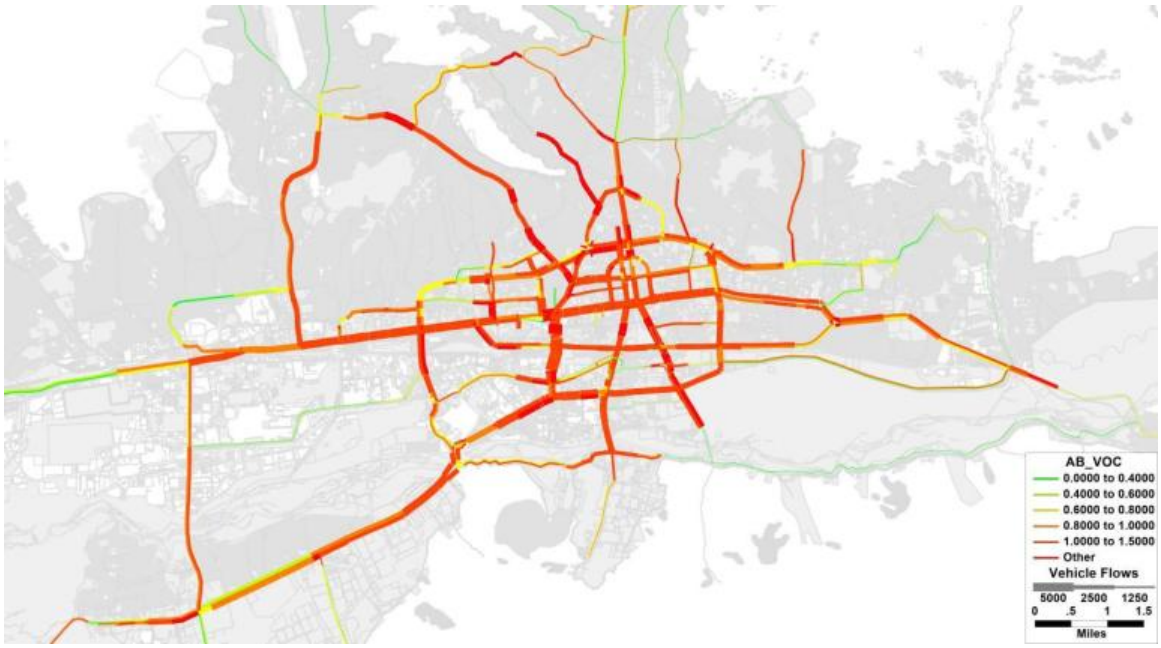

Figure 84 Noon Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2040

Figure 85 Noon Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2040

3) Evening peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 86 and 87.

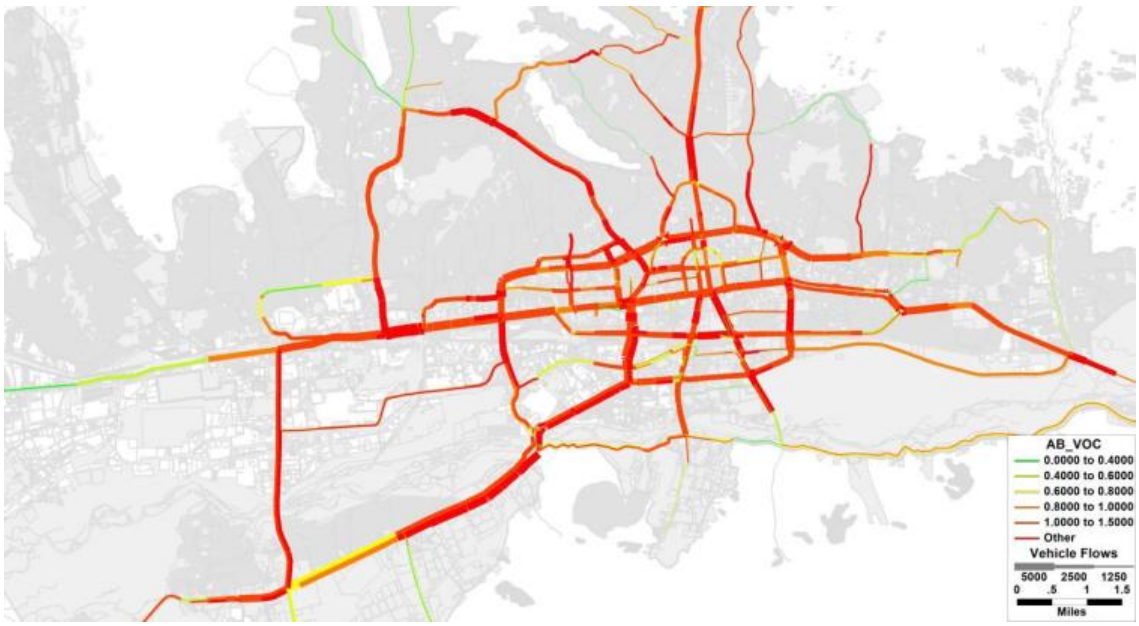

Figure 86 Evening Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2040

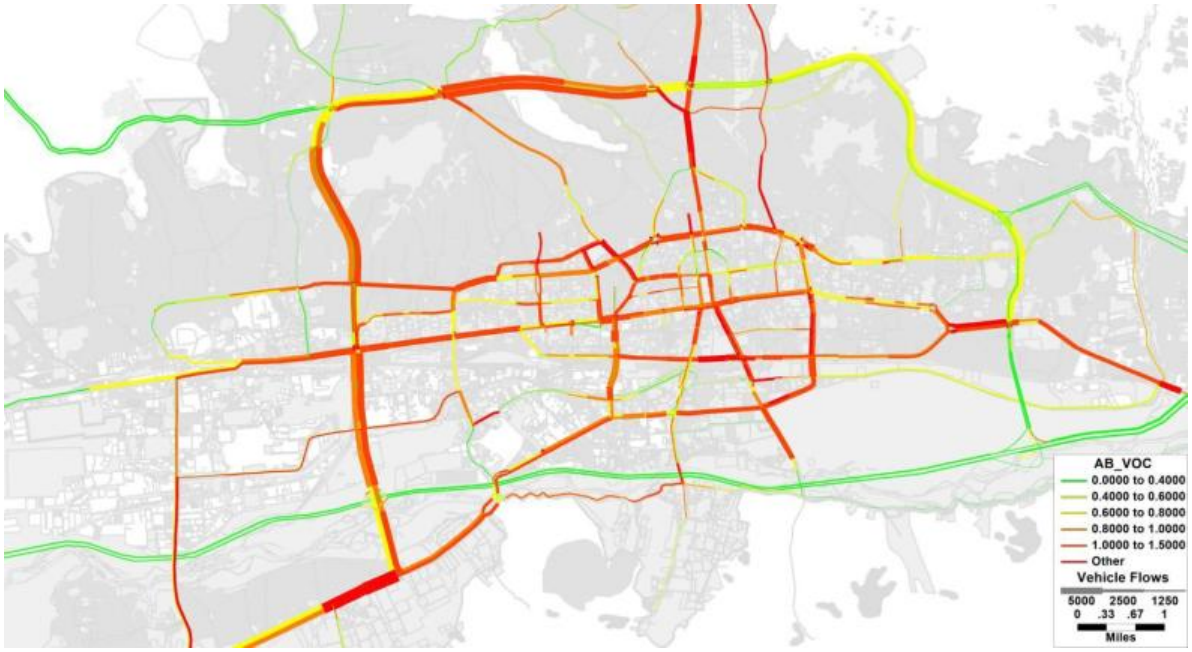

Figure 87 Evening Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2040

6.9 2044 Traffic Assignment Forecasting

1) Morning peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment

maps shown in Figures 88 and 89.

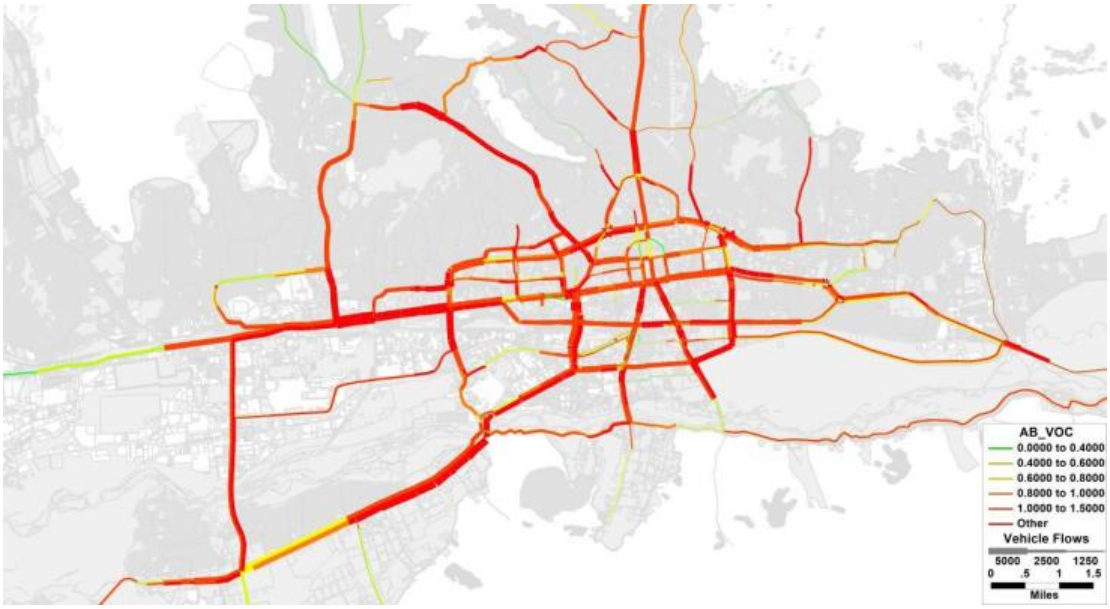

Figure 88 Morning Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2044

Figure 89 Morning Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2044

2) Noon peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 90 and 91.

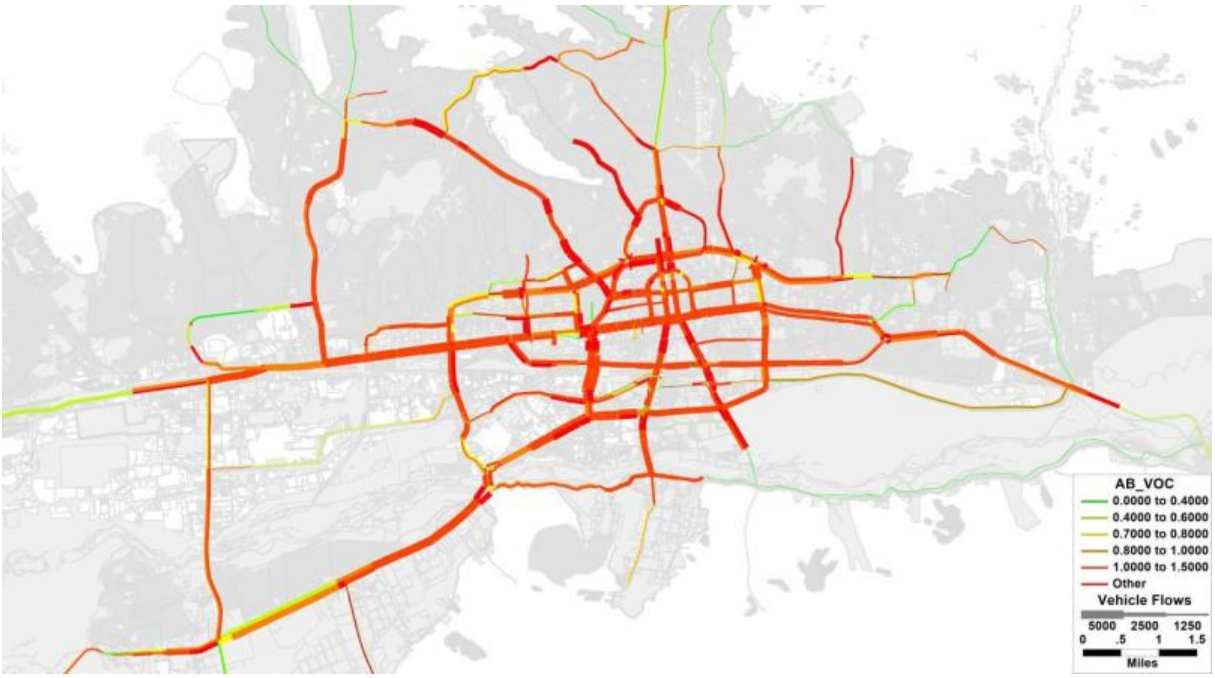

Figure 90 Noon Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2040

Figure 91 Noon Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2040

3) Evening peak traffic assignment for the road network before and after the implementation of the New Ring Road was carried out, resulting in the assignment maps shown in Figures 92 and 93.

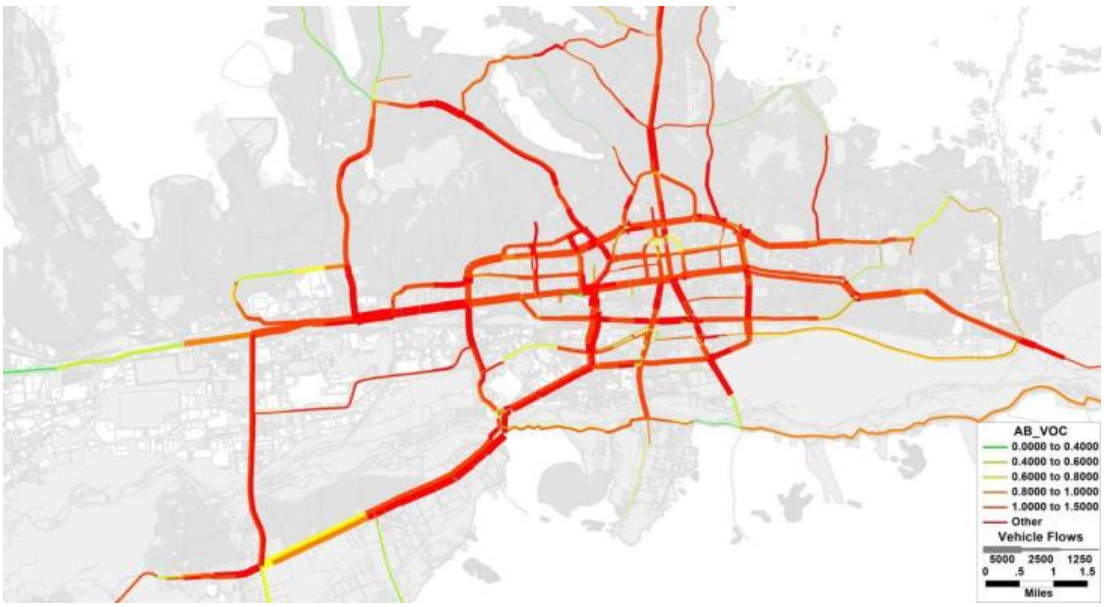

Figure 92 Evening Peak Traffic Assignment for the Road Network Before the Implementation of the New Ring Road in 2044

Figure 93 Evening Peak Traffic Assignment for the Road Network After the Implementation of the New Ring Road in 2044

6.10 Preliminary Traffic Flow Forecast for the Ring Road

1. Traffic Volume Forecast for the New Ring Road Section

After project implementation, the forecasted Design Hourly Volume (DDHV) and Annual Average Daily Traffic (AADT) for the new ring road are shown in Table 33.

Among these, Design Hourly Volume (DDHV) = AADT × Peak Hour Factor (K) × Directional Split Factor (D).

Table 32 New Ring Road Traffic Volume by PCU for the Forecast Year

Year	DDHV (pcu/h)	AADT (pcu/d)
2028	3598	92280
2030	3722	95473
2035	3966	102492
2040	4217	108149
2044	4355	111685
2048	4459	114348

In TransCAD, a road network model of Ulaanbaatar, including the newly constructed ring road, was developed. The traffic matrix for the forecast year was then assigned to the network. Traffic volumes at each entry and exit point of the ring road were extracted using the path flow query function. Based on the key-year data, regression analysis was applied to calculate the full-year traffic data for 2028-2048.

Table 33 Total Ring Road Traffic Trip Volume for the Forecast Year(veh*trips/day)

Year	Jeep4WD	Car light and medium	Bus			Truck				Total
			Light	Medium	Heavy	Light	Medium	Heavy	Articulated	
2028	74734	112103	2538	279	1799	23922	8236	5097	1963	230671
2030	77863	116797	2644	290	1874	24923	8580	5310	2045	240326
2035	83936	125907	2851	313	2020	26867	9250	5724	2205	259073
2040	87511	131269	2972	326	2107	28012	9644	5968	2299	270108
2044	89080	133623	3025	332	2144	28514	9817	6075	2340	274950
2048	89851	134779	3051	335	2163	28761	9901	6128	2360	277329

Notes: The unit for each vehicle type is veh*trips/day.

2. Traffic Volume Forecast for Key Grade-Separated Intersections on the New Ring Road

There are 8 major grade-separated intersections along the new ring road. Traffic volumes are forecasted individually for each intersection. The names and distribution of these intersections are listed in the table below, and their spatial arrangement is shown in the accompanying figure.

Table 34 New Ring Road Grade-Separated Intersections Name

No.	Intersection Name
1	Intersection of New Ring Road and Mosco Street
2	Intersection of New Ring Road and Ard Ayush Road
3	Intersection of New Ring Road and West Second Ring Road
4	Intersection of New Ring Road and No. VII Road
5	Intersection of New Ring Road and Dariehe Street

6	Intersection of New Ring Road and East Second Ring Road
7	Intersection of New Ring Road and Police Academy Avenue
8	Intersection of New Ring Road and Tula Expressway

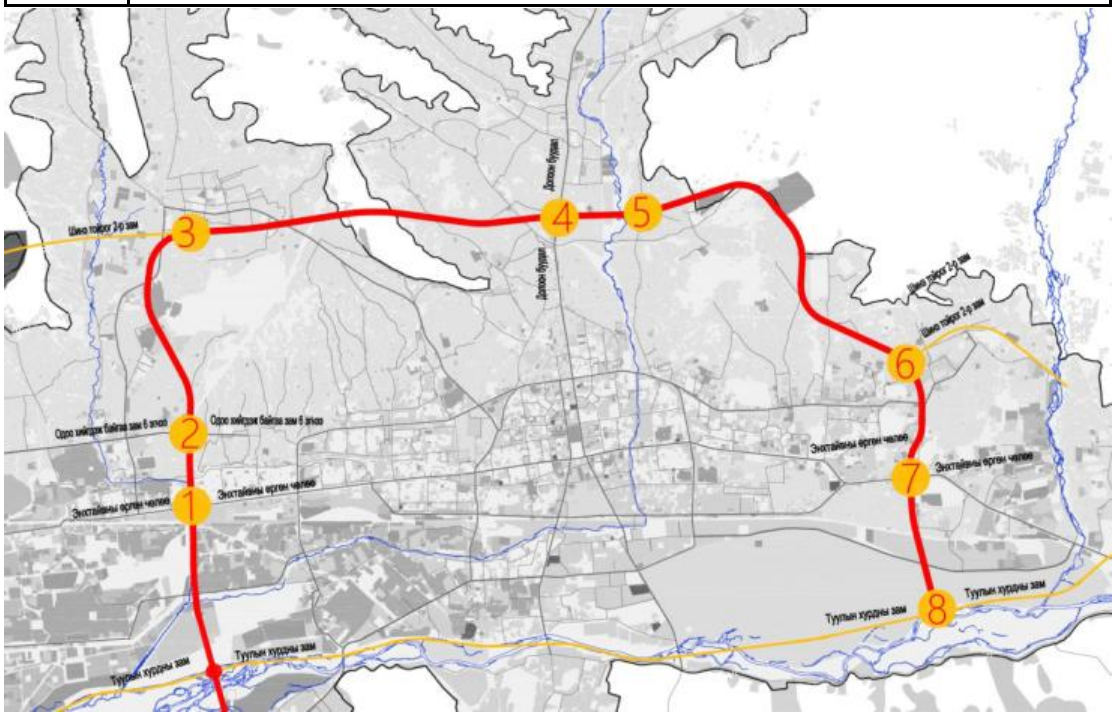

Figure 94 New Ring Road Grade-Separated Intersections Location

Traffic volume forecast statistics for key grade-separated intersections on the New Ring Road are presented in the table below.

Table 35 Traffic Volume Forecast for the New Ring Road Grade-Separated Intersections

No.	Intersection Name
1	Intersection of New Ring Road and Mosco Street
2	Intersection of New Ring Road and Ard Ayush Road
3	Intersection of New Ring Road and West Second Ring Road
4	Intersection of New Ring Road and No. VII Road
5	Intersection of New Ring Road and Dariehe Street
6	Intersection of New Ring Road and East Second Ring Road
7	Intersection of New Ring Road and Police Academy Avenue
8	Intersection of New Ring Road and Tula Expressway

6.11 Impact of the New Ring Road on Ulaanbaatar's Road Network Traffic Demand

This study evaluates changes in traffic load (24-hour bidirectional average daily traffic [ADT]) on major urban roads before and after the implementation of the new ring road. Nineteen key road segments were analyzed, with their spatial distribution

illustrated in the figure below.

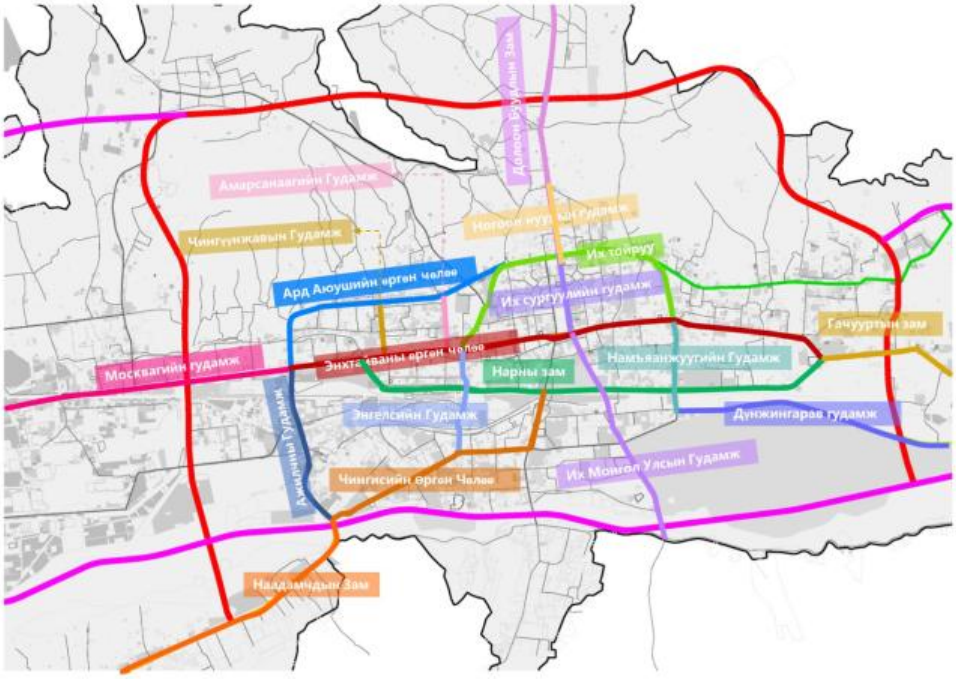

Figure 95 Schematic Diagram of Road Segment Distribution

(1) Impact on traffic load of existing arterial roads after the implementation of the new ring road project in 2028 (24-hour bidirectional ADT change)

Table 36 Impact on Traffic Load of Existing Arterial Roads After the Implementation of the New Ring Road in 2028 (24-hour bidirectional ADT change)

Road Segment Name	Flow Before Project Implementation	Flow After Project Implementation	Traffic Load Reduction	Load Change Rate
Moscow Street	75317	55642	19676	-26.12%
Ard.Ayush Avenue	61171	44457	16714	-27.32%
Ikh Toiruu	52426	43399	9027	-17.22%
Peace Avenue	61523	47884	13639	-22.17%
Narnii Rd	39845	35994	3850	-9.66%
Dunjingarav St	24669	16121	8547	-34.65%
Gachuurt Rd	47278	46559	719	-1.52%
Chinggis.Khan Ave	58632	41791	16841	-28.72%
Tovchoo Rd	84034	76530	7504	-8.93%
Товчооны зам	36347	24584	11763	-32.36%
Ajilchin St	52976	22849	30127	-56.87%
Chingynjav St	38195	33159	5035	-13.18%

Amarsanaa Rd	48096	42666	5430	-11.29%
Engels St	71819	57165	14654	-20.40%
Chingeltei Ave	52243	54711	-2468	4.72%
Nogoon Nuur St	44725	40677	4048	-9.05%
Ikh Surguuli St	39111	36982	2130	-5.45%
Great Mongolian State St	58477	55882	2595	-4.44%
Nam Yan Ju St	60578	54683	5896	-9.73%

The average traffic volume on the roads in 2028 is reduced by 18.37%. The percentage reduction in traffic volume is as follows: roads with a 10-20% reduction: Ikh Toiruu、Chingynjav St、Amarsanaa Rd， roads with a 20-40% reduction: Moscow Street、Ard Ayush Avenue、Peace Avenue、Dunjingarav St、Chinggis Khan Ave、Товчооны зам、Engels St， and roads with a reduction of more than 40%:Ajilchin St ， Some roads, due to intersections with the ring road or their proximity to it, show minimal or slight increases in traffic flow.

(2) Impact on traffic load of existing arterial roads after the implementation of the new ring road project in 2030 (24-hour bidirectional ADT change)

Table 37 Impact on Traffic Load of Existing Arterial Roads After the Implementation of the New Ring Road in 2030 (24-hour bidirectional ADT change)

Road Segment Name	Flow Before Project Implementation	Flow After Project Implementation	Traffic Load Reduction	Load Change Rate
Moscow Street	82440	56291	26149	-32%
Ard Ayush Avenue	64725	47349	17376	-27%
Ikh Toiruu	54697	45459	9238	-17%
Peace Avenue	65571	50311	15260	-23%
Narnii Rd	42792	37715	5077	-12%
Dunjingarav St	26531	17686	8845	-33%
Gachuurt Rd	46643	45867	776	-2%
Chinggis Khan Ave	62722	46600	16122	-26%
Tovchoo Rd	87899	82948	4951	-6%
Товчооны зам	38913	25092	13821	-36%
Ajilchin St	54697	24345	30352	-55%
Chingynjav St	41678	34809	6869	-16%
Amarsanaa Rd	52060	45331	6729	-13%
Engels St	86601	62313	24288	-28%
Chingeltei Ave	53766	55134	-1368	3%
Nogoon Nuur St	44344	40775	3569	-8%

Ikh Surguuli St	41057	38180	2877	-7%
Great Mongolian State St	60889	54809	6080	-10%
Nam Yan Ju St	62370	57108	5262	-8%

The average traffic volume on the roads in 2030 is reduced by 19.57%. The percentage reduction in traffic volume is as follows: roads with a 10-20% reduction: Ikh Toiruu, Narnii Rd, Narnii Rd, Chingynjav St, Amarsanaa Rd, and Great Mongolian State St; roads with a 20-40% reduction: Moscow Street, Ард Аюушийн өргөн чөл, Энхтайваны өргөн чөл, Dunjingarav St, Чингисийн Өргөн Чөл, Товчооны зам, and Engels St; and roads with a reduction of more than 40%: Ajilchin St. Some roads, due to intersections with the ring road or their proximity to it, show minimal or slight increases in traffic flow.

(3) Impact on traffic load of existing arterial roads after the implementation of the new ring road project in 2040 (24-hour bidirectional ADT change)

Table 38 Impact on Traffic Load of Existing Arterial Roads After the Implementation of the New Ring Road in 2040 (24-hour bidirectional ADT change)

Road Segment Name	Flow Before Project Implementation	Flow After Project Implementation	Traffic Load Reduction	Load Change Rate
Moscow Street	90113	66700	23413	-26%
Ard Ayush Avenue	73413	55670	17743	-24%
Ikh Toiruu	61594	49492	12102	-20%
Peace Avenue	71720	57786	13934	-19%
Narnii Rd	47518	42003	5515	-12%
Dunjingarav St	29633	21354	8279	-28%
Gachuurt Rd	49887	44415	5472	-11%
Chinggis Khan Ave	68985	49704	19281	-28%
Tovchoo Rd	99323	91580	7743	-8%
Товчооны зам	43287	28998	14289	-33%
Ajilchin St	62383	29874	32509	-52%
Chingynjav St	45952	39153	6799	-15%
Amarsanaa Rd	57559	50240	7319	-13%
Engels St	100324	67884	32440	-32%
Chingeltei Ave	58829	59859	-1030	2%
Nogoon Nuur St	48040	42947	5093	-11%

Ikh Surguuli St	45260	40973	4287	-9%
Great Mongolian State St	65839	60324	5515	-8%
Nam Yan Ju St	71439	64894	6545	-9%

The average traffic volume on the roads in 2040 is reduced by 19.47%. The percentage reduction in traffic volume is as follows: roads with a 10-20% reduction: Энхтайваны өргөн чөл, Narnii Rd, Gachuurt Rd, Chingynjav St, Amarsanaa Rd, and Nogoon Nuur St; roads with a 20-40% reduction: Moscow Street, Ард Аюушийн өргөн чөл, Ikh Toiruu, Dunjingarav St, Чингисийн Өргөн Чөл, Товчооны зам, Engels St, and Engels St; and roads with a reduction of more than 40%: Ajilchin St. Some roads, due to intersections with the ring road or their proximity to it, show minimal or slight increases in traffic flow.

(4) Impact on traffic load of existing arterial roads after the implementation of the new ring road project in 2044 (24-hour bidirectional ADT change)

Table 39 Impact on Traffic Load of Existing Arterial Roads After the Implementation of the New Ring Road in 2044 (24-hour bidirectional ADT change)

Road Segment Name	Flow Before Project Implementation	Flow After Project Implementation	Traffic Load Reduction	Load Change Rate
Moscow Street	96418	68675	27743	-29%
Ard Ayush Avenue	76403	58998	17405	-23%
Ikh Toiruu	63978	51693	12285	-19%
Peace Avenue	76558	59844	16714	-22%
Narnii Rd	49802	43949	5853	-12%
Dunjingarav St	27785	21847	5938	-21%
Gachuurt Rd	51213	45233	5980	-12%
Chinggis Khan Ave	73696	50719	22977	-31%
Tovchoo Rd	106417	94457	11960	-11%
Товчооны зам	46107	30705	15402	-33%
Ajilchin St	66558	34626	31932	-48%
Chingynjav St	49281	41115	8166	-17%
Amarsanaa Rd	67250	50691	16559	-25%
Engels St	105148	70522	34626	-33%
Chingeltei Ave	62891	62397	494	-1%
Nogoon Nuur St	52863	44287	8576	-16%
Ikh Surguuli St	49492	42031	7461	-15%

Great Mongolian State St	68801	63851	4950	-7%
Nam Yan Ju St	72849	66572	6277	-9%

The average traffic volume on the roads in 2044 is reduced by 21.15%. The percentage reduction in traffic volume is as follows: roads with a 10-20% reduction: Ikh Toiruu, Narnii Rd, Gachuurt Rd, Tovchoo Rd, Chingynjav St, Nogoon Nuur St, and Ikh Surguuli St; roads with a 20-40% reduction: Moscow Street, Ард Аюушийн өргөн чөл Энхтайваны өргөн чөл, Dunjingarav St, Чингисийн Өргөн Чөл,Товчооны зам, Amarsanaa Rd, and Engels St; and roads with a reduction of more than 40%: Ajilchin St. Some roads, due to intersections with the ring road or their proximity to it, show minimal or slight increases in traffic flow.

6.12 Basis for the Selection of the Ring Road Options

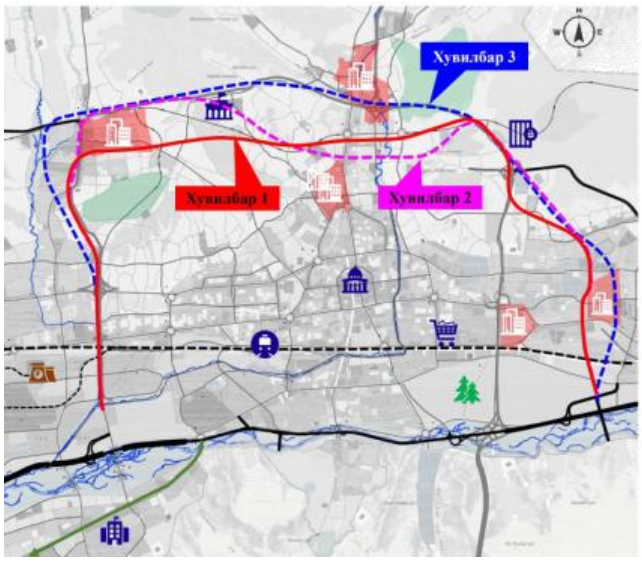

Figure 96 Recommended Road Alignment Plan

Figure 96 presents 3 planning options for the First Ring Road (Ring Road 1). Option 1: Connects the northern residential areas, features a shorter route, and has a relatively strong traffic flow attraction. According to preliminary forecasts, the peak hourly traffic volume for this ring road model in 2030 is estimated to be 3,722 vehicles per hour, with an annual average daily traffic (AADT) of 95,473 vehicles. Option 2: Certain road segments in the northern part involve a longer detour; the western segment is farther from the city center, while the eastern segment is closer to the city center. The AADT for this option is 0.96 times that of Option 1. Option 3: Due to the relatively long total length of the ring road and its greater distance from the city center, the AADT

is only 0.9 times that of the recommended Option 1. After considering factors such as traffic flow scale and economic benefits, Option 1 is recommended.

6.13 Traffic Organization Design for Key Intersections on the New Ring Road

6.13.1 Grade Separation Design

1. Interchange between the New Ring Road and the Moscow Street

According to the reply letter (No. 02/603) from the National Power Transmission Grid State Owned Joint Stock Company in Mongolia, the 220 KV high-voltage iron tower on the west side of the road cannot be relocated, and the height of the high-voltage wire from the ground is only 13.27 m. If a ramp is arranged on the west side of the road, the horizontal safety distance and clearance from the high-voltage wire do not meet the requirements of Article 1.5.20 of the Mongolian Specification ЗЗБНбД 22-004-2016 *Road design*.

There are lots of high-rise residential buildings on the north side of the intersection, with difficulty in demolition, and there is also no space for the layout of ramps.

Therefore, Scheme I adopts a separated interchange with the main road of the New Ring Road crossing over the Moscow Street. The ground level side road of the New Ring Road level intersects with Moscow Street, and the ground level intersection is used for traffic transition.

Figure 97 Separation Interchange between the New Ring Road and the Moscow Street

2. Interchange between the New Ring Road and the Ard Ayush Road

Based on the results of predicted traffic volume and the presence of new frame bridges in the surrounding area, Scheme I adopts a simple diamond interchange with the New Ring Road crossing over the Ard Ayush Road.

Two ramp bridges parallel to the main road of the New Ring Road are set up on the south side, connecting to the ground intersection of Ard Ayush Road. Due to the high terrain on the north side of the intersection, the main road of the New Ring Road adopts a 2.8% longitudinal slope for climbing. If the two ramps on the north side are connected to the main road in the form of bridges, according to Article1.6 "The longitudinal slope of the bridge shall not exceed 4%" in Mongolian regulations БНбД 32-02-12 *Road bridge and culvert design*, it will result in the bridge length being too long and the project cost being too high. Therefore, the two ramps on the north side will be connected to the main road after climbing the slope using the subgrade method.

Figure 98 Interchange between the New Ring Road and the Ard Ayush Road

3. Interchange between the New Ring Road and the west side of the Second Ring Road

Based on the prediction results of traffic volume and the surrounding construction conditions, Scheme I adopts a single horn interchange with the New Ring Road crossing over the Second Ring Road. At the north and south ends of the intersection, the New Ring Road level intersects with the existing Bayankhoshuu Street through side roads.

Figure 99 Interchange between the New Ring Road and the West Side of the Second Ring Road

4. Interchange between the New Ring Road and the Doloon Buudal road

Due to the high terrain on the west side of the intersection, the main road adopts a 3.8% longitudinal slope. If a ramp is set up on the west side, it will cause the bridge length to be too long and the engineering cost to be too high. Therefore, Scheme I adopts a simple cloverleaf interchange with the New Ring Road crossing over Doloon Buudal road.

The ramps A and D level intersect with the Doloon Buudal road level, allowing vehicles to turn left and right, and then pass through the ramps B, C, E, and F to enter and exit New Ring Road.

Figure 100 Interchange between the New Ring Road and the Doloon Buudal road

5.Interchange between the New Ring Road and the Dari-Ekh street

Based on the prediction results of traffic volume and the surrounding terrain conditions, Scheme I adopts a partially cloverleaf interchange with the New Ring Road crossing over Dari-Ekh street. The ramps A and D level intersect with the Dari-Ekh street level, allowing vehicles to turn left and right, and then pass through the ramps B, C, E, and F to enter and exit New Ring Road.

Figure 101 Interchange between the New Ring Road and the Dari-Ekh street

6. Interchange between the New Ring Road and the east side of the Second Ring Road

Based on the prediction results of traffic volume and the surrounding terrain conditions, Scheme I adopts a single horn interchange with the New Ring Road passing under the Second Ring Road. The ramp B adopts a circular ramp type, serving the traffic flow of the Second Ring Road turning left into New Ring Road. The ramp C adopts a directional ramp type, serving the traffic flow from the left turn of the New Ring Road to the Second Ring Road. Vehicles turning right between the New Ring Road and the Second Ring Road can use the ramps D and E. The side road is set up by detouring outside the interchange.

Figure 102 Interchange between the New Ring Road and the East Side of the Second Ring Road

7. Interchange between the New Ring Road and the Police Academy Avenue

Based on the predicted traffic volume and the distributions of surrounding buildings, Scheme I adopts a diamond interchange with the New Ring Road crossing over the Police Academy Avenue. Four ramps A, B, C, and D can be used to enter and exit the main road of the New Ring Road, and left and right turns can be achieved at ground level intersections.

Figure 103 Interchange between the New Ring Road and the Police Academy Avenue

8. Interchange between the New Ring Road and the Tuul Expressway

Based on the prediction results of traffic volume, Scheme I adopts a single horn interchange with the New Ring Road crossing over the Tuul Expressway. The ramp B adopts a circular ramp type, serving the traffic flow from the left turn of the New Ring Road to the Tuul Expressway. The ramp C adopts a directional ramp type, serving the traffic flow of turning left into New Ring Rampoad on the Tuul Expressway. Vehicles turning right between the New Ring Road and the Tuul Expressway can use the ramps D and E.

Figure 104 Interchange between the New Ring Road and the Tuul Expressway

6.13.2 Level intersection design

ntersections are the connecting points of the road network and the throat for urban transportation. Their design and use are particularly important for the safety and smoothness of road traffic. Therefore, the quality of intersection design will directly affect the traffic capacity of the road and the function of the entire road and road network.

(1) Level intersection of roads

Traffic channelization refers to marking lines on roads or separating lanes with greenbelts and traffic islands, so that vehicles of different natures and speeds can travel in the prescribed direction without interfering with each other, just like the water flow in the channel. Organizing channelized traffic can effectively solve traffic congestion and blockages on roads, reduce traffic conflicts, and ensure traffic safety.

As the traffic capacity of the intersection is lower than that of normal road sections, to meet the demands for traffic, necessary channelization design is carried out at the intersection based on traffic analysis and engineering needs, and light control is implemented to reduce the area of vehicle intersection. Meanwhile, dedicated left turn

lanes and dedicated right turn lanes are set up to guarantee that vehicles can pass quickly at intersections and pedestrians can safely pass through intersections.

Figure 105 Design Rendering of the Level Intersection

(2) Level intersection of the road and the railway

The ground side road and railway will adopt a level crossing type in the near future, and reserve space for future underpass of the railway.

1) Management principles

① Safety priority: The safe passage is ensured for pedestrians, vehicles, and trains, and conflicts are avoided.

② Efficiency coordination: Signal control and traffic organization are optimized to reduce waiting time for vehicles on road.

③ Clear rights and responsibilities: The collaborative management responsibilities are defined between the railway department and the road department.

2) Traffic organization measures

① Priority regulations: Railway trains have absolute priority in passage, while road vehicles need to stop and give way.

② Speed limit requirement: On the roadside, the speed limit within 60 m before and after the intersection is 20 km/h (adjusted according to actual conditions).

Railway side: The speed of trains passing through intersections should be in accordance with the regulations of the railway department.

③ Prohibited behaviors: Vehicles are strictly prohibited from parking, overtaking, or turning around in the intersection area.

3) Protective design

Standard railway crossing signs, approach warning signs, and road markings should be set up at level intersections.

6.13.3 The New Ring Road Traffic Organization Design

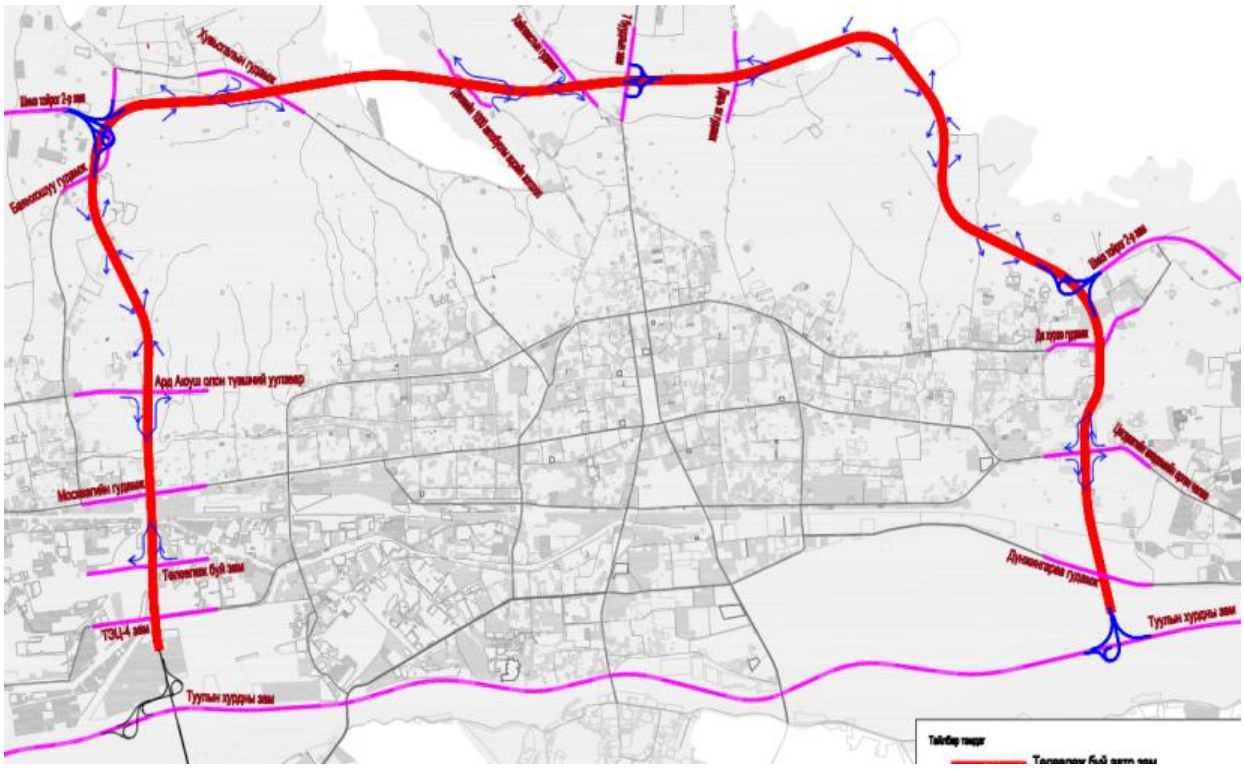

Figure 106 Traffic transition between main road and side road systems

The biggest feature of this project is the use of two systems, i.e., the main road and the side road. During the design, the design speed for the outermost lane of the main road is 80 km/h, and the design speed for the side road is 40 km/h. Acceleration lanes and parallel lanes are set between the main road and the side road to ensure safe traffic transitions between them. After setting up side roads, the current roads and plots along

the road can enter the main road through the side roads, thus improving the service function of the road to surrounding areas and reducing the fragmentation on both sides. Meanwhile, 21 pairs of bus stops will be set up on side roads, allowing buses to pass through the outer lanes of the main road and side roads, thus building a fast urban public transportation network for Ulaanbaatar.

7. "New Ring Road" Project Traffic Demand Forecasts for 2028,2030, 2040, and 2044

7.1 2028 Road Traffic Flow Forecast for the New Ring Road Project

7.1.1 Traffic Volume Forecast for the Road Network Before the Implementation of the New Ring Road

Traffic assignment for the road network before the implementation of the new ring road was conducted, as shown in Figure 107. The traffic flow for key road segments during the evening peak in 2028 is summarized in Table 40.

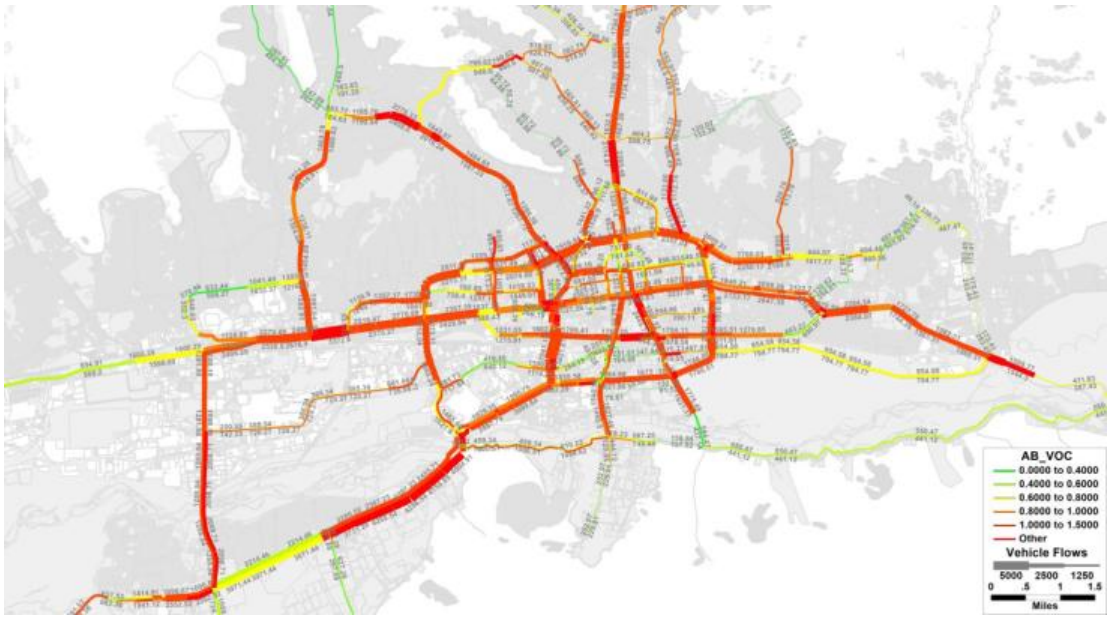

Figure 107 Evening Peak Traffic Flow Map Before the Project Implementation in 2028

Table 40 Major Road Traffic Flow Before the Implementation of the New Ring Road in 2028

Road Segment Name	Direction	Minimum Flow	Maximum Flow
Moscow Street	East to West	2279	3216
	West to East	2213	3405
Ard Ayush Avenue	East to West	1548	3279
	West to East	1299	2979
Ikh Toiruu	East to West	524	2762
	West to East	1005	4067
Peace Avenue	East to West	1266	3478
	West to East	1588	3175
Narnii Rd	East to West	483	2278
	West to East	890	2704
Dunjingarav St	East to West	794	954
	West to East	794	954

Gachuurt Rd	East to West	1562	1768
	West to East	1562	1842
Chinggis Khan Ave	East to West	962	2081
	West to East	1364	3099
Tovchoo Rd	East to West	2158	4398
	West to East	2387	4398
Товчооны зам	East to West	428	2098
	West to East	457	2406
Ajilchin St	North to South	1565	1812
	South to North	1990	2073
Chingynjav St	North to South	1086	1536
	South to North	1459	1501
Amarsanaa Rd	North to South	1049	1526
	South to North	1841	2378
Engels St	North to South	2135	3599
	South to North	2135	3640
Chingeltei Ave	North to South	1482	2414
	South to North	1482	2385
Nogoon Nuur St	North to South	1320	1527
	South to North	1780	2004
Ikh Surguuli St	North to South	1104	1683
	South to North	911	1683
Great Mongolian State St	North to South	1494	2445
	South to North	1907	2457
Nam Yan Ju St	North to South	1866	2453
	South to North	1930	2497

7.1.2 Traffic Volume Forecast for the Road Network After the Implementation of the New Ring Road

Traffic assignment for the road network after the implementation of the new ring road was conducted, as shown in Figure 108. The traffic flow for key road segments during the evening peak in 2028 is summarized in Table 41.

Figure 108 Evening Peak Traffic Flow Map After the Project Implementation in 2028

Table 41 Major Road Traffic Flow After the Implementation of the New Ring Road in 2028

Road Segment Name	Direction	Minimum Flow	Maximum Flow
Moscow Street	East to West	1494	3442
	West to East	1358	2931
Ard Ayush Avenue	East to West	1029	2622
	West to East	861	1971
Ikh Toiruu	East to West	387	2169
	West to East	668	3030
Peace Avenue	East to West	976	2894
	West to East	1103	2561
Narnii Rd	East to West	553	2481
	West to East	337	2091
Dunjingarav St	East to West	657	657
	West to East	486	486
Gachuurt Rd	East to West	1454	2118
	West to East	1634	2143
Chinggis Khan Ave	East to West	728	1743
	West to East	732	2099
Tovchoo Rd	East to West	1669	3353
	West to East	474	4687
Товчооны зам	East to West	88	1284
	West to East	133	1898
Ajilchin St	North to South	672	1004
	South to North	662	1039
Chingynjav St	North to South	789	1368
	South to North	1287	1396
Amarsanaa Rd	North to South	1049	1526

	South to North	1586	1911
Engels St	North to South	1259	2380
	South to North	1892	2547
Chingeltei Ave	North to South	1477	2326
	South to North	1589	2324
Nogoon Nuur St	North to South	1099	1525
	South to North	1372	1869
Ikh Surguuli St	North to South	897	1610
	South to North	1059	1575
Great Mongolian State St	North to South	1682	2448
	South to North	1507	1956
Nam Yan Ju St	North to South	1740	2384
	South to North	1683	2204

7.1.3 Traffic Volume Changes Before and After the Implementation of the New Ring Road

By comparing the road network traffic flow before and after the implementation of the new ring road in 2028, flow changes and flow change rates for road segments were calculated. The flow change rate was derived using the following formula: Flow Change Rate = (Flow After Implementation of New Ring Road - Flow Before Implementation of New Ring Road) / Flow Before Implementation of New Ring Road. The flow change was calculated as: Flow Change = Flow After Implementation of New Ring Road - Flow Before Implementation of New Ring Road, as shown in Table 42.

Table 42 2028 Flow Changes

Road Segment Name	Direction	2028 Flow Change Rate	2028 Flow Changes
Moscow Street	East to West	-31%	-804
	West to East	-22%	-591
Ard Ayush Avenue	East to West	-25%	-547
	West to East	-30%	-638
Ikh Toiruu	East to West	-16%	-265
	West to East	-19%	-375
Peace Avenue	East to West	-22%	-480
	West to East	-22%	-487
Narnii Rd	East to West	-6%	-87
	West to East	-13%	-186
Dunjingarav St	East to West	-26%	-235
	West to East	-43%	-371
Gachuurt Rd	East to West	-7%	-109
	West to East	3%	58

Chinggis Khan Ave	East to West	-22%	-386
	West to East	-34%	-808
Tovchoo Rd	East to West	-4%	-118
	West to East	-12%	-414
Товчооны зам	East to West	-35%	-446
	West to East	-30%	-388
Ajilchin St	North to South	-53%	-909
	South to North	-60%	-1227
Chingynjav St	North to South	-19%	-228
	South to North	-9%	-129
Amarsanaa Rd	North to South	0%	-5
	South to North	-18%	-380
Engels St	North to South	-21%	-504
	South to North	-20%	-535
Chingeltei Ave	North to South	0%	8
	South to North	9%	167
Nogoon Nuur St	North to South	-6%	-83
	South to North	-11%	-204
Ikh Surguuli St	North to South	-7%	-99
	South to North	-4%	-52
Great Mongolian State St	North to South	5%	108
	South to North	-14%	-292
Nam Yan Ju St	North to South	-5%	-107
	South to North	-14%	-311

By comparing the data, the distribution of flow changes across 19 road segments in 2028 was statistically analyzed, as well as the range of flow change rates before and after the implementation of the new ring road.

By conducting a general distribution analysis of the 38 directional road segments in 2028, the results are summarized in the table below.

Table 43 2028 Flow summarized Changes

Traffic Flow Change Type	Number of Road Segments (Direction)	Percentage
Traffic Flow Decrease	31	86%
Traffic Flow Increase	3	8%
Traffic Flow Remains Nearly Unchanged	2	6%

East-West Direction: The range of flow change rate reduction in the east-west direction is -4% to -43%. The range of flow change rate increase in the east-west direction is 0% to 3%.

North-South Direction: The range of flow change rate reduction in the north-south direction is -4% to -60%. The range of flow change rate increase in the north-south direction is 5% to 9%. Sections experiencing positive growth trends exhibit increased traffic volumes during north-south directional transfers with the New Ring Road.

After the implementation of the new ring road, the road segment with the largest optimization is Ajilchin St, where the flow change in the north-south direction is -909 and -1277, with a north-to-south change rate of -53% and a south-to-north change rate of -60%. The traffic diversion measures of the new ring road led to a significant reduction in traffic flow on this segment.

7.2 2030 Road Traffic Flow Forecast for the New Ring Road Project

7.2.1 Traffic Volume Forecast for the Road Network Before the Implementation of the New Ring Road

Traffic assignment for the road network before the implementation of the new ring road was conducted, as shown in Figure 109. The traffic flow for key road segments during the evening peak in 2030 is summarized in Table 44.

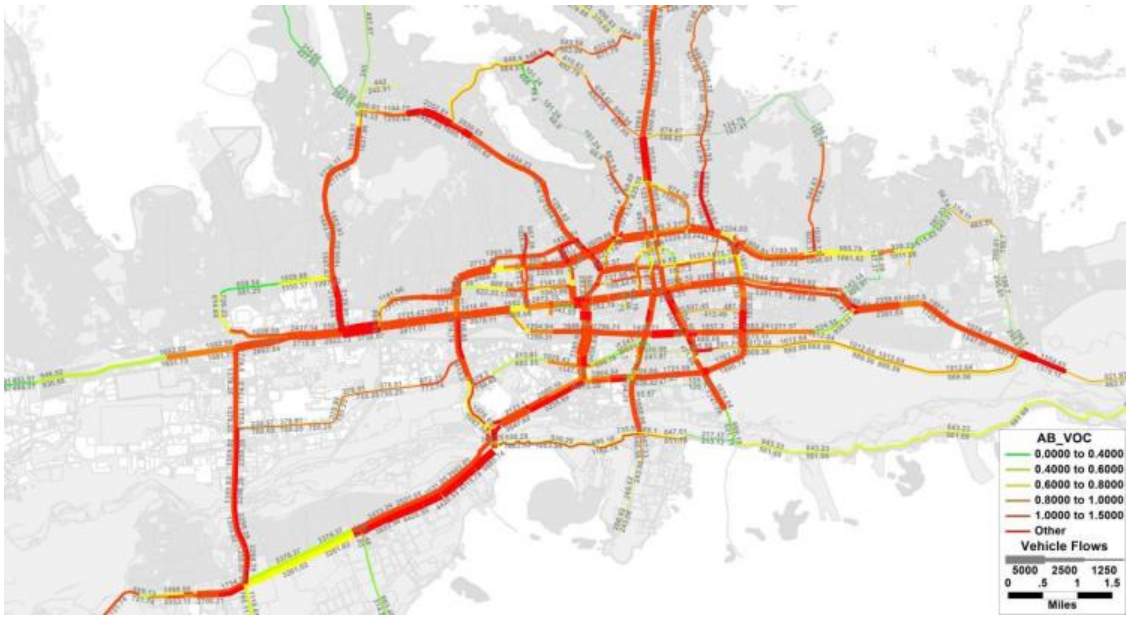

Figure 109 Evening Peak Traffic Flow Map Before the Project Implementation in 2030

Table 44 Major Road Traffic Flow Before the Implementation of the New Ring Road in 2030

Road Segment Name	Direction	Minimum Flow	Maximum Flow	Average Flow
Moscow Street	East to West	2371	3427	2850
	West to East	2628	3776	2995

Ard Ayush Avenue	East to West	1637	3571	2328
	West to East	1359	3197	2261
Ikh Toiruu	East to West	601	2849	1847
	West to East	848	4021	2031
Peace Avenue	East to West	1348	3325	2292
	West to East	1668	3318	2357
Narnii Rd	East to West	534	2867	1508
	West to East	938	2490	1526
Dunjingarav St	East to West	1012	1012	1012
	West to East	869	869	869
Gachuurt Rd	East to West	1537	1807	1665
	West to East	1537	1811	1642
Chinggis Khan Ave	East to West	1087	2175	1872
	West to East	1637	3255	2575
Tovchoo Rd	East to West	2376	4575	3303
	West to East	2316	4575	2929
Товчооны зам	East to West	453	2277	1346
	West to East	484	2662	1413
Ajilchin St	North to South	1613	1874	1771
	South to North	2018	2155	2107
Chingynjav St	North to South	1189	1697	1343
	South to North	1529	1690	1612
Amarsanaa Rd	North to South	1375	2200	1740
	South to North	1419	2194	1951
Engels St	North to South	2069	3223	2838
	South to North	2612	3671	3302
Chingeltei Ave	North to South	1502	2347	1833
	South to North	1520	2609	1979
Nogoon Nuur St	North to South	1251	1464	1293
	South to North	1803	2033	1851

Ikh Surguuli St	North to South	1028	1832	1431
	South to North	1014	1930	1480
Great Mongolian State St	North to South	1698	2492	2240
	South to North	1558	2436	2077
Nam Yan Ju St	North to South	1918	2605	2210
	South to North	1938	2646	2212

7.2.2 Traffic Volume Forecast for the Road Network After the Implementation of the New Ring Road

Traffic assignment for the road network after the implementation of the new ring road was conducted, as shown in Figure 110. The traffic flow for key road segments during the evening peak in 2030 is summarized in Table 45.

Figure 110 Evening Peak Traffic Flow Map After the Project Implementation in 2030

Table 45 Major Road Traffic Flow After the Implementation of the New Ring Road in 2030

Road Segment Name	Direction	Minimum Flow	Maximum Flow	Average Flow
Moscow Street	East to West	1563	3671	1916
	West to East	1235	2849	2075
Ard Ayush Avenue	East to West	1113	2703	1731
	West to East	968	2294	1626

Ikh Toiruu	East to West	402	2239	1501
	West to East	681	3167	1722
Peace Avenue	East to West	1067	3036	1787
	West to East	1251	2677	1780
Narnii Rd	East to West	562	2560	1367
	West to East	517	2238	1307
Dunjingarav St	East to West	704	704	704
	West to East	550	550	550
Gachuurt Rd	East to West	1446	2110	1555
	West to East	1587	2129	1697
Chinggis Khan Ave	East to West	827	1814	1499
	West to East	954	2311	1805
Tovchoo Rd	East to West	1747	3524	2637
	West to East	529	5138	3244
Товчооны зам	East to West	103	1371	859
	West to East	157	1698	920
Ajilchin St	North to South	728	955	820
	South to North	753	1127	906
Chingynjav St	North to South	833	1447	1055
	South to North	1368	1435	1413
Amarsanaa Rd	North to South	1090	1653	1363
	South to North	1684	2022	1851
Engels St	North to South	1579	2605	2088
	South to North	1915	2707	2330
Chingeltei Ave	North to South	1491	2354	1920
	South to North	1605	2324	1989
Nogoon Nuur St	North to South	1129	1576	1315
	South to North	1363	1848	1576
Ikh Surguuli St	North to South	899	1677	1391

	South to North	1073	1582	1316
Great Mongolian State St	North to South	1630	2361	2140
	South to North	1470	1931	1746
Nam Yan Ju St	North to South	1891	2499	2112
	South to North	1733	2299	1937

7.2.3 Traffic Volume Changes Before and After the Implementation of the New Ring Road

By comparing the road network traffic flow before and after the implementation of the new ring road in 2030, flow changes and flow change rates for road segments were calculated. The flow change rate was derived using the following formula: Flow Change Rate = (Flow After Implementation of New Ring Road - Flow Before Implementation of New Ring Road) / Flow Before Implementation of New Ring Road. The flow change was calculated as: Flow Change = Flow After Implementation of New Ring Road - Flow Before Implementation of New Ring Road, as shown in Table 46.

Table 46 2030 Flow Changes

Road Segment Name	Direction	2030 Flow Change Rate	2030 Flow Changes
Moscow Street	East to West	-33%	-934
	West to East	-31%	-920
Ard Ayush Avenue	East to West	-26%	-597
	West to East	-28%	-635
Ikh Toiruu	East to West	-19%	-346
	West to East	-15%	-309
Peace Avenue	East to West	-22%	-505
	West to East	-24%	-577
Narnii Rd	East to West	-9%	-141
	West to East	-14%	-219
Dunjingarav St	East to West	-30%	-308
	West to East	-37%	-319
Gachuurt Rd	East to West	-7%	-110
	West to East	3%	55
Chinggis Khan Ave	East to West	-20%	-373
	West to East	-30%	-770
Tovchoo Rd	East to West	-20%	-666
	West to East	11%	315
Товчооны зам	East to West	-36%	-487
	West to East	-35%	-493
Ajilchin St	North to South	-54%	-951
	South to North	-57%	-1201
Chingynjav St	North to South	-21%	-288
	South to North	-12%	-199
Amarsanaa Rd	North to South	-22%	-377
	South to North	-5%	-100
Engels St	North to South	-26%	-750
	South to North	-29%	-972
Chingeltei Ave	North to South	5%	87
	South to North	1%	10

Nogoon Nuur St	North to South	2%	22
	South to North	-15%	-275
Ikh Surguuli St	North to South	-3%	-40
	South to North	-11%	-164
Great Mongolian State St	North to South	-4%	-100
	South to North	-16%	-331
Nam Yan Ju St	North to South	-4%	-98
	South to North	-12%	-275

By comparing the data, the distribution of flow changes across 19 road segments in 2030 was statistically analyzed, as well as the range of flow change rates before and after the implementation of the new ring road.

By conducting a general distribution analysis of the 38 directional road segments in 2030, the results are summarized in the table below.

Table 47 2030 Flow summarized Changes

Traffic Flow Change Type	Number of Road Segments (Direction)	Percentage
Traffic Flow Decrease	33	87%
Traffic Flow Increase	5	13%
Traffic Flow Remains Nearly Unchanged	0	0

East-West Direction: The range of flow change rate reduction in the east-west direction is -7% to -37%. The range of flow change rate increase in the east-west direction is 3% to 11%. Road segments with positive growth are located near the east-west section of the new ring road, where traffic flows through these segments into the main urban area, resulting in an increase in both flow and flow change rate.

North-South Direction: The range of flow change rate reduction in the north-south direction is -4% to -57%. The range of flow change rate increase in the north-south direction is 1% to 5%. Road segments with positive growth are those where traffic flows through these segments via the new ring road in the north-south direction, resulting in an increase in flow, although the increase is minimal and generally stable.

After the implementation of the new ring road, the road segment with the largest optimization is Ajilchin St, where the flow change in the north-south direction is -951 and -1201, with a north-to-south change rate of -54% and a south-to-north change rate of -57%. The traffic diversion measures of the new ring road led to a significant reduction in traffic flow on this segment.

7.3 2040 Road Traffic Flow Forecast for the New Ring Road Project

7.3.1 Traffic Volume Forecast for the Road Network Before the Implementation of the New Ring Road

Traffic assignment for the road network before the implementation of the new ring road was conducted, as shown in Figure 111. The traffic flow for key road segments during the evening peak in 2040 is summarized in Table 48.

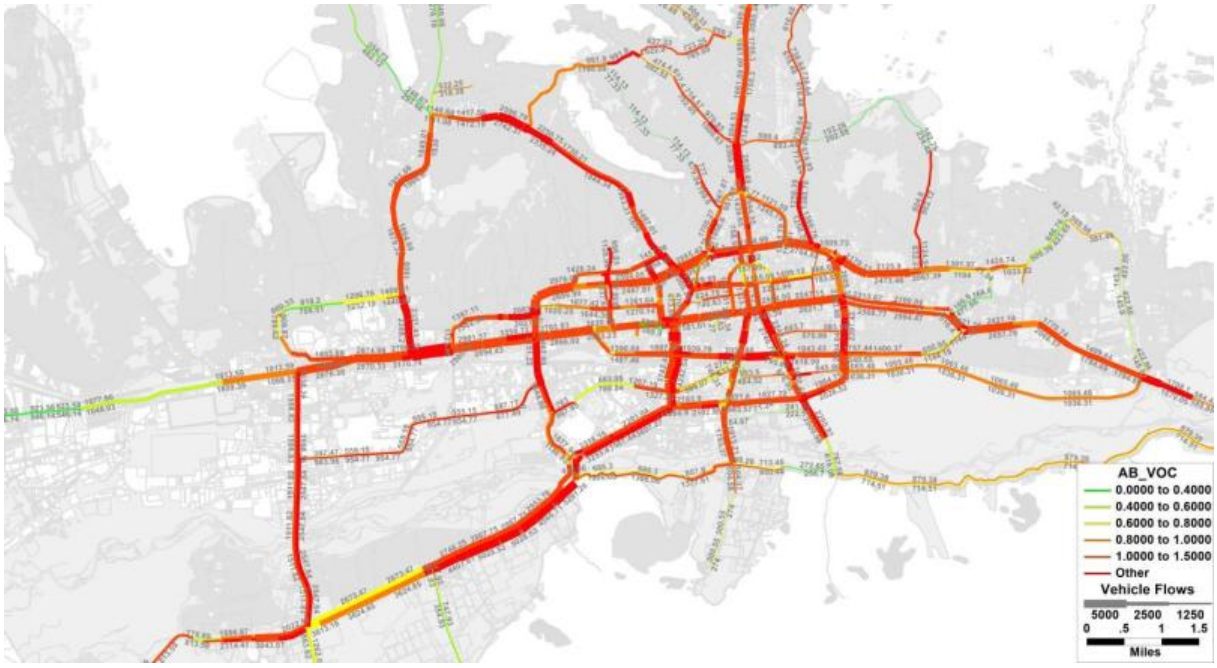

Figure111 Evening Peak Traffic Flow Map Before the Project Implementation in 2040

Table 48 Major Road Traffic Flow Before the Implementation of the New Ring Road in 2040

Road Segment Name	Direction	Minimum Flow	Maximum Flow	Average Flow
Moscow Street	East to West	2601	3821	3134
	West to East	2867	4203	3255
Ard Ayush Avenue	East to West	1893	3944	2628
	West to East	1623	3431	2577
Ikh Toiruu	East to West	574	3210	2076
	West to East	1021	4653	2291
Peace Avenue	East to West	1557	3671	2513
	West to East	2053	3455	2572
Narnii Rd	East to West	650	3119	1677
	West to East	1144	2808	1692
Dunjingarav St	East to West	1065	1065	1065
	West to East	1036	1036	1036
Gachuurt Rd	East to West	1499	1843	1713
	West to East	1499	2127	1824
Chinggis Khan Ave	East to West	1282	2417	2065
	West to East	1798	3611	2826
Tovchoo Rd	East to West	2673	5199	3731
	West to East	2606	5199	3311
Товчооны зам	East to West	523	2451	1502
	West to East	546	2876	1567
Ajilchin St	North to South	1844	2151	2033
	South to North	2239	2462	2390
Chingynjav St	North to South	1323	1844	1474
	South to North	1711	1850	1784
Amarsanaa Rd	North to South	1395	2355	1873
	South to North	1754	2384	2208
Engels St	North to South	2342	3742	3277
	South to North	3078	4257	3836
Chingeltei Ave	North to South	1557	2720	2002
	South to North	1618	2961	2169

Nogoon Nuur St	North to South	1439	1670	1490
	South to North	1844	2153	1916
Ikh Surguuli St	North to South	1209	2152	1576
	South to North	1333	2110	1633
Great Mongolian State St	North to South	1407	2789	2406
	South to North	1719	2928	2262
Nam Yan Ju St	North to South	2274	3005	2509
	South to North	2397	2890	2556

7.3.2 Traffic Volume Forecast for the Road Network After the Implementation of the New Ring Road

Traffic assignment for the road network after the implementation of the new ring road was conducted, as shown in Figure112. The traffic flow for key road segments during the evening peak in 2040 is summarized in Table 49.

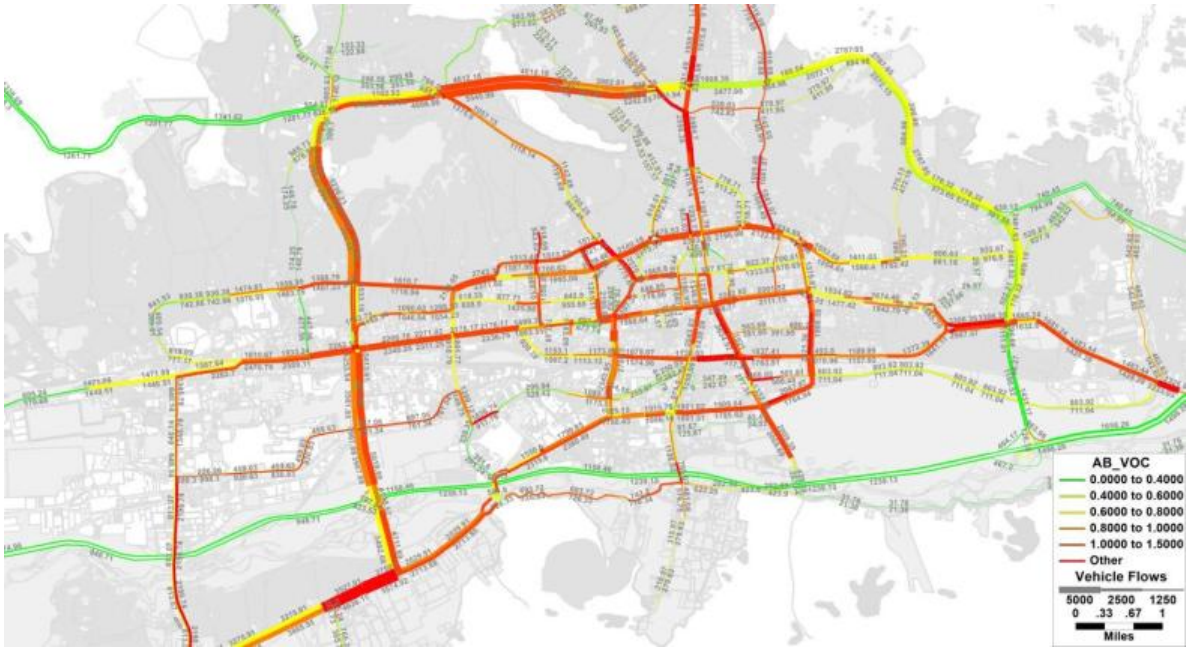

Figure 112 Evening Peak Traffic Flow Map After the Project Implementation in 2040

Table 49 Major Road Traffic Flow After the Implementation of the New Ring Road in 2040

Road Segment Name	Direction	Minimum Flow	Maximum Flow	Average Flow
Moscow Street	East to West	1810	4185	2193
	West to East	1650	3568	2536
Ard Ayush Avenue	East to West	1378	3071	2013
	West to East	1245	2523	1934
Ikh Toiruu	East to West	424	2508	1646
	West to East	679	3429	1863
Peace Avenue	East to West	1307	3306	2050
	West to East	1477	3087	2047
Narnii Rd	East to West	821	2804	1524
	West to East	317	2382	1454
Dunjingarav St	East to West	803	803	803
	West to East	711	711	711
Gachuurt Rd	East to West	1483	2232	1600
	West to East	1428	2251	1549
Chinggis Khan Ave	East to West	979	1930	1626

	West to East	1035	2395	1898
Tovchoo Rd	East to West	2029	3759	2909
	West to East	813	5574	3584
Товчооны зам	East to West	157	1587	970
	West to East	203	2262	1086
Ajilchin St	North to South	910	1150	1011
	South to North	891	1399	1107
Chingynjav St	North to South	1024	1566	1231
	South to North	1507	1559	1545
Amarsanaa Rd	North to South	1241	1911	1567
	South to North	1798	2195	1995
Engels St	North to South	1530	2894	2282
	South to North	1994	2970	2531
Chingeltei Ave	North to South	1681	2556	2123
	South to North	1682	2484	2121
Nogoon Nuur St	North to South	1201	1688	1402
	South to North	1391	1956	1643
Ikh Surguuli St	North to South	989	1879	1551
	South to North	1070	1641	1354
Great Mongolian State St	North to South	1800	2634	2339
	South to North	1552	2161	1938
Nam Yan Ju St	North to South	2193	2837	2414
	South to North	1988	2593	2187

7.3.3 Traffic Volume Changes Before and After the Implementation of the New Ring Road

By comparing the road network traffic flow before and after the implementation of the new ring road in 2040, flow changes and flow change rates for road segments were calculated. The flow change rate was derived using the following formula: Flow Change Rate = (Flow After Implementation of New Ring Road - Flow Before Implementation of New Ring Road) / Flow Before Implementation of New Ring Road. The flow change was calculated as: Flow Change = Flow After Implementation of New Ring Road - Flow Before Implementation of New Ring Road, as shown in Table 50.

Table 50 2040 Flow Changes

Road Segment Name	Direction	2040 Flow Change Rate	2040 Flow Changes
Moscow Street	East to West	-30%	-941
	West to East	-22%	-719
Ard Ayush Avenue	East to West	-23%	-615
	West to East	-25%	-643

Ikh Toiruu	East to West	-21%	-430
	West to East	-19%	-428
Peace Avenue	East to West	-18%	-463
	West to East	-20%	-525
Narnii Rd	East to West	-9%	-153
	West to East	-14%	-238
Dunjingarav St	East to West	-25%	-262
	West to East	-31%	-325
Gachuurt Rd	East to West	-7%	-113
	West to East	-15%	-275
Chinggis Khan Ave	East to West	-21%	-439
	West to East	-33%	-928
Tovchoo Rd	East to West	-22%	-822
	West to East	8%	273
Товчооны зам	East to West	-35%	-532
	West to East	-31%	-481
Ajilchin St	North to South	-50%	-1022
	South to North	-54%	-1283
Chingynjav St	North to South	-16%	-243
	South to North	-13%	-239
Amarsanaa Rd	North to South	-16%	-306
	South to North	-10%	-213
Engels St	North to South	-30%	-995
	South to North	-34%	-1305
Chingeltei Ave	North to South	6%	121
	South to North	-2%	-48
Nogoon Nuur St	North to South	-6%	-88
	South to North	-14%	-273
Ikh Surguuli St	North to South	-2%	-25

	South to North	-17%	-279
Great Mongolian State St	North to South	-3%	-67
	South to North	-14%	-324
Nam Yan Ju St	North to South	-4%	-95
	South to North	-14%	-369

By comparing the data, the distribution of flow changes across 19 road segments in 2040 was statistically analyzed, as well as the range of flow change rates before and after the implementation of the new ring road.

By conducting a general distribution analysis of the 38 directional road segments in 2040, the results are summarized in the table below.

Table 51 2040 Flow summarized Changes

Traffic Flow Change Type	Number of Road Segments (Direction)	Percentage
Traffic Flow Decrease	36	95%
Traffic Flow Increase	2	5%
Traffic Flow Remains Nearly Unchanged	0	0

East-West Direction: The range of flow change rate reduction in the east-west direction is -7% to -35%. The road segment with an increase in flow change rate in the east-west direction is Tovchoo Rd, with a change rate of 8%. This segment is located at the southwest junction of the new ring road, where traffic flows through the segment into the main urban area, resulting in an increase in both traffic flow and flow change rate.

North-South Direction: The range of flow change rate reduction in the north-south direction is -2% to -54%. The road segment with an increase in flow change rate in the north-south direction is Chingeltei Ave, with a change rate of 6%. This segment with positive growth is where traffic is diverted through the new ring road in the north-south direction, resulting in an increase in traffic flow.

After the implementation of the new ring road, the road segment with the largest optimization is Ajilchin St, where the flow change in the north-south direction is -1022 and -1283, with a north-to-south change rate of -50% and a south-to-north change rate of -54%. The optimization measures of the new ring road, including structural

adjustments and traffic diversion, led to a significant reduction in traffic flow on this segment.

7.4 2044 Road Traffic Flow Forecast for the New Ring Road Project

7.4.1 Traffic Volume Forecast for the Road Network Before the Implementation of the New Ring Road

Traffic assignment for the road network before the implementation of the new ring road was conducted, as shown in Figure 113. The traffic flow for key road segments during the evening peak in 2044 is summarized in Table 52.

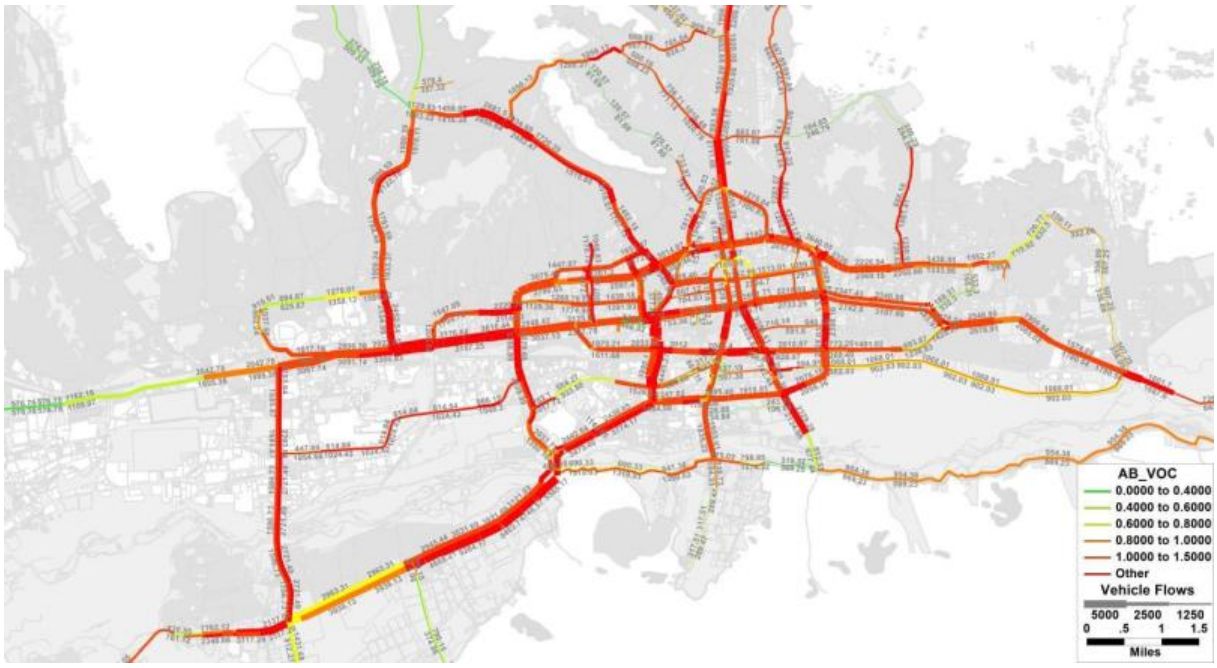

Figure 113 Evening Peak Traffic Flow Map Before the Implementation of the New Ring Road in 2044

Table 52 Traffic Flow Before the Implementation of the New Ring Road in 2044

Road Segment Name	Direction	Minimum Flow	Maximum Flow	Average Flow
Moscow Street	East to West	2740	4107	3350
	West to East	2995	4526	3486
Ard Ayush Avenue	East to West	1968	4146	2735
	West to East	1704	3618	2682
Ikh Toiruu	East to West	665	3393	2144
	West to East	952	4748	2392
Peace Avenue	East to West	1534	4137	2675
	West to East	2292	3915	2753
Narnii Rd	East to West	683	3210	1774

	West to East	1171	2895	1757
Dunjingarav St	East to West	1068	1068	1068
	West to East	902	902	902
Gachuurt Rd	East to West	1574	1991	1786
	West to East	1574	2117	1845
Chinggis Khan Ave	East to West	1325	2668	2238
	West to East	1907	3774	2987
Tovchoo Rd	East to West	2945	5463	3989
	West to East	2887	5463	3556
Товчооны зам	East to West	576	2597	1607
	West to East	578	3067	1662
Ajilchin St	North to South	2028	2306	2206
	South to North	2349	2621	2513
Chingynjav St	North to South	1460	1939	1618
	South to North	1846	1907	1876
Amarsanaa Rd	North to South	1687	2689	2193
	South to North	2081	2837	2575
Engels St	North to South	2463	3998	3492
	South to North	3174	4464	3963
Chingeltei Ave	North to South	1636	3013	2098
	South to North	1833	3255	2361
Nogoon Nuur St	North to South	1558	1786	1600
	South to North	2055	2394	2148
Ikh Surguuli St	North to South	1197	2156	1679
	South to North	1399	2362	1830
Great Mongolian State St	North to South	1512	2841	2486
	South to North	1833	2990	2392
Nam Yan Ju St	North to South	2409	3004	2587
	South to North	2387	2992	2578

7.4.2 Traffic Volume Forecast for the Road Network After the Implementation of the New Ring Road

Traffic assignment for the road network before the implementation of the new ring road was conducted, as shown in Figure 114. The traffic flow for key road segments during the evening peak in 2044 is summarized in Table 53.

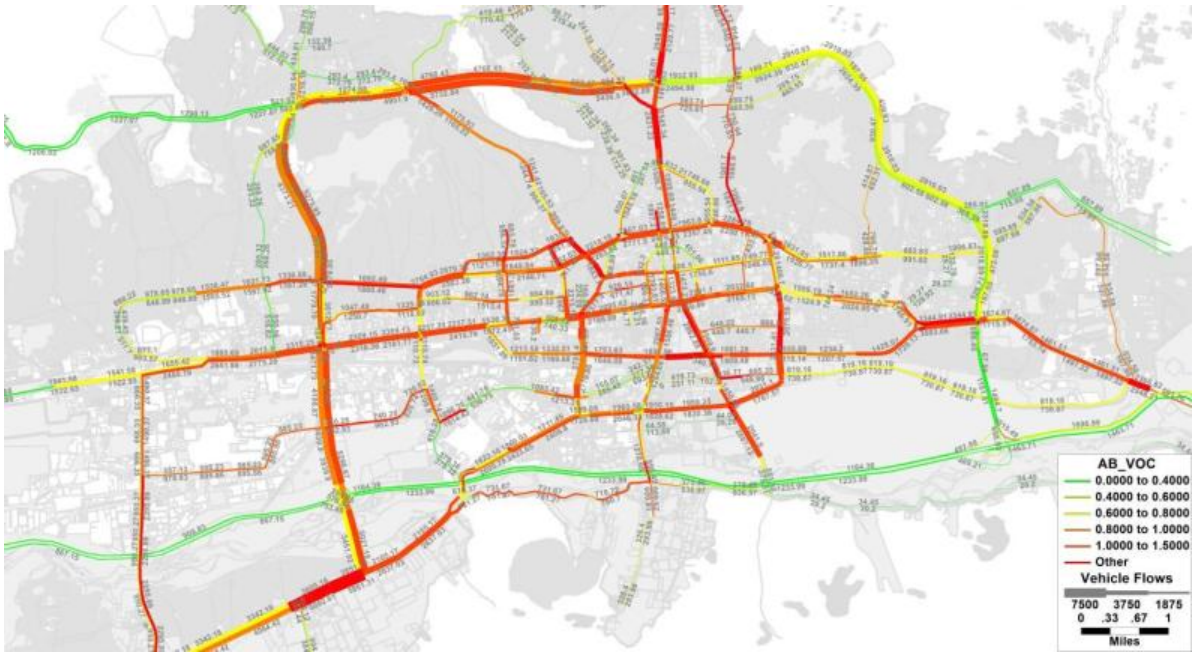

Figure 114 Evening Peak Traffic Flow Map After the Implementation of the New Ring Road in 2044

Table 53 Traffic Flow After the Implementation of the New Ring Road in 2044

Road Segment Name	Direction	Minimum Flow	Maximum Flow	Average Flow
Moscow Street	East to West	1885	4307	2277
	West to East	1693	3698	2592
Ard Ayush Avenue	East to West	1439	3285	2138
	West to East	1354	2764	2045
Ikh Toiruu	East to West	445	2581	1721
	West to East	677	3526	1944
Peace Avenue	East to West	1363	3344	2103
	West to East	1522	3119	2140
Narnii Rd	East to West	852	2916	1592
	West to East	340	2469	1524
Dunjingarav St	East to West	819	819	819
	West to East	730	730	730
Gachuurt Rd	East to West	1461	2229	1583
	West to East	1497	2331	1624
Chinggis Khan Ave	East to West	1027	1960	1631
	West to East	1161	2423	1965
Tovchoo Rd	East to West	2105	3851	2986
	West to East	950	5861	3711
Товчооны зам	East to West	158	1655	1013
	West to East	220	2460	1164
Ajilchin St	North to South	1110	1345	1169
	South to North	1115	1531	1286

Chingynjav St	North to South	1051	1640	1271
	South to North	1618	1661	1644
Amarsanaa Rd	North to South	1260	1966	1599
	South to North	1778	2215	1995
Engels St	North to South	1544	3024	2394
	South to North	2020	3099	2606
Chingeltei Ave	North to South	1763	2631	2197
	South to North	1787	2706	2227
Nogoon Nuur St	North to South	1222	1740	1432
	South to North	1448	2036	1708
Ikh Surguuli St	North to South	1036	1954	1560
	South to North	1115	1735	1420
Great Mongolian State St	North to South	1879	2862	2544
	South to North	1586	2280	1983
Nam Yan Ju St	North to South	2239	2924	2464
	South to North	2075	2625	2256

7.4.3 Traffic Volume Changes Before and After the Implementation of the New Ring Road

By comparing the road network traffic flow distribution before and after the implementation of the new ring road in 2044, flow changes and flow change rates for road segments were calculated. The flow change rate was derived using the following formula: Flow Change Rate = (Flow After Implementation of New Ring Road - Flow Before Implementation of New Ring Road) / Flow Before Implementation of New Ring Road. The flow change was calculated as: Flow Change = Flow After Implementation of New Ring Road - Flow Before Implementation of New Ring Road, as shown in Table 54.

Table 54 2044 Flow Changes

Road Segment Name	Direction	2044 Flow Change Rate	2044 Flow Changes
Moscow Street	East to West	-32%	-1073
	West to East	-26%	-894
Ard Ayush Avenue	East to West	-22%	-597
	West to East	-24%	-637
Ikh Toiruu	East to West	-20%	-423
	West to East	-19%	-448
Peace Avenue	East to West	-21%	-572
	West to East	-22%	-613
Narnii Rd	East to West	-10%	-182
	West to East	-13%	-233
Dunjingarav St	East to West	-23%	-249
	West to East	-19%	-172
Gachuurt Rd	East to West	-11%	-203
	West to East	-12%	-221
Chinggis Khan Ave	East to West	-27%	-607
	West to East	-34%	-1022
Tovchoo Rd	East to West	-25%	-1003
	West to East	4%	155
Товчооны зам	East to West	-37%	-594
	West to East	-30%	-498
Ajilchin St	North to South	-47%	-1037
	South to North	-49%	-1227
Chingynjav St	North to South	-21%	-347
	South to North	-12%	-232
Amarsanaa Rd	North to South	-27%	-594
	South to North	-23%	-580
Engels St	North to South	-31%	-1098

	South to North	-34%	-1357
Chingeltei Ave	North to South	5%	99
	South to North	-6%	-134
Nogoon Nuur St	North to South	-11%	-168
	South to North	-20%	-440
Ikh Surguuli St	North to South	-7%	-119
	South to North	-22%	-410
Great Mongolian State St	North to South	2%	58
	South to North	-17%	-409
Nam Yan Ju St	North to South	-5%	-123
	South to North	-12%	-322

By comparing the data, the distribution of flow changes across 19 road segments in 2044 was statistically analyzed, as well as the range of flow change rates before and after the implementation of the new ring road.

By conducting a general distribution analysis of the 38 directional road segments in 2044, the results are summarized in the table below.

Table 55 2044 Flow summarized Changes

Traffic Flow Change Type	Number of Road Segments (Direction)	Percentage
Traffic Flow Decrease	35	92%
Traffic Flow Increase	3	8%
Traffic Flow Remains Nearly Unchanged	0	0

East-West Direction: The range of flow change rate reduction in the east-west direction is -10% to -37%. The road segment with an increase in flow change rate in the east-west direction is Tovchoo Rd, with a west-to-east change rate of 4%. This segment is located at the southwest junction of the new ring road, where traffic flows through the segment into the main urban area, resulting in an increase in both traffic flow and flow change rate.

North-South Direction: The range of flow change rate reduction in the north-south direction is -5% to -49%. The range of flow change rate increase in the north-south direction is 2% to 5%. Road segments with positive growth are those where traffic flows through these segments via the new ring road in the north-south direction, resulting in an increase in flow.

After the implementation of the new ring road, the road segment with the largest optimization is Ajilchin St, where the flow change in the north-south direction is -1037 and -1227, with a north-to-south change rate of -47% and a south-to-north change rate

of -49%. The optimization measures of the new ring road, including structural adjustments and traffic diversion, led to a significant reduction in traffic flow on this segment.

7.5 VCR Change Analysis of Ulaanbaatar's Road Network in 2028

7.5.1 Road Network VCR Data Before the Implementation of the New Ring Road

Traffic assignment for the road network before the implementation of the new ring road was conducted, as shown in Figure 115. The saturation for key road segments during the evening peak in 2028 is summarized in Table 56.

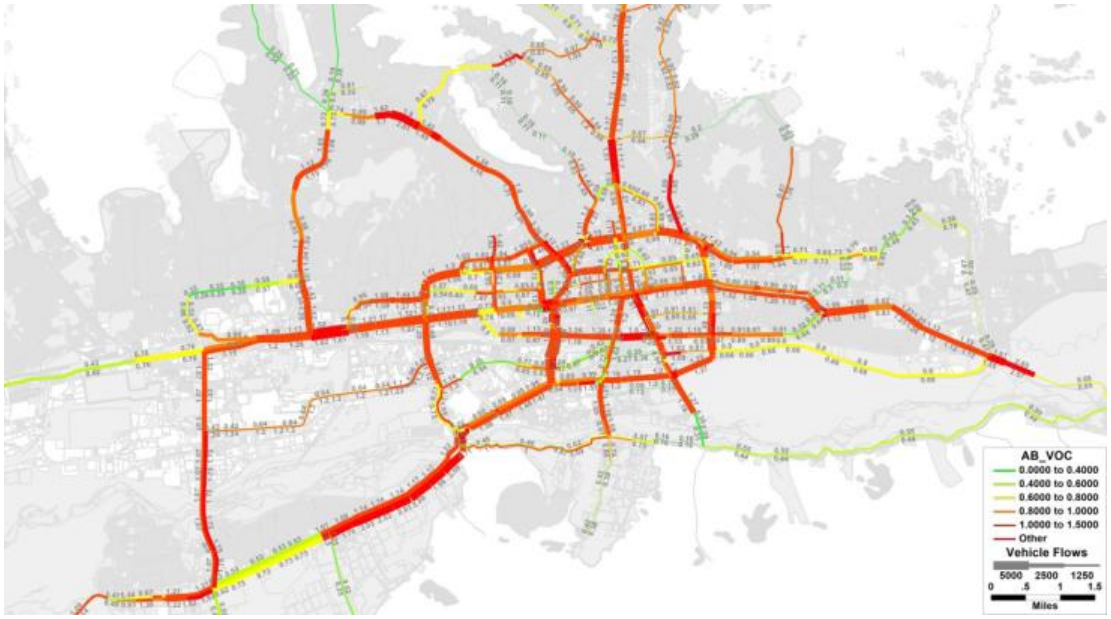

Figure 115 Evening Peak Road Network Saturation Map Before the Implementation of the New Ring Road in 2028

Table 56 Saturation Table Before the Implementation of the New Ring Road in 2028

Road Segment Name	Direction	Minimum Saturation	Maximum Saturation	Average Saturation
Moscow Street	East to West	1.08	1.53	1.23
	West to East	1.05	1.62	1.3
Ard Ayush Avenue	East to West	0.73	1.56	1.05
	West to East	0.61	1.41	1.02
Ikh Toiruu	East to West	0.43	1.65	0.97
	West to East	0.58	1.93	1.11
Peace Avenue	East to West	0.60	1.65	1.02
	West to East	0.62	1.53	1.04
Narnii Rd	East to West	0.34	1.62	1.00
	West to East	0.63	1.93	1.00

Dunjingarav St	East to West	0.66	0.79	0.74
	West to East	0.66	0.79	0.71
Gachuurt Rd	East to West	0.81	1.26	1.07
	West to East	0.82	1.25	1.08
Chinggis Khan Ave	East to West	0.39	1.37	0.90
	West to East	0.64	1.51	1.26
Tovchoo Rd	East to West	0.51	2.09	1.02
	West to East	0.61	2.09	1.26
Товчооны зам	East to West	0.20	0.99	0.60
	West to East	0.21	1.14	0.62
Ajilchin St	North to South	0.74	1.29	1.18
	South to North	0.98	1.48	1.43
Chingynjav St	North to South	0.9	1.28	1.02
	South to North	1.21	1.25	1.23
Amarsanaa Rd	North to South	0.7	1.11	0.9
	South to North	1.02	1.32	1.18
Engels St	North to South	0.88	1.71	1.11
	South to North	1.01	1.17	1.24
Chingeltei Ave	North to South	1.05	1.72	1.34
	South to North	1.01	1.70	1.25
Nogoon Nuur St	North to South	0.94	1.09	0.97
	South to North	0.84	1.43	1.25
Ikh Surguuli St	North to South	0.78	1.37	1.01
	South to North	0.65	1.20	0.96
Great Mongolian State St	North to South	1.2	1.74	1.55
	South to North	0.93	1.33	1.24
Nam Yan Ju St	North to South	0.96	1.48	1.31
	South to North	0.96	1.59	1.34

7.5.2 Road Network Saturation Data After the Implementation of the New Ring Road

Traffic assignment for the road network after the implementation of the new ring road was conducted, as shown in Figure 116. The saturation for key road segments during the evening peak in 2028 is summarized in Table 57.

Figure 116 Evening Peak Road Network Saturation Map After the Implementation of the New Ring Road in 2028

Table 57 Saturation Table After the Implementation of the New Ring Road in 2030

Road Segment Name	Direction	Minimum Saturation	Maximum Saturation	Average Saturation
Moscow Street	East to West	0.71	1.63	0.85
	West to East	0.64	1.39	1.02
Ard Ayush Avenue	East to West	0.49	1.24	0.79
	West to East	0.41	0.93	0.71
Ikh Toiruu	East to West	0.32	1.24	0.78
	West to East	0.43	1.44	0.90
Peace Avenue	East to West	0.46	1.37	0.79
	West to East	0.52	1.32	0.81
Narnii Rd	East to West	0.33	1.77	0.94
	West to East	0.38	1.49	0.87
Dunjingarav St	East to West	0.54	0.54	0.54

	West to East	0.40	0.40	0.40
Gachuurt Rd	East to West	0.77	1.16	1.03
	West to East	0.86	1.29	1.15
Chinggis Khan Ave	East to West	0.35	0.95	0.68
	West to East	0.35	1.21	0.83
Tovchoo Rd	East to West	0.61	1.59	0.94
	West to East	0.39	2.23	1.08
Товчооны зам	East to West	0.04	0.61	0.38
	West to East	0.06	0.90	0.44
Ajilchin St	North to South	0.47	0.71	0.54
	South to North	0.33	0.74	0.57
Chingynjav St	North to South	0.65	1.14	0.83
	South to North	1.07	1.16	1.12
Amarsanaa Rd	North to South	0.58	1.74	0.73
	South to North	0.88	2.65	1.01
Engels St	North to South	0.59	1.13	0.78
	South to North	0.75	1.21	0.90
Chingeltei Ave	North to South	1.05	1.66	1.31
	South to North	1.13	1.66	1.42
Nogoon Nuur St	North to South	0.78	1.08	0.91
	South to North	0.81	1.33	1.10
Ikh Surguuli St	North to South	0.64	1.15	0.94

	South to North	0.75	1.12	0.92
Great Mongolian State St	North to South	1.20	1.74	1.55
	South to North	0.93	1.33	1.24
Nam Yan Ju St	North to South	0.91	1.39	1.24
	South to North	0.84	1.30	1.15

7.5.3 Road Network Saturation Changes Before and After the Implementation of the New Ring Road

By comparing the road network saturation changes before and after the implementation of the new ring road in 2028, the saturation change rate for road segments before and after the implementation of the new ring road was calculated. The saturation change rate is defined as: Saturation Change Rate = (Saturation After Implementation of New Ring Road - Saturation Before Implementation of New Ring Road) / Saturation Before Implementation of New Ring Road; and Saturation Change = Saturation After Implementation of New Ring Road - Saturation Before Implementation of New Ring Road, as shown in Table 58.

Table 58 2028 Saturation Changes

Road Segment Name	Direction	2028 Saturation Change Rate	2028 Saturation Changes
Moscow Street	East to West	-31%	-0.38
	West to East	-22%	-0.28
Ard Ayush Avenue	East to West	-25%	-0.26
	West to East	-30%	-0.31
Ikh Toiruu	East to West	-20%	-0.19
	West to East	-19%	-0.21
Peace Avenue	East to West	-23%	-0.23
	West to East	-22%	-0.23
Narnii Rd	East to West	-6%	-0.06
	West to East	-13%	-0.13
Dunjingarav St	East to West	-27%	-0.2
	West to East	-44%	-0.31
Gachuurt Rd	East to West	-4%	-0.04
	West to East	6%	0.07
Chinggis Khan Ave	East to West	-24%	-0.22
	West to East	-34%	-0.43

Tovchoo Rd	East to West	-8%	-0.08
	West to East	-14%	-0.18
Товчооны зам	East to West	-37%	-0.22
	West to East	-29%	-0.18
Ajilchin St	North to South	-54%	-0.64
	South to North	-60%	-0.86
Chingynjav St	North to South	-19%	-0.19
	South to North	-9%	-0.11
Amarsanaa Rd	North to South	-19%	-0.17
	South to North	-14%	-0.17
Engels St	North to South	-30%	-0.33
	South to North	-27%	-0.34
Chingeltei Ave	North to South	-2%	-0.03
	South to North	14%	0.17
Nogoon Nuur St	North to South	-6%	-0.06
	South to North	-12%	-0.15
Ikh Surguuli St	North to South	-7%	-0.07
	South to North	-4%	-0.04
Great Mongolian State St	North to South	0%	0
	South to North	0%	0
Nam Yan Ju St	North to South	-5%	-0.07
	South to North	-14%	-0.19

By comparing the data, the saturation changes across 19 road segments in 2028 were statistically analyzed, as well as the range of saturation change rates before and after the implementation of the new ring road.

By conducting a general distribution analysis of the 38 directional road segments in 2028, the results are summarized in the table below.

Table 59 38 Directional Road Segments Summarized Saturation Changes

Saturation Change Types	Number of Road Segments (Direction)	Percentage
Decrease	34	89%
Increase	2	5%
Remain Essentially Unchanged	2	5%

East-West Direction: The range of saturation change rate reduction in the east-west direction is -4% to -44%. The range of saturation change rate increase in the east-west direction is 0% to 6%. The road segment Gachuurt Rdis located at the east-west junction of the new ring road, where traffic flows through the segment into and out of the main urban area, resulting in an increase in both traffic saturation and saturation change rate.

North-South Direction: The range of saturation change rate reduction in the north-south direction is -2% to -60%. The range of saturation change rate increase in the east-west direction is 0% to 14%. The road segment with positive growth in saturation change is that where traffic is diverted via the new ring road in the north-south direction, resulting in an increase in traffic flow and a rise in saturation.

After the implementation of the new ring road, the road segment with the largest optimization is Ajilchin St, where the range of the saturation change in the north-south direction is -0.64 and -0.86, with a north-to-south saturation change rate of -54% and a south-to-north saturation change rate of -60%. The structural optimization and traffic diversion measures of the new ring road led to a great reduction in traffic saturation on this segment.

7.5.4 Analysis of Individual Road Segment Saturation Changes in 2028

Based on the saturation of each road segment before and after the implementation of the new ring road, lane count weighting was applied to each road segment. The directional saturation change for each road segment was then calculated, and the corresponding weight coefficients were multiplied. The results were summed to determine the overall saturation change for each road segment. Saturation Change = Saturation After Implementation of New Ring Road - Saturation Before Implementation of New Ring Road; Lane Count Weight Coefficient = Lane Count per Direction / Total Lane Count of Road Segment. The saturation change for each road segment was calculated by multiplying the saturation change by the lane count weight coefficient, followed by summing the results to determine the overall saturation change for each individual road segment. As shown in Table 60.

Table 60 Table of Individual Road Segment Saturation Changes in 2028

Road Segment Name	Direction	Single-Direction Saturation Change	Overall Saturation Change
Moscow Street	East to West	-0.38	-0.33
	West to East	-0.28	
Ard Ayush Avenue	East to West	-0.26	-0.29
	West to East	-0.31	
Ikh Toiruu	East to West	-0.19	-0.20
	West to East	-0.21	
Peace Avenue	East to West	-0.23	-0.23
	West to East	-0.23	
Narnii Rd	East to West	-0.06	-0.10
	West to East	-0.13	

Dunjingarav St	East to West	-0.2	-0.26
	West to East	-0.31	
Gachuurt Rd	East to West	-0.04	0.01
	West to East	0.07	
Chinggis Khan Ave	East to West	-0.22	-0.33
	West to East	-0.43	
Tovchoo Rd	East to West	-0.08	-0.13
	West to East	-0.18	
Товчооны зам	East to West	-0.22	-0.20
	West to East	-0.18	
Ajilchin St	North to South	-0.64	-0.75
	South to North	-0.86	
Chingynjav St	North to South	-0.19	-0.15
	South to North	-0.11	
Amarsanaa Rd	North to South	-0.17	-0.17
	South to North	-0.17	
Engels St	North to South	-0.33	-0.34
	South to North	-0.34	
Chingeltei Ave	North to South	-0.03	0.07
	South to North	0.17	
Nogoon Nuur St	North to South	-0.06	-0.11
	South to North	-0.15	
Ikh Surguuli St	North to South	-0.07	-0.06
	South to North	-0.04	
Great Mongolian State St	North to South	0	0.00
	South to North	0	
Nam Yan Ju St	North to South	-0.07	-0.13
	South to North	-0.19	

Based on the saturation changes in 2028, the overall saturation reduction range for major road segments in 2028 is from -0.01 to -0.71, growth range is 0.01 to 0.07.

7.5.5 Analysis of Overall Road Segment Saturation Changes in 2028

By comparing the saturation of road segments before and after the implementation of the new ring road, the overall saturation change for each road segment was calculated. The saturation change for each road segment was multiplied by the lane count weight coefficient, where the lane count weight coefficient was calculated as: Lane Count Weight Coefficient = Lane Count of Individual Segment / Total Lane Count of All Segments. The sum of all road segments was then calculated to determine the average saturation change for all road segments, as shown in Table 61.

Table 61 Overall Road Segment Saturation Change Table

Road Segment	2028 Overall Change
19 Key Road Segments	-20.27%

By analyzing the saturation before and after the implementation of the new ring road, a comparison of the saturation for road segments before and after the implementation was made. The overall trend of road segment saturation changes for 2028 indicates that after the implementation of the new ring road, road segment saturation decreased by 20.27% compared with that previously. This demonstrates that the planned route has had a positive impact on Ulaanbaatar's traffic, significantly improving travel speed and alleviating congestion.

7.6 VCR Change Analysis of Ulaanbaatar's Road Network in 2030

7.6.1 Road Network VCR Data Before the Implementation of the New Ring Road

Traffic assignment for the road network before the implementation of the new ring road was conducted, as shown in Figure117. The saturation for key road segments during the evening peak in 2030 is summarized in Table 62.

Figure 117 Evening Peak Road Network Saturation Map Before the Implementation of the New Ring Road in 2030

Table 62 Saturation Table Before the Implementation of the New Ring Road in 2030

Road Segment Name	Direction	Minimum Saturation	Maximum Saturation	Average Saturation
Moscow Street	East to West	1.12	1.63	1.35
	West to East	1.25	1.79	1.42
Ard Ayush Avenue	East to West	0.77	1.7	1.1
	West to East	0.64	1.52	1.08
Ikh Toiruu	East to West	0.5	1.66	1.01
	West to East	0.51	1.95	1.1
Peace Avenue	East to West	0.62	1.58	1.08
	West to East	0.65	1.6	1.11
Narnii Rd	East to West	0.38	2.04	1.07
	West to East	0.67	1.77	1.09
Dunjingarav St	East to West	0.84	0.84	0.84
	West to East	0.72	0.72	0.72
Gachuurt Rd	East to West	0.85	1.29	1.11
	West to East	0.82	1.25	1.09
Chinggis Khan Ave	East to West	0.44	1.51	0.96
	West to East	0.77	1.67	1.36
Tovchoo Rd	East to West	0.56	2.17	1.26
	West to East	0.55	2.17	1.11
Товчооны зам	East to West	0.21	1.08	0.64
	West to East	0.23	1.26	0.67
Ajilchin St	North to South	0.76	1.33	1.21
	South to North	1.02	1.53	1.48
Chingynjav St	North to South	0.99	1.41	1.11
	South to North	1.27	1.4	1.34
Amarsanaa Rd	North to South	0.76	1.22	0.96
	South to North	0.78	1.21	1.08
Engels St	North to South	0.95	1.53	1.17
	South to North	1.16	1.72	1.37
Chingeltei Ave	North to South	1.07	1.59	1.26
	South to North	1.08	1.86	1.42
Nogoon Nuur St	North to South	0.89	1.04	0.92
	South to North	0.85	1.45	1.27
Ikh Surguuli St	North to South	0.73	1.3	1.02
	South to North	0.72	1.37	1.05
Great Mongolian State St	North to South	1.21	1.78	1.6
	South to North	1.06	1.66	1.45
Nam Yan Ju St	North to South	0.99	1.56	1.37
	South to North	0.97	1.57	1.35

7.6.2 Road Network Saturation Data After the Implementation of the New Ring Road

Traffic assignment for the road network after the implementation of the new ring road was conducted, as shown in Figure 118. The saturation for key road segments during the evening peak in 2030 is summarized in Table 63.

Figure 118 Evening Peak Road Network Saturation Map After the Implementation of the New Ring Road in 2030

Table 63 Saturation Table After the Implementation of the New Ring Road in 2030

Road Segment Name	Direction	Minimum Saturation	Maximum Saturation	Average Saturation
Moscow Street	East to West	0.74	1.74	0.91
	West to East	0.58	1.35	0.98
Ard Ayush Avenue	East to West	0.53	1.28	0.82
	West to East	0.46	1.09	0.78
Ikh Toiruu	East to West	0.33	1.34	0.94
	West to East	0.44	1.50	0.82
Peace Avenue	East to West	0.50	1.44	0.84
	West to East	0.59	1.35	0.84
Narnii Rd	East to West	0.35	1.82	0.97
	West to East	0.36	1.59	0.93
Dunjingarav St	East to West	0.58	0.58	0.58
	West to East	0.45	0.45	0.45
Gachuurt Rd	East to West	0.78	1.18	1.04
	West to East	0.85	1.28	1.14
Chinggis Khan Ave	East to West	0.41	1.12	0.77
	West to East	0.46	1.32	0.95
Tovchoo Rd	East to West	0.65	1.67	0.99
	West to East	0.44	2.44	1.21

Товчооны зам	East to West	0.04	0.65	0.40
	West to East	0.07	0.80	0.43
Ajilchin St	North to South	0.45	0.68	0.55
	South to North	0.38	0.8	0.63
Chingynjav St	North to South	0.69	1.2	0.87
	South to North	1.14	1.19	1.17
Amarsanaa Rd	North to South	0.60	1.81	0.78
	South to North	0.93	2.82	1.07
Engels St	North to South	0.67	1.24	0.87
	South to North	0.83	1.28	0.97
Chingeltei Ave	North to South	1.06	1.68	1.32
	South to North	1.14	1.66	1.42
Nogoon Nuur St	North to South	0.80	1.12	0.93
	South to North	0.79	1.32	1.08
Ikh Surguuli St	North to South	0.64	1.19	0.99
	South to North	0.76	1.13	0.94
Great Mongolian State St	North to South	1.16	1.68	1.52
	South to North	0.91	1.37	1.22
Nam Yan Ju St	North to South	0.94	1.47	1.31
	South to North	0.86	1.34	1.19

7.6.3 Road Network Saturation Changes Before and After the Implementation of the New Ring Road

By comparing the road network saturation changes before and after the

implementation of the new ring road in 2030, the saturation change rate for road segments before and after the implementation of the new ring road was calculated. The saturation change rate is defined as: Saturation Change Rate = (Saturation After Implementation of New Ring Road - Saturation Before Implementation of New Ring Road) / Saturation Before Implementation of New Ring Road; and Saturation Change = Saturation After Implementation of New Ring Road - Saturation Before Implementation of New Ring Road, as shown in Table 64.

Table 64 2030 Saturation Changes

Road Segment Name	Direction	2030 Saturation Change Rate	2030 Saturation Changes
Moscow Street	East to West	-33%	-0.44
	West to East	-31%	-0.44
Ard Ayush Avenue	East to West	-25%	-0.28
	West to East	-28%	-0.30
Ikh Toiruu	East to West	-7%	-0.07
	West to East	-25%	-0.28
Peace Avenue	East to West	-22%	-0.24
	West to East	-24%	-0.27
Narnii Rd	East to West	-9%	-0.10
	West to East	-15%	-0.16
Dunjingarav St	East to West	-31%	-0.26
	West to East	-38%	-0.27
Gachuurt Rd	East to West	-6%	-0.07
	West to East	5%	0.05
Chinggis Khan Ave	East to West	-20%	-0.19
	West to East	-30%	-0.41
Tovchoo Rd	East to West	-21%	-0.27
	West to East	9%	0.10
Товчооны зам	East to West	-38%	-0.24
	West to East	-36%	-0.24
Ajilchin St	North to South	-55%	-0.66
	South to North	-57%	-0.85
Chingynjav St	North to South	-22%	-0.24
	South to North	-13%	-0.17
Amarsanaa Rd	North to South	-19%	-0.18
	South to North	-1%	-0.01
Engels St	North to South	-26%	-0.3
	South to North	-29%	-0.4
Chingeltei Ave	North to South	5%	0.06
	South to North	0%	0
Nogoon Nuur St	North to South	1%	0.01
	South to North	-15%	-0.19
Ikh Surguuli St	North to South	-3%	-0.03
	South to North	-10%	-0.11
Great Mongolian State St	North to South	-5%	-0.08
	South to North	-16%	-0.23
Nam Yan Ju St	North to South	-4%	-0.06
	South to North	-12%	-0.16

By comparing the data, the saturation changes across 19 road segments in 2030

were statistically analyzed, as well as the range of saturation change rates before and after the implementation of the new ring road.

By conducting a general distribution analysis of the 38 directional road segments in 2030, the results are summarized in the table below.

Table 65 38 Directional Road Segments Summarized Saturation Changes

Saturation Change Types	Number of Road Segments (Direction)	Percentage
Decrease	33	85%
Increase	4	12%
Remain Essentially Unchanged	1	3%

East-West Direction: The range of saturation change rate reduction in the east-west direction is -7% to -38%. The range of saturation change rate increase in the east-west direction is 5% to 9%. The road segment Tovchoo Rd is located at the southwest junction of the new ring road, where traffic flows through the segment into and out of the main urban area, resulting in an increase in both traffic saturation and saturation change rate.

North-South Direction: The range of saturation change rate reduction in the north-south direction is -1% to -57%. The range of saturation change rate increase in the east-west direction is 1% to 5%. The road segment with positive growth in saturation change is that where traffic is diverted via the new ring road in the north-south direction, resulting in an increase in traffic flow and a rise in saturation.

After the implementation of the new ring road, the road segment with the largest optimization is Ajilchin St, where the range of the saturation change in the north-south direction is -0.66 and -0.85, with a north-to-south saturation change rate of -55% and a south-to-north saturation change rate of -57%. The structural optimization and traffic diversion measures of the new ring road led to a great reduction in traffic saturation on this segment.

7.6.4 Analysis of Individual Road Segment Saturation Changes in 2030

Based on the saturation of each road segment before and after the implementation of the new ring road, lane count weighting was applied to each road segment. The directional saturation change for each road segment was then calculated, and the corresponding weight coefficients were multiplied. The results were summed to

determine the overall saturation change for each road segment. Saturation Change = Saturation After Implementation of New Ring Road - Saturation Before Implementation of New Ring Road; Lane Count Weight Coefficient = Lane Count per Direction / Total Lane Count of Road Segment. The saturation change for each road segment was calculated by multiplying the saturation change by the lane count weight coefficient, followed by summing the results to determine the overall saturation change for each individual road segment. As shown in Table 66.

Table 66 Table of Individual Road Segment Saturation Changes in 2030

Road Segment Name	Direction	Single-Direction Saturation Change	Overall Saturation Change
Moscow Street	East to West	-0.44	-0.44
	West to East	-0.44	
Ard Ayush Avenue	East to West	-0.28	-0.29
	West to East	-0.30	
Ikh Toiruu	East to West	-0.07	-0.18
	West to East	-0.28	
Peace Avenue	East to West	-0.24	-0.26
	West to East	-0.27	
Narnii Rd	East to West	-0.10	-0.13
	West to East	-0.16	
Dunjingarav St	East to West	-0.26	-0.27
	West to East	-0.27	
Gachuurt Rd	East to West	-0.07	-0.01
	West to East	0.05	
Chinggis Khan Ave	East to West	-0.19	-0.30
	West to East	-0.41	
Tovchoo Rd	East to West	-0.27	-0.09
	West to East	0.10	
Товчооны зам	East to West	-0.24	-0.24
	West to East	-0.24	
Ajilchin St	North to South	-0.66	-0.76
	South to North	-0.85	
Chingynjav St	North to South	-0.24	-0.21
	South to North	-0.17	
Amarsanaa Rd	North to South	-0.18	-0.10
	South to North	-0.01	
Engels St	North to South	-0.3	-0.35
	South to North	-0.4	
Chingeltei Ave	North to South	0.06	0.03
	South to North	0	
Nogoon Nuur St	North to South	0.01	-0.09

	South to North	-0.19	
Ikh Surguuli St	North to South	-0.03	-0.07
	South to North	-0.11	
Great Mongolian State St	North to South	-0.08	-0.16
	South to North	-0.23	
Nam Yan Ju St	North to South	-0.06	-0.11
	South to North	-0.16	

Based on the saturation changes in 2030, the overall saturation reduction range for major road segments in 2030 is from -0.01 to -0.76. The segment with an increase is Chingeltei Ave, which shows an overall saturation change of 0.03.

7.6.5 Analysis of Overall Road Segment Saturation Changes in 2030

By comparing the saturation of road segments before and after the implementation of the new ring road, the overall saturation change for each road segment was calculated. The saturation change for each road segment was multiplied by the lane count weight coefficient, where the lane count weight coefficient was calculated as: Lane Count Weight Coefficient = Lane Count of Individual Segment / Total Lane Count of All Segments. The sum of all road segments was then calculated to determine the average saturation change for all road segments, as shown in Table 67.

Table 67 Overall Road Segment Saturation Change Table

Road Segment	2030 Overall Change
19 Key Road Segments	-21.94%

By analyzing the saturation before and after the implementation of the new ring road, a comparison of the saturation for road segments before and after the implementation was made. The overall trend of road segment saturation changes for 2030 indicates that after the implementation of the new ring road, road segment saturation decreased by 21.94% compared with that previously. This demonstrates that the planned route has had a positive impact on Ulaanbaatar's traffic, significantly improving travel speed and alleviating congestion.

7.7 VCR Change Analysis of Ulaanbaatar's Road Network in 2040

7.7.1 Road Network Saturation Data Before the Implementation of the New Ring

Road

Traffic assignment for the road network before the implementation of the new ring road was conducted, as shown in Figure 119. The saturation of key road segments during the evening peak in 2040 was statistically analyzed, as shown in Table 68.

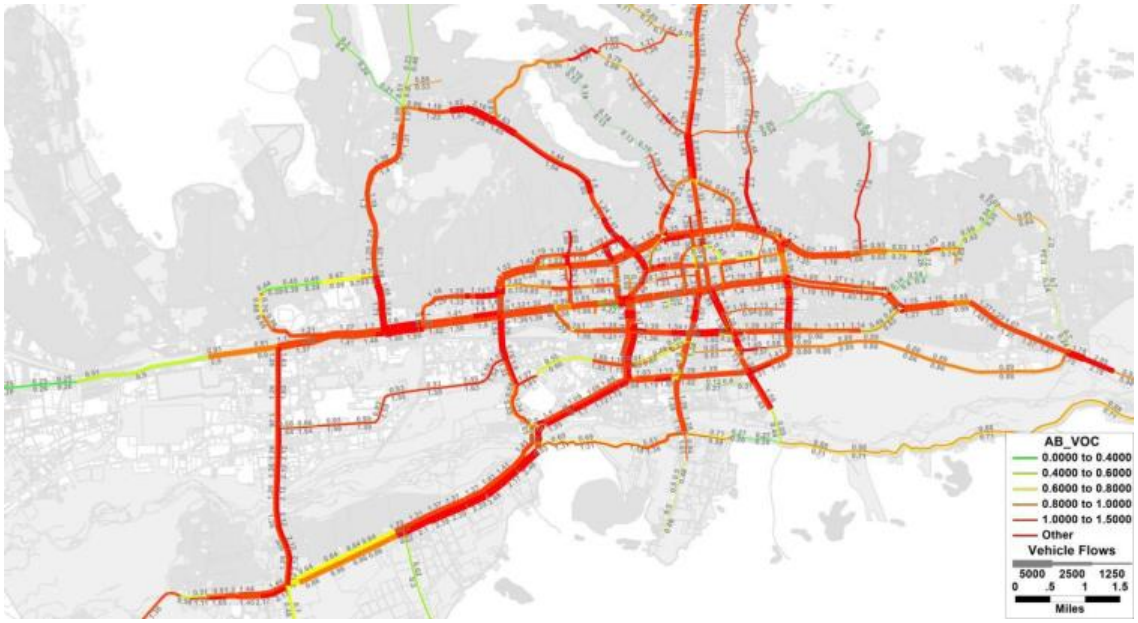

Figure 119 Road Network Saturation Map Before the Implementation of the New Ring Road in 2040

Table 68 Major Road Saturation Table Before the Implementation of the New Ring Road in 2040

Road Segment Name	Direction	Minimum Saturation	Maximum Saturation	Average Saturation
Moscow Street	East to West	1.23	1.81	1.49
	West to East	1.36	2	1.55
Ard Ayush Avenue	East to West	0.9	1.87	1.25
	West to East	0.77	1.63	1.23
Ikh Toiruu	East to West	0.47	1.88	1.14
	West to East	0.64	2.2	1.26
Peace Avenue	East to West	0.74	1.78	1.19
	West to East	0.8	1.7	1.22
Narnii Rd	East to West	0.46	2.22	1.19
	West to East	0.81	2	1.2
Dunjingarav St	East to West	0.88	0.88	0.88
	West to East	0.86	0.86	0.86
Gachuurt Rd	East to West	0.84	1.27	1.14
	West to East	0.98	1.47	1.21
Chinggis Khan Ave	East to West	0.53	1.65	1.06
	West to East	0.85	1.85	1.49
Tovchoo Rd	East to West	0.63	2.47	1.42

	West to East	0.62	2.47	1.26
Товчооны зам	East to West	0.24	1.16	0.71
	West to East	0.26	1.36	0.74
Ajilchin St	North to South	0.87	1.53	1.39
	South to North	1.17	1.75	1.68
Chingynjav St	North to South	1.1	1.5	1.22
	South to North	1.42	1.54	1.48
Amarsanaa Rd	North to South	0.77	1.3	1.04
	South to North	0.97	1.32	1.22
Engels St	North to South	1.11	1.76	1.35
	South to North	1.37	2	1.59
Chingeltei Ave	North to South	1.11	1.83	1.38
	South to North	1.15	2.11	1.54
Nogoon Nuur St	North to South	1.02	1.19	1.06
	South to North	0.87	1.53	1.32
Ikh Surguuli St	North to South	0.86	1.53	1.12
	South to North	0.95	1.5	1.16
Great Mongolian State St	North to South	1	1.99	1.71
	South to North	1.22	1.71	1.58
Nam Yan Ju St	North to South	1.13	1.71	1.55
	South to North	1.16	1.78	1.57

7.7.2 Road Network Saturation Data After the Implementation of the New Ring Road

Traffic assignment for the road network after the implementation of the new ring road was conducted, as shown in Figure 120. The saturation of key road segments during the evening peak in 2040 was statistically analyzed, as shown in Table 69.

Figure 120 Road Network Saturation Map After the Implementation of the New Ring Road

Table 69 Major Road Saturation Table After the Implementation of the New Ring Road

Road Segment Name	Direction	Minimum Saturation	Maximum Saturation	Average Saturation
Moscow Street	East to West	0.86	1.99	1.04
	West to East	0.78	1.69	1.2
Ard Ayush Avenue	East to West	0.65	1.46	0.95
	West to East	0.59	1.2	0.92
Ikh Toiruu	East to West	0.35	1.35	0.89
	West to East	0.46	1.63	1.06
Peace Avenue	East to West	0.62	1.57	0.97
	West to East	0.70	1.51	0.97
Narnii Rd	East to West	0.52	2.00	1.08
	West to East	0.22	1.70	1.03
Dunjingarav St	East to West	0.66	0.66	0.66
	West to East	0.59	0.59	0.59
Gachuurt Rd	East to West	0.80	1.22	1.07
	West to East	0.77	1.19	1.03
Chinggis Khan Ave	East to West	0.47	1.10	0.84
	West to East	0.49	1.41	1.00
Tovchoo Rd	East to West	0.72	1.82	1.10
	West to East	0.67	2.65	1.34
Товчооны зам	East to West	0.07	0.75	0.46
	West to East	0.09	1.07	0.51
Ajilchin St	North to South	0.47	0.71	0.67
	South to North	0.56	0.98	0.84
Chingynjav St	North to South	0.83	1.29	0.99

	South to North	1.26	1.31	1.30
Amarsanaa Rd	North to South	0.67	2.00	0.87
	South to North	0.96	2.90	1.11
Engels St	North to South	0.78	1.37	0.99
	South to North	0.94	1.47	1.13
Chingeltei Ave	North to South	1.20	1.89	1.48
	South to North	1.09	1.75	1.48
Nogoon Nuur St	North to South	0.82	0.93	0.84
	South to North	0.74	1.24	1.10
Ikh Surguuli St	North to South	0.72	1.34	1.10
	South to North	0.76	1.26	1.00
Great Mongolian State St	North to South	0.75	1.88	1.49
	South to North	0.94	1.44	1.27
Nam Yan Ju St	North to South	1.10	1.68	1.48
	South to North	0.98	1.47	1.29

7.7.3 Road Network Saturation Changes Before and After the Implementation of the New Ring Road

By comparing the road network saturation changes before and after the implementation of the new ring road in 2040, the saturation change rate for road segments before and after the implementation of the new ring road was calculated. The saturation change rate is defined as: Saturation Change Rate = (Saturation After Implementation of New Ring Road - Saturation Before Implementation of New Ring Road) / Saturation Before Implementation of New Ring Road; and Saturation Change = Saturation After Implementation of New Ring Road - Saturation Before Implementation of New Ring Road, as shown in Table 70.

Table 70 Road Segment Change Table Before and After the Implementation of the New Ring Road

Road Segment Name	Direction	2040 Saturation Change Rate	2040 Saturation Changes
Moscow Street	East to West	-30%	-0.45
	West to East	-23%	-0.35
Ard Ayush Avenue	East to West	-24%	-0.30
	West to East	-25%	-0.31
Ikh Toiruu	East to West	-22%	-0.25
	West to East	-16%	-0.20
Peace Avenue	East to West	-18%	-0.22
	West to East	-20%	-0.25
Narnii Rd	East to West	-9%	-0.11

	West to East	-14%	-0.17
Dunjingarav St	East to West	-25%	-0.22
	West to East	-31%	-0.27
Gachuurt Rd	East to West	-6%	-0.07
	West to East	-15%	-0.18
Chinggis Khan Ave	East to West	-21%	-0.22
	West to East	-33%	-0.49
Tovchoo Rd	East to West	-23%	-0.32
	West to East	6%	0.08
Товчооны зам	East to West	-35%	-0.25
	West to East	-31%	-0.23
Ajilchin St	North to South	-52%	-0.72
	South to North	-50%	-0.84
Chingynjav St	North to South	-19%	-0.23
	South to North	-12%	-0.18
Amarsanaa Rd	North to South	-16%	-0.17
	South to North	-9%	-0.11
Engels St	North to South	-27%	-0.36
	South to North	-29%	-0.46
Chingeltei Ave	North to South	7%	0.10
	South to North	-4%	-0.06
Nogoon Nuur St	North to South	-21%	-0.22
	South to North	-17%	-0.22
Ikh Surguuli St	North to South	-2%	-0.02
	South to North	-14%	-0.16
Great Mongolian State St	North to South	-13%	-0.22
	South to North	-20%	-0.31
Nam Yan Ju St	North to South	-5%	-0.07
	South to North	-18%	-0.28

By comparing the data, the saturation changes across 19 road segments in 2040 were statistically analyzed, as well as the range of saturation change rates before and after the implementation of the new ring road.

By conducting a general distribution analysis of the 38 directional road segments in 2040, the results are summarized in the table below.

Table 71 38 Directional Road Segments Summarized Saturation Changes

Saturation Change Types	Number of Road Segments (Direction)	Percentage
Decrease	33	95%
Increase	2	5%
Remain Essentially	0	0

Unchanged		

East-West Direction: The range of saturation change rate reduction in the east-west direction is -6% to -35%. The road segment with an increase in saturation change rate in the east-west direction is Tovchoo Rd, with a change rate of 6%. The road segment Tovchoo Rd is located at the southwest junction of the new ring road, where traffic flows through the segment into the main urban area, resulting in an increase in both traffic saturation and saturation change rate.

North-South Direction: The range of saturation change rate reduction in the north-south direction is -2% to -52%. The road segment with an increase in saturation change rate in the east-west direction is Chingeltei Ave, with a change rate of 7%. The road segment with positive growth is that where traffic is diverted via the new ring road in the north-south direction, resulting in an increase in traffic flow and a rise in saturation.

After the implementation of the new ring road, the road segment with the largest optimization is Ajilchin St, where the range of the saturation change in the north-south direction is -0.72 and -0.84, with a north-to-south saturation change rate of -52% and a south-to-north saturation change rate of -50%. The structural optimization and traffic diversion measures of the new ring road led to a great reduction in traffic saturation on this segment.

7.7.4 Analysis of Individual Road Segment Saturation Changes in 2040

Based on the saturation of each road segment before and after the implementation of the new ring road, lane count weighting was applied to each road segment. The directional saturation change for each road segment was then calculated, and the corresponding weight coefficients were multiplied. The results were summed to determine the overall saturation change for each road segment. Saturation Change = Saturation After Implementation of New Ring Road - Saturation Before Implementation of New Ring Road; Lane Count Weight Coefficient = Lane Count per Direction / Total Lane Count of Road Segment. The saturation change for each road segment was calculated by multiplying the saturation change by the lane count weight coefficient, followed by summing the results to determine the overall saturation change for each individual road segment. As shown in Table 72.

Table72 Table of Individual Road Segment Saturation Changes in 2040

Road Segment Name	Direction	Single-Direction Saturation Change	Overall Saturation Change
Moscow Street	East to West	-0.45	-0.40
	West to East	-0.35	
Ard Ayush Avenue	East to West	-0.30	-0.31
	West to East	-0.31	
Ikh Toiruu	East to West	-0.25	-0.23
	West to East	-0.20	
Peace Avenue	East to West	-0.22	-0.24
	West to East	-0.25	
Narnii Rd	East to West	-0.11	-0.14
	West to East	-0.17	
Dunjingarav St	East to West	-0.22	-0.25
	West to East	-0.27	
Gachuurt Rd	East to West	-0.07	-0.13
	West to East	-0.18	
Chinggis Khan Ave	East to West	-0.22	-0.36
	West to East	-0.49	
Tovchoo Rd	East to West	-0.32	-0.12
	West to East	0.08	
Товчооны зам	East to West	-0.25	-0.24
	West to East	-0.23	
Ajilchin St	North to South	-0.72	-0.78
	South to North	-0.84	
Chingynjav St	North to South	-0.23	-0.21
	South to North	-0.18	

Amarsanaa Rd	North to South	-0.17	-0.14
	South to North	-0.11	
Engels St	North to South	-0.36	-0.41
	South to North	-0.46	
Chingeltei Ave	North to South	0.10	0.02
	South to North	-0.06	
Nogoon Nuur St	North to South	-0.22	-0.22
	South to North	-0.22	
Ikh Surguuli St	North to South	-0.02	-0.09
	South to North	-0.16	
Great Mongolian State St	North to South	-0.22	-0.27
	South to North	-0.31	
Nam Yan Ju St	North to South	-0.07	-0.18
	South to North	-0.28	

Comparing the saturation data for 2040, the overall saturation reduction range for major road segments in 2040 is from -0.09 to -0.78. The segment with an increase is Chingeltei Ave, which shows an overall saturation change of 0.02.

7.7.5 Analysis of Overall Road Segment Saturation Changes in 2040

By comparing the saturation of road segments before and after the implementation of the new ring road, the overall saturation change for each road segment was calculated. The saturation change for each road segment was multiplied by the lane count weight coefficient, where the lane count weight coefficient was calculated as: Lane Count Weight Coefficient = Lane Count of Individual Segment / Total Lane Count of All Segments. The sum of all road segments was then calculated to determine the average saturation change for all road segments, as shown in Table 73.

Table 73 Overall Road Segment Saturation Change Table

Road Segment	2040 Overall Change
19 Key Road Segments	-25.21%

By analyzing the saturation before and after the implementation of the new ring road, a comparison of the saturation for road segments before and after the implementation was made. The overall trend of road segment saturation changes for 2040 indicates that after the implementation of the new ring road, road segment saturation decreased by 25.21% compared with that previously. This demonstrates that the planned route has had a positive impact on Ulaanbaatar's traffic, significantly improving travel speed and alleviating congestion.

7.8 VCR Change Analysis of Ulaanbaatar's Road Network in 2044

7.8.1 Road Network Saturation Data Before the Implementation of the New Ring Road

Traffic assignment for the road network before the implementation of the new ring road was conducted, as shown in Figure 121. The saturation of key road segments during the evening peak in 2044 was statistically analyzed, as shown in Table 74.

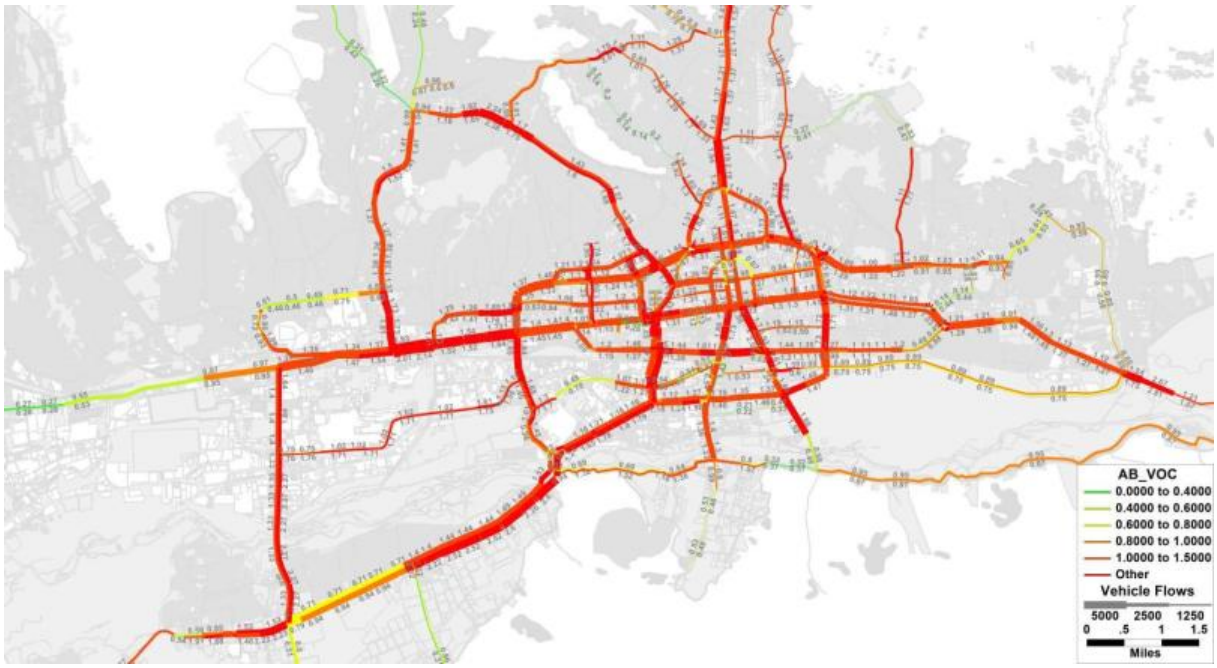

Figure 121 Evening Peak Road Network Saturation Map Before the Implementation of the New Ring Road in 2044

Table 74 Saturation Table Before the Implementation of the New Ring Road in 2044

Road Segment Name	Direction	Minimum Saturation	Maximum Saturation	Average Saturation
Moscow Street	East to West	1.3	1.95	1.59
	West to East	1.42	2.15	1.66
Ard Ayush Avenue	East to West	0.93	1.97	1.3
	West to East	0.81	1.72	1.28
Ikh Toiruu	East to West	0.55	1.78	1.17
	West to East	0.58	2.26	1.31
Peace Avenue	East to West	0.73	1.97	1.26
	West to East	0.94	1.95	1.3
Narnii Rd	East to West	0.48	2.29	1.26
	West to East	0.83	2.06	1.25
Dunjingarav St	East to West	0.89	0.89	0.89
	West to East	0.75	0.75	0.75
Gachuurt Rd	East to West	0.9	1.36	1.19

	West to East	0.98	1.47	1.23
Chinggis Khan Ave	East to West	0.58	1.74	1.15
	West to East	0.9	1.97	1.58
Tovchoo Rd	East to West	0.7	2.6	1.52
	West to East	0.68	2.6	1.34
Товчооны зам	East to West	0.27	1.23	0.76
	West to East	0.27	1.46	0.79
Ajilchin St	North to South	0.96	1.64	1.51
	South to North	1.22	1.87	1.76
Chingynjav St	North to South	1.21	1.61	1.34
	South to North	1.53	1.58	1.56
Amarsanaa Rd	North to South	0.93	1.49	1.21
	South to North	1.15	1.57	1.43
Engels St	North to South	1.17	1.86	1.44
	South to North	1.39	2.1	1.64
Chingeltei Ave	North to South	1.16	1.93	1.44
	South to North	1.3	2.32	1.68
Nogoon Nuur St	North to South	1.11	1.27	1.14
	South to North	0.97	1.71	1.48
Ikh Surguuli St	North to South	0.85	1.54	1.19
	South to North	0.99	1.68	1.3
Great Mongolian State St	North to South	1.08	2.02	1.77
	South to North	1.27	1.88	1.67
Nam Yan Ju St	North to South	1.21	1.81	1.6
	South to North	1.13	1.81	1.58

7.8.2 Road Network Saturation Data After the Implementation of the New Ring Road

Traffic assignment for the road network before the implementation of the new ring road was conducted, as shown in Figure 122. The saturation of key road segments during the evening peak in 2044 was statistically analyzed, as shown in Table 75.

Figure 122 Evening Peak Road Network Saturation Map After the Implementation of the New Ring Road in 2044

Table 75 Saturation Table After the Implementation of the New Ring Road in 2044

Road Segment Name	Direction	Minimum Saturation	Maximum Saturation	Average Saturation
Moscow Street	East to West	0.89	2.05	1.08
	West to East	0.8	1.76	1.23
Ard Ayush Avenue	East to West	0.68	1.56	1.01
	West to East	0.64	1.31	0.98
Ikh Toiruu	East to West	0.37	1.5	0.94
	West to East	0.46	1.79	1.06
Peace Avenue	East to West	0.64	1.59	0.99
	West to East	0.72	1.54	1.01
Narnii Rd	East to West	0.56	2.08	1.13
	West to East	0.07	1.76	1.08
Dunjingarav St	East to West	0.68	0.68	0.68
	West to East	0.60	0.60	0.60
Gachuurt Rd	East to West	0.79	1.21	1.06
	West to East	0.81	1.25	1.08
Chinggis Khan Ave	East to West	0.53	1.15	0.84
	West to East	0.55	1.46	1.04
Tovchoo Rd	East to West	0.75	1.91	1.13
	West to East	0.78	2.79	1.38
Товчооны зам	East to West	0.07	0.78	0.48
	West to East	0.10	1.17	0.55
Ajilchin St	North to South	0.57	0.86	0.79
	South to North	0.72	1.09	0.90

Chingynjav St	North to South	0.87	1.36	1.05
	South to North	1.34	1.38	1.37
Amarsanaa Rd	North to South	0.70	2.11	0.92
	South to North	0.98	2.98	1.15
Engels St	North to South	0.73	1.44	0.99
	South to North	0.93	1.47	1.09
Chingeltei Ave	North to South	1.21	1.87	1.52
	South to North	1.27	1.93	1.59
Nogoon Nuur St	North to South	0.87	1.24	1.02
	South to North	0.86	1.45	1.17
Ikh Surguuli St	North to South	0.74	1.39	1.11
	South to North	0.79	1.23	1.01
Great Mongolian State St	North to South	1.34	2.04	1.81
	South to North	1.08	1.49	1.38
Nam Yan Ju St	North to South	1.06	1.73	1.53
	South to North	1.02	1.55	1.38

7.8.3 Road Network Saturation Changes Before and After the Implementation of the New Ring Road

By comparing the road network saturation changes before and after the implementation of the new ring road in 2044, the saturation change rate for road segments before and after the implementation of the new ring road was calculated. The saturation change rate is defined as: Saturation Change Rate = (Saturation After Implementation of New Ring Road - Saturation Before Implementation of New Ring Road) / Saturation Before Implementation of New Ring Road; and Saturation Change = Saturation After Implementation of New Ring Road - Saturation Before Implementation of New Ring Road, as shown in Table 76.

Table 76 Road Segment Change Table Before and After the Implementation of the New Ring Road in 2044

Road Segment Name	Direction	2044 Saturation Change Rate	2044 Saturation Changes
Moscow Street	East to West	-32%	-0.51
	West to East	-26%	-0.43
Ard Ayush Avenue	East to West	-22%	-0.29
	West to East	-23%	-0.30
Ikh Toiruu	East to West	-20%	-0.23
	West to East	-19%	-0.25
Peace Avenue	East to West	-21%	-0.27
	West to East	-22%	-0.29
Narnii Rd	East to West	-10%	-0.13
	West to East	-14%	-0.17
Dunjingarav St	East to West	-24%	-0.21
	West to East	-20%	-0.15
Gachuurt Rd	East to West	-11%	-0.13
	West to East	-12%	-0.15
Chinggis Khan Ave	East to West	-27%	-0.31
	West to East	-34%	-0.54
Tovchoo Rd	East to West	-26%	-0.39
	West to East	3%	0.04
Товчооны зам	East to West	-37%	-0.28
	West to East	-30%	-0.24
Ajilchin St	North to South	-48%	-0.72
	South to North	-49%	-0.86
Chingynjav St	North to South	-22%	-0.29
	South to North	-12%	-0.19
Amarsanaa Rd	North to South	-24%	-0.29
	South to North	-20%	-0.28
Engels St	North to South	-31%	-0.45
	South to North	-34%	-0.55
Chingeltei Ave	North to South	6%	0.08
	South to North	-5%	-0.09
Nogoon Nuur St	North to South	-11%	-0.12
	South to North	-21%	-0.31
Ikh Surguuli St	North to South	-7%	-0.08
	South to North	-22%	-0.29
Great Mongolian State St	North to South	2%	0.04
	South to North	-17%	-0.29
Nam Yan Ju St	North to South	-4%	-0.07
	South to North	-13%	-0.20

By comparing the data, the saturation changes across 19 road segments in 2044 were statistically analyzed, as well as the range of saturation change rates before and after the implementation of the new ring road.

By conducting a general distribution analysis of the 38 directional road segments in 2044, the results are summarized in the table below.

Table 77 38 Directional Road Segments Summarized Saturation Changes

Saturation Change Types	Number of Road Segments (Direction)	Percentage
Decrease	35	92%
Increase	3	8%
Remain Essentially Unchanged	0	0

East-West Direction: The range of saturation change rate reduction in the east-west direction is -10% to -37%. The road segment with an increase in saturation change rate in the east-west direction is Tovchoo Rd, with a change rate of 3% in the east-west direction. The road segment Tovchoo Rd is located at the southwest junction of the new ring road, where traffic flows through the segment into and out of the main urban area, resulting in an increase in both traffic saturation and saturation change rate.

North-South Direction: The range of saturation change rate reduction in the north-south direction is -4% to -49%. The range of saturation change rate increase in the east-west direction is 2% to 6%. The road segment with positive growth is that where traffic is diverted via the new ring road in the north-south direction, resulting in an increase in traffic flow and a rise in saturation.

After the implementation of the new ring road, the road segment with the largest optimization is Ajilchin St, where the range of the saturation change in the north-south direction is -0.72 and -0.86, with a north-to-south saturation change rate of -48% and a south-to-north saturation change rate of -49%. The structural optimization and traffic diversion measures of the new ring road led to a significant reduction in traffic saturation on this segment.

7.8.4 Analysis of Individual Road Segment Saturation Changes in 2044

Based on the saturation of each road segment before and after the implementation of the new ring road, lane count weighting was applied to each road segment. The directional saturation change for each road segment was then calculated, and the

corresponding weight coefficients were multiplied. The results were summed to determine the overall saturation change for each road segment. Saturation Change = Saturation After Implementation of New Ring Road - Saturation Before Implementation of New Ring Road; Lane Count Weight Coefficient = Lane Count per Direction / Total Lane Count of Individual Road Segment. The saturation change for each road segment was calculated by multiplying the saturation change by the lane count weight coefficient, followed by summing the results to determine the overall saturation change for each individual road segment. As shown in Table 789.

Table 78 Table of Individual Road Segment Saturation Changes in 2044

Road Segment Name	Direction	Single-Direction Saturation Change	Overall Saturation Change
Moscow Street	East to West	-0.51	-0.47
	West to East	-0.43	
Ard Ayush Avenue	East to West	-0.29	-0.30
	West to East	-0.30	
Ikh Toiruu	East to West	-0.23	-0.24
	West to East	-0.25	
Peace Avenue	East to West	-0.27	-0.28
	West to East	-0.29	
Narnii Rd	East to West	-0.13	-0.15
	West to East	-0.17	
Dunjingarav St	East to West	-0.21	-0.18
	West to East	-0.15	
Gachuurt Rd	East to West	-0.13	-0.14
	West to East	-0.15	
Chinggis Khan Ave	East to West	-0.31	-0.43
	West to East	-0.54	
Tovchoo Rd	East to West	-0.39	-0.18
	West to East	0.04	
Товчооны зам	East to West	-0.28	-0.26
	West to East	-0.24	
Ajilchin St	North to South	-0.72	-0.79
	South to North	-0.86	
Chingynjav St	North to South	-0.29	-0.24
	South to North	-0.19	
Amarsanaa Rd	North to South	-0.29	-0.29
	South to North	-0.28	
Engels St	North to South	-0.45	-0.50
	South to North	-0.55	
Chingeltei Ave	North to South	0.08	0.00
	South to North	-0.09	

Nogoon Nuur St	North to South	-0.12	-0.22
	South to North	-0.31	
Ikh Surguuli St	North to South	-0.08	-0.19
	South to North	-0.29	
Great Mongolian State St	North to South	0.04	-0.13
	South to North	-0.29	
Nam Yan Ju St	North to South	-0.07	-0.14
	South to North	-0.20	

Comparing the saturation data for 2044, the overall saturation reduction range for major road segments in 2044 is from -0.13 to -0.79. The segment Chingeltei Ave shows no change in overall saturation, indicating minimal impact.

7.8.5 Analysis of Overall Road Segment Saturation Changes in 2044

By comparing the saturation before and after the implementation of the new ring road, the overall saturation change for each road segment was calculated. The saturation change for each road segment was multiplied by the lane count weight coefficient, where the lane count weight coefficient was calculated as: Lane Count Weight Coefficient = Lane Count of Individual Segment / Total Lane Count of All Segments. The sum of all road segments was then calculated to determine the average saturation change for all road segments, as shown in Table 79.

Table 79 Overall Road Segment Saturation Change Table

Road Segment	2044 Overall Change
19 Key Road Segments	-28.11%

By analyzing the saturation before and after the implementation of the new ring road, a comparison of the saturation for road segments before and after the implementation was made. The overall trend of road segment saturation changes for 2044 indicates that after the implementation of the new ring road, road segment saturation decreased by 28.11% compared with that previously. This demonstrates that the planned route has had a positive impact on Ulaanbaatar's traffic, significantly improving travel speed and alleviating congestion.

7.9 Motor Vehicle Speed Study for 2028,2030, 2040, and 2044

7.9.1 2028 Road Segment Average Speed Analysis

By comparing the road segment saturation before and after the implementation of

the new ring road in 2028, the average speed for each road segment was analyzed, as shown in Table 80.

Table 80 2030 Road Segment Average Speed Table

Road Segment Name	Direction	Before the Implementation of the New Ring Road (km/h)	After the Implementation of the New Ring Road (km/h)	Average Speed Change (km/h)
Moscow Street	East to West	9	18	9
	West to East	8	14	6
Ard Ayush Avenue	East to West	13	20	7
	West to East	14	22	8
Ikh Toiruu	East to West	15	20	5
	West to East	12	17	5
Peace Avenue	East to West	14	20	6
	West to East	13	19	6
Narnii Rd	East to West	15	16	1
	West to East	15	18	3
Dunjingarav St	East to West	21	25	4
	West to East	22	27	5
Gachuurt Rd	East to West	13	14	1
	West to East	12	11	-1
Chinggis Khan Ave	East to West	17	22	5
	West to East	8	19	11
Tovchoo Rd	East to West	14	16	2
	West to East	8	12	4
Товчооны зам	East to West	24	27	3
	West to East	24	27	3
Ajilchin St	North to South	10	25	15
	South to North	6	25	19
Chingynjav St	North to South	14	19	5
	South to North	9	11	2
Amarsanaa Rd	North to South	17	21	4
	South to North	10	14	4
Engels St	North to South	12	20	8
	South to North	9	17	8
Chingeltei Ave	North to South	7	7	0
	South to North	8	6	-2
Nogoon Nuur St	North to South	15	17	2
	South to North	8	12	4
Ikh Surguuli St	North to South	14	16	2
	South to North	15	16	1
	North to South	4	4	0

Great Mongolian State St	South to North	9	9	0
Nam Yan Ju St	North to South	7	9	2
	South to North	7	11	4

Through comparative analysis of the aforementioned data, the average speed change of road segments was calculated. The observed increase in average speed ranges from 1 km/h to 19 km/h. Segments exhibiting reduced average speeds are located at interfaces with the New Ring Road, where traffic volume transfers occur. Increased traffic volumes at these junctions contribute to the overall rise in average speeds

7.9.2 Analysis of Average Speed Changes on Major Road Segments in 2028

Based on the average speed for each road segment before and after the implementation of the new ring road, lane count weighting was applied to each road segment. The directional average speed change for each road segment was then calculated, and the corresponding weight coefficients were multiplied. The results were summed to determine the overall average speed change for each road segment. Average Speed Change = Average Speed After Implementation of New Ring Road - Average Speed Before Implementation of New Ring Road; Lane Count Weight Coefficient = Lane Count per Direction / Total Lane Count of Individual Road Segment. The average speed change for each road segment was calculated by multiplying the average speed change by the lane count weight coefficient, followed by summing the results to determine the overall average speed change for each individual road segment. As shown in Table 81.

Table 81 2028 Road Segment Average Speed Table

Road Segment Name	Direction	Directional Average Speed Change +(km/h)	Overall Average Speed Change (km/h)
Moscow Street	East to West	9	7
	West to East	6	
Ard Ayush Avenue	East to West	7	7
	West to East	8	
Ikh Toiruu	East to West	5	5
	West to East	5	
Peace Avenue	East to West	6	6
	West to East	6	
Narnii Rd	East to West	1	2
	West to East	3	

Dunjingarav St	East to West	4	4
	West to East	5	
Gachuurt Rd	East to West	1	0
	West to East	-1	
Chinggis Khan Ave	East to West	5	8
	West to East	11	
Tovchoo Rd	East to West	2	3
	West to East	4	
Товчооны зам	East to West	3	3
	West to East	3	
Ajilchin St	North to South	15	17
	South to North	19	
Chingynjav St	North to South	5	3
	South to North	2	
Amarsanaa Rd	North to South	4	4
	South to North	4	
Engels St	North to South	8	8
	South to North	8	
Chingeltei Ave	North to South	0	-1
	South to North	-2	
Nogoon Nuur St	North to South	2	3
	South to North	4	
Ikh Surguuli St	North to South	2	1
	South to North	1	
Great Mongolian State St	North to South	0	0
	South to North	0	
Nam Yan Ju St	North to South	2	3
	South to North	4	

Based on the data comparison for 2028, the overall increase in average speed for major road segments in 2028 ranges from 0 km/h to 17 km/h. The road segment with the greatest increase is Ajilchin St, which experienced an overall average speed change of 17 km/h.

7.9.3 Analysis of Average Speed Changes on Overall Road Segments in 2028

By comparing the average speed of road segments before and after the implementation of the new ring road, the overall average speed change for each road segment was calculated. The average speed change for each road segment was multiplied by the lane count weight coefficient, where the lane count weight coefficient was calculated as: Lane Count Weight Coefficient = Lane Count of

Individual Segment / Total Lane Count of All Segments. The sum of all road segments was then calculated to determine the average speed change for all road segments, as shown in Table 82.

Table 82 Road Segment Overall Average Speed Change Table

Road Segment	2028 Overall Change
19 Key Road Segments	4.6km/h

By analyzing the average speed before and after the implementation of the new ring road, and comparing the average speeds of the road segments before and after the implementation of the new ring road, the overall trend of road segment average speed changes for 2028 was determined. After the implementation of the new ring road, the average speed of the road segments increased by 4.6 km/h. The construction of the planned ring road has shown a positive impact on Ulaanbaatar's traffic, significantly improving residents' travel efficiency and reducing traffic congestion pressure.

7.9.4 2030 Road Segment Average Speed Analysis

By comparing the road segment saturation before and after the implementation of the new ring road in 2030, the average speed for each road segment was analyzed, as shown in Table 83.

Table 83 2030 Road Segment Average Speed Table

Road Segment Name	Direction	Before the Implementation of the New Ring Road (km/h)	After the Implementation of the New Ring Road (km/h)	Average Speed Change (km/h)
Moscow Street	East to West	7	17	9
	West to East	6	15	9
Ard Ayush Avenue	East to West	12	19	7
	West to East	13	20	7
Ikh Toiruu	East to West	14	16	2
	West to East	12	19	7
Peace Avenue	East to West	13	18	5
	West to East	12	18	6
Narnii Rd	East to West	13	15	2
	West to East	12	16	4
Dunjingarav St	East to West	18	25	6
	West to East	21	26	5
Gachuurt Rd	East to West	12	14	2
	West to East	12	11	-1
	East to West	15	20	5

Chinggis Khan Ave	West to East	7	16	9
Tovchoo Rd	East to West	8	15	7
	West to East	12	9	-3
Товчооны зам	East to West	23	27	4
	West to East	23	27	4
Ajilchin St	North to South	9	25	16
	South to North	5	24	18
Chingynjav St	North to South	12	18	6
	South to North	7	10	3
Amarsanaa Rd	North to South	15	20	5
	South to North	13	13	0
Engels St	North to South	10	18	8
	South to North	6	15	8
Chingeltei Ave	North to South	8	7	-1
	South to North	6	6	0
Nogoon Nuur St	North to South	16	16	0
	South to North	8	13	4
Ikh Surguuli St	North to South	14	15	1
	South to North	13	16	3
Great Mongolian State St	North to South	4	5	1
	South to North	5	9	4
Nam Yan Ju St	North to South	6	7	1
	South to North	7	10	3

By comparing the data in 2030, the average speed change for each road segment was calculated. The range of average speed increase for road segments is from 1 to 18, while the range of average speed reduction is from -1 to -3. The road segments with reduced average speed are located at the junctions of the new ring road. These segments experience an increase in traffic flow due to the traffic flow conversion with the new ring road, leading to an overall increase in average speed. Based on the average speed changes after the implementation of the new ring road, traffic pressure gradually decreases, resulting in a significant reduction in residents' travel time.

7.9.5 Analysis of Average Speed Changes on Major Road Segments in 2030

Based on the average speed for each road segment before and after the implementation of the new ring road, lane count weighting was applied to each road segment. The directional average speed change for each road segment was then calculated, and the corresponding weight coefficients were multiplied. The results were

summed to determine the overall average speed change for each road segment. Average Speed Change = Average Speed After Implementation of New Ring Road - Average Speed Before Implementation of New Ring Road; Lane Count Weight Coefficient = Lane Count per Direction / Total Lane Count of Individual Road Segment. The average speed change for each road segment was calculated by multiplying the average speed change by the lane count weight coefficient, followed by summing the results to determine the overall average speed change for each individual road segment. As shown in Table 84.

Table 84 2030 Road Segment Average Speed Table

Road Segment Name	Direction	Directional Average Speed Change +(km/h)	Overall Average Speed Change (km/h)
Moscow Street	East to West	9	10
	West to East	9	
Ard Ayush Avenue	East to West	7	7
	West to East	7	
Ikh Toiruu	East to West	2	4
	West to East	7	
Peace Avenue	East to West	5	6
	West to East	6	
Narnii Rd	East to West	2	3
	West to East	4	
Dunjingarav St	East to West	6	6
	West to East	5	
Gachuurt Rd	East to West	2	0
	West to East	-1	
Chinggis Khan Ave	East to West	5	7
	West to East	9	
Tovchoo Rd	East to West	7	2
	West to East	-3	
Товчооны зам	East to West	4	4
	West to East	4	
Ajilchin St	North to South	16	17
	South to North	18	
Chingynjav St	North to South	6	5
	South to North	3	
Amarsanaa Rd	North to South	5	2
	South to North	0	
Engels St	North to South	8	8
	South to North	8	
Chingeltei Ave	North to South	-1	-1

	South to North	0	
Nogoon Nuur St	North to South	0	2
	South to North	4	
Ikh Surguuli St	North to South	1	2
	South to North	3	
Great Mongolian State St	North to South	1	2
	South to North	4	
Nam Yan Ju St	North to South	1	2
	South to North	3	

Based on the data comparison for 2030, the overall increase in average speed for major road segments in 2030 ranges from 0 km/h to 17 km/h. The road segment with the greatest increase is Ajilchin St, which experienced an overall average speed change of 17 km/h.

7.9.6 Analysis of Average Speed Changes on Overall Road Segments in 2030

By comparing the average speed of road segments before and after the implementation of the new ring road, the overall average speed change for each road segment was calculated. The average speed change for each road segment was multiplied by the lane count weight coefficient, where the lane count weight coefficient was calculated as: Lane Count Weight Coefficient = Lane Count of Individual Segment / Total Lane Count of All Segments. The sum of all road segments was then calculated to determine the average speed change for all road segments, as shown in Table 85.

Table 85 Road Segment Overall Average Speed Change Table

Road Segment	2030 Overall Change
19 Key Road Segments	4.8km/h

By analyzing the average speed before and after the implementation of the new ring road, and comparing the average speeds of the road segments before and after the implementation of the new ring road, the overall trend of road segment average speed changes for 2030 was determined. After the implementation of the new ring road, the average speed of the road segments increased by 4.8 km/h. The construction of the planned ring road has shown a positive impact on Ulaanbaatar's traffic, significantly improving residents' travel efficiency and reducing traffic congestion pressure.

7.9.7 2040 Road Segment Average Speed Analysis

By comparing the road segment saturation before and after the implementation of

the new ring road in 2040, the average speed for each road segment was analyzed, as shown in Table 86.

Table 86 2040 Road Segment Average Speed Table

Road Segment Name	Direction	Before the Implementation of the New Ring Road (km/h)	After the Implementation of the New Ring Road (km/h)	Average Speed Change (km/h)
Moscow Street	East to West	5	14	9
	West to East	4	10	6
Ard Ayush Avenue	East to West	9	16	7
	West to East	9	16	7
Ikh Toiruu	East to West	11	17	6
	West to East	8	13	5
Peace Avenue	East to West	10	15	5
	West to East	9	15	6
Narnii Rd	East to West	10	13	3
	West to East	10	14	4
Dunjingarav St	East to West	17	23	6
	West to East	18	24	6
Gachuurt Rd	East to West	11	13	2
	West to East	9	14	5
Chinggis Khan Ave	East to West	13	18	5
	West to East	5	15	10
Tovchoo Rd	East to West	6	12	6
	West to East	8	7	-1
Товчооны зам	East to West	22	26	4
	West to East	21	26	5
Ajilchin St	North to South	6	23	17
	South to North	3	18	15
Chingynjav St	North to South	9	15	6
	South to North	5	8	3
Amarsanaa Rd	North to South	13	18	5
	South to North	9	12	3
Engels St	North to South	7	15	8
	South to North	4	11	7
Chingeltei Ave	North to South	6	5	-1
	South to North	4	5	1
Nogoon Nuur St	North to South	13	18	5
	South to North	7	12	5
Ikh Surguuli St	North to South	11	12	1
	South to North	10	15	5
	North to South	3	5	2

Great Mongolian State St	South to North	4	8	4
Nam Yan Ju St	North to South	4	5	1
	South to North	4	8	4

By comparing the above data, the average speed change for each road segment was calculated. The range of average speed increase for road segments is from 1 to 17, indicating that the new ring road has played a positive role in improving the road network's capacity, with significant long-term planning effects.

The west-to-east direction average speed change for road segment Tovchoo Rd decreased by -1 km/h, while the north-to-south direction average speed change for road segment Chingeltei Ave decreased by -1 km/h. The road segments with reduced average speed are located at the junctions of the new ring road. These segments experience an increase in traffic flow due to the traffic flow conversion with the new ring road, leading to an overall increase in average speed.

7.9.8 Analysis of Average Speed Changes on Major Road Segments in 2040

Based on the average speed for each road segment before and after the implementation of the new ring road, lane count weighting was applied to each road segment. The directional average speed change for each road segment was then calculated, and the corresponding weight coefficients were multiplied. The results were summed to determine the overall average speed change for each road segment. Average Speed Change = Average Speed After Implementation of New Ring Road - Average Speed Before Implementation of New Ring Road; Lane Count Weight Coefficient = Lane Count per Direction / Total Lane Count of Individual Road Segment. The average speed change for each road segment was calculated by multiplying the average speed change by the lane count weight coefficient, followed by summing the results to determine the overall average speed change for each individual road segment. As shown in Table 87.

Table 87 2040 Road Segment Average Speed Table

Road Segment Name	Direction	Directional Average Speed Change (km/h)	Overall Average Speed Change (km/h)
Moscow Street	East to West	9	7
	West to East	6	
Ard Ayush Avenue	East to West	7	7
	West to East	7	

Ikh Toiruu	East to West	6	5
	West to East	5	
Peace Avenue	East to West	5	6
	West to East	6	
Narnii Rd	East to West	3	3
	West to East	4	
Dunjingarav St	East to West	6	6
	West to East	6	
Gachuurt Rd	East to West	2	3
	West to East	5	
Chinggis Khan Ave	East to West	5	8
	West to East	10	
Tovchoo Rd	East to West	6	2
	West to East	-1	
Товчооны зам	East to West	4	5
	West to East	5	
Ajilchin St	North to South	17	16
	South to North	15	
Chingynjav St	North to South	6	4
	South to North	3	
Amarsanaa Rd	North to South	5	3
	South to North	3	
Engels St	North to South	8	8
	South to North	7	
Chingeltei Ave	North to South	-1	0
	South to North	1	
Nogoon Nuur St	North to South	5	5
	South to North	5	
Ikh Surguuli St	North to South	1	2
	South to North	5	
Great Mongolian State St	North to South	2	3
	South to North	4	
Nam Yan Ju St	North to South	1	2
	South to North	4	

Based on the data comparison for 2040, the overall increase in average speed for major road segments in 2040 ranges from 0 km/h to 16 km/h. The segment with the greatest increase is Ajilchin St, which experienced an overall average speed change of 16 km/h.

7.9.9 Analysis of Average Speed Changes on Overall Road Segments in 2040

By comparing the average speed of road segments before and after the

implementation of the new ring road, the overall average speed change for each road segment was calculated. The average speed change for each road segment was multiplied by the lane count weight coefficient, where the lane count weight coefficient was calculated as: Lane Count Weight Coefficient = Lane Count of Individual Segment / Total Lane Count of All Segments. The sum of all road segments was then calculated to determine the average speed change for all road segments, as shown in Table 88.

Table 88 Road Segment Overall Average Speed Changes

Road Segment	2040 Overall Change
19 Key Road Segments	5.1km/h

By analyzing the average speed before and after the implementation of the new ring road, and comparing the average speeds of the road segments before and after the implementation of the new ring road, the overall trend of road segment average speed changes for 2040 was determined. After the implementation of the new ring road, the average speed of the road segments increased by 5.1 km/h. The construction of the planned ring road has shown a positive impact on Ulaanbaatar's traffic, significantly improving residents' travel efficiency and reducing traffic congestion pressure.

7.9.10 2044 Road Segment Average Speed Analysis

By comparing the road segment saturation before and after the implementation of the new ring road in 2044, the average speed for each road segment was analyzed, as shown in Table 89.

Table 89 2044 Road Segment Average Speed Table

Road Segment Name	Direction	Before the Implementation of the New Ring Road (km/h)	After the Implementation of the New Ring Road (km/h)	Average Speed Change (km/h)
Moscow Street	East to West	4	13	9
	West to East	4	9	5
Ard Ayush Avenue	East to West	8	15	7
	West to East	8	15	7
Ikh Toiruu	East to West	11	16	5
	West to East	8	13	5
Peace Avenue	East to West	9	15	6
	West to East	8	15	7
Narnii Rd	East to West	9	12	3
	West to East	9	13	4

Dunjingarav St	East to West	18	23	5
	West to East	21	25	4
Gachuurt Rd	East to West	10	13	3
	West to East	9	13	4
Chinggis Khan Ave	East to West	11	19	8
	West to East	4	14	10
Tovchoo Rd	East to West	5	12	7
	West to East	7	7	0
Товчооны зам	East to West	21	27	6
	West to East	20	26	6
Ajilchin St	North to South	5	20	15
	South to North	3	17	14
Chingynjav St	North to South	7	14	7
	South to North	5	7	2
Amarsanaa Rd	North to South	10	17	7
	South to North	6	11	5
Engels St	North to South	6	15	9
	South to North	4	13	9
Chingeltei Ave	North to South	6	5	-1
	South to North	4	4	0
Nogoon Nuur St	North to South	11	15	4
	South to North	5	11	4
Ikh Surguuli St	North to South	10	12	2
	South to North	8	15	7
Great Mongolian State St	North to South	3	3	0
	South to North	4	7	3
Nam Yan Ju St	North to South	4	5	1
	South to North	4	7	3

By comparing the above data, the average speed change for each road segment was calculated. The range of average speed increase for road segments is from 1 to 15, indicating that the new ring road has played a positive role in improving the road network's capacity, with good long-term planning effects.

The west-to-east direction average speed change for road segment Tovchoo Rd decreased by -1, while the north-to-south direction average speed change for road segment Great Mongolian State St decreased by -1 km/h. The road segments with reduced average speeds are located near the new ring road, where traffic flow

conversion results in increased traffic volume, subsequently leading to an improvement in the average speed.

The north-to-south direction average speed change for road segment Chingeltei Ave decreased by -1 km/h. The road segments with reduced average speeds are located near the new ring road, where traffic flow conversion results in increased traffic volume, subsequently leading to decrease in the average speed.

7.9.11 Analysis of Average Speed Changes on Major Road Segments in 2044

Based on the average speed for each road segment before and after the implementation of the new ring road, lane count weighting was applied to each road segment. The directional average speed change for each road segment was then calculated, and the corresponding weight coefficients were multiplied. The results were summed to determine the overall average speed change for each road segment. Average Speed Change = Average Speed After Implementation of New Ring Road - Average Speed Before Implementation of New Ring Road; Lane Count Weight Coefficient = Lane Count per Direction / Total Lane Count of Individual Road Segment. The average speed change for each road segment was calculated by multiplying the average speed change by the lane count weight coefficient, followed by summing the results to determine the overall average speed change for each individual road segment. As shown in Table 90.

Table 90 2044 Road Segment Average Speed Table

Road Segment Name	Direction	Directional Average Speed Change (km/h)	Overall Average Speed Change (km/h)
Moscow Street	East to West	9	7
	West to East	5	
Ard Ayush Avenue	East to West	7	7
	West to East	7	
Ikh Toiruu	East to West	5	5
	West to East	5	
Peace Avenue	East to West	6	7
	West to East	7	
Narnii Rd	East to West	3	3
	West to East	4	
Dunjingarav St	East to West	5	4
	West to East	4	

Gachuurt Rd	East to West	3	3
	West to East	4	
Chinggis Khan Ave	East to West	8	9
	West to East	10	
Tovchoo Rd	East to West	7	3
	West to East	0	
Товчооны зам	East to West	6	6
	West to East	6	
Ajilchin St	North to South	15	15
	South to North	14	
Chingynjav St	North to South	7	4
	South to North	2	
Amarsanaa Rd	North to South	7	6
	South to North	5	
Engels St	North to South	9	9
	South to North	9	
Chingeltei Ave	North to South	-1	0
	South to North	0	
Nogoon Nuur St	North to South	4	4
	South to North	4	
Ikh Surguuli St	North to South	2	4
	South to North	7	
Great Mongolian State St	North to South	0	1
	South to North	3	
Nam Yan Ju St	North to South	1	1
	South to North	3	

Based on the data comparison for 2044, the overall increase in average speed for major road segments in 2044 ranges from 1 km/h to 15 km/h. The segment with the greatest increase is Ajilchin St, which experienced an overall average speed change of 15 km/h.

7.9.12 Analysis of Average Speed Changes on Overall Road Segments in 2044

By comparing the average speed of road segments before and after the implementation of the new ring road, the overall average speed change for each road segment was calculated. The average speed change for each road segment was multiplied by the lane count weight coefficient, where the lane count weight coefficient

was calculated as: Lane Count Weight Coefficient = Lane Count of Individual Segment / Total Lane Count of All Segments. The sum of all road segments was then calculated to determine the average speed change for all road segments, as shown in Table 91.

Table 91 Road Segment Overall Average Speed Changes

Road Segment	2044 Overall Change
19 Key Road Segments	5.5km/h

By analyzing the average speed before and after the implementation of the new ring road, and comparing the average speeds of the road segments before and after the implementation of the new ring road, the overall trend of road segment average speed changes for 2044 was determined. After the implementation of the new ring road, the average speed of the road segments increased by 5.5 km/h. The construction of the planned ring road has shown a positive impact on Ulaanbaatar's traffic, significantly improving residents' travel efficiency and reducing traffic congestion pressure.

7.10 Analysis of Average Speed Changes on Overall Road Segments

In terms of the overall road segment average speed change trends for 2028,2030, 2040, and 2044, after the implementation of the new ring road, the bus average speed for road segments increased by 4.6km/h,4.8 km/h, 5.1 km/h, and 5.5 km/h, respectively. The completion of the ring road had a positive impact on the traffic in Ulaanbaatar, increasing vehicle speeds on the roads, as shown in the table below.

Table 92 Road Segment Overall Average Speed Changes

Road Segment	2030 Overall Change	2030 Overall Change	2040 Overall Change	2044 Overall Change
19 Key Road Segments	4.6km/h	4.8km/h	5.1 km/h	5.5 km/h

8. Ulaanbaatar Bus Network Study

8.1 Ulaanbaatar Bus Accessibility Analysis

In the analysis of public transport stop influence zones within Ulaanbaatar's main urban area, a multi-radius buffering method (400m, 800m, 1200m, 1800m, 2000m) was employed. For flat terrain areas, based on a walking speed of 1 m/s, a 400m radius corresponds to a 400-second walking time – with identical logic applied to other radii. For the topographically varied southwest and northwest regions, where walking speeds fall below 1 m/s, radius reductions were applied to maintain equivalent walking time thresholds.

In the figure below, Ulaanbaatar bus stations are marked in green. The bright green areas represent regions within 6min40s of walking to a bus station. These areas may cover enterprises, government agencies, and schools. The progressively changing colors represent the areas accessible to bus stations within 13min20s, 20min, 30min, and 33min20s. The increasing colors indicate areas further from the bus stations.

Figures 123 and 124 show the accessibility of the core area and the overall area before the implementation of the new ring road. Figures 125 and 126 show the accessibility of the core area and the overall area after the implementation of the new ring road.

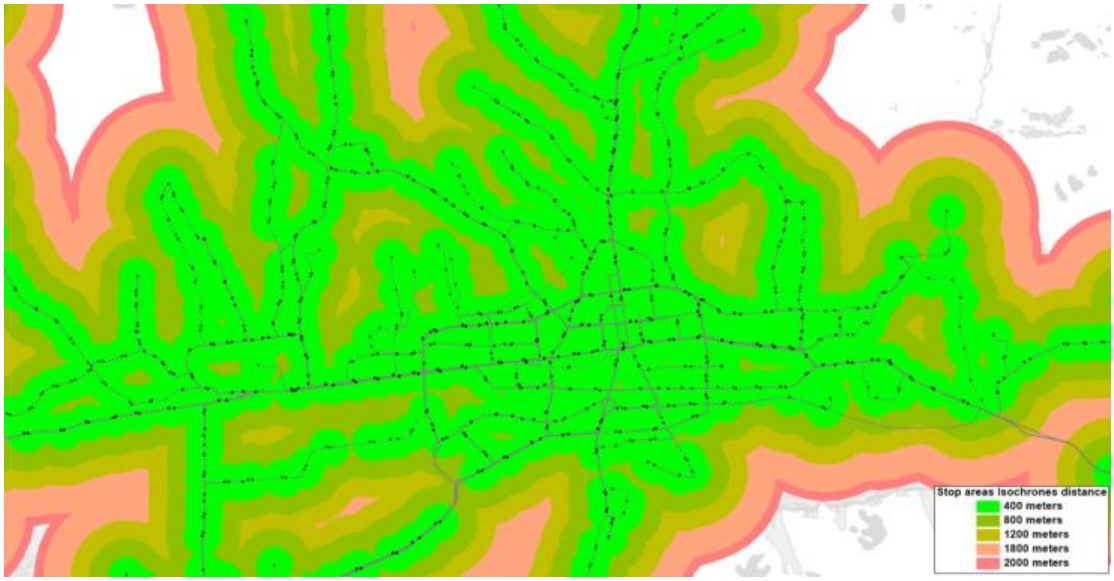

Figure 123 Core Area Accessibility Before the Implementation of the New Ring Road

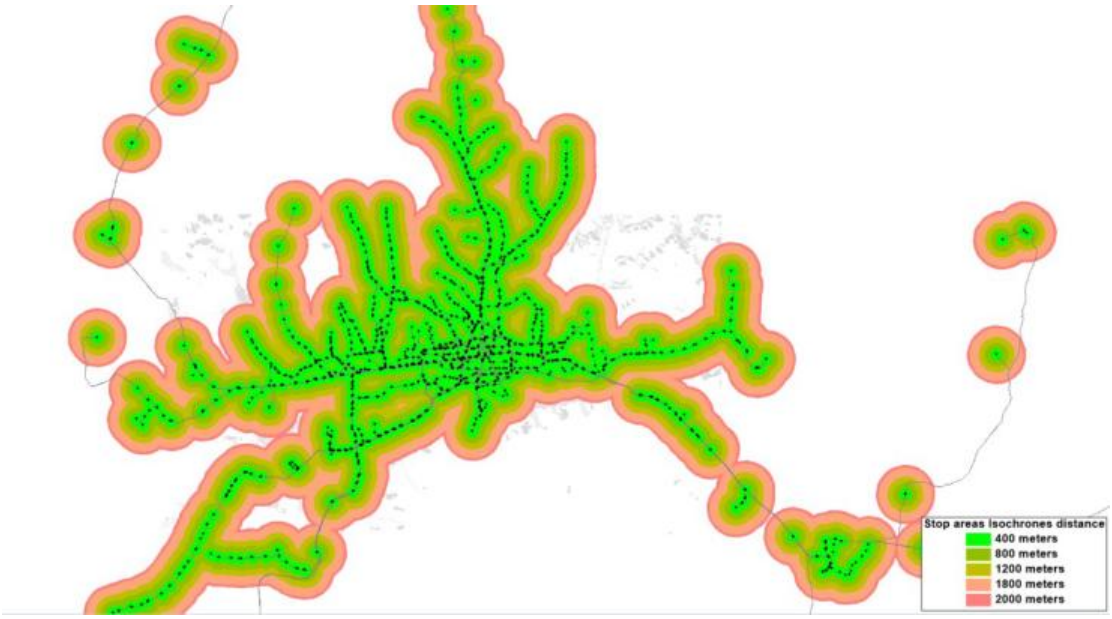

Figure 124 Overall Area Accessibility Before the Implementation of the New Ring Road

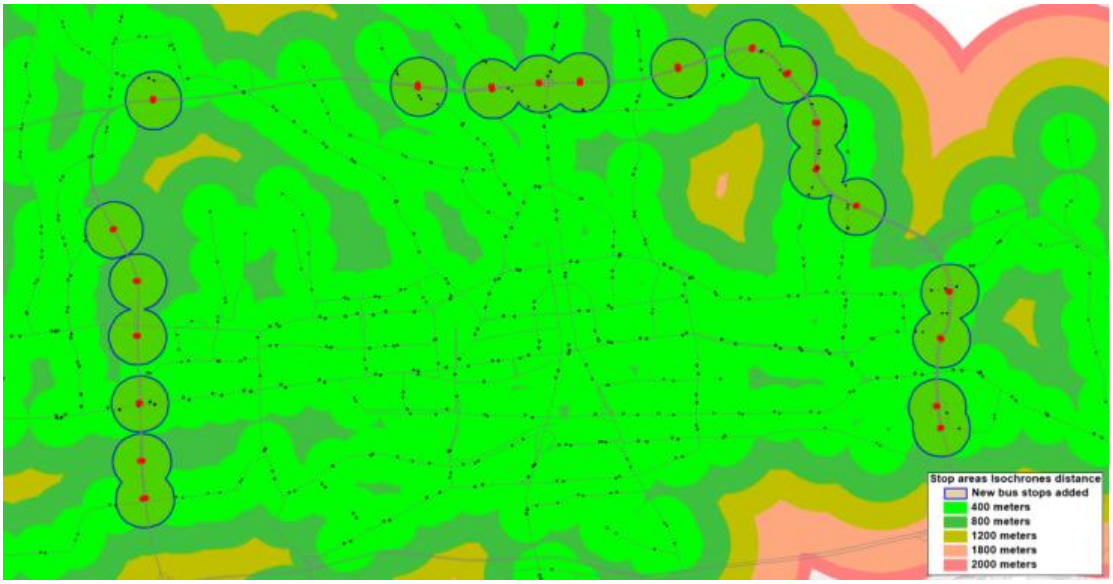

Figure 125 Core Area Accessibility After the Implementation of the New Ring Road

Figure 126 Overall Area Accessibility After the Implementation of the New Ring Road

8.2 Improvement in Public Transport Travel Distance for Ulaanbaatar Residents

The implementation of the new Northern Ring Road bus route has systematically integrated previously independent north-south bus corridors through a ring-shaped transit network. By optimizing the topology of the existing bus network, axial integration of north-south transit corridors has been achieved.

Improvements for Northern Residents:

The new ring road significantly enhances mobility for northern residents. A 9.29-km northern segment with 7 stations effectively connects existing north-south transit corridors, reducing average east-west travel distances by 33% and improving overall transit efficiency.

System-Wide Enhancements:

Route extension: +25 km of bus lanes

New stations: 21 added stops

Coverage expansion: Improved transit access in western, northern, and eastern districts of Ulaanbaatar.

The bus network after the construction of new bus routes is shown in Figure 119.

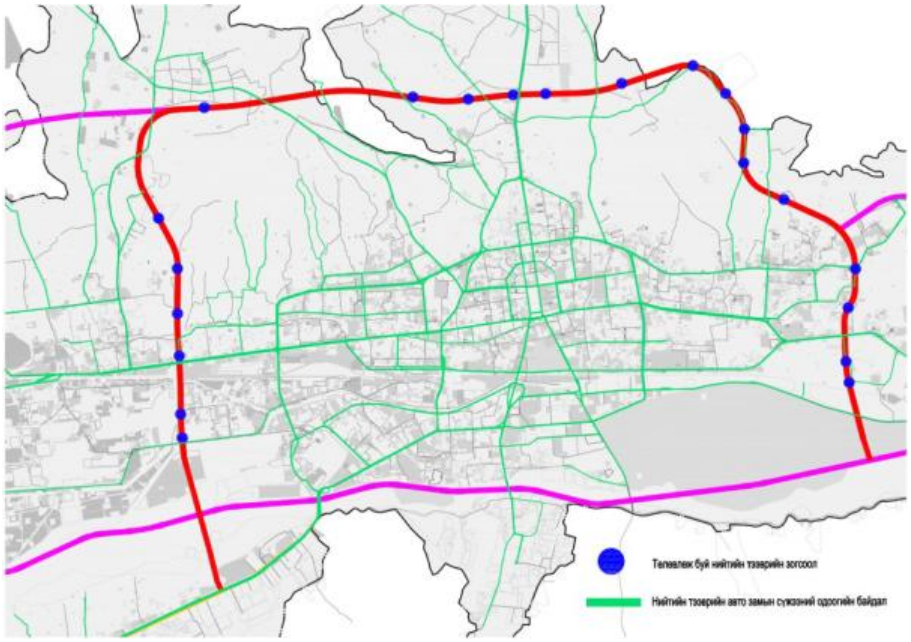

Figure 127 Bus Station Distribution Map for the New Ring Road Design

8.3 Ulaanbaatar Bus Speed Changes

8.3.1 2028 Bus Road Segment Average Speed Analysis

By comparing the bus road segment saturation before and after the implementation of the new ring road in 2028, the average speed for each bus road segment is analyzed, as shown in Table 93.

Table 93 2028 Bus Road Segment Average Speed Table

Road Segment Name	Direction	Before the Implementation of the New Ring Road(km/h)	After the Implementation of the New Ring Road (km/h)	Average Speed Change (km/h)
Moscow Street	East to West	9	16	7
	West to East	8	17	9
Ard Ayush Avenue	East to West	13	16	3
	West to East	14	17	3
Ikh Toiruu	East to West	15	16	1
	West to East	12	15	3
Peace Avenue	East to West	14	16	2
	West to East	13	15	2
Narnii Rd	East to West	15	17	2
	West to East	15	16	1
Dunjingarav St	East to West	17	20	3

	West to East	17	21	4
Gachuurt Rd	East to West	13	14	1
	West to East	12	11	-1
Chinggis Khan Ave	East to West	15	18	3
	West to East	8	17	9
Tovchoo Rd	East to West	14	14	0
	West to East	8	11	3
Товчооны зам	East to West	19	21	2
	West to East	19	21	2
Ajilchin St	North to South	10	20	10
	South to North	6	20	14
Chingynjav St	North to South	14	17	3
	South to North	9	13	4
Amarsanaa Rd	North to South	17	17	0
	South to North	10	16	6
Engels St	North to South	12	16	4
	South to North	9	15	6
Chingeltei Ave	North to South	7	8	1
	South to North	8	7	-1
Nogoon Nuur St	North to South	14	15	1
	South to North	8	13	5
Ikh Surguuli St	North to South	14	16	2
	South to North	15	15	0
Great Mongolian State St	North to South	4	4	0
	South to North	9	9	0
Nam Yan Ju St	North to South	7	10	3
	South to North	7	12	5

8.3.2 2030 Bus Road Segment Average Speed Analysis

By comparing the bus road segment saturation before and after the implementation of the new ring road in 2030, the average speed for each bus road segment is analyzed, as shown in Table 94.

Table 94 2030 Bus Road Segment Average Speed Table

Road Segment Name	Direction	Before the Implementation of the New Ring Road(km/h)	After the Implementation of the New Ring Road (km/h)	Average Speed Change (km/h)
Moscow Street	East to West	7	17	10
	West to East	6	15	9
Ard Ayush Avenue	East to West	12	17	5

	West to East	13	16	3
Ikh Toiruu	East to West	14	16	2
	West to East	12	17	5
Peace Avenue	East to West	13	16	3
	West to East	12	16	4
Narnii Rd	East to West	13	15	2
	West to East	12	16	4
Dunjingarav St	East to West	16	20	4
	West to East	17	21	4
Gachuurt Rd	East to West	12	14	2
	West to East	12	11	-1
Chinggis Khan Ave	East to West	15	16	1
	West to East	7	16	9
Tovchoo Rd	East to West	8	15	7
	West to East	12	9	-3
Товчооны зам	East to West	19	21	2
	West to East	18	21	3
Ajilchin St	North to South	9	20	11
	South to North	5	19	14
Chingynjav St	North to South	12	16	4
	South to North	7	10	3
Amarsanaa Rd	North to South	15	16	1
	South to North	13	13	0
Engels St	North to South	10	16	6
	South to North	6	15	9
Chingeltei Ave	North to South	8	7	-1
	South to North	6	6	0
Nogoon Nuur St	North to South	16	16	0
	South to North	8	13	5
Ikh Surguuli St	North to South	14	15	1
	South to North	13	16	3
Great Mongolian State St	North to South	4	5	1
	South to North	5	9	4
Nam Yan Ju St	North to South	6	7	1
	South to North	7	10	3

8.3.3 Analysis of Average Speed on Bus Road Segments in 2040

By comparing the bus road segment saturation before and after the implementation of the new ring road in 2040, the average speed for each bus road segment is analyzed, as shown in Table 95.

Table 95 2040 Bus Road Segment Average Speed Table

Road Segment Name	Direction	Before the Implementation of the New Ring Road(km/h)	After the Implementation of the New Ring Road (km/h)	Average Speed Change (km/h)
Moscow Street	East to West	5	14	9
	West to East	4	10	6
Ard Ayush Avenue	East to West	9	16	7
	West to East	9	16	7
Ikh Toiruu	East to West	11	15	4
	West to East	8	13	5
Peace Avenue	East to West	10	15	5
	West to East	9	15	6
Narnii Rd	East to West	10	13	3
	West to East	10	14	4
Dunjingarav St	East to West	16	18	2
	West to East	16	19	3
Gachuurt Rd	East to West	11	13	2
	West to East	9	14	5
Chinggis Khan Ave	East to West	13	16	3
	West to East	5	15	10
Tovchoo Rd	East to West	6	12	6
	West to East	8	7	-1
Товчооны зам	East to West	17	21	4
	West to East	17	20	3
Ajilchin St	North to South	6	18	12
	South to North	3	16	13
Chingynjav St	North to South	9	15	6
	South to North	5	8	3
Amarsanaa Rd	North to South	13	16	3
	South to North	9	12	3
Engels St	North to South	7	15	8
	South to North	4	11	7
Chingeltei Ave	North to South	6	5	-1
	South to North	4	5	1
Nogoon Nuur St	North to South	13	16	3
	South to North	7	12	5
Ikh Surguuli St	North to South	11	12	1
	South to North	10	15	5
Great Mongolian State St	North to South	3	5	2
	South to North	4	8	4
Nam Yan Ju St	North to South	4	5	1
	South to North	4	8	4

8.3.4 Analysis of Average Speed on Bus Road Segments in 2044

By comparing the bus road segment saturation before and after the implementation of the new ring road in 2044, the average speed for each bus road segment is analyzed, as shown in Table 96.

Table 96 2044 Bus Road Segment Average Speed Table

Road Segment Name	Direction	Before the Implementation of the New Ring Road (km/h)	After the Implementation of the New Ring Road (km/h)	Average Speed Change (km/h)
Moscow Street	East to West	4	13	9
	West to East	3	9	6
Ard Ayush Avenue	East to West	8	14	6
	West to East	8	15	7
Ikh Toiruu	East to West	10	14	4
	West to East	7	13	6
Peace Avenue	East to West	8	15	7
	West to East	8	14	6
Narnii Rd	East to West	8	11	3
	West to East	9	13	4
Dunjingarav St	East to West	15	18	3
	West to East	18	19	1
Gachuurt Rd	East to West	10	13	3
	West to East	9	13	4
Chinggis Khan Ave	East to West	11	16	5
	West to East	4	14	10
Tovchoo Rd	East to West	5	11	7
	West to East	7	6	-1
Товчооны зам	East to West	16	21	5
	West to East	16	20	4
Ajilchin St	North to South	5	16	11
	South to North	3	15	12
Chingynjav St	North to South	7	13	6
	South to North	4	6	2
Amarsanaa Rd	North to South	9	15	6
	South to North	6	11	5
Engels St	North to South	5	15	10
	South to North	3	12	9
Chingeltei Ave	North to South	5	5	0
	South to North	3	4	1
Nogoon Nuur St	North to South	11	13	2
	South to North	5	10	5

Ikh Surguuli St	North to South	10	12	2
	South to North	8	14	6
Great Mongolian State St	North to South	3	2	-1
	South to North	3	6	3
Nam Yan Ju St	North to South	4	4	0
	South to North	4	6	2

By comparing the above data, the bus average speed change for each road segment was calculated. The range of bus average speed increase for road segments is from 1 km/h to 12 km/h, indicating that the new ring road has played a positive role in improving the road network's capacity, with significant long-term planning effects.

The west-to-east direction average speed change for road segment Tovchoo Rd decreased by -1 km/h, while the north-to-south direction average speed change for road segment Great Mongolian State St decreased by -1 km/h. The road segments with reduced bus average speeds are located near the new ring road, where traffic flow conversion results in increased traffic volume, subsequently leading to an improvement in the bus average speed.

8.4 Analysis of Bus Average Speed Changes on Major Road Segments

8.4.1 Analysis of Bus Average Speed Changes in 2028

Based on the bus average speed for each road segment before and after the implementation of the new ring road, lane count weighting was applied to each road segment. The directional average speed change for each road segment was then calculated, and the corresponding weight coefficients were multiplied. The results were summed to determine the overall average speed change for each road segment. Bus Average Speed Change = Bus Average Speed After Implementation of New Ring Road - Bus Average Speed Before Implementation of New Ring Road; Lane Count Weight Coefficient = Lane Count per Direction / Total Lane Count of Individual Road Segment. The bus average speed change for each road segment was calculated by multiplying the bus average speed change by the lane count weight coefficient, followed by summing the results to determine the overall bus average speed change for each individual road segment. As shown in Table 97.

Table 97 Table of Average Speed Changes on Individual Road Segments in 2030

Road Segment Name	Direction	Directional Average Speed Change (km/h)	Overall Average Speed Change (km/h)

Moscow Street	East to West	7	8
	West to East	9	
Ard Ayush Avenue	East to West	3	3
	West to East	3	
Ikh Toiruu	East to West	1	2
	West to East	3	
Peace Avenue	East to West	2	2
	West to East	2	
Narnii Rd	East to West	2	1
	West to East	1	
Dunjingarav St	East to West	3	3
	West to East	4	
Gachuurt Rd	East to West	1	0
	West to East	-1	
Chinggis Khan Ave	East to West	3	6
	West to East	9	
Tovchoo Rd	East to West	0	1
	West to East	3	
Товчооны зам	East to West	2	2
	West to East	2	
Ajilchin St	North to South	10	12
	South to North	14	
Chingynjav St	North to South	3	3
	South to North	4	
Amarsanaa Rd	North to South	0	3
	South to North	6	
Engels St	North to South	4	5
	South to North	6	
Chingeltei Ave	North to South	1	0
	South to North	-1	
Nogoon Nuur St	North to South	1	3
	South to North	5	
Ikh Surguuli St	North to South	2	1
	South to North	0	
Great Mongolian State St	North to South	0	0
	South to North	0	
Nam Yan Ju St	North to South	3	4
	South to North	5	

Analysis of 2028 data shows that the increase in average bus speeds ranged from 1 km/h to 12 km/h. The maximum improvement occurred on Ajilchin St (Workers' Street), where the overall average speed increased by 12 km/h.

8.4.2 Analysis of Bus Average Speed Changes in 2030

Based on the bus average speed for each road segment before and after the implementation of the new ring road, lane count weighting was applied to each road segment. The directional average speed change for each road segment was then calculated, and the corresponding weight coefficients were multiplied. The results were summed to determine the overall average speed change for each road segment. Bus Average Speed Change = Bus Average Speed After Implementation of New Ring Road - Bus Average Speed Before Implementation of New Ring Road; Lane Count Weight Coefficient = Lane Count per Direction / Total Lane Count of Individual Road Segment. The bus average speed change for each road segment was calculated by multiplying the bus average speed change by the lane count weight coefficient, followed by summing the results to determine the overall bus average speed change for each individual road segment. As shown in Table 98.

Table 98 Table of Average Speed Changes on Individual Road Segments in 2030

Road Segment Name	Direction	Directional Average Speed Change (km/h)	Overall Average Speed Change (km/h)
Moscow Street	East to West	10	10
	West to East	9	
Ard Ayush Avenue	East to West	5	4
	West to East	3	
Ikh Toiruu	East to West	2	4
	West to East	5	
Peace Avenue	East to West	3	4
	West to East	4	
Narnii Rd	East to West	2	3
	West to East	4	
Dunjingarav St	East to West	4	4
	West to East	4	
Gachuurt Rd	East to West	2	1
	West to East	-1	
Chinggis Khan Ave	East to West	1	5
	West to East	9	
Tovchoo Rd	East to West	7	2
	West to East	-3	
Товчооны зам	East to West	2	3
	West to East	3	
Ajilchin St	North to South	11	13
	South to North	14	
Chingynjav St	North to South	4	4

	South to North	3	
Amarsanaa Rd	North to South	1	1
	South to North	0	
Engels St	North to South	6	8
	South to North	9	
Chingeltei Ave	North to South	-1	-1
	South to North	0	
Nogoon Nuur St	North to South	0	3
	South to North	5	
Ikh Surguuli St	North to South	1	2
	South to North	3	
Great Mongolian State St	North to South	1	3
	South to North	4	
Nam Yan Ju St	North to South	1	2
	South to North	3	

By analyzing the data for 2030, the overall bus average speed reduction for major road segments in 2030 is Chingeltei Ave, where the bus average speed decreased by 1 km/h. The range of changes in overall bus road segment average speeds is from 1 km/h to 13 km/h.

8.4.3 Analysis of Bus Average Speed Changes in 2040

Based on the bus average speed for each road segment before and after the implementation of the new ring road, lane count weighting was applied to each road segment. The directional average speed change for each road segment was then calculated, and the corresponding weight coefficients were multiplied. The results were summed to determine the overall average speed change for each road segment. Bus Average Speed Change = Bus Average Speed After Implementation of New Ring Road - Bus Average Speed Before Implementation of New Ring Road; Lane Count Weight Coefficient = Lane Count per Direction / Total Lane Count of Individual Road Segment. The bus average speed change for each road segment was calculated by multiplying the bus average speed change by the lane count weight coefficient, followed by summing the results to determine the overall bus average speed change for each individual road segment. As shown in Table 99.

Table 99 Table of Average Speed Changes on Individual Road Segments in 2040

Road Segment Name	Direction	Directional Average Speed Change (km/h)	Overall Average Speed Change (km/h)
Moscow Street	East to West	9	8
	West to East	6	
Ard Ayush Avenue	East to West	7	7
	West to East	7	
Ikh Toiruu	East to West	4	5
	West to East	5	
Peace Avenue	East to West	5	6
	West to East	6	
Narnii Rd	East to West	3	4
	West to East	4	
Dunjingarav St	East to West	2	3
	West to East	3	
Gachuurt Rd	East to West	2	4
	West to East	5	
Chinggis Khan Ave	East to West	3	7
	West to East	10	
Tovchoo Rd	East to West	6	3
	West to East	-1	
Товчооны зам	East to West	4	4
	West to East	3	
Ajilchin St	North to South	12	13
	South to North	13	
Chingynjav St	North to South	6	5
	South to North	3	
Amarsanaa Rd	North to South	3	3
	South to North	3	
Engels St	North to South	8	8
	South to North	7	
Chingeltei Ave	North to South	-1	0
	South to North	1	
Nogoon Nuur St	North to South	3	4
	South to North	5	
Ikh Surguuli St	North to South	1	3
	South to North	5	
Great Mongolian State St	North to South	2	3
	South to North	4	
Nam Yan Ju St	North to South	1	3
	South to North	4	

Based on the data comparison for 2040, the overall increase in bus average speed

for major road segments in 2040 ranges from 3 km/h to 13 km/h. The segment with the greatest increase is Ajilchin St, which experienced an overall average speed change of 13 km/h.

8.4.4 Analysis of Bus Average Speed Changes in 2044

Based on the bus average speed for each road segment before and after the implementation of the new ring road, lane count weighting was applied to each road segment. The directional average speed change for each road segment was then calculated, and the corresponding weight coefficients were multiplied. The results were summed to determine the overall average speed change for each road segment. Bus Average Speed Change = Bus Average Speed After Implementation of New Ring Road - Bus Average Speed Before Implementation of New Ring Road; Lane Count Weight Coefficient = Lane Count per Direction / Total Lane Count of Individual Road Segment. The bus average speed change for each road segment was calculated by multiplying the bus average speed change by the lane count weight coefficient, followed by summing the results to determine the overall bus average speed change for each individual road segment. As shown in Table 100.

Table 100 Table of Average Speed Changes on Individual Road Segments in 2044

Road Segment Name	Direction	Directional Average Speed Change (km/h)	Overall Average Speed Change (km/h)
Moscow Street	East to West	9	8
	West to East	6	
Ard Ayush Avenue	East to West	6	7
	West to East	7	
Ikh Toiruu	East to West	4	5
	West to East	6	
Peace Avenue	East to West	7	7
	West to East	6	
Narnii Rd	East to West	3	4
	West to East	4	
Dunjingarav St	East to West	3	2
	West to East	1	
Gachuurt Rd	East to West	3	4
	West to East	4	
Chinggis Khan Ave	East to West	5	8
	West to East	10	
Tovchoo Rd	East to West	7	3
	West to East	-1	

Товчооны зам	East to West	5	5
	West to East	4	
Ajilchin St	North to South	11	12
	South to North	12	
Chingynjav St	North to South	6	4
	South to North	2	
Amarsanaa Rd	North to South	6	6
	South to North	5	
Engels St	North to South	10	10
	South to North	9	
Chingeltei Ave	North to South	0	1
	South to North	1	
Nogoon Nuur St	North to South	2	4
	South to North	5	
Ikh Surguuli St	North to South	2	4
	South to North	6	
Great Mongolian State St	North to South	-1	1
	South to North	3	
Nam Yan Ju St	North to South	0	1
	South to North	2	

Based on the data comparison for 2044, the overall increase in bus average speed for major road segments in 2044 ranges from 1 km/h to 12 km/h. The segment with the greatest increase is Ajilchin St, which experienced an overall average speed change of 12 km/h.

8.5 Analysis of Bus Average Speed Changes on Overall Road Segments

By comparing the bus average speed of road segments before and after the implementation of the new ring road, the overall bus average speed change for each road segment was calculated. The bus average speed change for each road segment was multiplied by the lane count weight coefficient, where the lane count weight coefficient was calculated as: Lane Count Weight Coefficient = Lane Count of Individual Segment / Total Lane Count of All Segments. The sum of all road segments was then calculated to determine the bus average speed change for all road segments, as shown in Table 101.

Table 101 Road Segment Overall Bus Average Speed Change Table

Road Segment	2028 Overall Change	2030 Overall Change	2040 Overall Change	2044 Overall Change
19 Key Road Segments	3.2km/h	3.8km/h	4.7km/h	5.0km/h

By analyzing the bus average speed before and after the implementation of the new ring road, and comparing the bus average speeds of road segments before and after the implementation of the new ring road, the overall trend of bus average speed changes for 2028,2030, 2040, and 2044 was determined. After the implementation of the new ring road, the bus average speed of the road segments increased by 3.2km/h in 2028,3.8 km/h in 2030, 4.7 km/h in 2040, and 5.0 km/h in 2044. This demonstrates that the planned ring road has had a positive impact on Ulaanbaatar's traffic, significantly improving residents' travel speed, increasing bus vehicle speed, and reducing traffic congestion pressure.

Further optimization of the bus system can be achieved through the following methods to reduce reliance on road network expansion:

① Signal priority system. Deploy RFID bus detection systems at ring road intersections, extending green light duration by 15-20%.

② Improvement of driver professionalism. Enhance bus driver professional quality through training, assessments, and incentives.

③Intelligent scheduling upgrade. Launch a real-time bus APP, displaying real-time departure times, expected arrival times, and bus crowd levels based on the mobile phone.

④ Build new subway connections to ring road hubs to shorten transfer distances.

9. Conclusions

9.1 Traffic Survey Findings

To assess the highway network, public transportation planning, and road traffic conditions in Ulaanbaatar, the following baseline surveys were conducted.

(1) Resident Travel Survey

A paper-based questionnaire survey was conducted with 2,600 households (10,400 residents) across 6 districts and 52 communities along the proposed new ring road. The collected data was consolidated and used for traffic demand modeling.

Survey findings:

Trip purposes: Commuting to work (44.56%), returning home (33.31%), dropping off/picking up children (9.43%), daily shopping (4.13%), going to school (2.87%), healthcare visits (2.24%), work or business meetings (1.96%), taxi or delivery driving (0.89%), government or social services (0.61%).

0.88% Mode of transport: Private car (48.82%), public bus (37.51%), walking (10%), bus and taxi (2.78%), others (e.g., motorcycles, taxis) (0.88%).

Trip duration: 0-10 minutes (4.50%), 10-20 minutes (12.91%), 20-30 minutes (19.65%), 30-40 minutes (13.99%), 40-50 minutes (8.76%), 50-60 minutes (22.75%), over 60 minutes (17.43%).

(2) Traffic Flow Survey

23 intersections were selected for field observation, with vehicle flow (left turn, right turn, straight, and vehicle type classification) recorded every 15 minutes between 05:00 and 24:00 on both weekdays and weekends.

Results showed that the LOS at most intersections was rated "E" or "F" (oversaturated conditions).

(3) Vehicle Speed Survey

GPS data from vehicles was collected to measure average speeds on 5 routes during morning, noon, and evening peak periods on both weekdays and weekends.

Results indicated that during peak periods, the average speed on arterial roads was 25 km/h, with some roads even dropping below 5 km/h.

9.2 Traffic Demand Modeling and Calculation Results

Travel volume forecast: 3.02 million trips per day in 2025. 3.60 million trips per day in 2030, and 4.10 million trips per day in 2040.

(1) Impact of the Ring Road on Average Traffic Volume on Arterial Roads

① 2028: Average traffic volume will decrease by 18.37%. Specifically,

10-20% decrease: Ikh Toiruu, Chingynjav St, Amarsanaa Rd.

20%-40% decrease: Moscow Street、Ард Аюушийн өргөн чөлө, Peace Avenue, Dunjingarav St, Chinggis Khan Ave, Товчооны зам、Engels St.

Over 40% decrease: Ajilchin St.

② 2030: Average traffic volume will decrease by 19.57%.

10-20% decrease: New Narnii Rd, Great Mongolian State St. Other road conditions will be similar to those in 2028.

③ 2040: Average traffic volume will decrease by 19.47%.

10-20% decrease: New Gachuurt Rd, Nogoon Nuur St

20-40% decrease: New Ikh Toiruu (increase from 10-20% to 20-40%)

Road conditions are similar to those in 2030.

④ 2044: Average traffic volume will decrease by 21.47%.

10-20% decrease: New Tovchoo Rd, Ikh Surguuli St

20-40% decrease: Amarsanaa Rd (increase from 10-20% to 20-40%)

Other categorized roads remain consistent with those in 2040.

Road conditions are similar to those in 2028.

(2) Impact of the Ring Road on Average Vehicle Speed on Arterial Roads

Private cars: Speed increase of 4.6/4.8/5.1/5.5 km/h in 2028/2030/2040/2044.

Public buses: Speed increase of 3.2/3.8/4.7/5.0 km/h in 2028/2030/2040/2044.

(3) Impact of the Ring Road on Arterial Road Saturation

Reduction in saturation by 20.27%, 21.94%, 25.21%, and 28.11% in 2028, 2030, 2040, and 2044, respectively.

(4) Public Bus Route Length and Accessibility Changes

The public bus network will expand by approximately 25 km, with 21 additional bus stations. This will improve the public transportation environment for residents in the western, northern, and eastern parts of Ulaanbaatar.

Improvements for northern residents. The new ring road will significantly enhance travel for northern residents. A 9.29 km road segment on the northern side will include 7 bus stations, effectively connecting with the existing north-south bus corridors. This will reduce the average east-west travel distance for northern residents by 33%,

improving the overall efficiency of the bus system.

9.3 Projected Traffic Volume on the Ring Road

The projected traffic volume for road segments of the new ring road is shown in the table below.

Table 102 Projected Traffic Volume for the New Ring Road

Year	DDHV (pcu/h)	AADT (pcu/d)	Vehicle Trips on Ring Road (veh*trips/d)
2028	3598	92280	230671
2030	3722	95473	240326
2035	3966	102492	259073
2040	4217	108149	270108
2044	4355	111685	274950
2048	4459	114348	277329

The traffic volume forecast for the 8 grade separation intersections on the new ring road is shown in the table below:

Table 103 Traffic Volume Forecast for the Major Grade Separation Intersections of the New Ring Road

No.	Intersection Name	DDHV (pcu/h)	AADT (pcu/d)
1	Intersection of New Ring Road and Mosco Street	11219	287715
2	Intersection of New Ring Road and Ard Ayush Road	6060	155416
3	Intersection of New Ring Road and West Second Ring Road	4450	114104
4	Intersection of New Ring Road and No. VII Road	8785	225289
5	Intersection of New Ring Road and Dariehe Street	4968	127391
6	Intersection of New Ring Road and East Second Ring Road	3421	87489
7	Intersection of New Ring Road and Police Academy Avenue	6821	174909
8	Intersection of New Ring Road and Tula Expressway	2260	57955