Utilization of Transport DB in Traffic Impact Assessment

Mooki Mo
Seokyeong University
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Ⅰ Introduction

1. Traffic Impact Assessment System

2. Legal Basis for Traffic Impact Assessment

1. Traffic Impact Assessment System

Necessity

◦ Large-scale development or construction → Increased traffic demand → Burden on existing transportation systems

- Increased traffic congestion : Sharp rise in vehicle and pedestrian demand after development
- Deterioration of traffic safety : Increase in the risk of accidents due to a sudden surge in road users
- Environmental problems : Air pollution and noise problems caused by traffic congestion
- Inefficient investment : Requires more time and costs for post-construction transport facility expansion

Objective

◦ Minimizing various traffic problems caused by the project through investigating, predicting, and analyzing changes in traffic volume, flow, and safety

- Prevention to traffic issues : predict traffic growth → appropriate improvements → prevent congestion and accidents
- Establish rational transportation plans : The linkage between the development and transportation facilities
- Minimize environmental and social impacts : Reduce environmental pollution and social costs
- Establishing a safe traffic environment : Ensure safety for vulnerable road users, pedestrians, and cyclists
- Secure sustainability of development : Promote sustainable development in transportation for the long-term

2. Legal Basis of Traffic Impact Assessment

Legal Basis

◦ Urban Traffic Improvement Promotion Act(Articles 15 to 32)

: Projects and regions subject to establishment, procedure, committee, changes, implementation etc

◦ Enforcement Decree of the Urban Traffic Improvement Promotion Act(Article 13)

: Subject to assessment, submission deadline, operation of the committee, requirements for changes etc

◦ Enforcement Rules of the Urban Traffic Improvement Promotion Act(Article 2)

: Report submission, management ledger, agent registration requirements, performance reports, etc

◦ Guidelines for traffic impact assessment

: Criteria for investigation and analysis

: Matters concerning the review and deliberation procedures, specific details concerning on changes, etc

◦ Other municipal ordinances on traffic impact analysis and improvement measures

Subjects of Traffic Impact Assessment

◦ Building constructions

- Single-use buildings
- Mixed-use buildings

◦ Development projects

- Urban development and infrastructure projects
- Transport infrastructure related projects
- Development projects in specific areas and special management areas

◦ In accordance with the Enforcement Decree, traffic impact assessment is conducted if the project exceeds the minimum standard

Significance of Traffic Impact Assessment

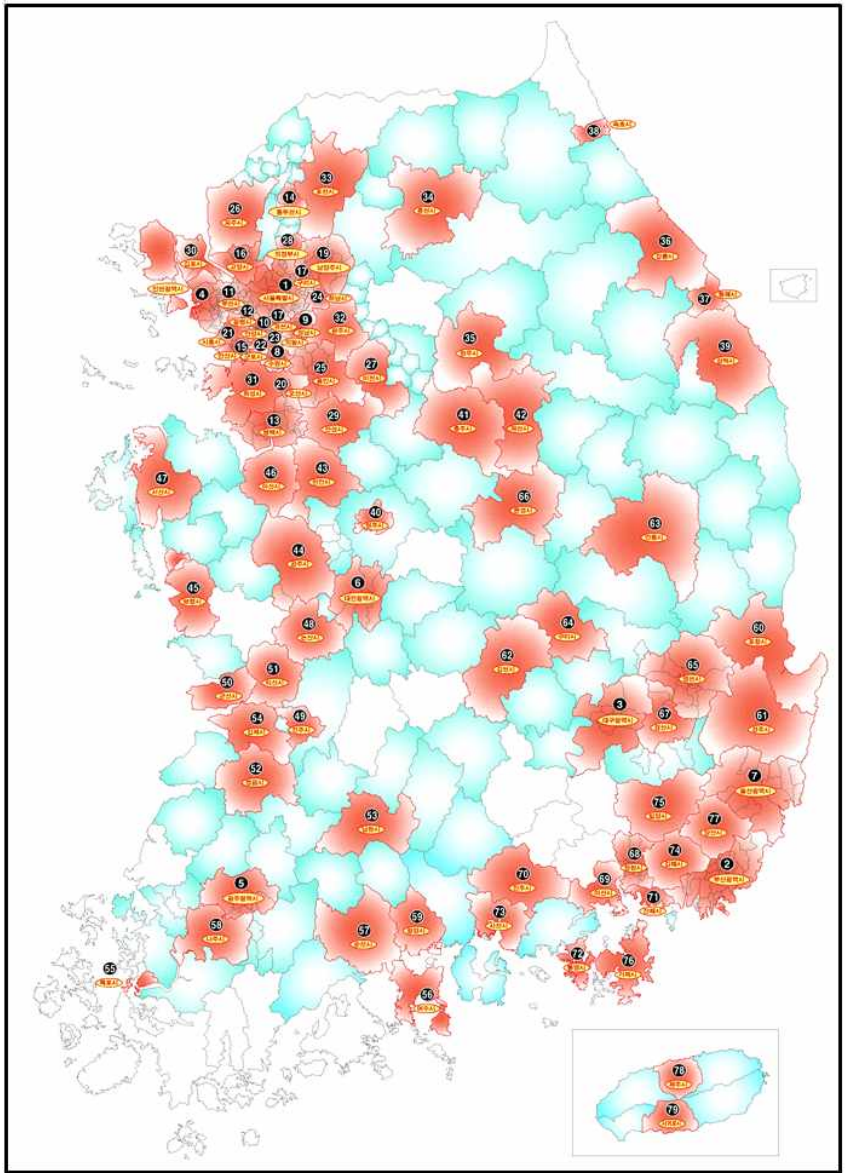
◦ Proactive means of traffic management

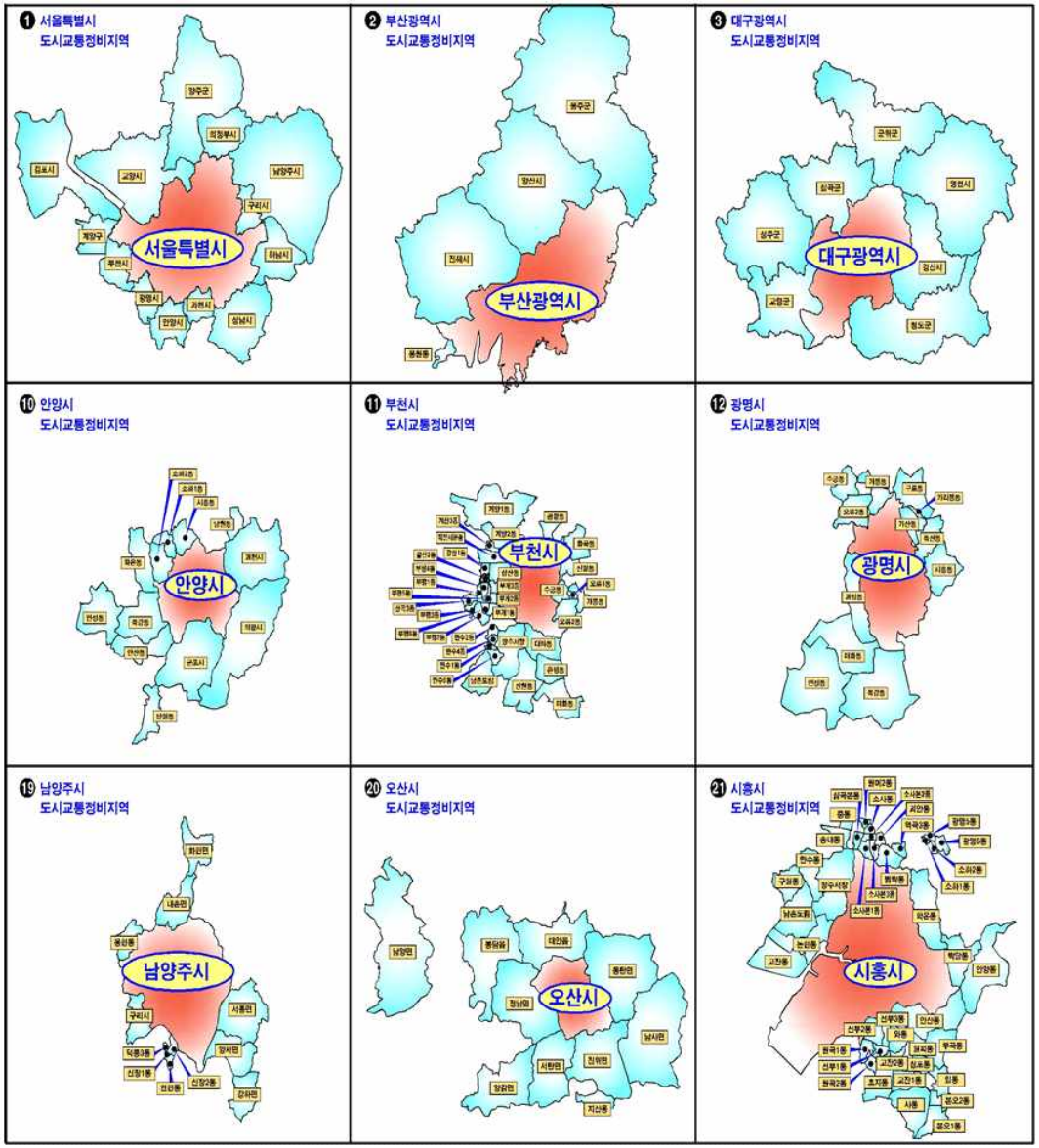
◦ Foundation for sustainable urban development

◦ Contributing to traffic safety and environmental protection

◦ Support rational decision-making and policy-making

◦ Increase user convenience and strengthen regional competitiveness

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㉑ 시흥시
도시교통정비지역
시흥시

II Main Contents of Traffic Impact Assessment

1. Main Contents of Traffic Impact Assessment

2. The Process of Traffic Impact Assessment

1. Main Contents of Traffic Impact Assessment

Scope of Assessment

Temporal scope

◦ Building constructions : 1 year and 3 years after the completion of the building construction

◦ Development projects : 1 year and 5 years after the completion of the development project

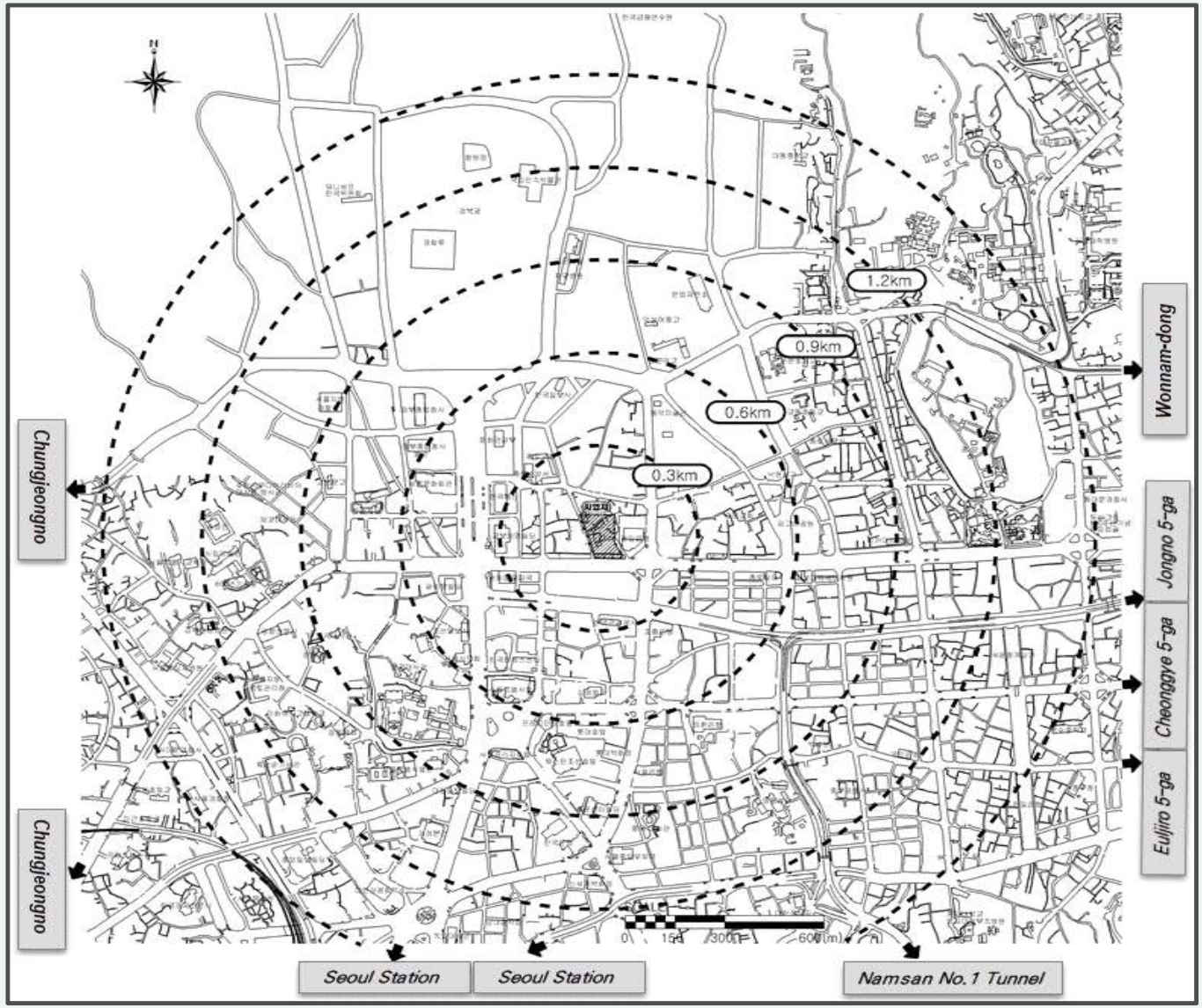
Spatial scope

◦ Building constructions : the nearest intersections from the main entrance and the streets within its scope

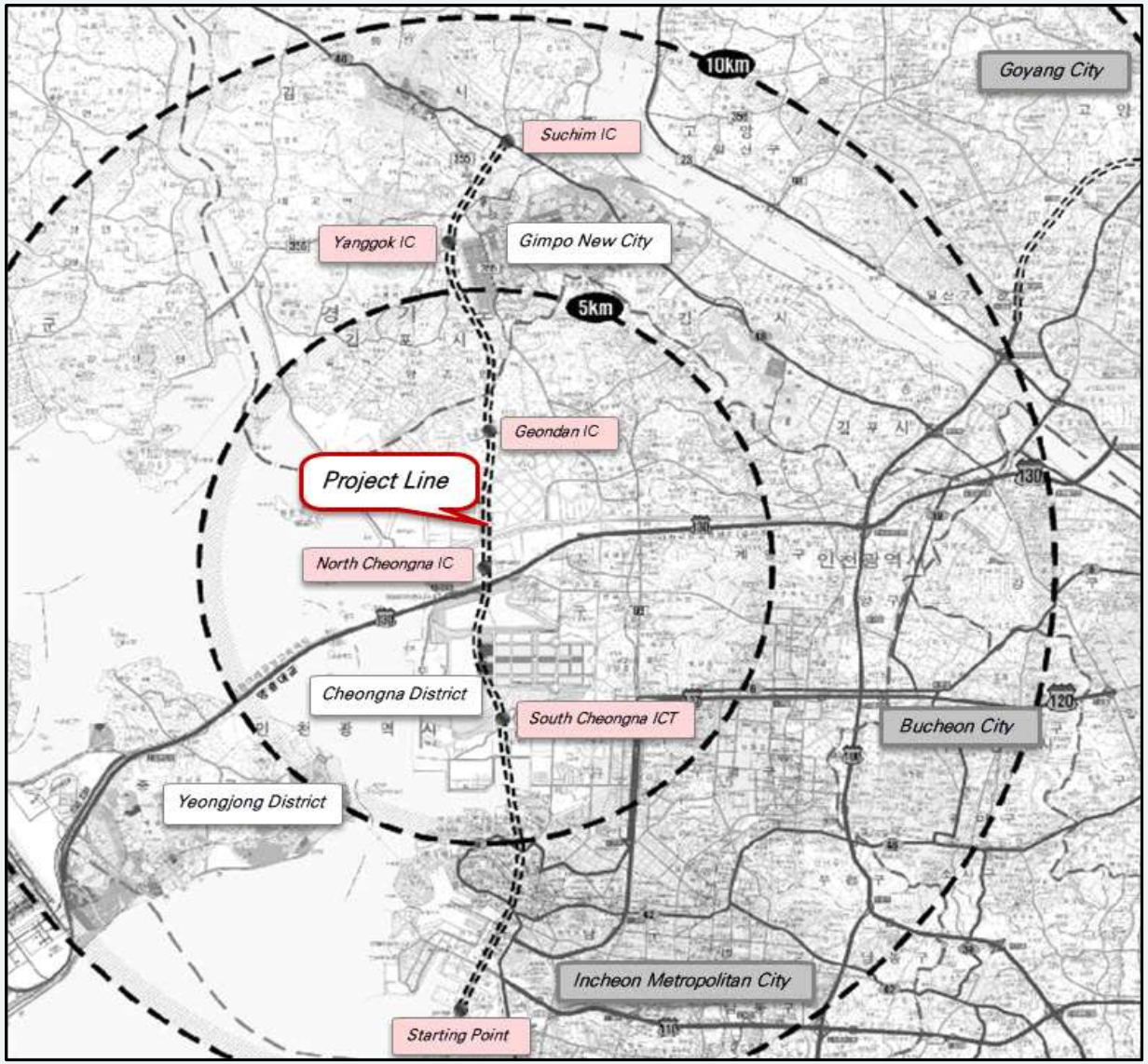
- Less than 4 times the minimum standard : at least 4 intersections within a radius of 1.0 km
- More than 4 times and less than 8 times the minimum standard : at least 8 intersections within a radius of 1.5 km
- More than 8 times the minimum standard : at least 12 intersections within a radius of 2.0 km

◦ Similar standards apply to the case of the development projects as well

Spatial scope case in Cheongjin districts 12 to 16 office facilities



Spatial scope case in the Incheon-Gimpo expressway construction project



Main Contents of Assessment

◦ Introduction

- Overview of the project and summary of assessment results

◦ Traffic environment analysis

- Analysis of the overall status

◦ Future traffic demand in the project area and surrounding regions

- Future traffic demand with and without the project implementation
- Parking demand

◦ Issues and Improvement measures arising from the implementation of the project

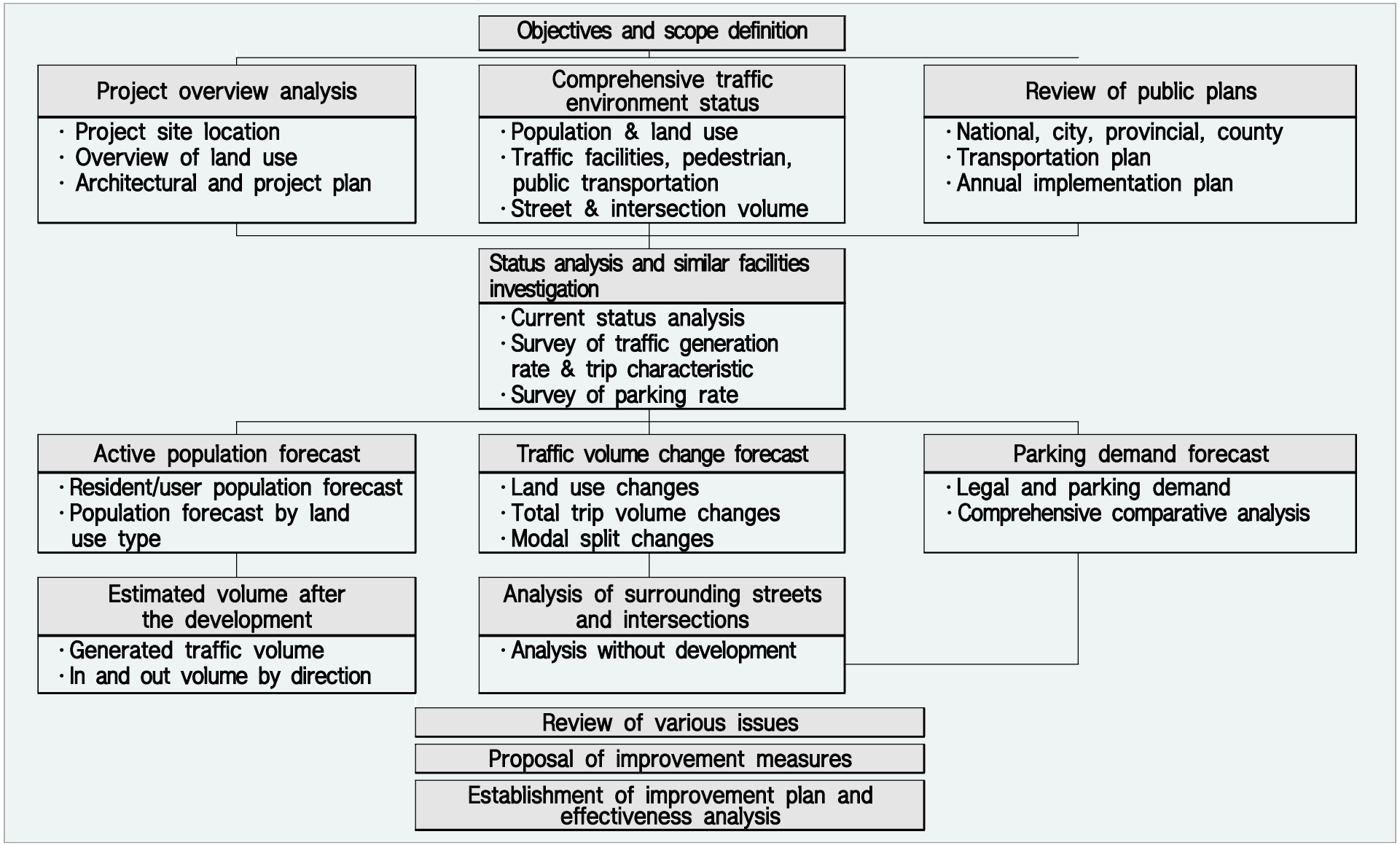
- Future diagnosis and expected issues
- Improvement measures

◦ Implementation plan for traffic improvement measures

◦ References

- Survey data and analysis results

2. The Process of Traffic Impact Assessment



Category for Improvement Measures

Building and urban development projects

- Internal and external traffic improvement
- Traffic flow routes for entry and exit
- Parking
- Traffic safety and others
- Surrounding streets and Intersections
- Public transport, pedestrian, and bicycle traffic systems
- Traffic demand management plan

Road construction projects

- Entry and exit points(interchanges, junctions, intersections)
- Surrounding streets and Intersections connected to entry and exit points
- Public transport and pedestrian traffic(excluding highways)
- Regional segregation mitigation plan for entire route(if required)
- Parking(rest areas, etc.), traffic safety, and others

Railway construction projects

- Inside station : external ↔ concourse, concourse ↔ platforms, inside platforms, transfer corridors and facilities
- Outside station : connections to other transport modes, pedestrian accessibility
- Parking : transfer parking flow, freight loading and unloading spaces, parking & stopping areas
- Regional segregation mitigation plan for entire route(if required)
- Traffic safety and others

Ⅲ The Process of Demand Analysis and Improvement Plan

1. Traffic Status Analysis

2. Future Traffic Demand Analysis

3. The Formulation of Comprehensive Improvement Plan

1. Traffic Status Analysis

Data Collection for Traffic Analysis

Traffic facilities and traffic flow conditions

- Traffic facility status
- Traffic flow conditions of streets and Intersections
- Traffic flow analysis of streets and Intersections
- Public transportation status and analysis
- Traffic accident occurrence status

Land use status and future development plans

- Land use status
- Socioeconomic Indicators
- Road and road facilities status
- Surrounding area development plans

Traffic-related plans

- Higher-level plans
- Regional plans

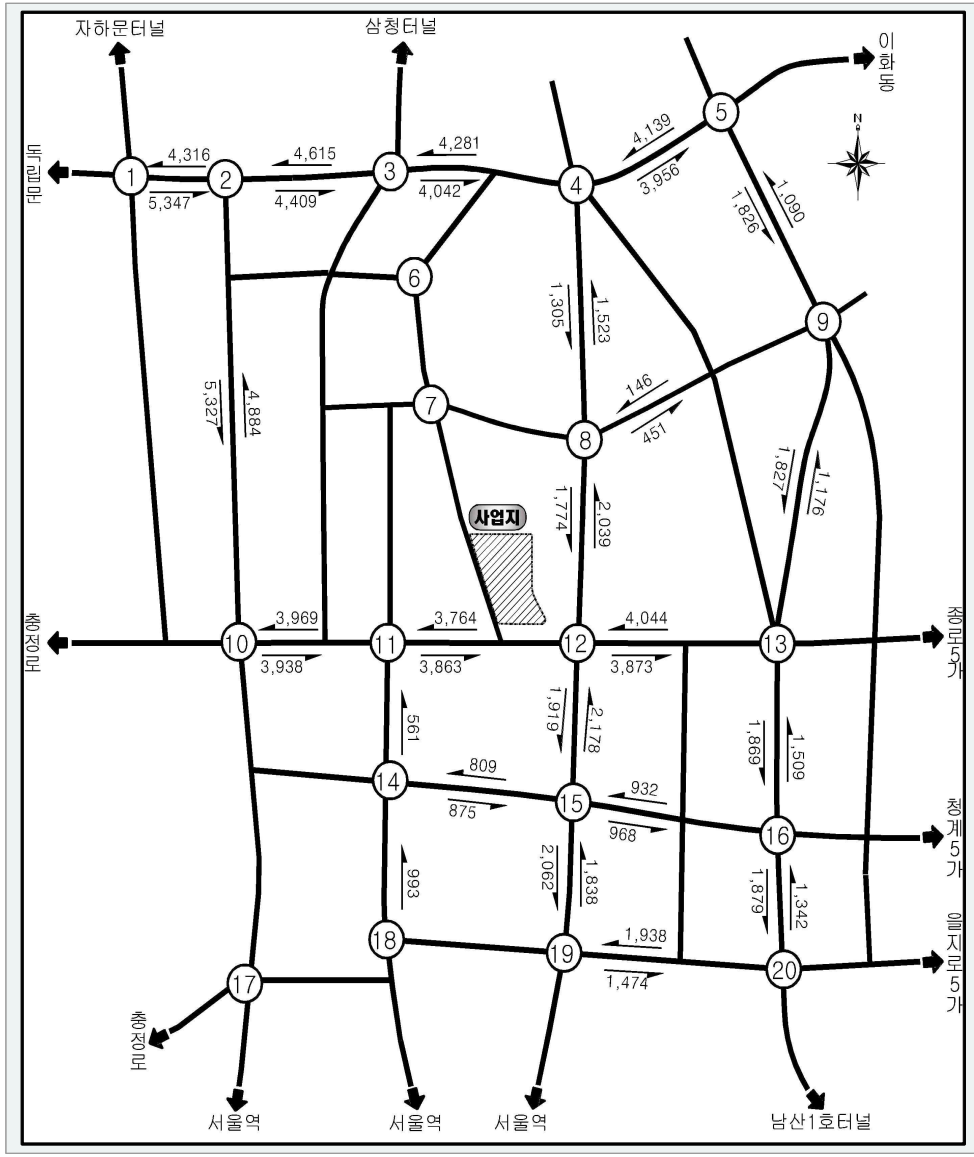
Traffic Status Analysis

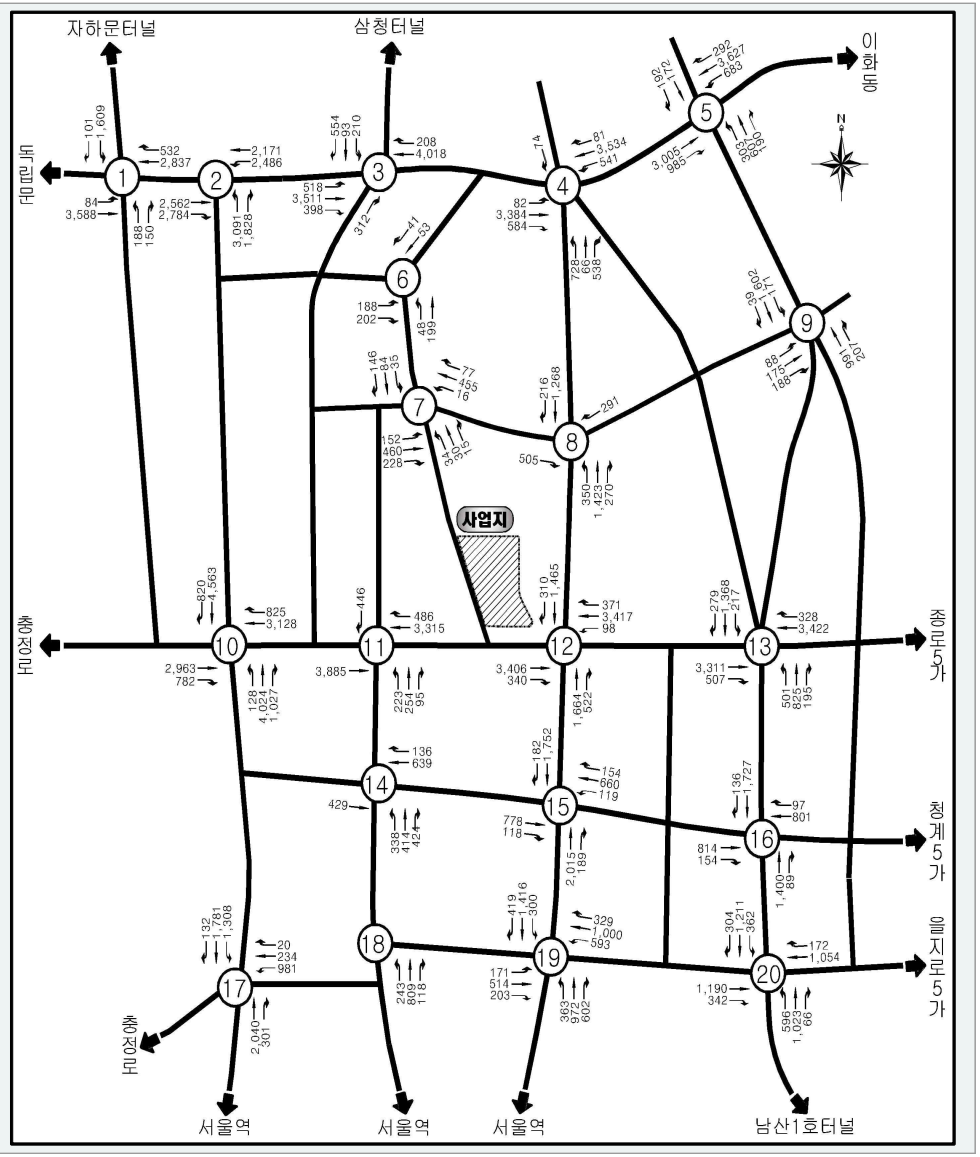
Basic data for traffic analysis

- Installed traffic facilities as presented in the road network map
- Intersection lane operations, geometric structure, signal operation systems
- Traffic volume by vehicle type
- Modal split
- Intersection average delay
- Average vehicle travel speed
- Average occupancy per vehicle and average load tonnage
- Public transport operations and usage status
- Parking facility usage characteristics of similar buildings
- The status of traffic accidents by region and type and the status of accident-prone areas
- Pedestrian and bicycle traffic volume, usage conditions, and issues

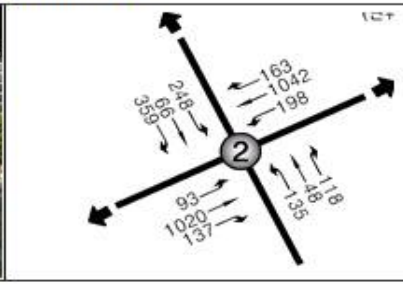
※ Utilization of data published by public institutions and built into DB Systems => Available

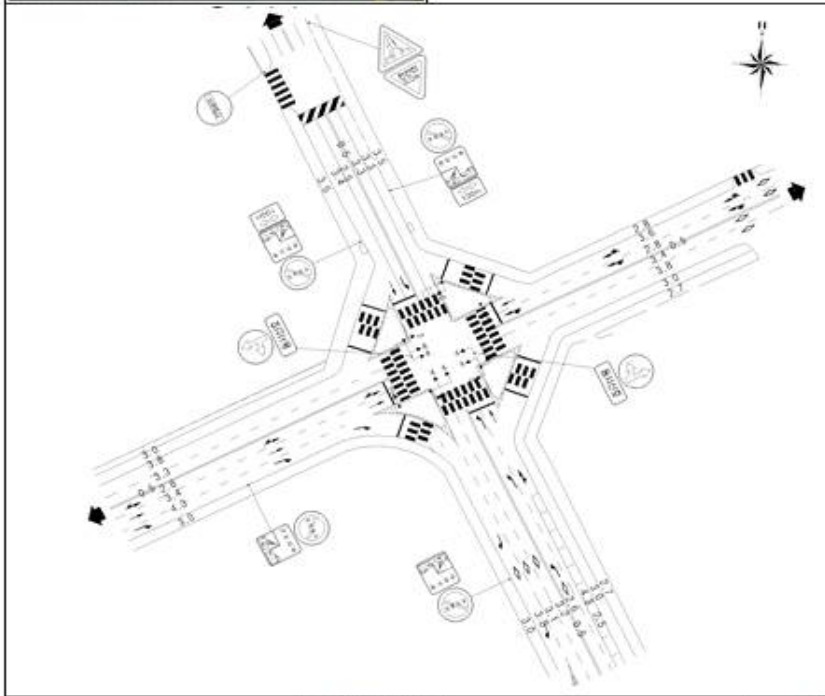
Examples of traffic volume survey





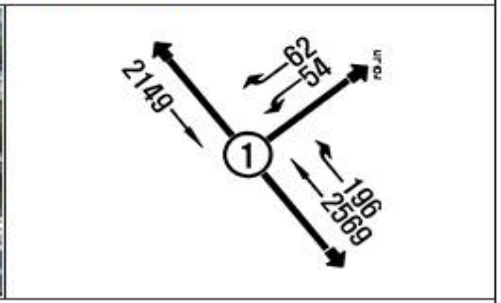
< Jangmi Intersection >

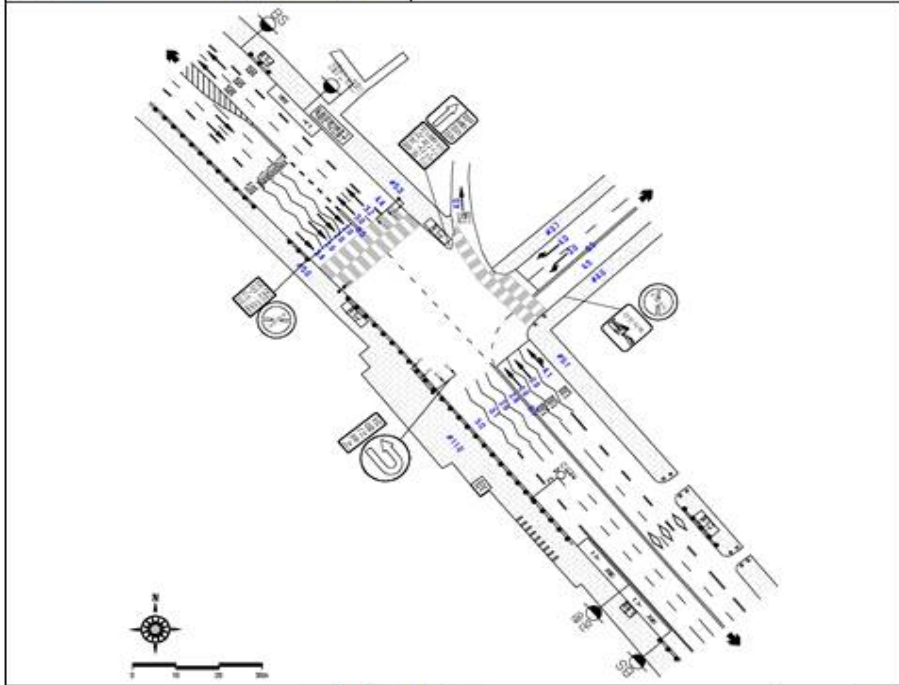




signal operation							note
	01	02	03	04	05	cycle	
direction					–	4phase	
phase	19(3)	26(3)	35(3)	48(3)	–	140sec	

< Muac APT intersection >

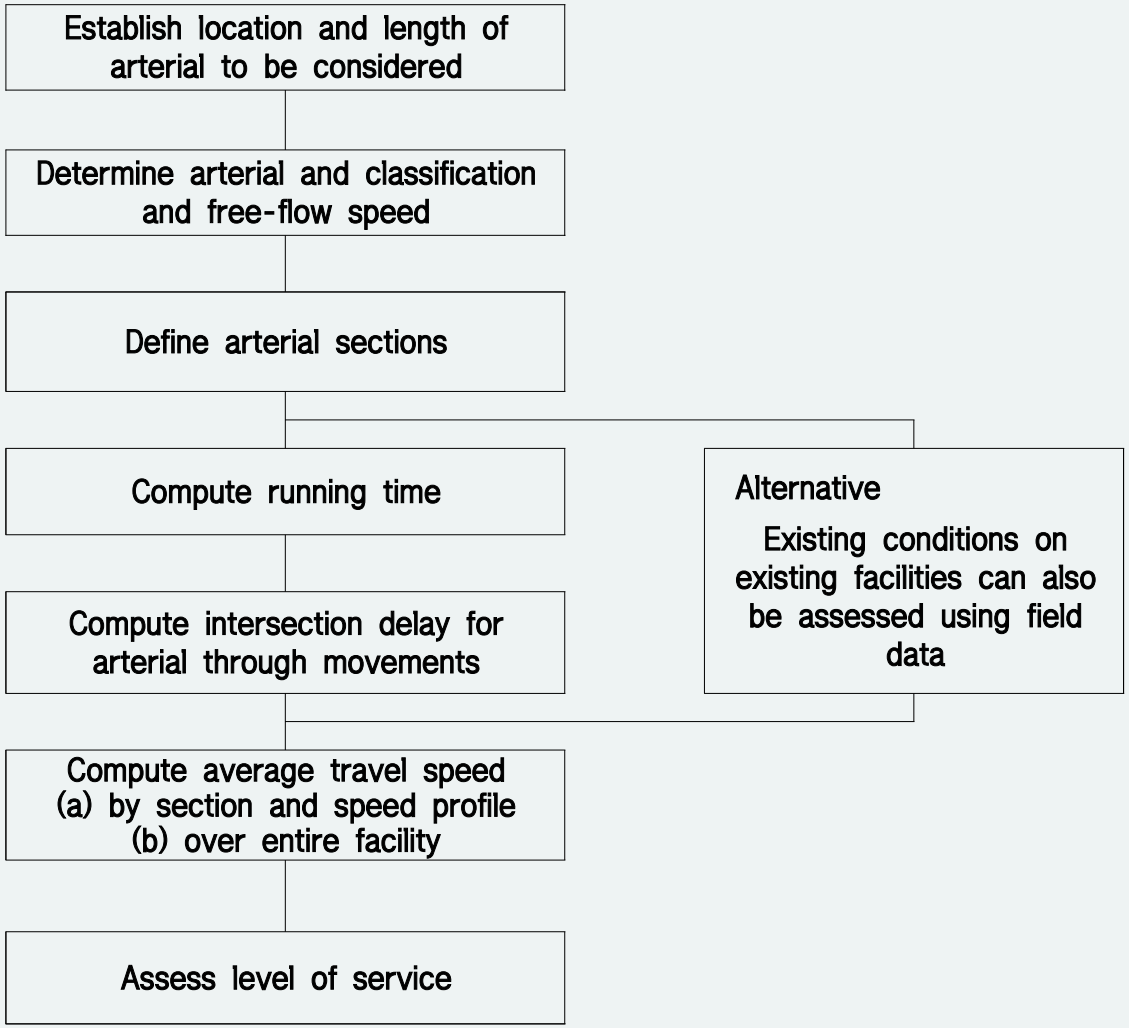




signal operation							note
	01	02	03	04	05	cycle	
direction			–	–	–	2phase	
phase	33(3)	181(3)	–	–	–	220sec	

Road traffic analysis

◦ Analysis process of urban and suburban arterial streets



◦ Analysis result cases of urban streets

		Dir.	Len. (km)	Traffic volume (pcu)	Average travel time (sec/veh)	Average travel speed (km/h)	LOS
Sajik-ro	①~②	→	0.21	5,347	35.67	21.19	D
		←	0.21	4,316	31.63	23.90	D
Yulgok-ro	②~③	→	0.25	4,409	24.11	37.32	C
		←	0.25	4,615	29.62	30.38	C
	③~④	→	0.33	1,042	41.22	28.82	D
		←	0.33	4,281	38.17	31.13	C
	④~⑤	→	0.32	3,956	67.71	17.01	E
		←	0.32	4,139	40.50	28.45	D
Jong-ro	⑩~⑪	→	0.21	3,938	31.80	23.77	D
		←	0.21	3,969	33.28	22.72	D
	⑪~⑫	→	0.32	3,863	36.92	31.20	C
		←	0.32	3,764	33.78	34.10	C
	⑫~⑬	→	0.42	3,873	45.52	33.22	C
		←	0.42	4,044	50.23	30.10	C
Cheong gyecheon-ro	⑭~⑮	→	0.32	875	39.68	29.03	C
		←	0.32	809	44.05	26.15	D
	⑮~⑯	→	0.43	968	52.73	29.36	C
		←	0.43	934	48.32	32.03	C
Sejong-ro	②~⑩	→	0.59	5,327	64.05	33.16	C
		←	0.59	4,884	75.78	28.03	D

		Dir.	Len. (km)	Traffic volume (pcu)	Average travel time (sec/veh)	Average travel speed (km/h)	LOS
Ujeongguk-ro	④~⑧	→	0.37	1,305	38.52	34.58	C
		←	0.37	1,523	47.93	27.79	D
	⑧~⑫	→	0.21	1,774	40.35	18.74	E
		←	0.21	2,039	30.27	24.97	D
Namdaemun-ro	⑫~⑮	→	0.15	1,919	27.33	19.75	E
		←	0.15	2,178	36.96	14.61	E
	⑮~⑲	→	0.31	2,062	51.49	21.67	D
		←	0.31	1,838	36.30	30.75	C
Samil-ro	⑤~⑨	→	0.40	1,826	40.80	35.29	C
		←	0.40	1,090	83.60	17.22	E
	⑨~⑬	→	0.16	1,827	36.77	15.67	E
		←	0.16	1,176	30.25	19.04	E
	⑬~⑯	→	0.23	1,869	36.31	22.80	D
		←	0.23	1,509	43.51	19.03	E
	⑯~⑳	→	0.22	1,879	38.03	20.83	D
		←	0.22	1,342	28.82	27.48	D
Mugyodong-gil	⑭~⑪	→	0.15	561	42.24	12.78	E
	⑱~⑭	→	0.23	993	44.85	18.46	E
Eulji-ro	⑲~⑳	→	0.43	1,474	56.69	27.31	D
		←	0.43	1,938	52.05	29.74	C

◦ Analysis process of freeways

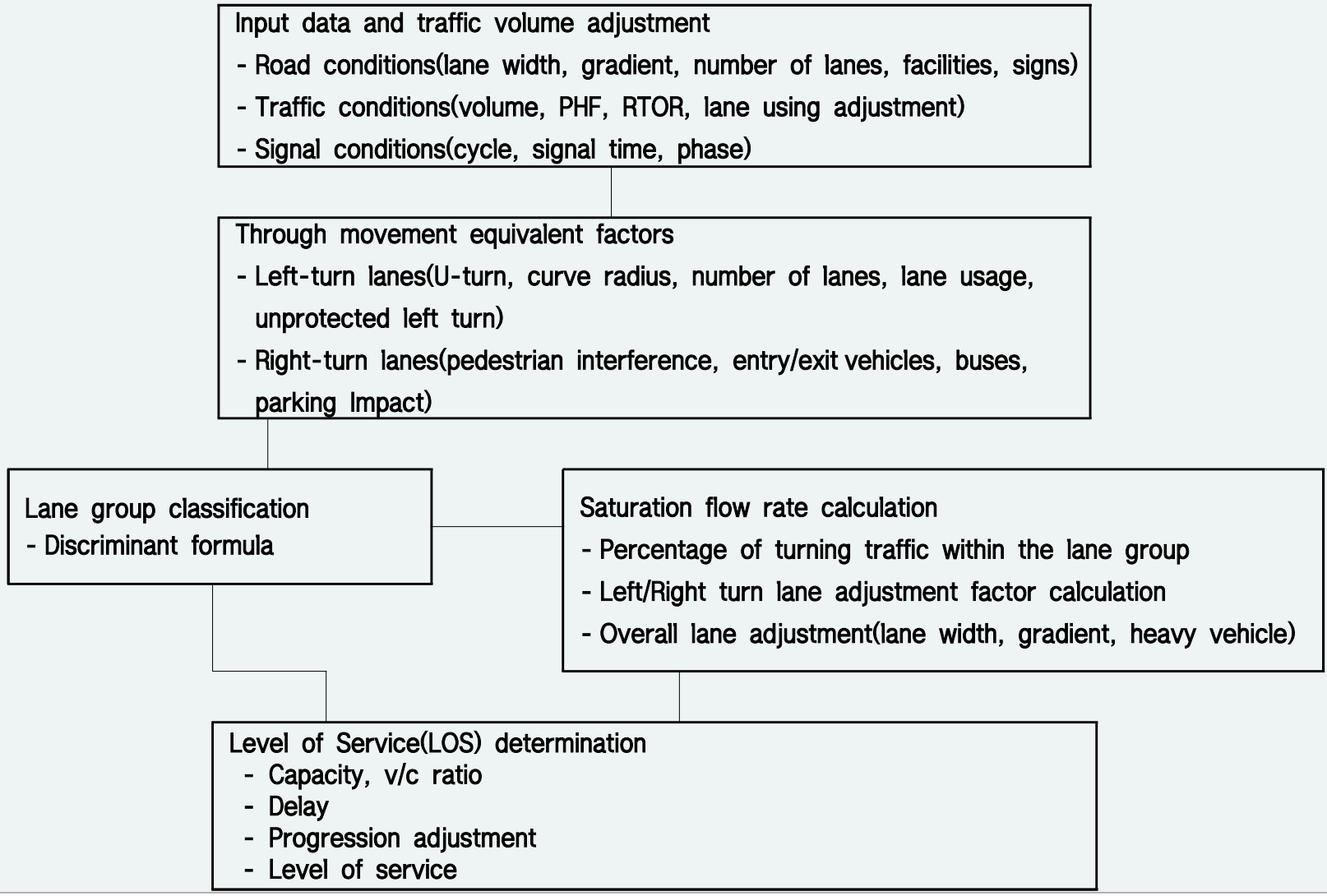
- Specification of the road conditions and traffic conditions of the analyzed road
- Calculation of the relevant adjustment factors(f_W , f_{HV}) for the given road and traffic conditions
- Converting the traffic volume(V) into 15-min passenger-car equivalent flow rate(Vp)
- Calculation the capacity(C) based on the given road and traffic conditions
- Computing the volume/capacity ratio(Vp/C) using the traffic volume(Vp) and capacity(C)
- Determination of the level of service (LOS) based on the volume/capacity ratio

◦ Other multi-lane rural roads, two-lane highways, ramp and ramp junctions

- Applying the respective analysis methods

Intersection traffic flow analysis

◦ The process of signalized Intersection analysis



◦ Analysis result cases of signalized Intersections

Inter section	Traffic volume (veh/hr)	Average control/ operating delay(sec)	LOS	Note
①	8,673	65.3	D	
②	14,922	124.2	F	
③	9,823	106.7	F	
④	9,612	118.5	F	
⑤	10,056	96.4	E	
⑥	717	4.3	A	
⑦	1,732	12.1	B	
⑧	4,323	23.2	B	
⑨	3,461	28.6	B	
⑩	18,260	163.3	F	

Inter section	Traffic volume (veh/hr)	Average control/ operating delay(sec)	LOS	Note
⑪	8,706	144.8	F	
⑫	11,593	126.3	F	
⑬	10,953	169.7	F	
⑭	2,718	30.4	C	
⑮	5,967	27.5	B	
⑯	5,218	31.8	C	
⑰	6,797	33.9	C	
⑱	1,170	7.2	A	
⑲	6,882	172.2	F	
⑳	6,320	57.6	D	

◦ Other unsignalized intersections and roundabouts follow

- Applying the respective analysis methods

2. Future Traffic Demand Analysis

The Concept of Future Traffic Demand Analysis

Structure of future traffic demand analysis

◦ Future traffic demand without development Implementation

: Current traffic demand + naturally increased traffic demand + demand reflecting surrounding development

◦ Future traffic demand with development Implementation

: Future traffic demand without Implementation + generated traffic demand due to development

◦ Compare and review the traffic demand with and without development to analyze the traffic impact

Demand estimation methods

◦ Generally using the 4-steps traffic demand forecasting model for future traffic demand estimation

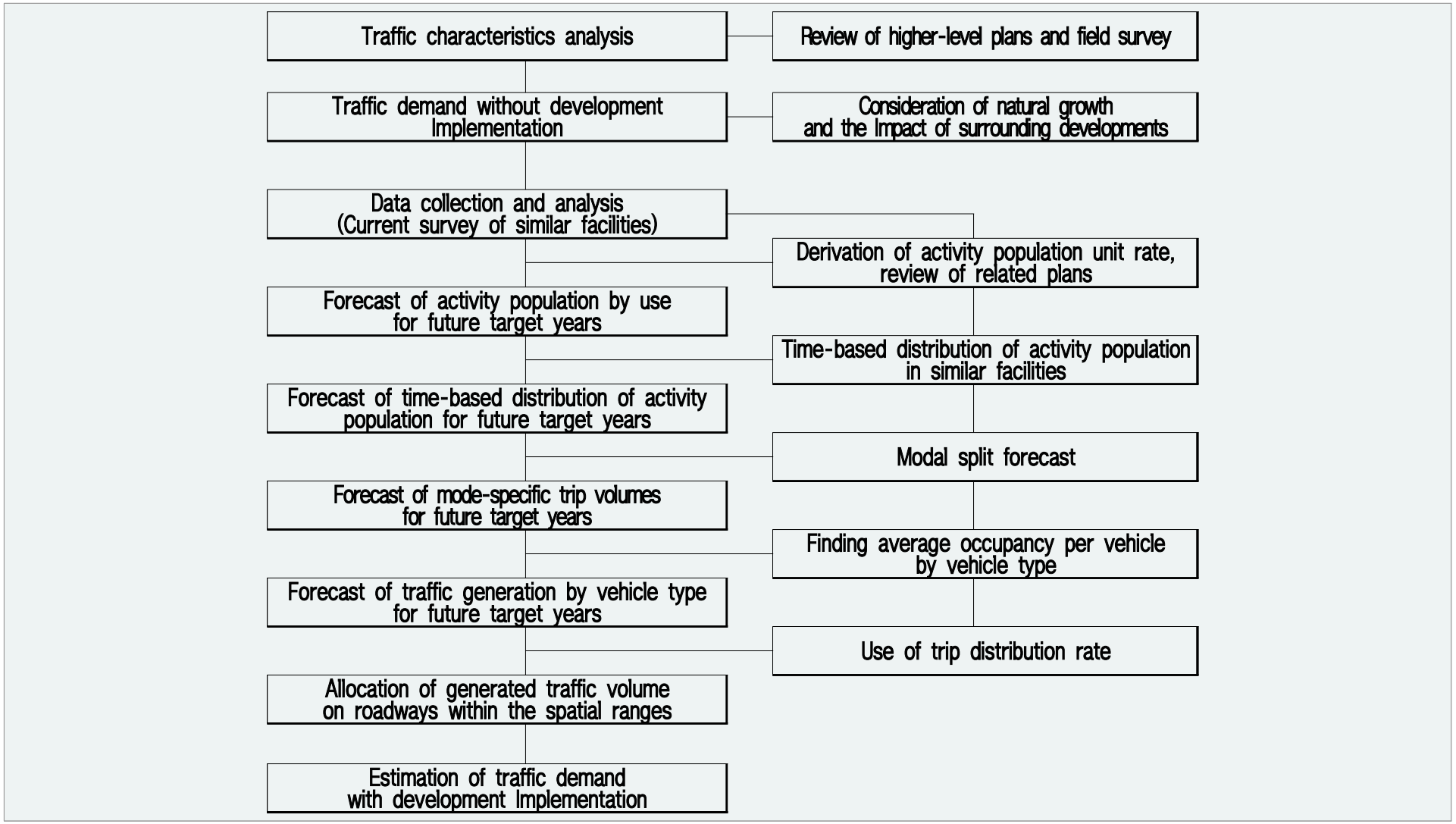
- Trip Generation, Trip Distribution, Mode Choice, Trip Assignment

◦ General future demand estimation process for building constructions and development projects

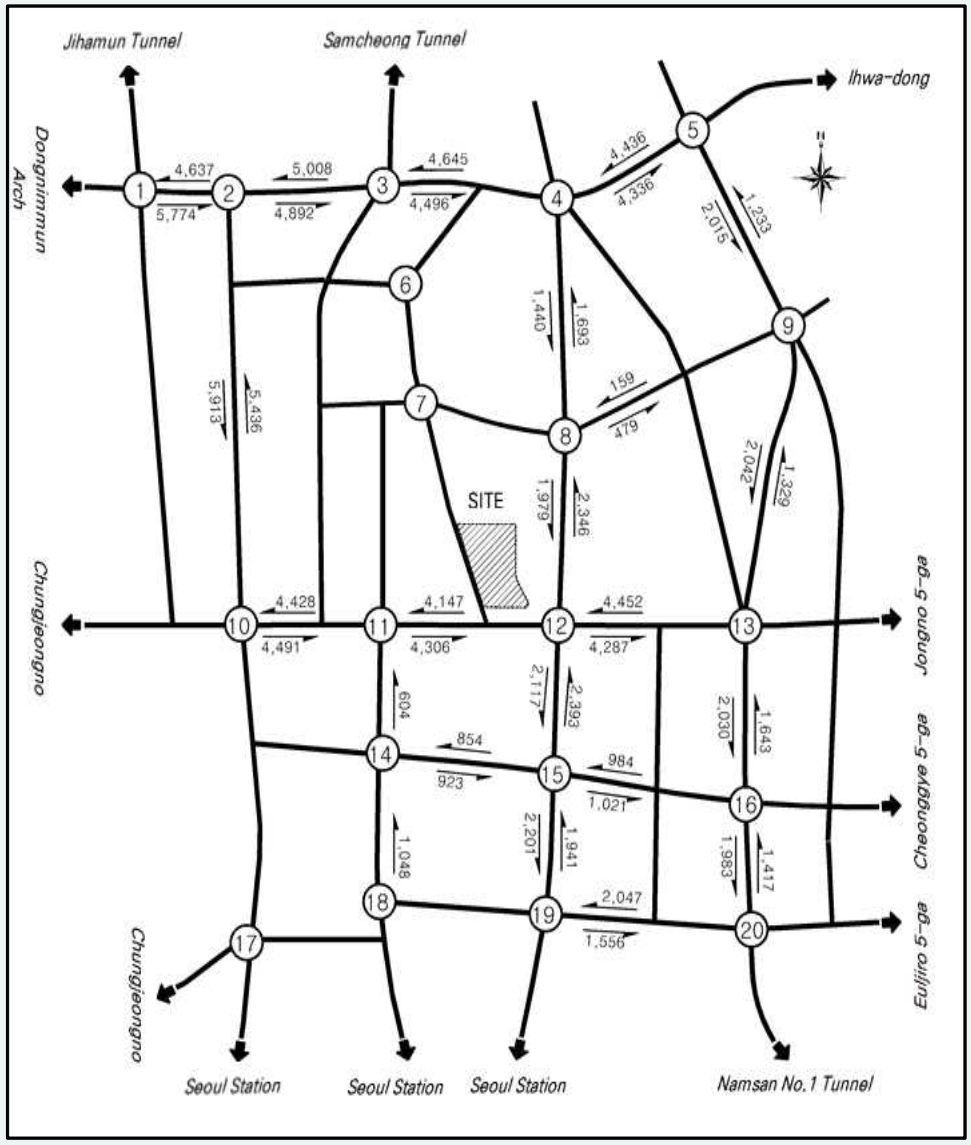
- For building constructions : future demand estimation without using OD and network data
- For development projects : future demand estimation using OD and network data

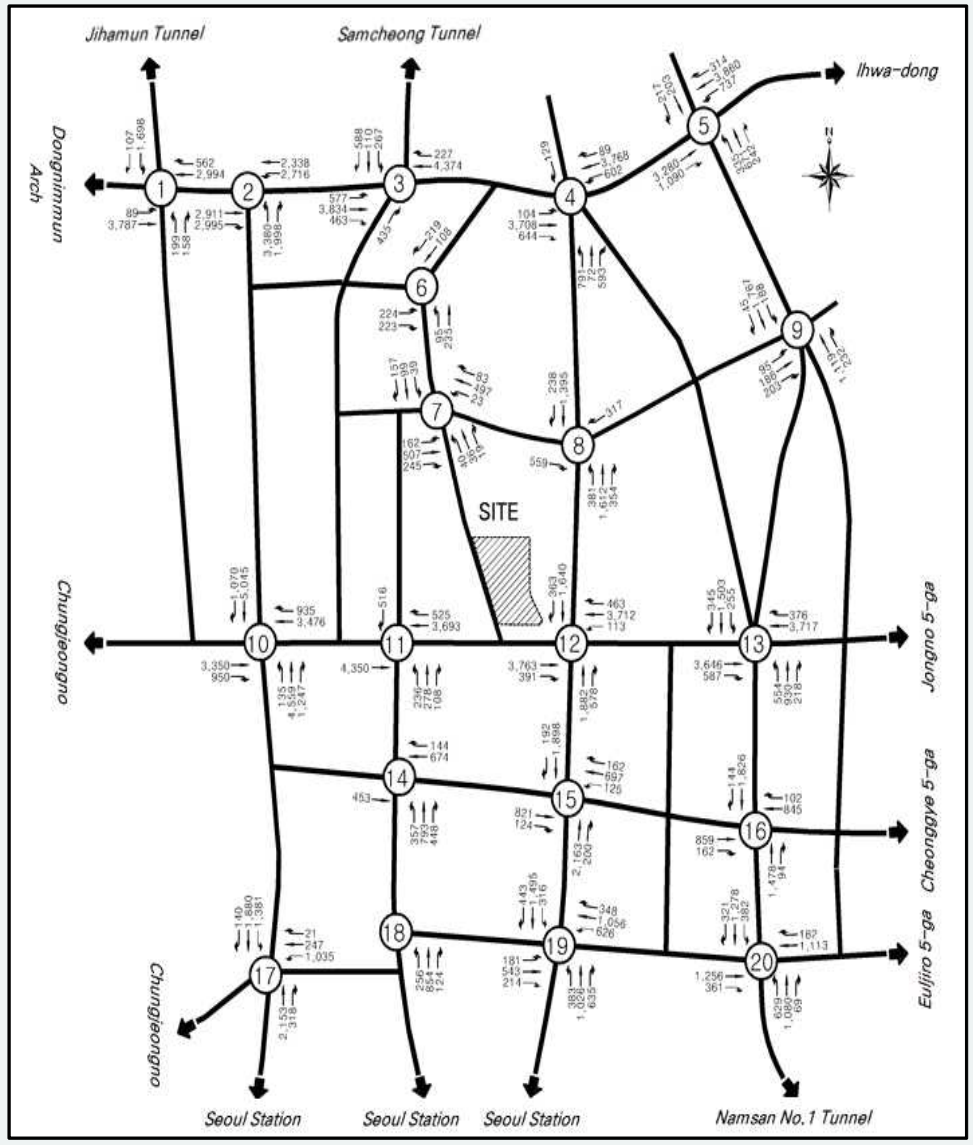
Future Traffic Demand Estimation Method

Future traffic demand estimation process for building construction

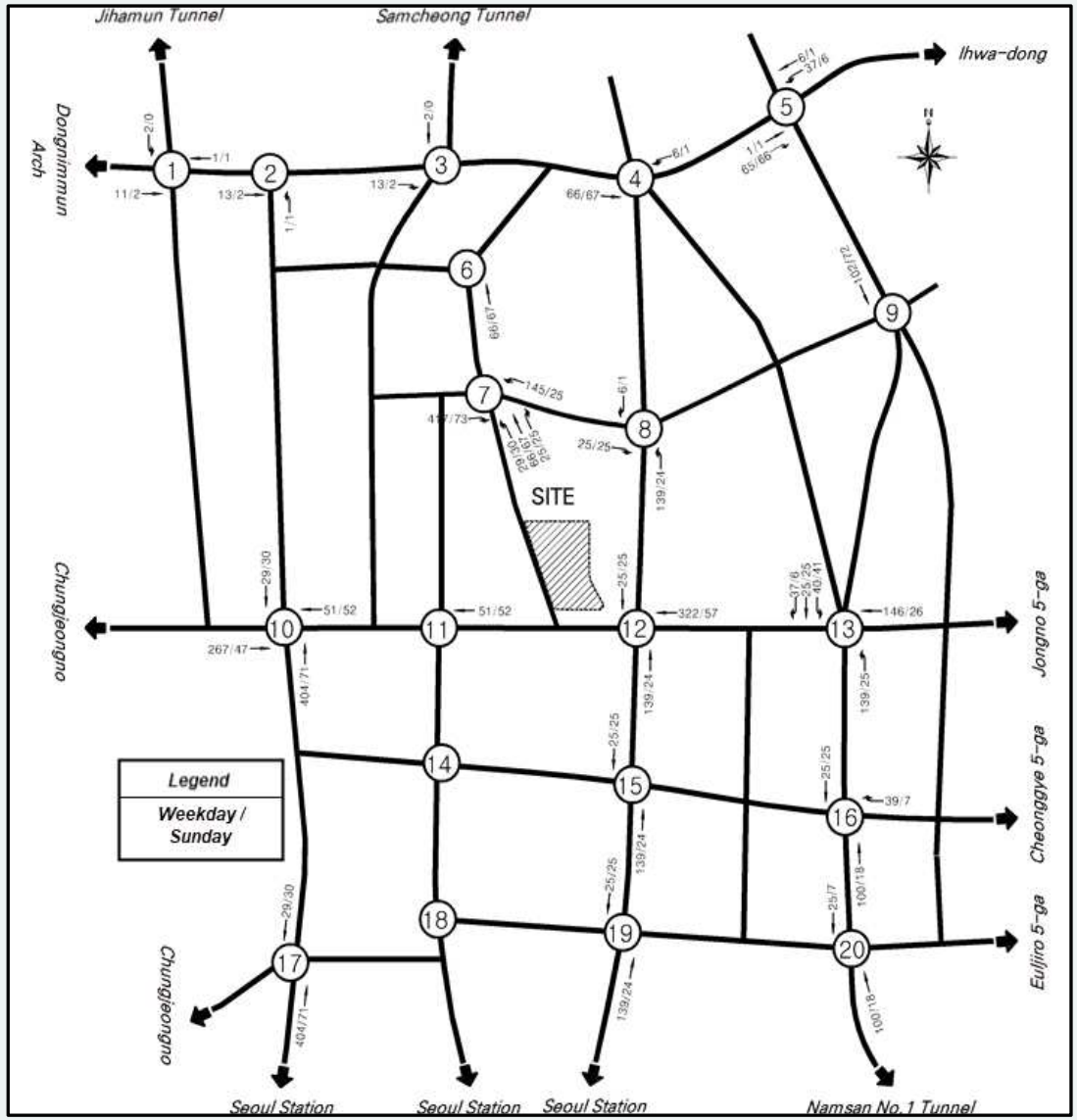


◦ Estimated future traffic volume without development implementation

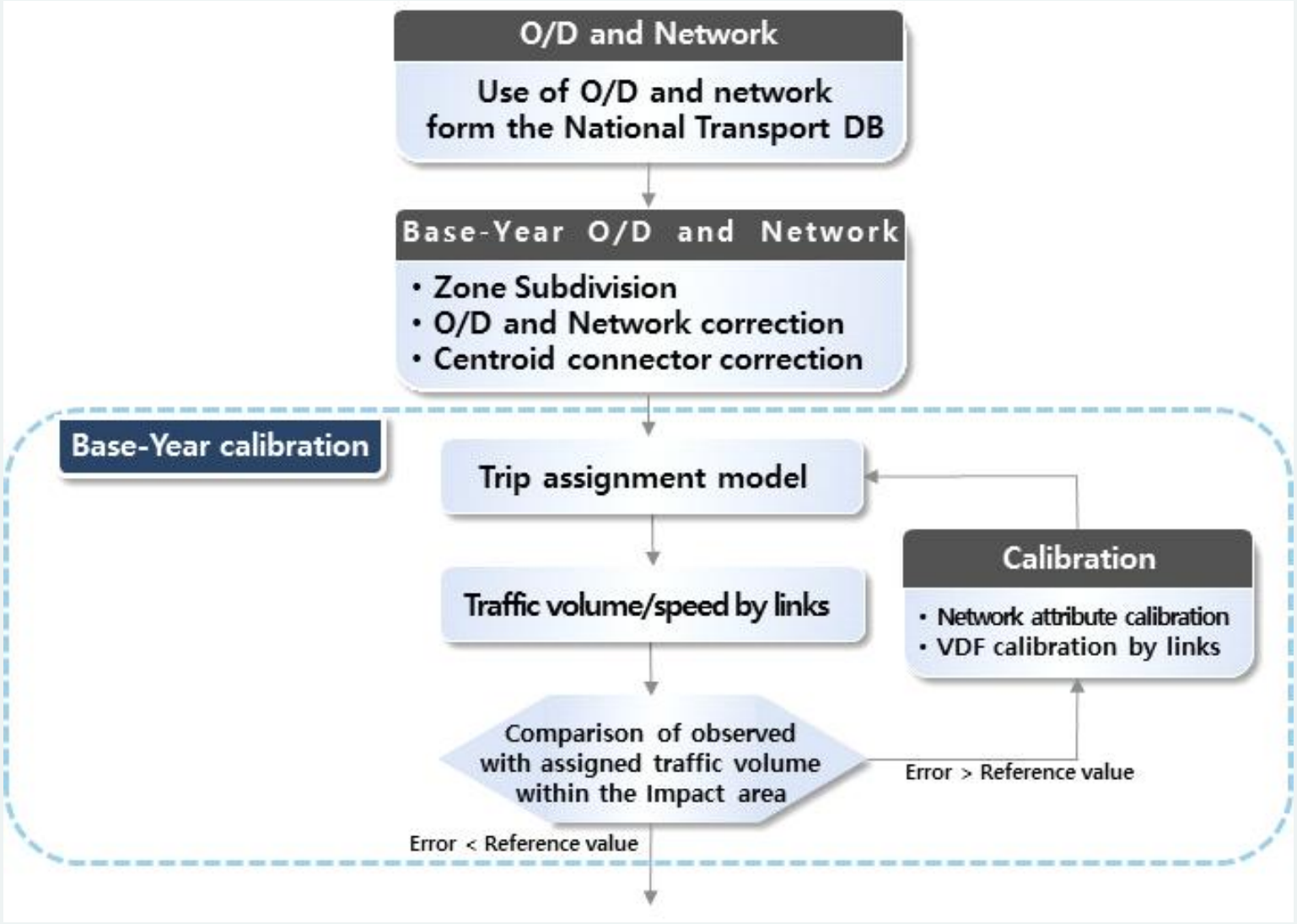


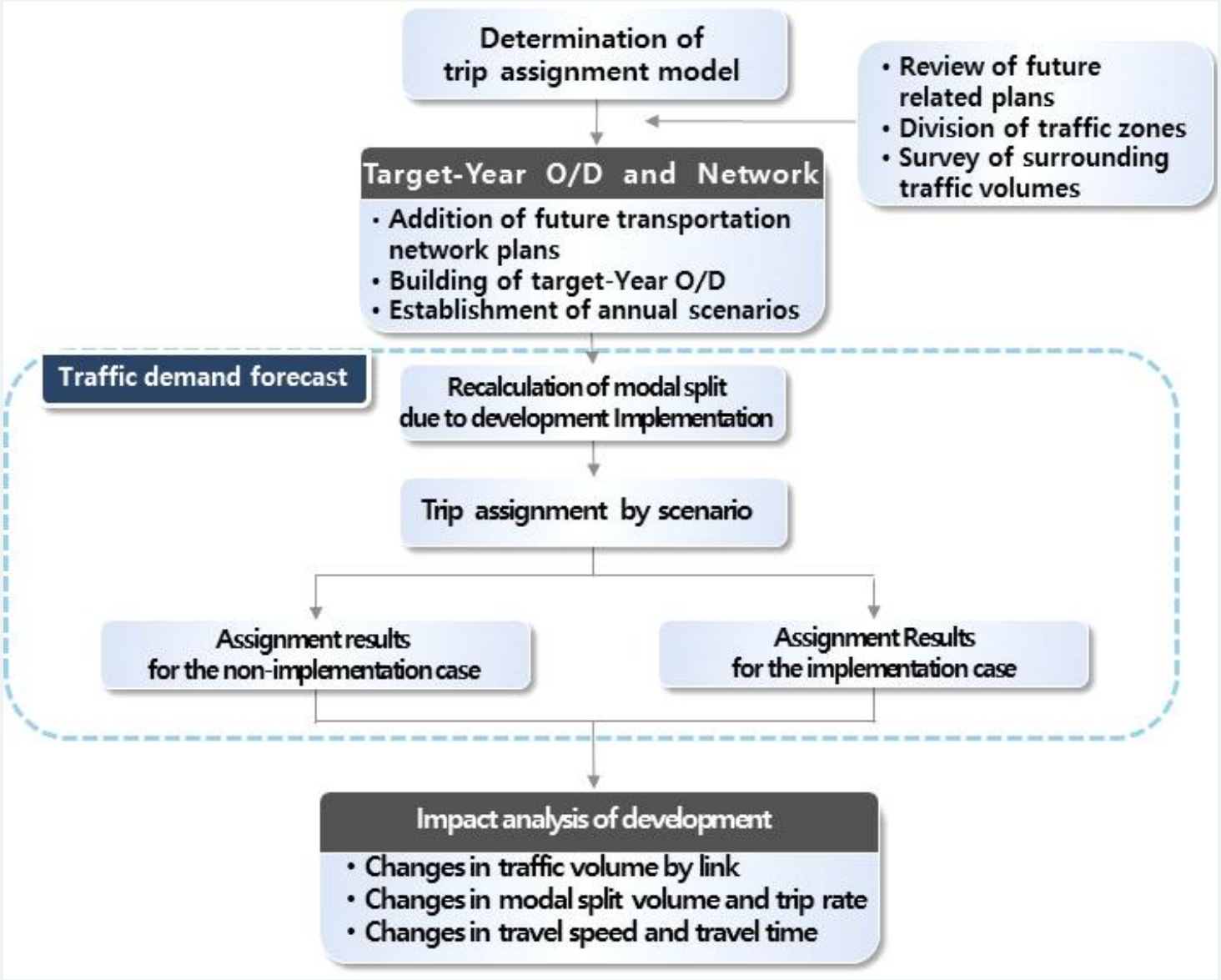


◦ Generated traffic volume for predicting future traffic flow post-development

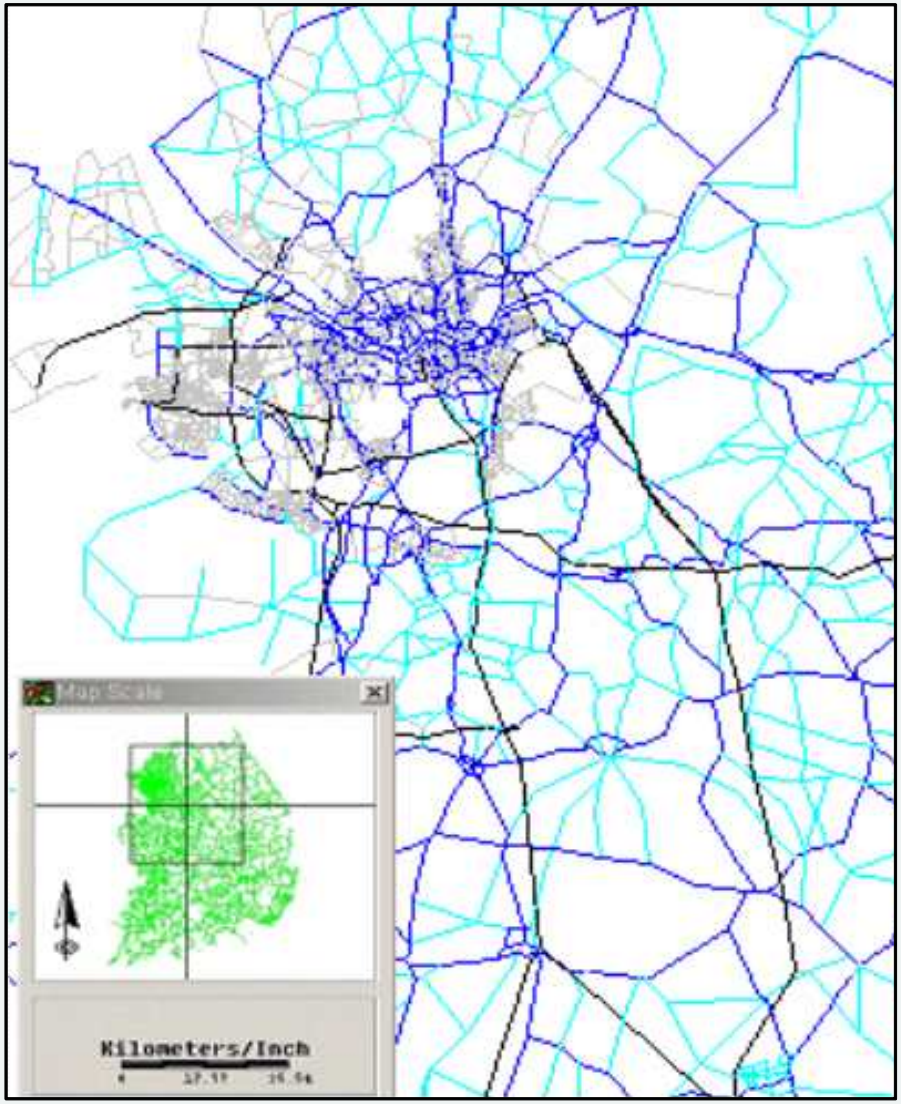


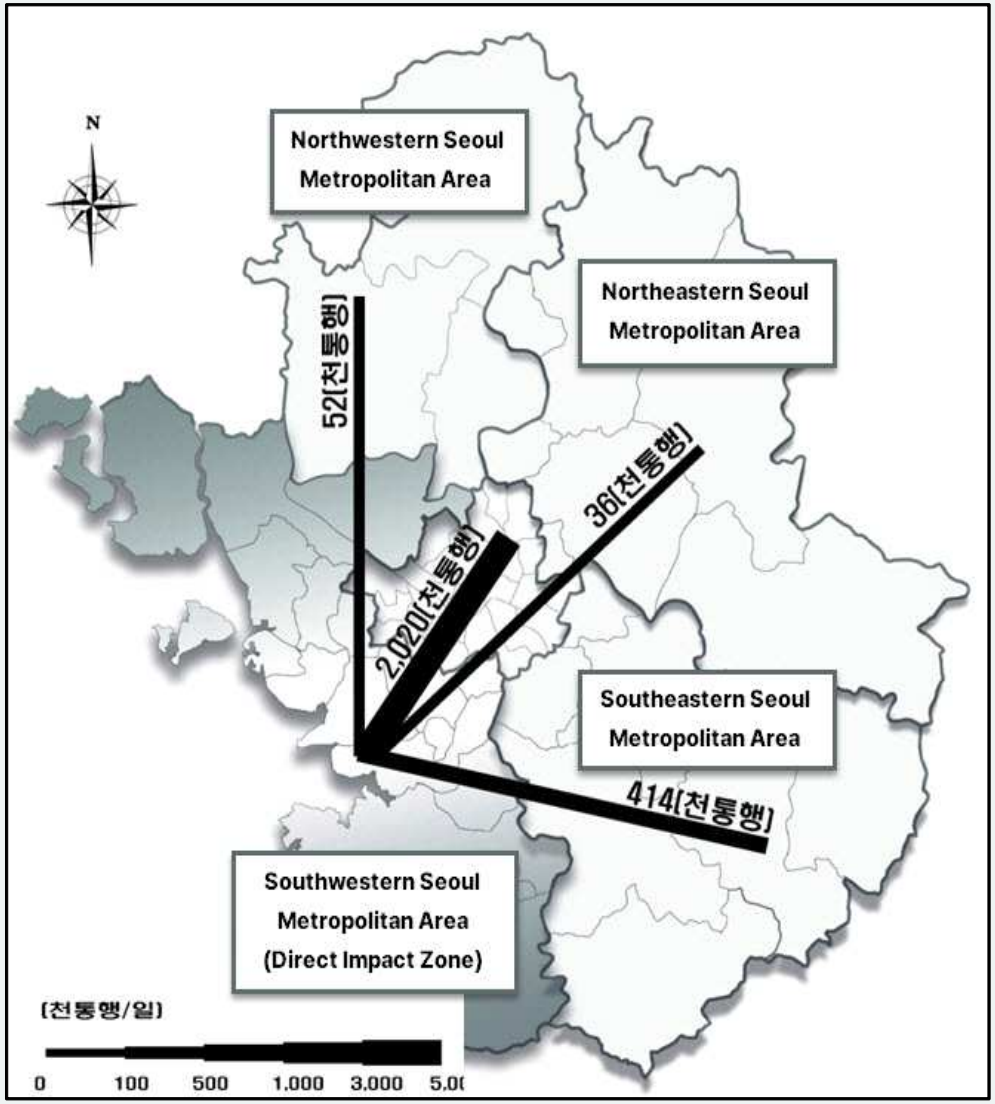
Future traffic demand estimation process for development projects




Determination of trip assignment model
• Review of future related plans
• Division of traffic zones
• Survey of surrounding traffic volumes
Target-Year O/D and Network
• Addition of future transportation network plans
• Building of target-Year O/D
• Establishment of annual scenarios
Traffic demand forecast
Recalculation of modal split due to development Implementation
Trip assignment by scenario
Assignment results for the non-implementation case
Assignment Results for the implementation case
Impact analysis of development
• Changes in traffic volume by link
• Changes in modal split volume and trip rate
• Changes in travel speed and travel time

◦ Examples of network and regional trip distribution





◦ Examples of traffic assignment result using network and OD data

3. The Formulation of Comprehensive Improvement Plan

Traffic Impact Analysis by Development Implementation

Comparison and review of implementation and non-implementation

◦ Comparison of traffic impact in surrounding intersections

Inter-section	Non-implementation (A)		Implementation (B)		B-A (㎞/h)	Inter-section	Non-implementation (A)		Implementation (B)		B-A (㎞/h)
	Delay(sec/veh)	LOS	Delay(sec/veh)	LOS			Delay(sec/veh)	LOS	Delay(sec/veh)	LOS	
①	155.0	F	155.3	F	0.3	⑪	360.9	FFF	373.1	FFF	12.2
②	151.8	F	151.8	F	0	⑫	226.9	FF	275.1	FF	48.2
③	198.2	F	198.3	F	0.1	⑬	293.0	FF	336.4	FF	43.4
④	202.3	F	218.5	F	16.2	⑭	27.6	B	27.6	B	0
⑤	129.5	F	132.7	F	3.2	⑮	28	B	28.5	B	0.5
⑥	5.3	A	5.5	A	0.2	⑯	25.9	B	26.5	B	0.6
⑦	13.3	B	24.1	C	10.8	⑰	35.1	C	110.5	F	75.4
⑧	37.1	C	65.7	D	28.6	⑱	7.3	A	7.3	A	0
⑨	89.6	E	92.9	E	3.3	⑲	194.7	F	214.1	F	19.4
⑩	198.3	F	216.8	F	18.5	⑳	82.1	E	82.1	E	0

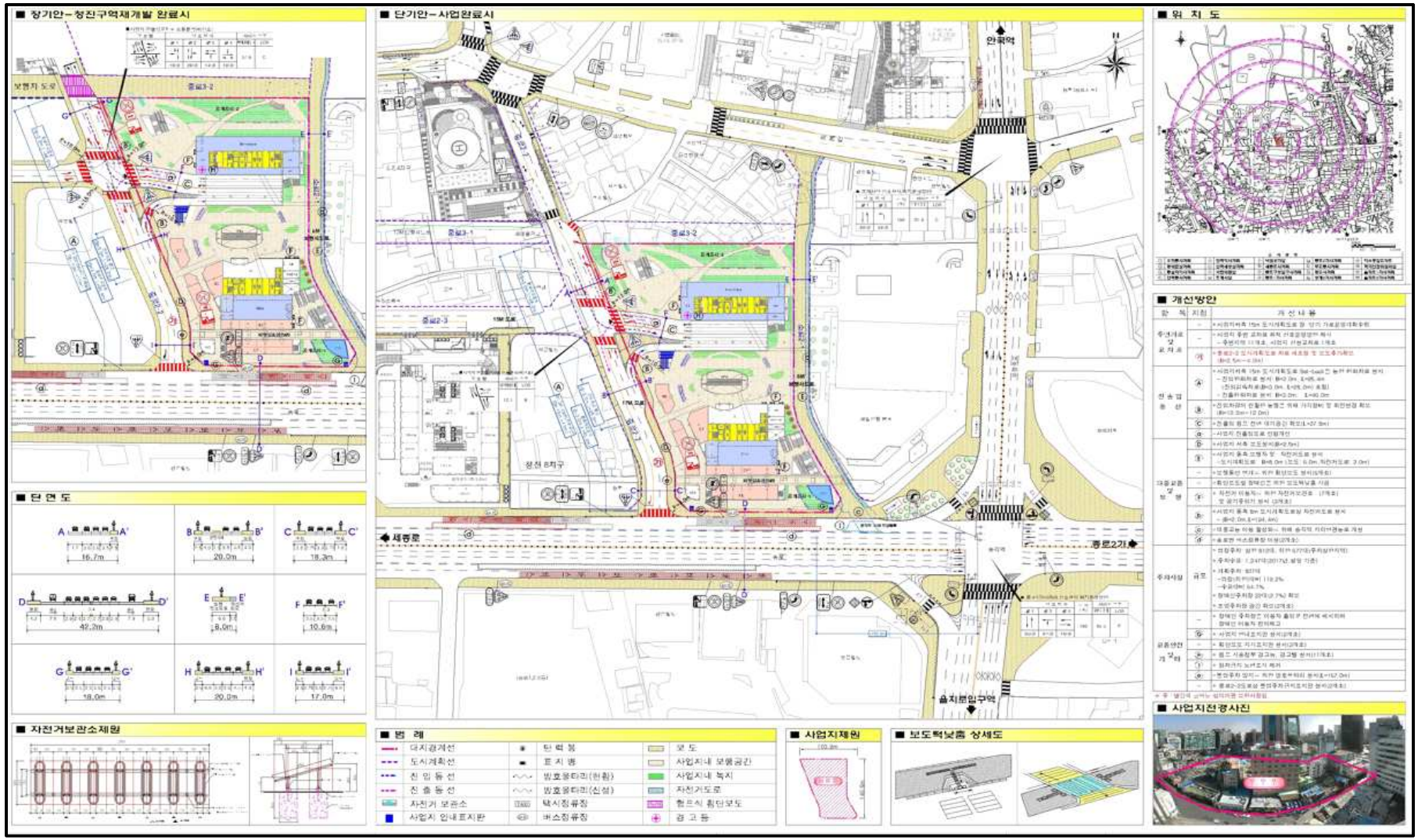
◦ Comparison of traffic impact in surrounding streets

Segment		Dir.	Non Implementation(A)		Implementation (B)		B-A (㎞/h)
			Average travel speed (km/h)	LOS	Average travel speed (km/h)	LOS	
Sajik-ro	①~②	→	20.39	D	20.35	D	-0.04
		←	23.59	D	23.59	D	0
	②~③	→	36.35	C	36.33	C	-0.02
		←	29.73	C	29.73	C	0
Yulgok-ro	③~④	→	26.45	D	26.09	D	-0.36
		←	30.82	C	30.82	C	0
	④~⑤	→	16.6	E	16.44	E	-0.16
		←	26.89	D	26.85	D	-0.04
Jong-ro	⑩~⑪	→	20.86	D	18.97	E	-1.89
		←	22.43	D	22.36	D	-0.07
	⑪~⑫	→	30.83	C	30.83	C	0
		←	33.67	C	33.43	C	-0.24
	⑫~⑬	→	32.94	C	32.94	C	0
		←	28.37	D	21.45	D	-6.92
Cheonggyecheon-ro	⑭~⑮	→	29.02	C	29.02	C	0
		←	26.11	D	26.11	D	0
	⑮~⑯	→	29.31	C	29.31	C	0
		←	31.98	C	31.98	C	0
Sejong-ro	②~⑩	→	32.91	C	32.91	C	0
		←	27.91	D	27.86	D	-0.05

Segment		Dir.	Non Implementation(A)		Implementation (B)		B-A (㎞/h)
			Average travel speed (km/h)	LOS	Average travel speed (km/h)	LOS	
Ujeongguk-ro	④~⑧	→	34.39	C	34.39	C	0
		←	27.74	D	27.74	D	0
	⑧~⑫	→	18.69	E	18.69	E	0
		←	24.21	D	23.75	D	-0.46
Namdaemun-ro	⑫~⑮	→	19.7	E	19.7	E	0
		←	14.54	E	14.49	E	-0.05
	⑮~⑲	→	21.66	D	21.63	D	-0.03
		←	30.74	C	30.68	C	-0.06
Samil-ro	⑤~⑨	→	35.19	C	35.13	C	-0.06
		←	16.91	E	16.91	E	0
	⑨~⑬	→	15.6	E	15.59	E	-0.01
		←	18.95	E	18.95	E	0
	⑬~⑯	→	22.57	D	22.55	D	-0.02
		←	18.97	E	18.87	E	-0.1
	⑯~⑳	→	20.78	D	20.78	D	0
		←	27.42	D	27.37	D	-0.05
Mugyodong-gil	⑭~⑪	→	12.76	E	12.76	E	0
	⑱~⑭	→	18.43	E	18.43	E	0
Eulji-ro	⑲~⑳	→	27.31	D	27.31	D	0
		←	29.74	C	29.74	C	0

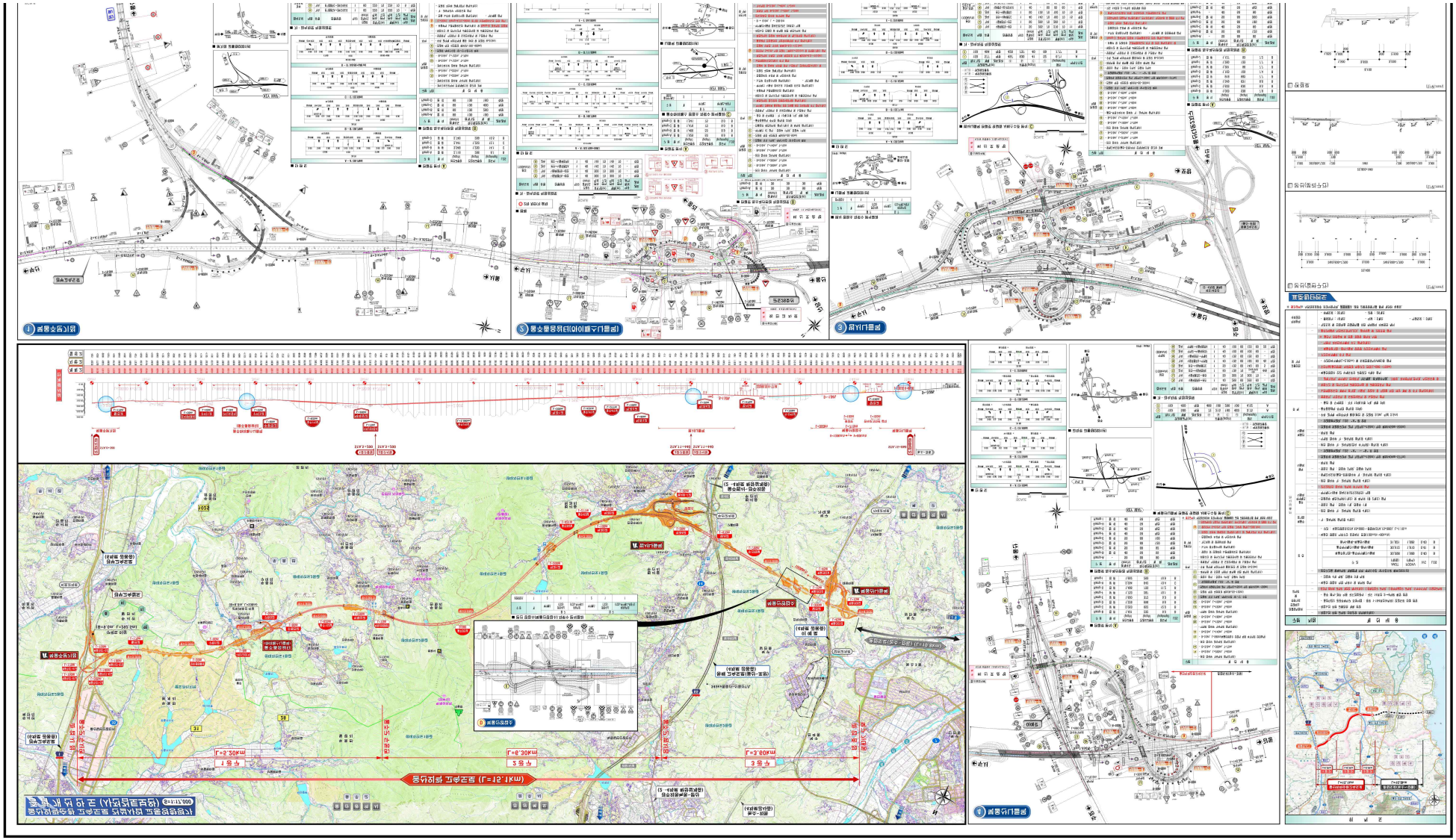
Comprehensive Improvement Plan

Example of building construction for Cheongjin districts 12 to 16 office facilities



Example of residential land development project

Example of freeway construction project



Ⅳ Utilization of Traffic DB in Traffic Impact Assessment

1. Use of Traffic DB in Current Traffic Condition Analysis

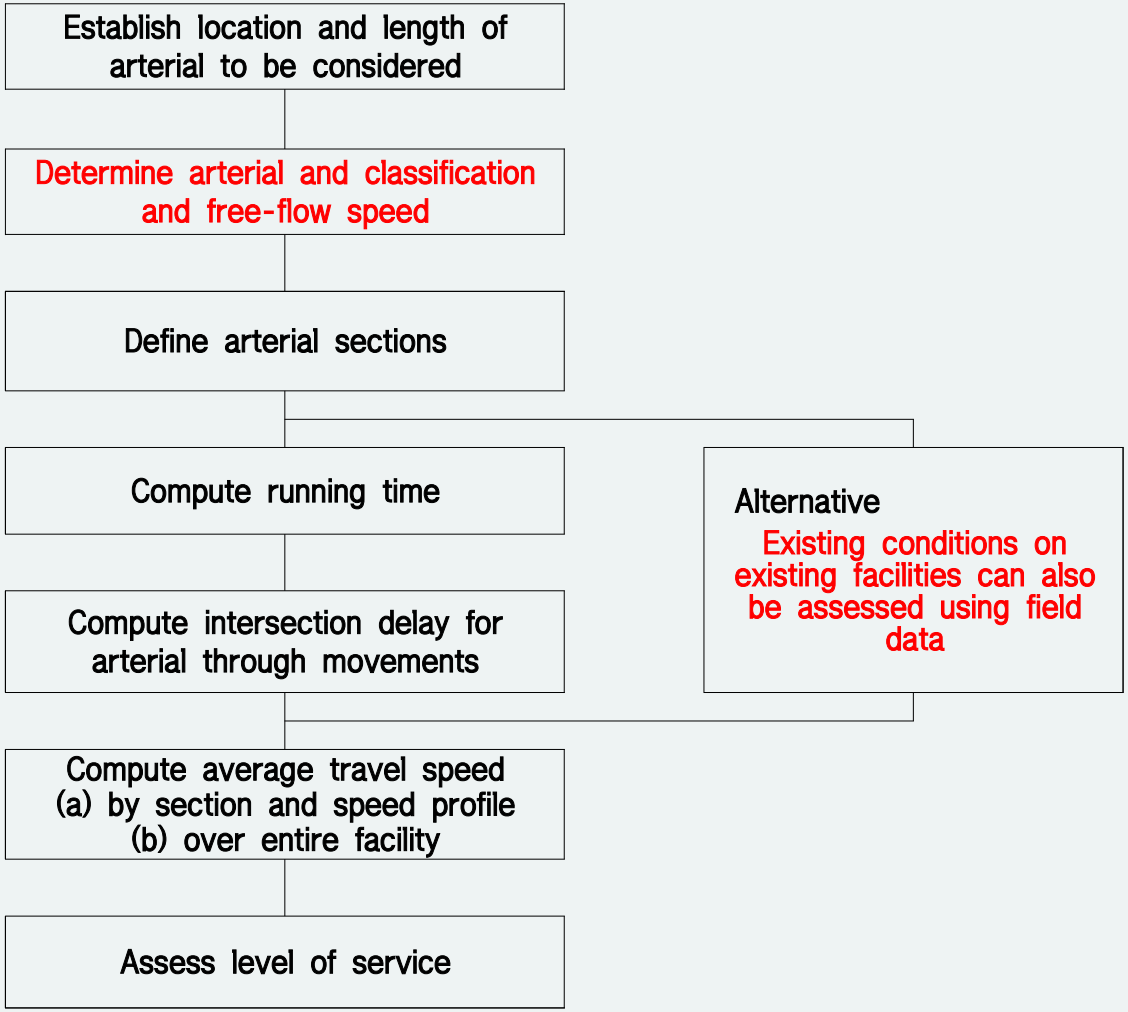
2. Use of Traffic DB in Future Traffic Demand Analysis

1. Use of Traffic DB in Current Traffic Condition Analysis

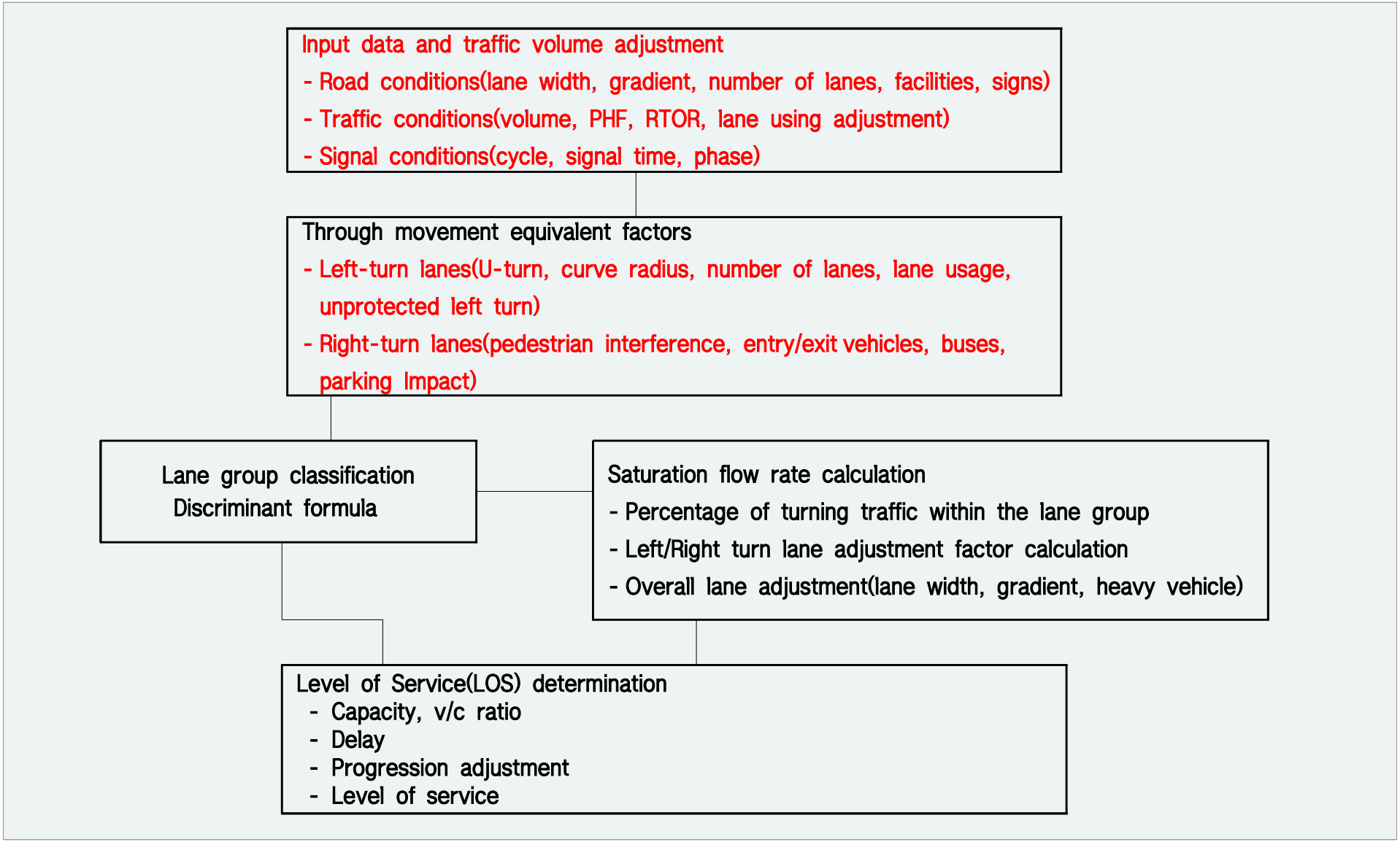
Data from traffic DB available for use in current traffic condition analysis

- Status of installed traffic and road facilities
- Intersection lane operation, geometric structure, signal operation systems
- Traffic volume by vehicle type
- Modal split
- Average delay at intersections and average vehicle travel speed
- Cost(travel cost, fare by mode, toll fee)
- Average occupancy per vehicle and average load tonnage
- Public transport operations and usage status
- Parking facility usage characteristics of similar buildings
- The status of traffic accidents by region and type and the status of accident-prone areas
- Pedestrian and bicycle traffic volume, usage conditions

Use of traffic DB in analysis process of urban and suburban arterial streets



Use of traffic DB in intersection traffic flow analysis process

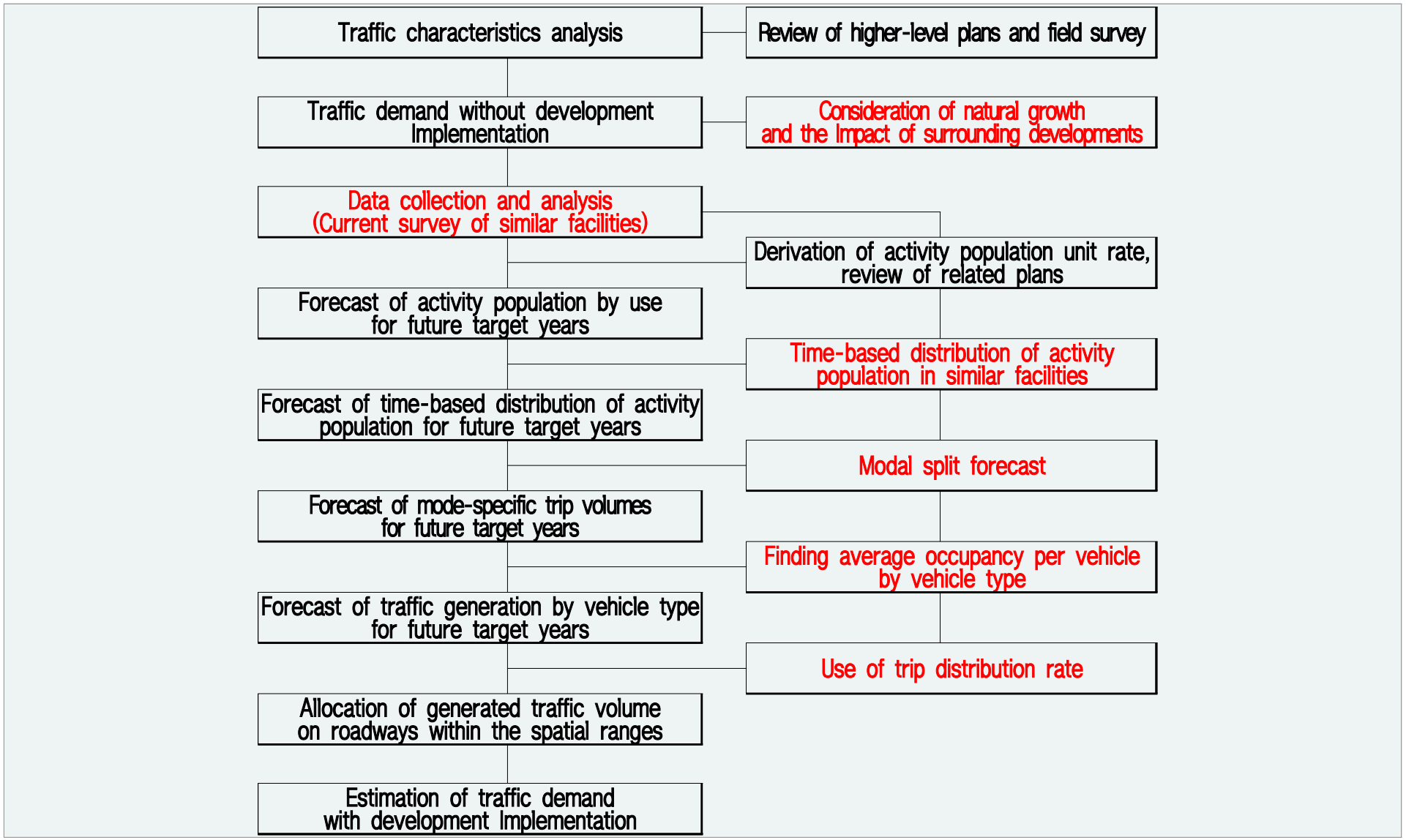


2. Use of Traffic DB in Future Traffic Demand Analysis

Use of traffic DB in traffic impact assessment of building construction project

◦ Trends of natural growth in traffic demand
  - Past traffic volume growth, growth in trips by mode and purpose
◦ Trip generation rates by facility usage type
  - Trip generation rate for user and resident populations
◦ Time-based entry and exit ratios of a facility
◦ Inter-regional trip distribution ratio
◦ Average occupancy per vehicle and average load tonnage
◦ Utilization rate for each transportation mode
◦ Parking generation rates by facility usage type

Use of traffic DB in traffic demand estimation process for building construction

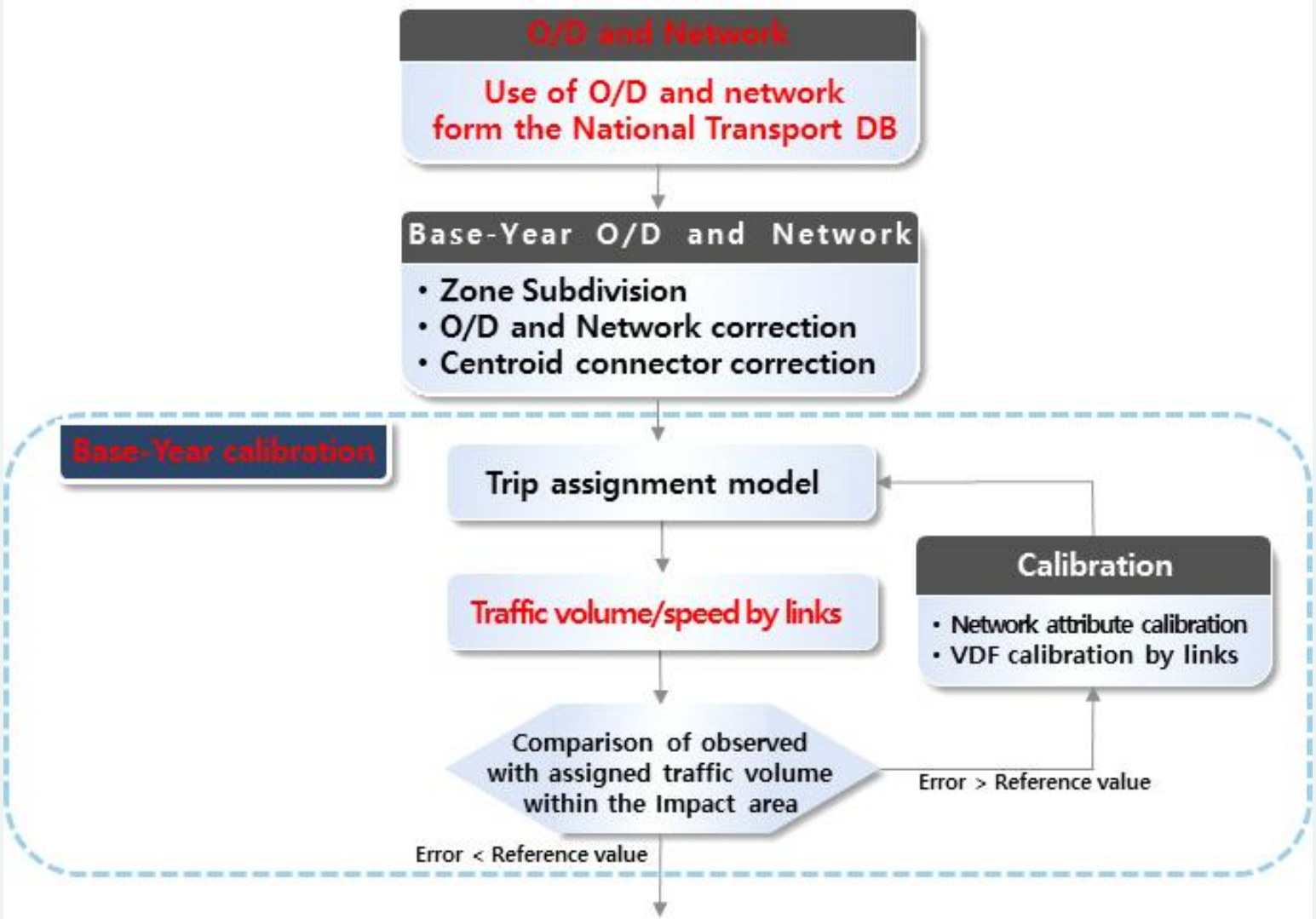


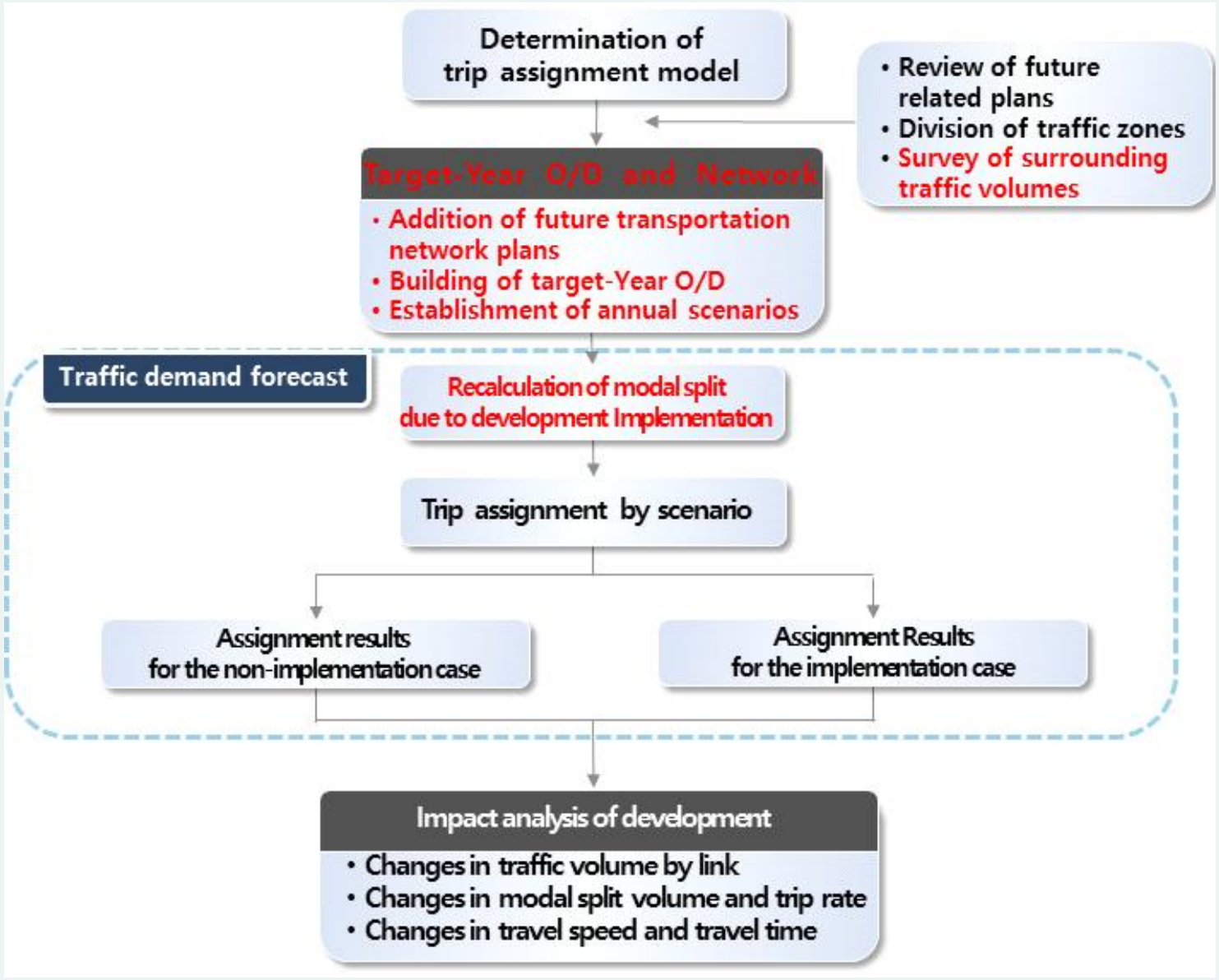
Use of traffic DB in traffic demand estimation process for development project

◦ Base year data
  - Passenger OD and freight OD
  - Road network and transit network
  - traffic volume for calibration
  - Travel speed for calibration
  - Travel cost functions and parameters

◦ Target year data
  - Passenger OD and freight OD
  - Road network and transit network
  - Trip generation rates by usage type
  - Modal split
  - Cost(congestion, logistic, environment, accident)

Use of traffic DB in traffic demand estimation process for development project




Determination of trip assignment model
• Review of future related plans
• Division of traffic zones
• Survey of surrounding traffic volumes
Target-Year O/D and Network
• Addition of future transportation network plans
• Building of target-Year O/D
• Establishment of annual scenarios
Traffic demand forecast
Recalculation of modal split due to development Implementation
Trip assignment by scenario
Assignment results for the non-implementation case
Assignment Results for the implementation case
Impact analysis of development
• Changes in traffic volume by link
• Changes in modal split volume and trip rate
• Changes in travel speed and travel time

VI Conclusion

Expected Benefits of Utilizing Traffic DB

◦ Improved accuracy

: Based on actual field data, it enhances prediction and analysis accuracy

◦ Increased efficiency

: Enables faster analysis of large traffic data, streamlining the assessment process and improving efficiency

◦ Support for policy decisions

: Guiding policy decisions and forming the foundation for traffic improvements and infrastructure design

Future Development Directions

◦ Standardization and integration of traffic DB

: Improving data integration from various institutions to enable consistent and comprehensive analysis

◦ Adoption of big data and AI technologies

: Developing machine learning-based traffic prediction models to continuously enhance assessment accuracy

◦ Strengthening policy and institutional support

: Mandating data-driven decision-making in traffic impact assessments to maximize effectiveness

Thank you !!