



DaCRISS

Workshop/Training on STRADA

Orientation
A: Transport Planning and STRADA
B: Technical process of STRADA

24 March 2010
Danang
JICA Study Team

■ Objectives of the Workshop/Training

- To understand possible function of STRADA in urban transport planning
- To practice step-by-step technical process of STRADA
- To discuss next steps to deepen knowledge and skills

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■ Program

- Day 1 (24/03) Orientation
 - A. Transport planning and STRADA
 - B. Technical process of STRADA
- Day 2 (25/03) C. Installation of STRADA and DaCRISS database
 - D. Various use of Highway Reporter
 - E. Matrix manipulation
 - F. Practice (1)
- Day 3 (26/03) G. Practice (2)
 - Discussion and wrap-up

A. TRANSPORT PLANNING AND STRADA

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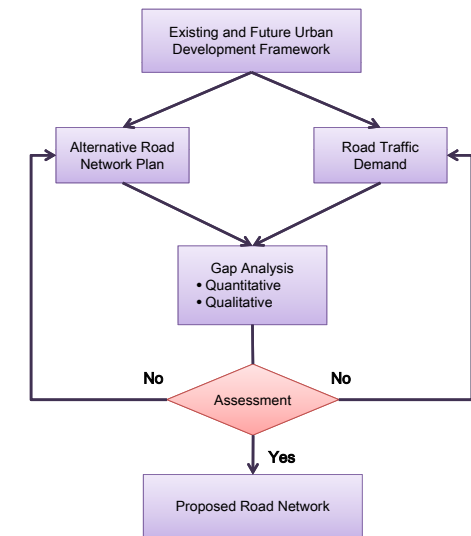
■ Areas of STRADA Application

- Road network analysis/planning
- Road project (road section, bridge, flyover, etc) assessment
- Intersection analysis
- Demand management analysis
- Transit line analysis
- Others

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■ Road Network Planning Process

- Step 1: Build road network plan (based on urban plan)
- Step 2: Prepare demand data (OD trip table)
- Step 3: Analyze network performance to identify supply-demand gaps
- Step 4: Prepare alternative road networks and improvement plans
- Step 5: Repeat Step 3 (feedbacks)
- Step 6: Select optimum alternative



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■ Person Trip Survey

- "Person trip" refers to the movement of a person
- The Person Trip Survey aims to capture all movements on one day by investigating "what kind of person" moved , "when", "for what purpose", "from where" ,"to where", and "by what modes of transportation"

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■ Transport Demand Forecast

■ Future Demand (2008-2025)

- Total daily demand:

2,284 (000) trips/day -> 6,666 (000) trips/day	*2.92
(incl. 745 (000) walk)	
413 (000) PCU/day -> 1241 (000) PCU/day	*2.93
- Average trip length:

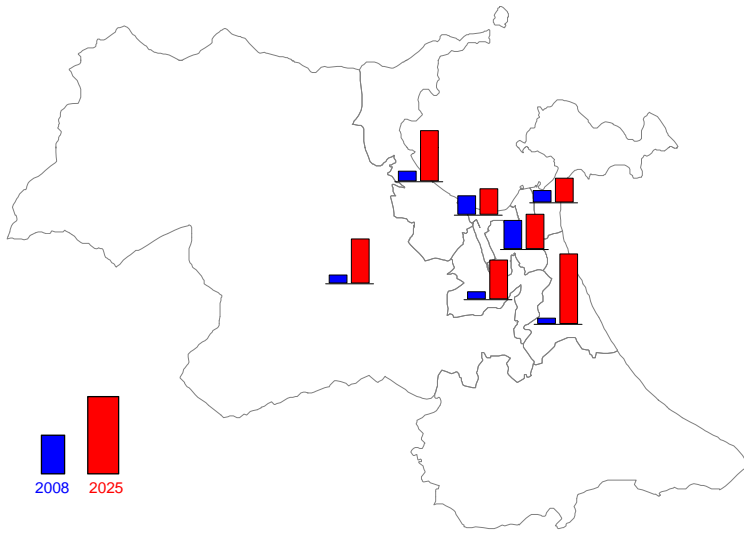
4.59 km -> 8.53 km	*1.86
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Traffic load (PCU-km): $2.93 * 1.86 = 5.45$

assumed modal share: bus 35%, car 15%, M/C 50%, and average occupancy: bus 15, car 2.0, M/C 1.3

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■ Trip Generation and Attraction 2008 and 2025)



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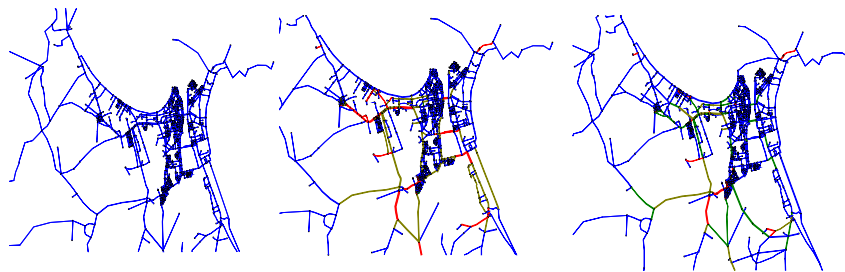
■ Trip Distribution (OD Table)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0	903	757	515	875	437	485	257	545	176	215	429	293	621	
2	1095	0	184	193	247	309	232	579	340	635	686	1267	475	648	
3	733	1901	0	271	141	132	791	165	505	621	716	658	382	807	
4	537	188	269	0	189	120	104	123	630	136	547	1454	1371	1574	
5	537	238	134	102	0	189	168	479	199	453	643	1807	675	1324	
6	458	247	127	121	188	0	122	45	185	430	812	913	414	1526	
7	429	307	835	107	112	124	0	353	234	388	413	685	131	584	
8	255	619	1089	1274	492	459	382	0	345	463	389	339	139	350	
9	703	524	514	3017	294	1915	2200	3474	0	2995	2403	2268	1948	3332	
10	1870	831	601	1362	484	456	341	420	3125	0	752	441	268	526	
11	2279	718	708	1506	630	646	353	325	2842	151	0	658	304	654	
12	4284	1310	662	1514	1487	968	583	306	2532	470	879	0	413	1611	
13	2911	593	430	1417	868	408	204	1962	305	380	473	0	335		
14	5487	1636	1075	1707	1452	1508	989	320	3548	913	786	1888	318		
15	2430	1618	983	1190	863	990	1157	552	1690	455	662	1011	485	2303	
16	1897	870	591	830	436	488	319	375	2154	310	278	202	112	308	
17	3745	1933	962	1449	881	1050	1191	540	3500	354	586	187	221	991	
18	4261	1651	939	1360	1125	1248	874	416	2865	534	643	1078	288	1030	
19	2580	680	578	315	703	782	381	204	1818	329	443	617	170	825	
20	223	235	201	249	121	122	255	121	195	107	216	386	158	2110	
21	2091	583	474	1418	687	451	291	222	2078	338	571	556	781	496	
22	954	525	455	970	387	284	387	282	1074	319	2389	848	354	906	
23	1343	371	311	704	352	244	215	152	1000	213	481	402	307	480	
24	1529	614	618	1100	403	368	292	326	2305	2027	812	387	308	471	
25	596	350	301	504	179	162	173	136	908	115	300	309	135	289	
26	753	239	231	452	199	162	121	122	677	360	267	196	93	227	

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■ Impact of "Do Nothing"/"Do Committed" Network

■ Congestion Ratio (V/C)



2008

2025 Do Nothing

2025 Do Committed

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■ Analysis of "Do Nothing" Network

		2008	2025	2025/ 08
Traffic Demand (000 PCU)		424	1,241	2.9
Traffic Load	PCU-km (000)	2,594.4	11,172.2	4.3
	PCU-hrs (000)	59.1	473.1	8.0
Travel Features	Ave. Travel Speed (kph)	43.9	23.6	0.5
	Ave. V/C Ratio	0.18	0.69	3.7
Transport Cost (000 US\$)	Vehicle Operating Cost	284.6	1,920.9	6.8
	Passenger Time Cost	359.6	6,307.1	17.5
	Total	644.2	8,228.0	12.8

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■ Analysis of “Do Committed” Network

		2008	2025	2025/ 08
Traffic Demand (000 PCU)		424	1,241	2.9
Traffic Load	PCU-km (000)	2,594.4	10,939.1	4.2
	PCU-hrs (000)	59.1	368.4	6.2
Travel Features	Ave. Travel Speed (kph)	43.9	29.7	0.7
	Ave. V/C Ratio	0.18	0.60	3.3
Transport Cost (000 US\$)	Vehicle Operating Cost	284.6	1,662.4	5.8
	Passenger Time Cost	359.6	4,866.7	13.5
	Total	644.2	6,529.1	10.1

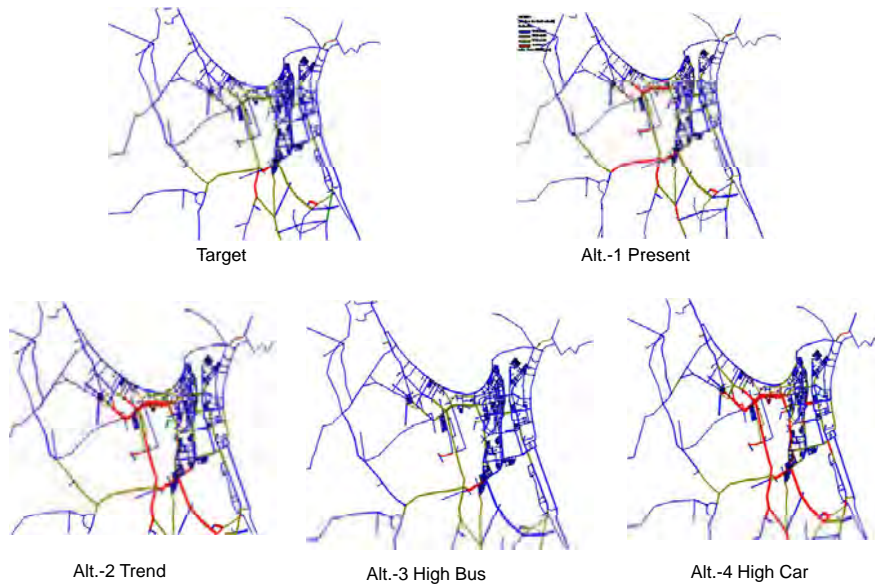
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■ Future Scenario

		Modal Share (%)			Average Occupancy (pax)		
		M/C	Car	Bus	M/C	Car	Bus
Base Target		50	15	35	1.3	2.0	36
Alternative	1. Present	94	2	4	1.3	2.0	15
	2. Target	70	20	10	1.3	2.0	15
	3. Strong Bus Improvement	35	15	50	1.3	2.0	50
	4. Increased of Car Use	60	30	10	1.3	2.0	15

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■ Traffic Assignment on Future Network by Scenario



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■ Proposed Master Plan Network



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■ Effects of Master Plan Network

		2008	2025	2025/ 08
Traffic Demand (000 PCU)		424	1,241	2.9
Traffic Load	PCU-km (000)	2,594.4	6,035.5	2.3
	PCU-hrs (000)	59.1	154.4	2.6
Travel Features	Ave. Travel Speed (kph)	43.9	39.1	0.9
	Ave. V/C Ratio	0.18	0.38	2.0
Transport Cost (000 US\$)	Vehicle Operating Cost	284.6	799.4	2.8
	Passenger Time Cost	359.6	2,096.0	5.8
	Total	644.2	2,895.3	4.5

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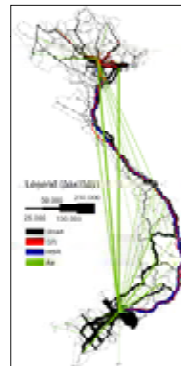
B. TECHNICAL PROCESS OF STRADA

1. Outline of JICA STRADA
2. OD Table
3. Network
4. Parameter
5. Traffic Assignment

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■ What is "JICA STRADA" ?

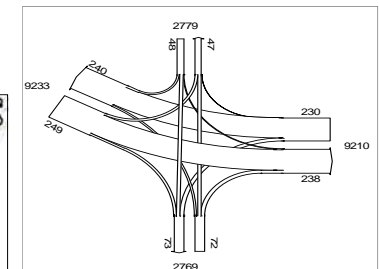
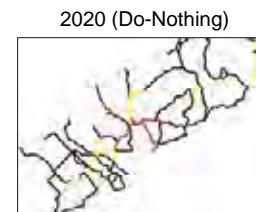
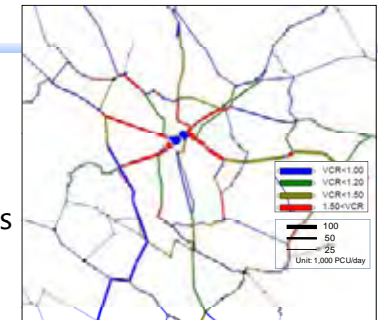
- JICA STRADA is a computer software developed by JICA for application in transport demand analysis and assignment. It is an abbreviation of "System for **T**RAFFIC **D**EMAND **A**NALYSIS".
- This software has been adopted among the world cities such as...
 - Metro Manila (Philippines: 1999, 2002, 2005)
 - Hanoi (Vietnam: 2005)
 - Lima (Peru: 2004)
 - Ho Chi Minh City (Vietnam: 2004)
 - Nairobi (Kenya: 2004)
 - Jakarta (Indonesia: 2003)
 - Cairo (Egypt: 2002)
 - ...etc.



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■ Possible Analysis

- Road Network Evaluation
- Road Project Evaluation
- Mass Transit Evaluation
- Traffic Flow Analysis at intersections
- Road Use Fee Setting
- Environmental Impact Evaluation
- ...etc

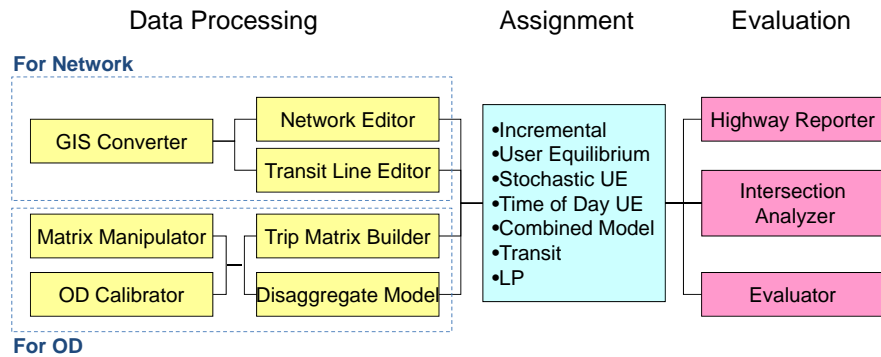


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Structure of JICA STRADA

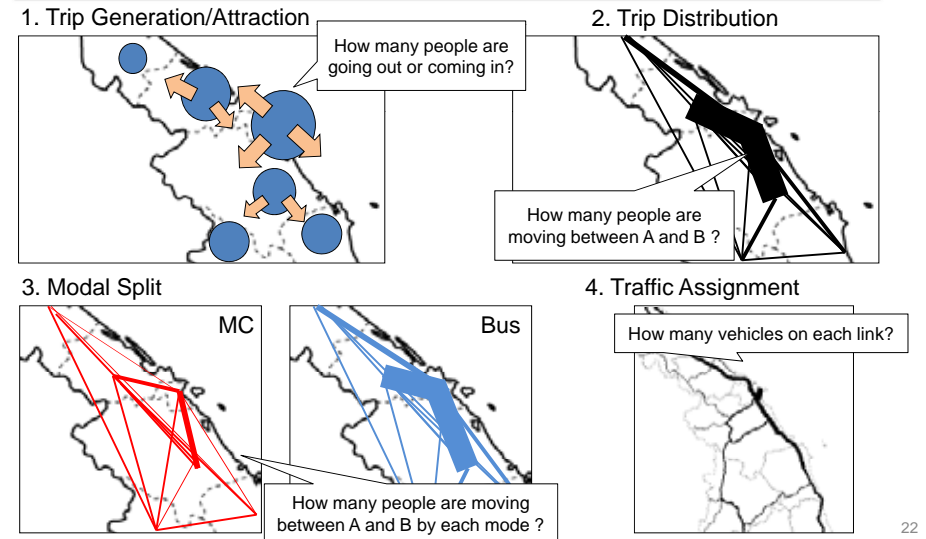
- Composed by 17 programs for **data basic processing**, **traffic assignment** and **transport evaluation** for traffic demand analysis



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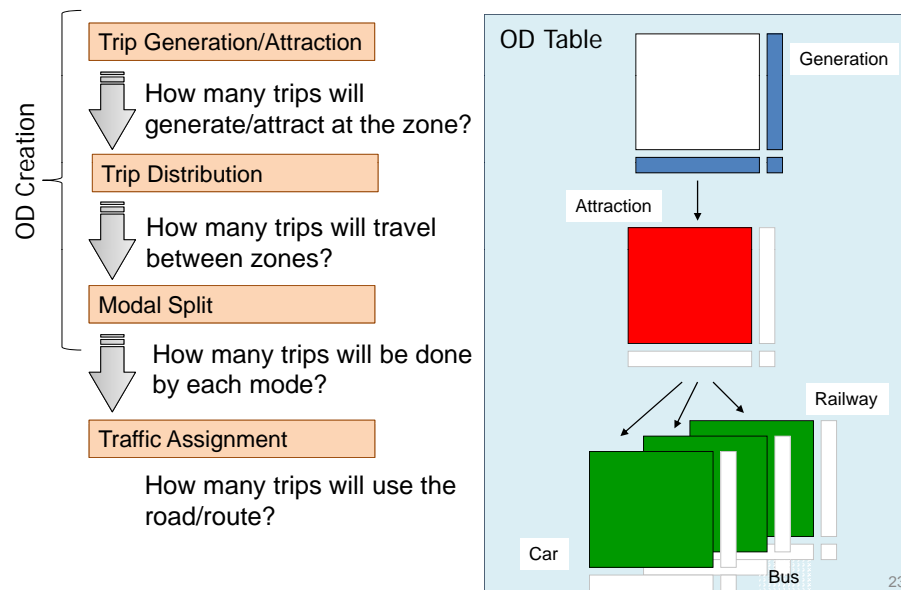
4 Steps Method

Traditional approach for future traffic demand forecast



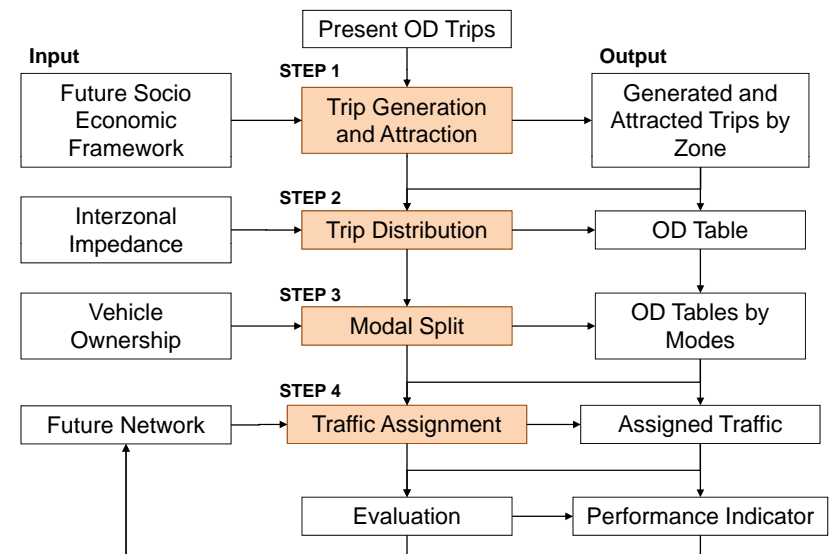
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4 Step Method: OD Creation



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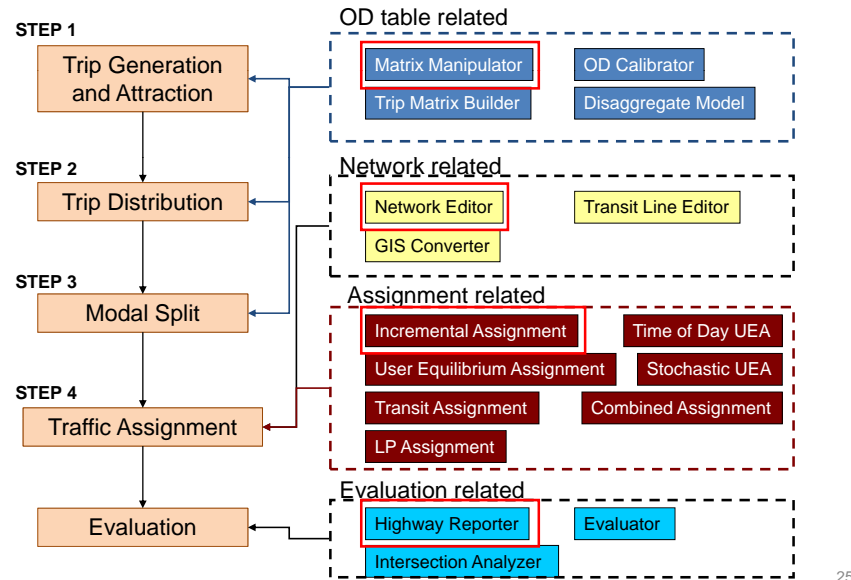
4 Steps Method: Input & Output



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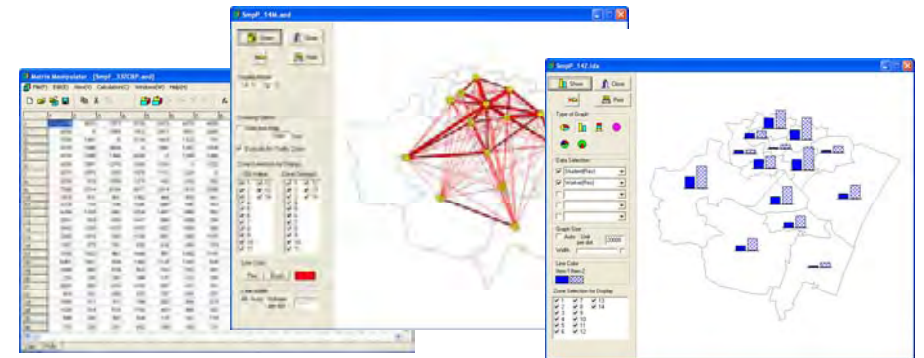
4 Steps Method: Framework



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Matrix Manipulator

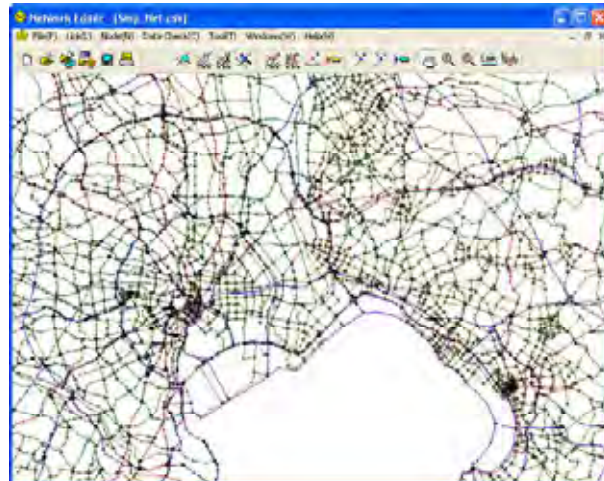
- Edit of OD matrix, Zonal Attributes, Trip Generation and Attraction
- Control total adjustment, Calculation across two or more OD matrices and across files
- Displaying data, Division and consolidation of zones



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Network Editor

- Edit of Network, Create of Assignment parameter
- Enhancement of a visual data check function



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Incremental Assignment

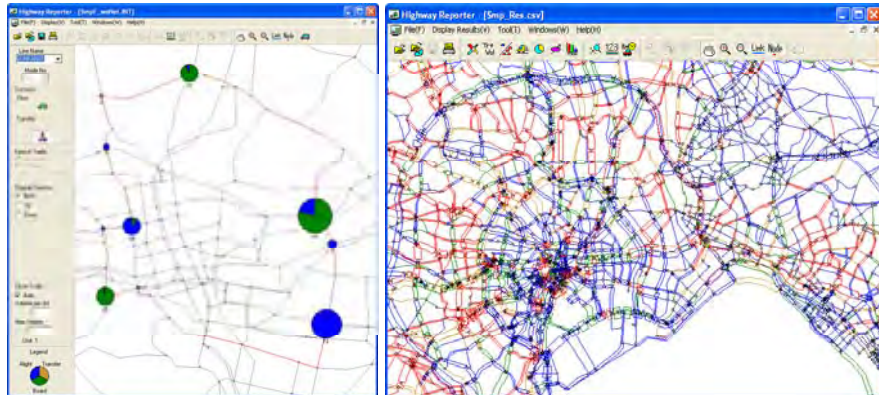
- Traffic Demand Assignment by Incremental Approach

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Highway Reporter

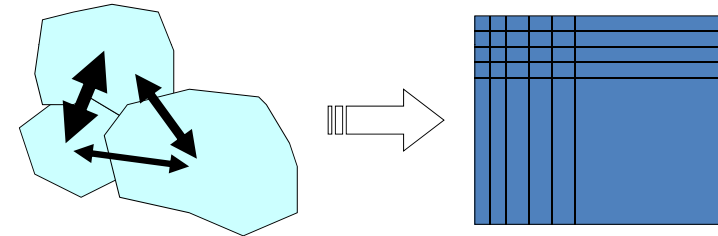
- Displaying Assignment Results, The metafile output of a display
- Route information, Directional traffic, Interzonal Time distance



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What is OD Table?

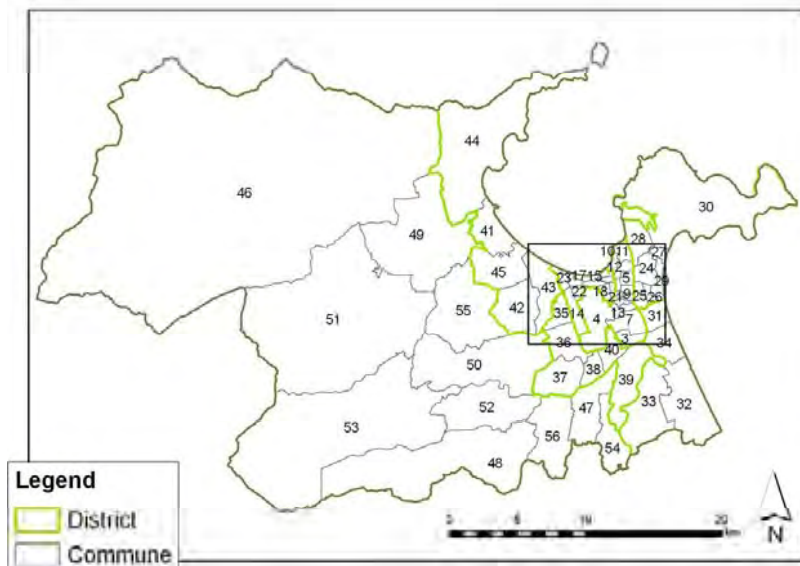
OD table express the movements of people/commodities by using a zoning matrix



- Need to convert all areas into 'zone'
- Need to know the movements of people/commodities between any two zones

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Zoning System on DaCRISS



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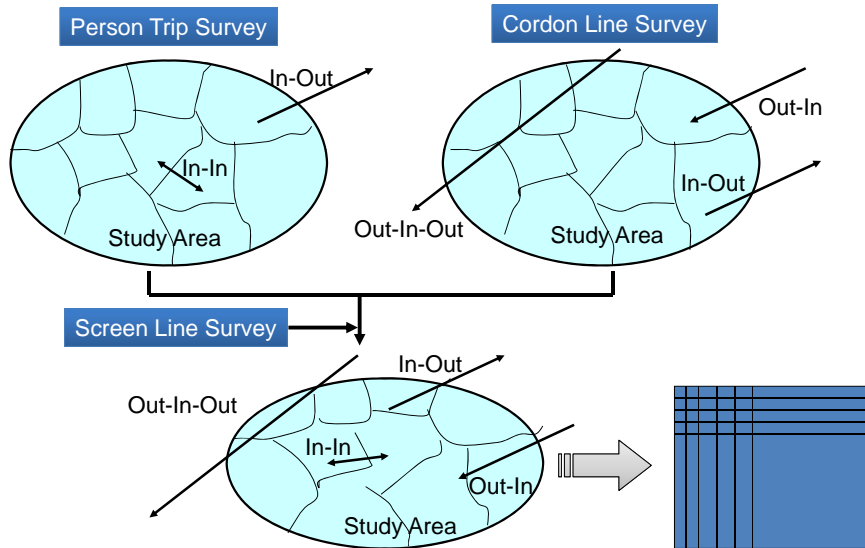
OD Table (Matrix)

To from	1	2	3	4	Total
1						} Generation
2						
3						
4						
.....						
.....						
Total	} Attraction					

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How to Make OD Table for the Present Situation



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Various Types of OD in STRADA

- **AOD** : normal type
(Showing traffic demand between zones ...etc)
- **IOD** : impedance matrix
(Showing travel time between zones ...etc)
- **GAD** : generation/attraction
(Showing generation and attraction on each zones)

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OD Table: Calculation

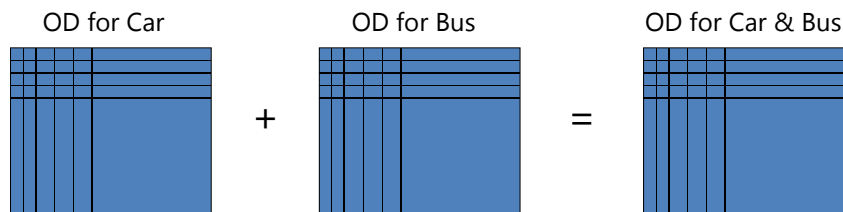
+ : add

- : minus

* : multiply (only $A_{ij} * B_{ij} = C_{ij}$)

/ : divide (only $A_{ij} / B_{ij} = C_{ij}, B_{ij} > 0$)

Ex.



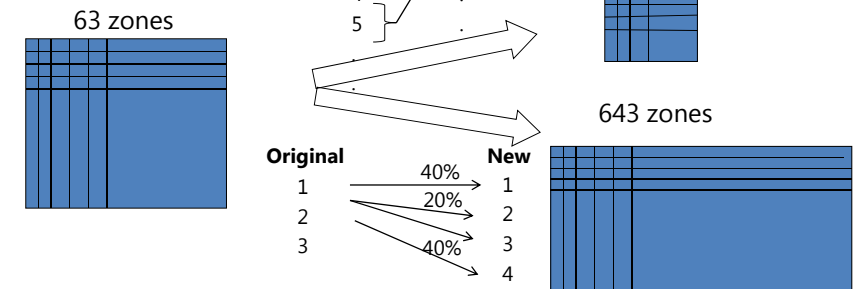
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OD Table: Zoning Calculation

- Prepare PZN (Zoning parameters)

Original Zone \rightarrow New Zone with %

Ex.



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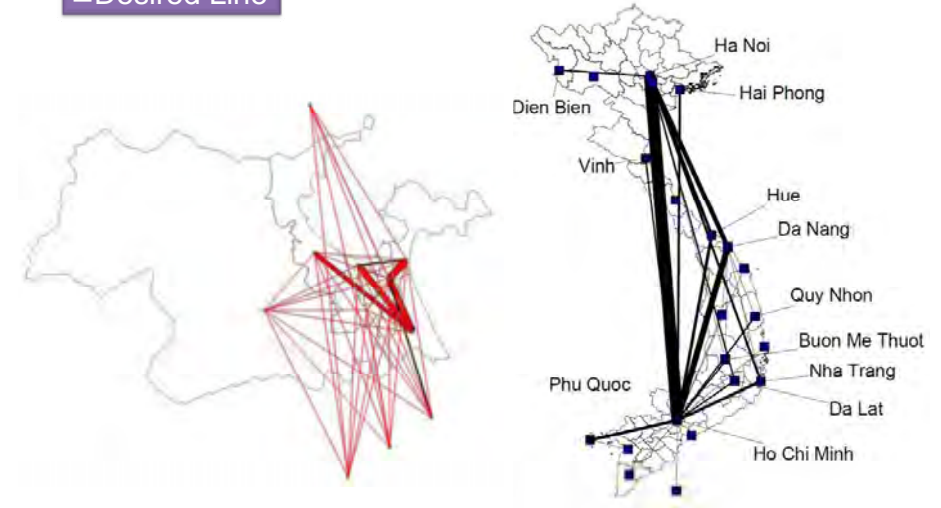
■ Adjusting OD

- by Total/Mode/File
- by FRATAR Method

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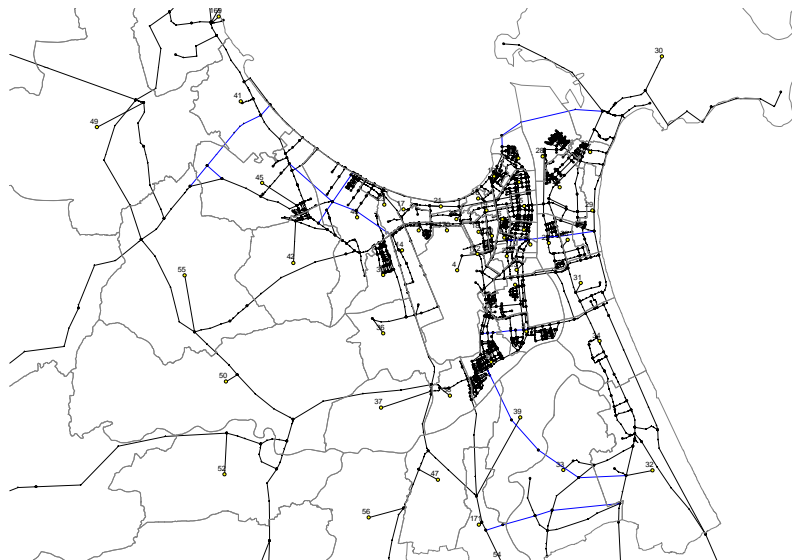
■ Showing OD

■ Desired Line



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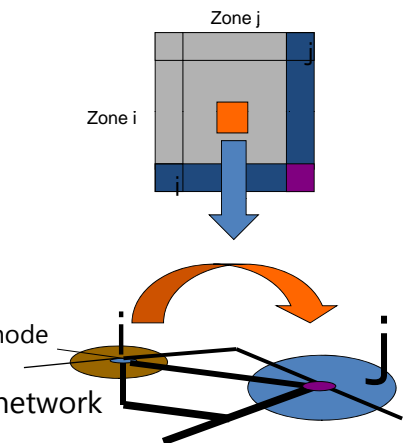
■ Road Network on DaCRISS



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■ The Flow for Traffic Assignment

- Building network
 - Travel speed
 - Link capacity
 - QV function
- Preparation of Parameter File
 - Zone centroid
 - Time equivalence (Value of Time)
 - Link cost function
 - Average occupancy
 - PCU (Passenger car unit) factor by mode
- Vehicle trips are assigned on the network
 - Several assignment technique



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■ Building Network: Road Network on DaCRISS

Code	Name of Road	Origin	Destination	Kind of Road	Length (km)	Asphalt		No. of Lanes	Clearance	Capacity
						L (Km)	W (m)			
U01	Lê Duẩn	Bạch Đằng	Điện Biên Phủ	Urban	2.223	2.223	15.00	4	1.00	56.250
U02	Đông Đa	Bạch Đằng	Ông Ích Khiêm	Urban	1.800	1.800	15.20	4	1.20	56.250
U03	Bạch Đằng	Đông Đa	Đường 2/9	Urban	2.542	2.542	15.00	4	1.00	56.250
U04	Ông Ích Khiêm	Nguyễn Tất Thành	Thanh Duyên	Urban	0.030	0.030	16.00	4	2.00	56.250
U05	Trần Phú	Đông Đa	Trung Nữ Vương	Urban	3.046	3.046	8.80	3	-1.70	42.500
U06	Đường 2/9	Bạch Đằng	Cầu Tuyên Sơn	Urban	3.377	3.377	21.00	6	0.00	85.000
N01	NH 14B	Cầu Tuyên Sơn	Núi Thành	NH	-	-	21.00	6	0.00	85.000
U07	Phan Đăng Lưu	Đường 2/9	Trường Ng. Hiền	Urban	0.550	0.550	14.00	4	0.00	56.250
		Trương Nguyễn Hiền	Nguyễn Hữu Thọ	Urban	0.908	0.908	14.00	4	0.00	56.250
U08	3 tháng 2	Nguyễn T. Thành	Bạch Đằng	Urban	1.000	1.000	21.00	6	0.00	85.000
U09	Trần Đăng Ninh	Đường gom cầu Tuyên Sơn	Đường ven sông	Urban	0.455	0.455	15.00	4	1.00	56.250
U10	Đường 30.4	Quảng trường 29/3	Nguyễn Hữu Thọ	Urban	1.200	1.200	21.00	6	0.00	85.000

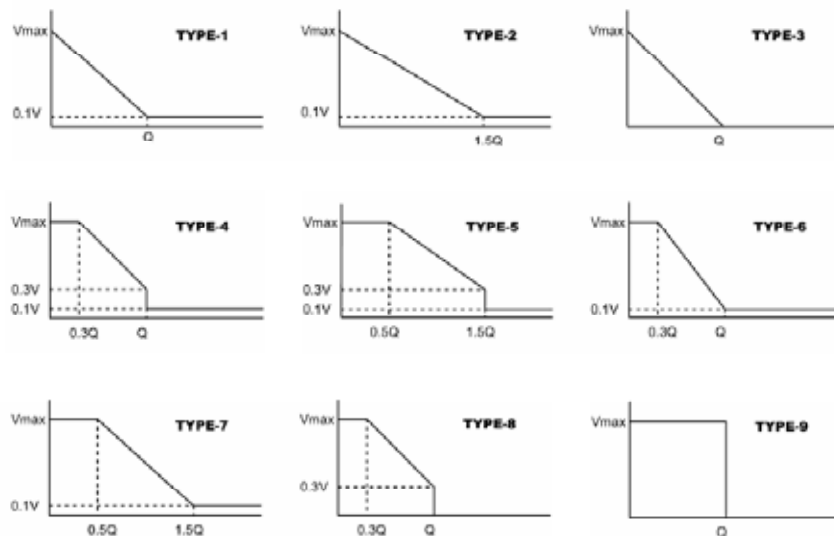
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■ Building Network: Travel Speed and Link Capacity

Class	Urban/ Rural	Vmax	Carriage-way		No. of Lanes	Cross Section (max)	Fixed	per m	Qmax/hour			Qmax/day			
			Min	Max					Service Level 1	Service Level 2	Service Level 3	Service Level 1	Service Level 2	Service Level 3	
Car Exclusive	Urban	80			2		1,300		2,600			26,000			
		100			4		2,200		8,800			88,000			
		100			6		2,200		13,200			132,000			
	Rural	70			2		1,000		2,000			20,000			
		80			4		1,760		7,000			70,000			
		80			6		1,760		10,600			106,000			
Primary	Urban	30		<6m	2	3m	2,500		1,300	1,400	1,600	16,250	17,500	20,000	
		35	7m	<12m	2+α	3.5+2.5m	2,500	250	1,300	1,400	1,600	16,250	17,500	20,000	
		40	13m	<20m	4+α	3.5+3.5+2.0m	2,200	300	4,500	5,100	5,600	56,250	63,750	70,000	
		45	21m	<28m	6	3.5+3.5+3.5+2.0	2,200	300	6,800	7,600	8,400	85,000	95,000	105,000	
		50	29m<		8	3.5+3.5+3.5+3.5+2.0	2,200		9,000	10,100	11,300	112,500	126,250	141,250	
		40		<6m	2	3m	2,500		1,700	1,900	2,300	17,000	19,000	23,000	
	Rural	45	7m	<12m	2+α	3.5+2.5m	2,500	250	1,700	1,900	2,300	17,000	19,000	23,000	
		50	13m	<20m	4+α	3.5+3.5+2.0m	2,200	300	5,900	6,700	7,900	59,000	67,000	79,000	
		55	21m	<28m	6	3.5+3.5+3.5+2.0	2,200	300	8,900	10,100	11,900	89,000	101,000	119,000	
		60	29m<		8	3.5+3.5+3.5+3.5+2.0	2,200		11,900	13,500	15,800	119,000	135,000	158,000	
		30		<6m	2	3m	2,500		1,100	1,300	1,400	13,750	16,250	17,500	
		35	7m	<12m	2+α	3.5+2.5m	2,500	200	1,100	1,300	1,400	13,750	16,250	17,500	
Secondary	Urban	40	13m	<20m	4+α	3.5+3.5+2.0m	2,200	220	3,900	4,400	4,900	48,750	55,000	61,250	
		45	21m	<28m	6	3.5+3.5+3.5+2.0	2,200	220	5,900	6,700	7,400	73,750	83,750	92,500	
		50	29m<		8	3.5+3.5+3.5+3.5+2.0	2,200		7,900	8,900	9,900	98,750	111,250	123,750	
		40		<6m	2	3m	2,500		1,300	1,500	1,800	13,000	15,000	18,000	
		45	7m	<12m	2+α	3.5+2.5m	2,500	200	1,300	1,500	1,800	13,000	15,000	18,000	
		50	13m	<20m	4+α	3.5+3.5+2.0m	2,200	220	4,600	5,200	6,200	46,000	52,000	62,000	
	Rural	55	21m	<28m	6	3.5+3.5+3.5+2.0	2,200	220	6,900	7,900	9,200	69,000	79,000	92,000	
		60	29m<		8	3.5+3.5+3.5+3.5+2.0	2,200		9,200	10,500	12,300	92,000	105,000	123,000	
		25		<6m	2	3m	2,500		1,100	1,200	1,400	13,750	15,000	17,500	
		30	7m	<12m	2+α	3+2.5m	2,500	200	1,100	1,200	1,400	13,750	15,000	17,500	
		35	13m	<20m	4+α	3.5+3.5+2.0m	2,200	200	3,800	4,300	4,800	47,500	53,750	60,000	
		35		<6m	2	3m	2,500		900	1,100	1,300	9,000	11,000	13,000	
Tertiary	Urban	40	7m	<12m	2+α	3.5+2.5m	2,500	200	900	1,100	1,300	9,000	11,000	13,000	
		45		<6m	2	3m	2,500		900	1,100	1,300	9,000	11,000	13,000	
		45	13m	<20m	4+α	3.5+3.5+2.0m	2,200	200	3,300	3,700	4,400	33,000	37,000	44,000	

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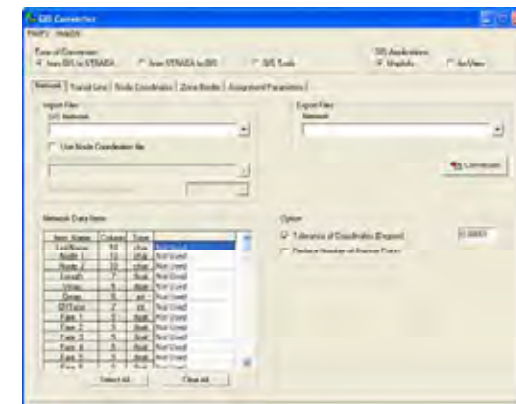
■ Building Network: QV function



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■ Using GIS Converter

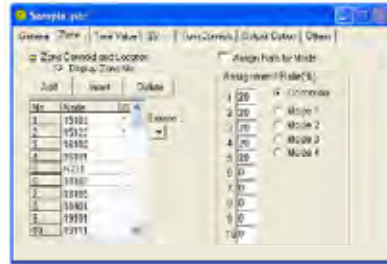
- The file conversion between the data: MapInfo, ArcView ↔ STRADA
- Network, Zone Figure, Line Data, Zone Centroid, Assignment Results



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■ Preparation of Parameter File

- Zone centroid
- Time equivalence (Value of Time)
- Link cost function
- Average occupancy
- PCU (Passenger car unit) factor by mode



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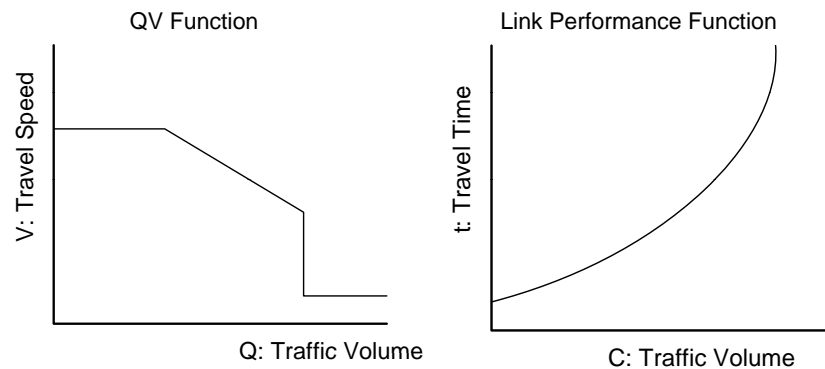
■ Highway Type Assignment

- Incremental Assignment
 - OD trips are divided n times and assigned on shortest route. Shortest route is searched at each time according to travel time calculated by QV function
- Diversion Rate Assignment
 - Network includes toll road, two routes shortest route w or w/o toll road are searched and diversion between those are calculated
- Equilibrium Assignment
 - Equilibrium situation on a network is calculated reflecting that road users select optimal travel route

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■ QV Function and Link Performance Function

- Highway Type Assignment



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■ Parameters for BPR Function

- Highway Type Assignment
 - Incremental and equilibrium using QV function are not so different but theoretically BPR function should be used for the equilibrium assignment
 - Both parameters for BPR function (USA parameter and Dutch parameter) have not been examined yet in the Vietnamese situation and it is considered that original parameters should be needed aside from these known parameters.

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■ Traffic Assignment

- The Transit Assignment Program loads OD passenger trips of public transportation by searching feasible paths of low generalized costs in the transit line network.

Network : Highway Type Network

Line Data : Bus/Rail Route

OD Table : Public

Parameter : Generalized cost/Time value

Output : Mode/Route/Link Information, Station OD

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■ Combination of Highway/ Transit

- Highway type by mode
- Highway type -> Transit
 - using IRE for input for Transit
 - (preload pcu to link)
- Transit -> Highway type
 - using IRE for input for Highway type
 - (preload pcu by pax to link)

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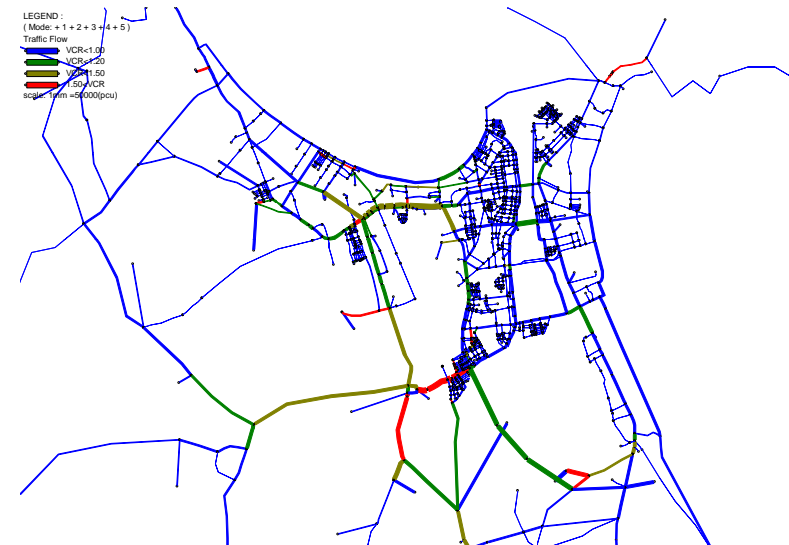
■ Evaluation

- Network Performance
 - Volume Capacity Ratio (VC Ratio)
 - Average Speed
 - Vehicle (PCU) - Km
 - Vehicle (PCU) - Hour
- Economic Indices: Direct Impact
 - Vehicle Operating Cost (VOC)
 - Travel Time Cost (TTC)

➔ Comparison of "With" case and "Without case"
- Economic Indices: Indirect Impact
 - Loss by Accident / Injury and Death
 - Air Pollution / Noise

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■ Traffic Assignment Result



A8-150

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