

Study on VICS Data for Road Administration Use

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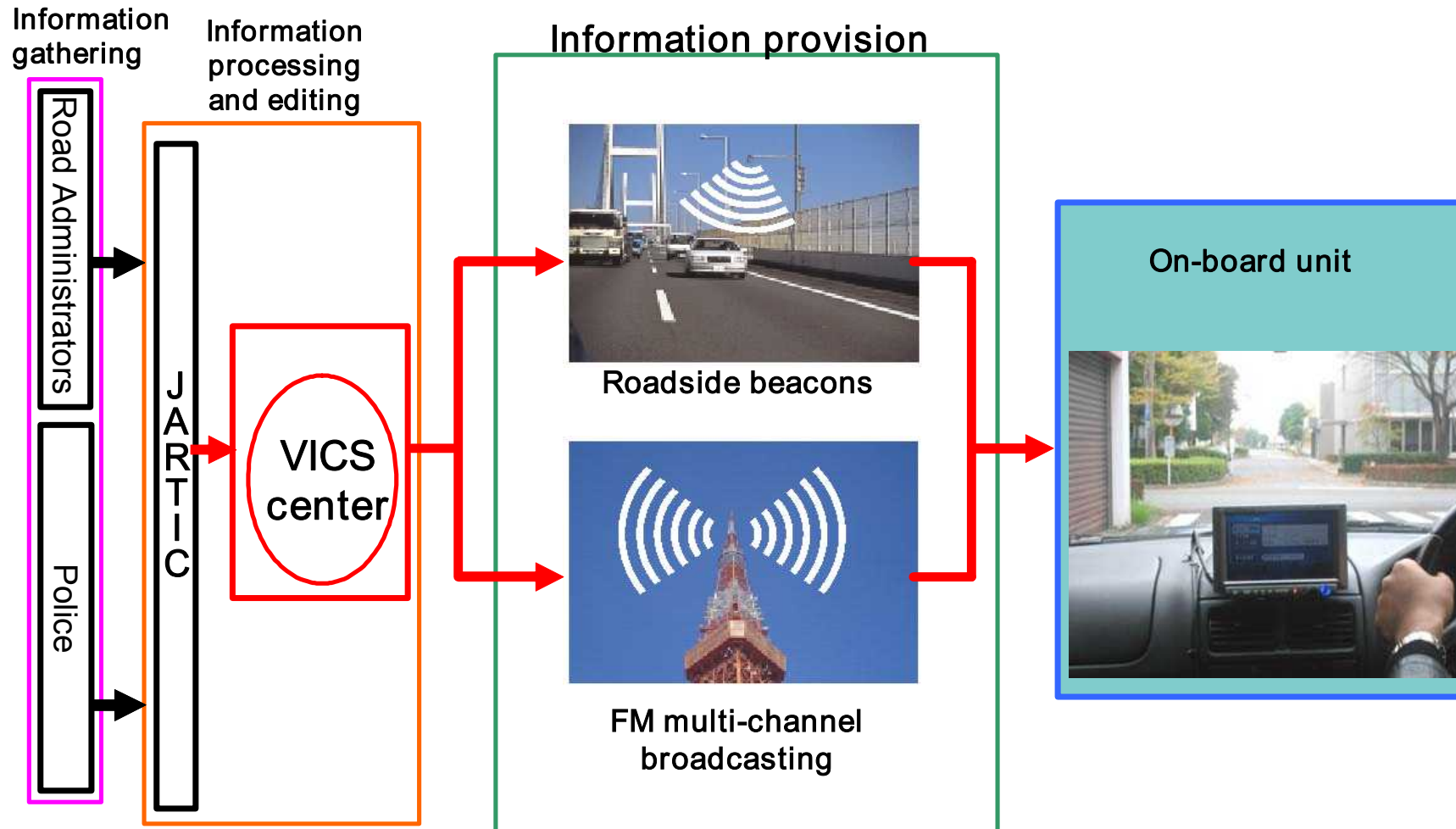
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Road Traffic Control Division of Road Bureau
Ministry of Land, Infrastructure and Transport

0. VICS Outline

(1) VICS Equipment

VICS=Vehicle Information and Communication System



0. VICS Outline

(2) VICS Information

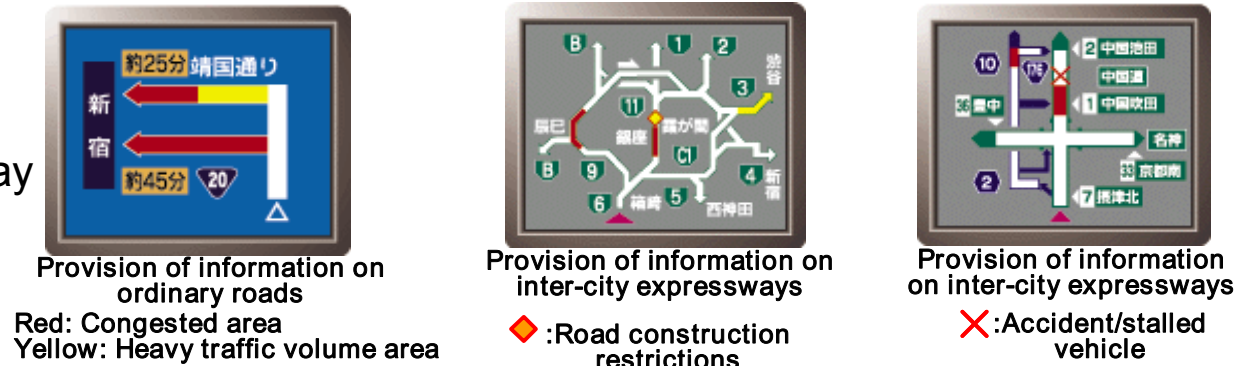
Level 1

- text data display



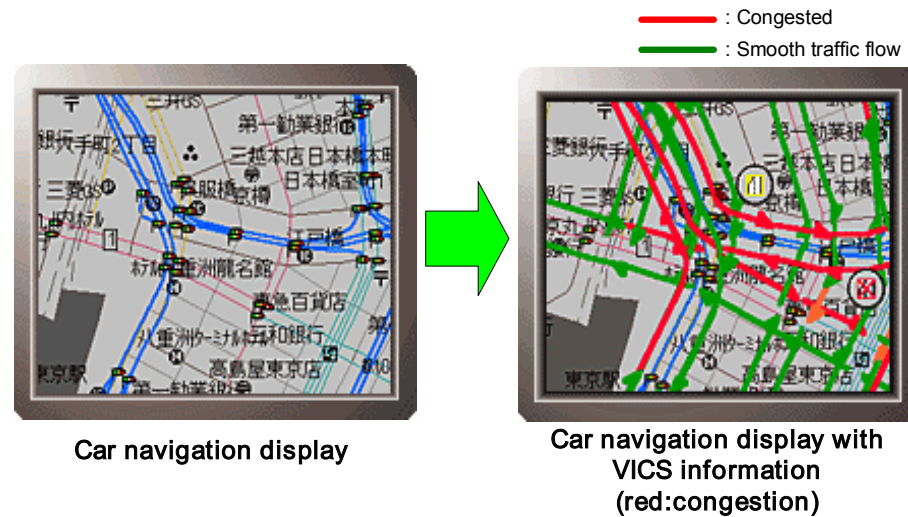
Level 2

- synoptic diagram display



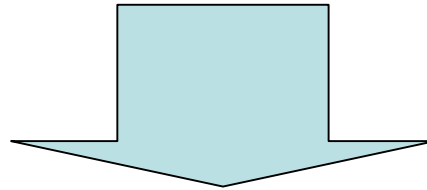
Level 3

- data display on car navigation map display



1. Study Objectives

- The steady stream of data provided by VICS operations throughout the nations has significant potential for our understanding of traffic condition
- Because VICS was originally devised for traffic info distribution, further study for other purposed has not been adequately explored

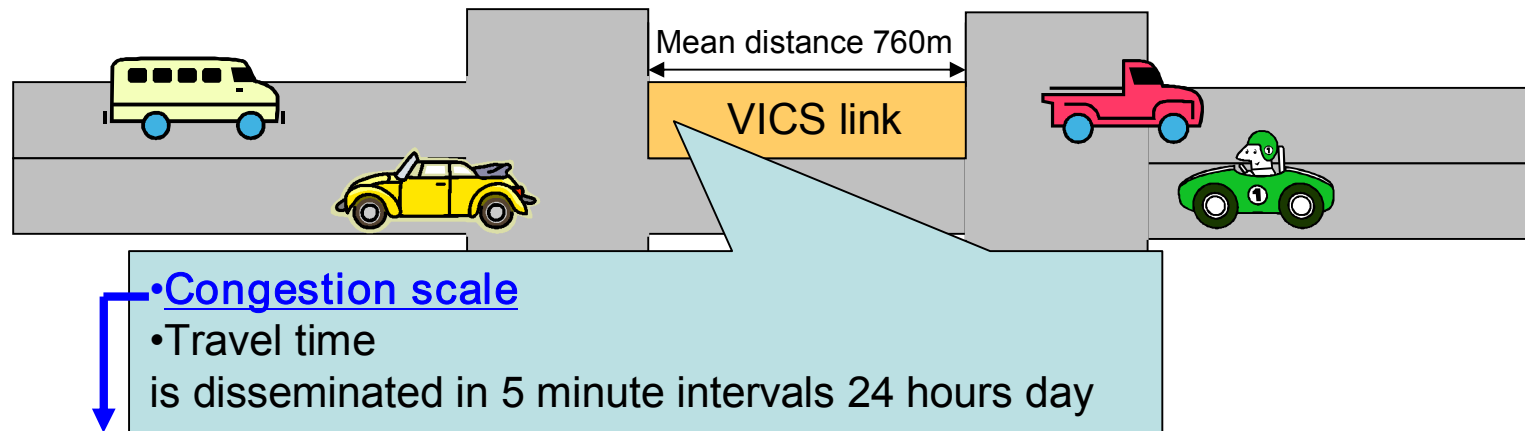


Analyze VICS data accuracy and characteristics and study potentials for road administration

2. Basic Characteristic of VICS Travel Time Info

(1) VICS data specification

- Spatial unit of VICS : VICS link
(in both inbound and outbound direction in a section between primary cross-sections, a mean distance is 760m)
- info on 'congestion scale' as well as 'travel time' in 5 minute intervals, 24 hours day over each VICS link
- A 'congestion scale' is a classification of travel speed calculated by travel time



• Correlative chart of congestion scale and travel time (travel speed)

Road type (VICS link section)	Congestion scale definition		
	1. Non-congestion	2. Moderate	3. Jam
1. Expressway	More than 61km/h	Less than 60km/h	Less than 40km/h
2. Elevated expressway	More than 41km/h	Less than 40km/h	Less than 20km/h
3. Ordinary routes	More than 21km/h	Less than 20km/h	Less than 10km/h
4. Others			

2. Basic Characteristic of VICS Travel Time Info

(2) VICS data coverage

- VICS link available for congestion scale and travel time accounts for 15% and 10%, respectively
- In terms of road type, a coverage ratio on expressway and elevated expressway is prominent

Road type (VICS link section)	Mileage (X 1000km)	2002 coverage ratio (distance X1000km, coverage ratio %)	
		Congestion scale subject area	Travel time subject area
1. Expressway	18.4	16.1 87%	14.8 80%
2. Elevated expressway	1.9	1.6 85%	1.4 75%
3. Ordinary routes	377.7	40.4 11%	23.2 6%
4. Others	1.4	0.7 51%	0.5 36%
Total	399.5	58.9 15%	40.0 10%

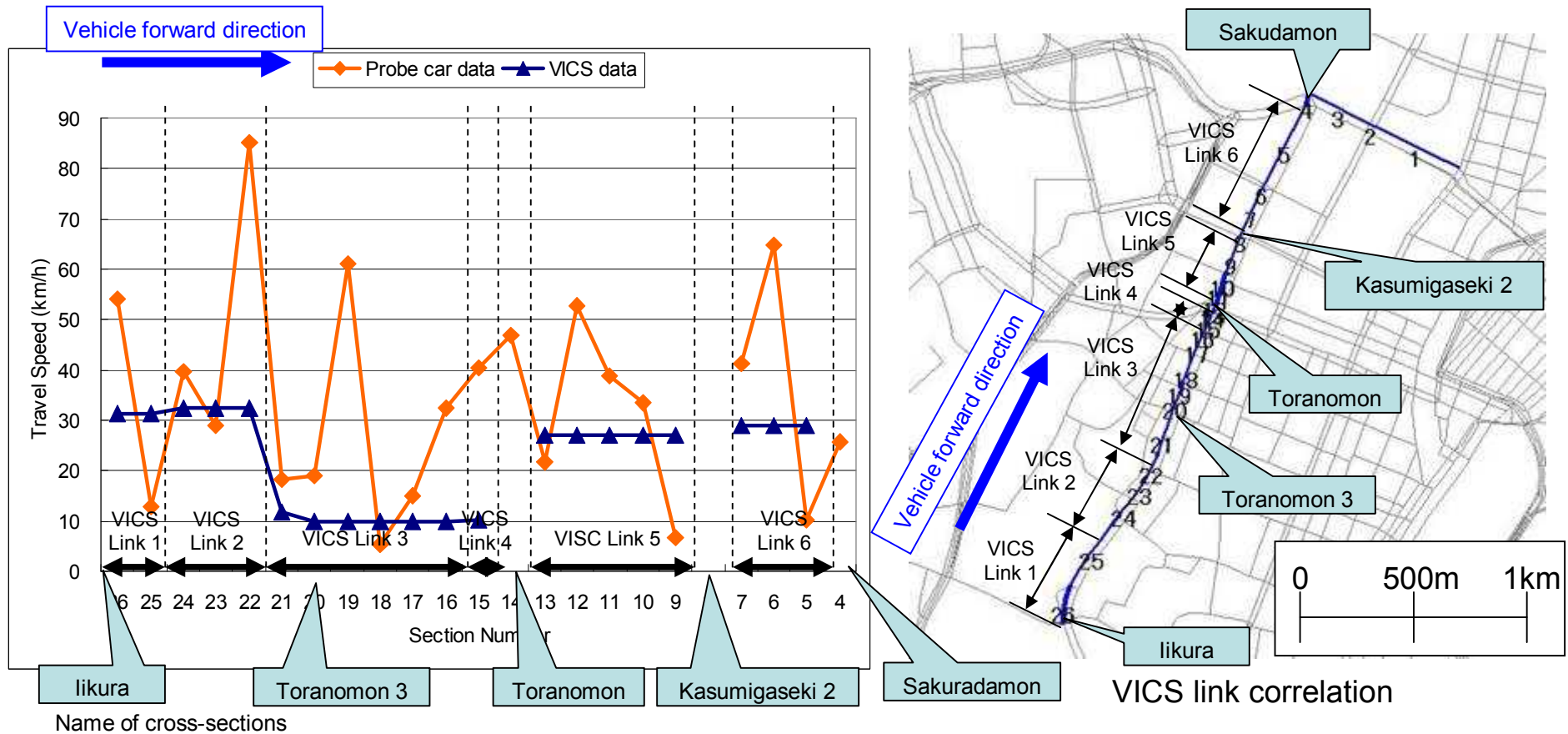
- Calculated using VICS data in 2002
- National route, primary local road and prefectural road are subject to VICS link as a group of 'ordinary route'; additionally, specified municipal road is subject as 'others'
- Since a distance is calculated by each inbound and outbound, the distance over the real road should be divided in half

2. Basic Characteristic of VICS Travel Time Info

(3) Correlation of VICS data and probe data

- For travel speed in VICS data is an extrapolation using roadside sensors in a subject section. A travel speed is expressed a 'mean value'.

- Correlation of travel speed by probe car and one in VICS in same time period



3. VICS Traffic Data Analysis over Tokyo

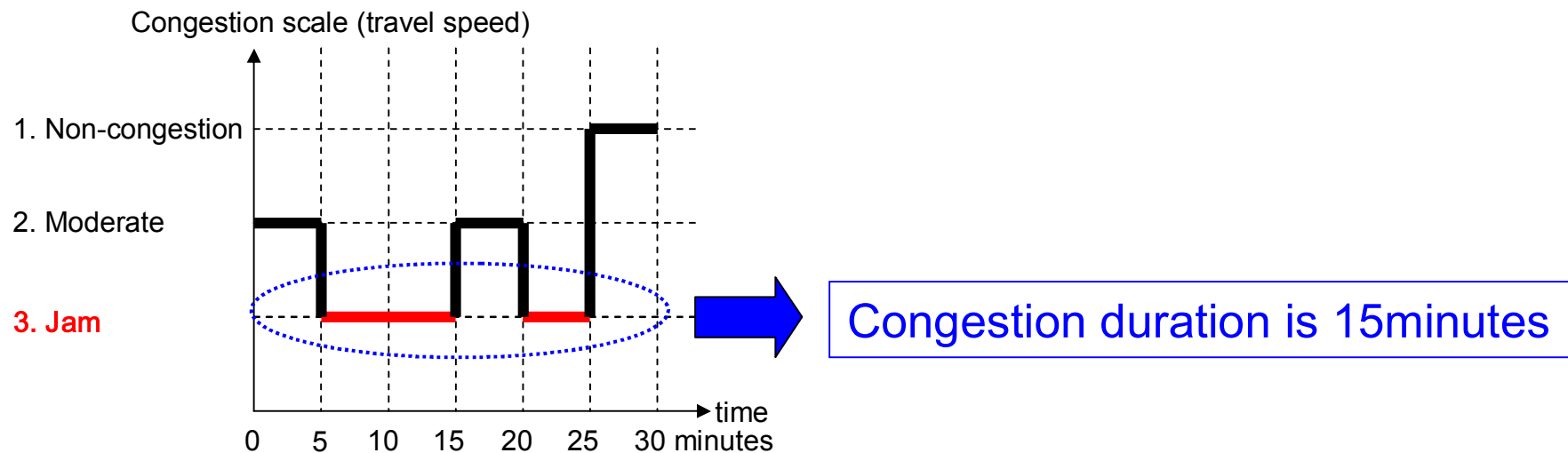
(1) Proposal on analysis index using VICS data

- Define 'congestion duration' as an index to analyze congestion condition using VICS data
- 'Congestion duration' is a sum of period where slowest operations continue over all the subject VICS links

$$\text{Congestion duration} = \sum_t \sum_i \delta_{ti} \times 5 \text{ minutes}$$

δ_{ti} = for Time t (5 minutes), when congestion level for VICS link i is jam, input 1. Others are 0.

Example : a calculation of congestion duration over a single VICS link

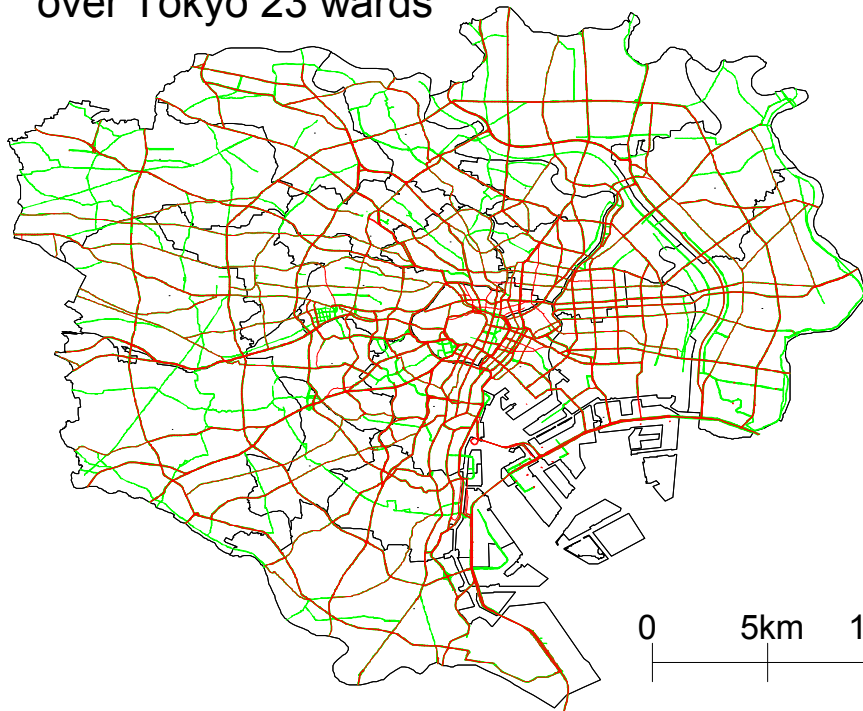


3. VICS Traffic Data Analysis over Tokyo

(2) VICS service condition over Tokyo

- VICS link coverage ratios in Tokyo is quite high compared to the national average, 72% in Tokyo compared to the average 15%

- VICS link (congestion scale offering link) over Tokyo 23 wards



【legend】
■ road higher than municipal level
■ sections in VICS link, offering congestion scale VICS

- VICS coverage ratio over Tokyo 23 wards

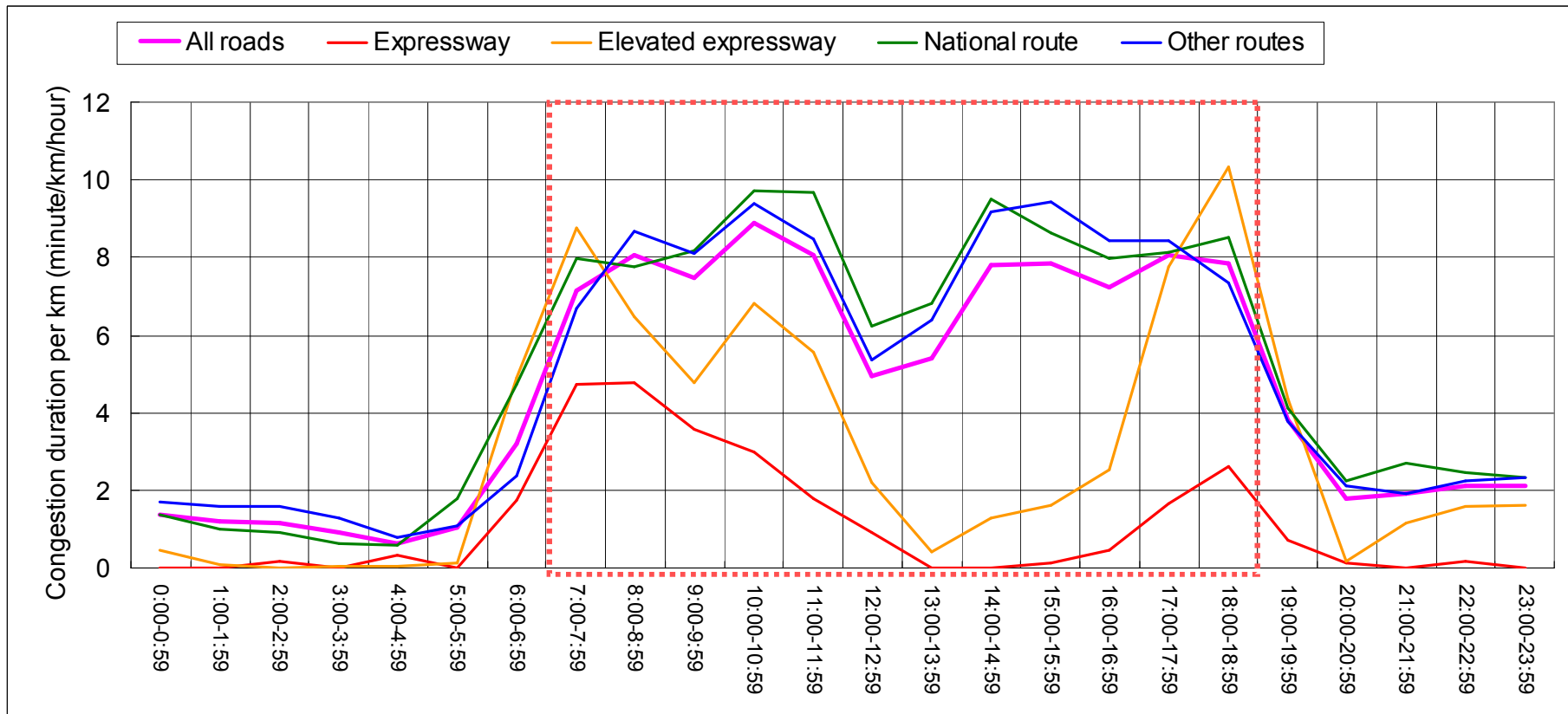
Road type (VICS link section)	Mileage (km)	2002 coverage ratio (distance km, coverage ratio %)	
		Congestion scale subject area	Travel time subject area
1. Expressway	123	114 92%	102 83%
2. Elevated expressway	593	452 76%	452 76%
3. Ordinary routes	764	657 86%	634 83%
4. Others	2,589	1,694 65%	1,650 64%
Total	4,070	2,917 72%	2,838 70%

- Calculated using VICS data in 2002
- National route, primary local road and prefectural road are subject to VICS link as a group of 'ordinary route'; additionally, specified municipal road is subject as 'others'
- Since a distance is calculated by each inbound and outbound, the distance over the real road should be divided in half

3. VICS Traffic Data Analysis over Tokyo

(3) Hourly shift of congestion duration

- Congestion continues during hours of 0700 and 1800
- Congestion temporarily decreases during hours of 1200 and 1300
- Morning and evening peaks occur only on expressways and elevated expressways



Data : on October 8 (Wednesday), 2003

4. Potential of VICS Use for Road Administration

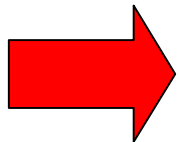
(1) Characteristic of VICS data and probe data

VICS data

- Data collection and storage in 5 minute intervals on primary roads across the nation
- A time sequential shift in congestion condition is visible
- Congestion conditions over extended areas is available

Probe data

- Required data on location or time is collected by allowing a probe vehicle to be operational
- Frequent and extended area data collection requires a hefty budget



The VICS data use suitable to its characteristics makes a cost effective collection possible in a large amount over wide ranges

4. Potential of VICS Use for Road Administration

(2) Subject administration areas

- The chart shows potential areas for making VICS data use for road administrations

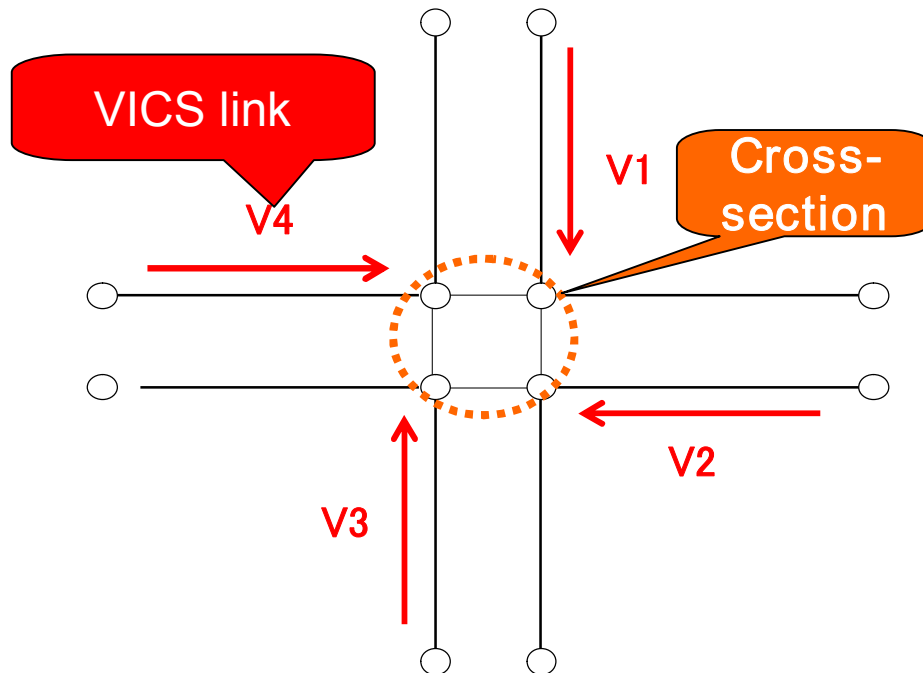
area	subject area	objective
plan	specify congestion points	work site selection
	congestion characteristics (hour of day, direction, causality, etc.)	
evaluation/ monitoring	performance measurement on impact by road works	needs of project and meets the needs by project
	performance measurements before/after a project	

5. Verification of VICS Data Use for Road Administration

(1) Specify congestion points

- Congestion conditions on each cross-section are understandable when VICS links converge on cross-section points
- Consequently, a cross-section in severe congestion is specified for use by road administrations

- a calculation method



Congestion duration
at cross-section

$$= \sum_n C_n$$

C_n : congestion duration on VICS link V_n

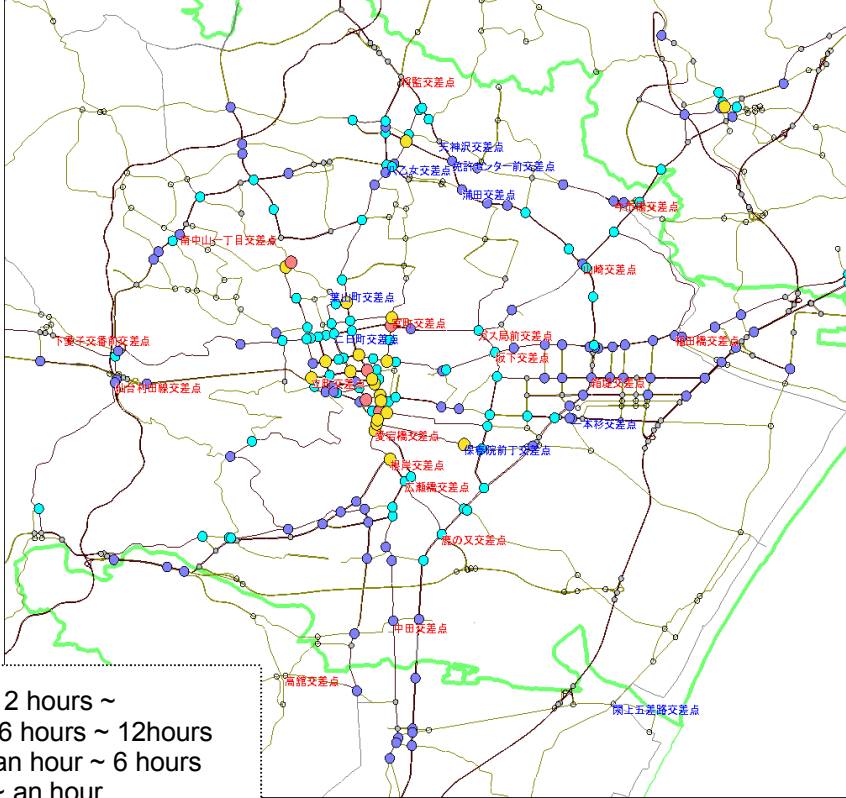
5. Verification of VICS Data Use for Road Administration

(1) Specify congestion points

•Example: City of Sendai

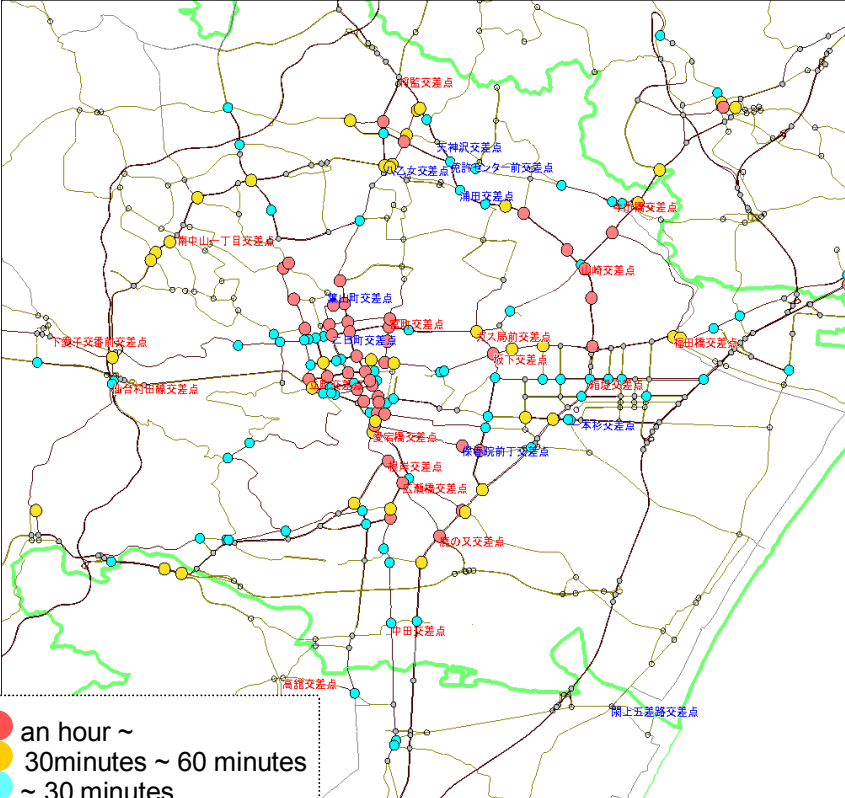
- Congestion condition at cross-section is understandable by hour of day and day of week
- A cross-section subject to congestion all day is distinguishable from one subject only peak periods

• Weekday (24h)



- 12 hours ~
- 6 hours ~ 12hours
- an hour ~ 6 hours
- ~ an hour
- 0 hour
- no data

•Morning on weekdays (7:00-9:59)

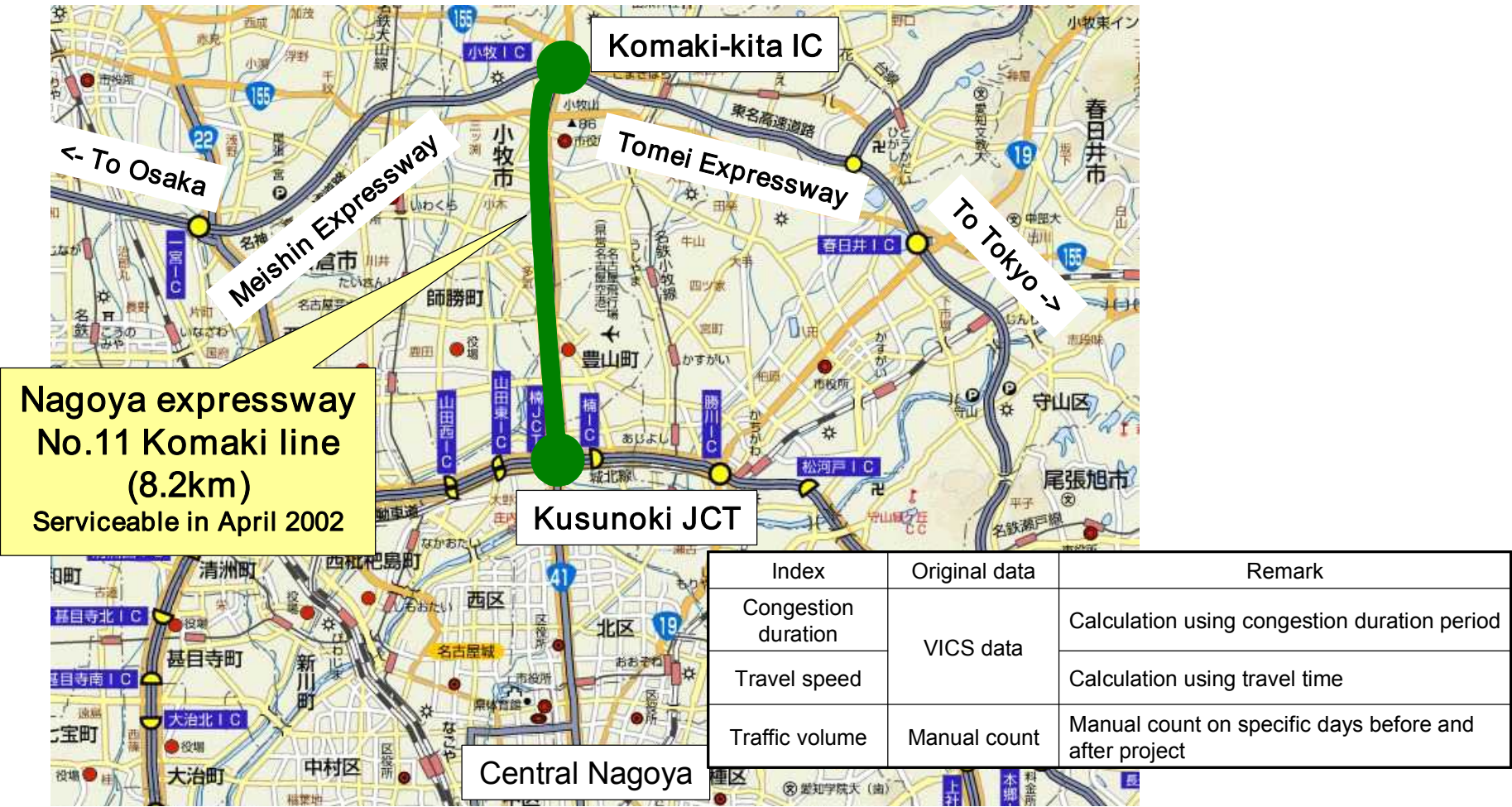


- an hour ~
- 30minutes ~ 60 minutes
- ~ 30 minutes
- 0 minute
- no data

5. Verification of VICS Data Use for Road Administration

(2) Performance measurements before/after a project

1) A large scale road project and data use



(c) 2005 Alps Mapping K. K.

5. Verification of VICS Data Use for Road Administration

(2) Performance measurements before/after a project

2) Impact analysis on National Route No.41 (1/2)

- Congestion decreases by 60% due to newly serviceable road operations in parallel

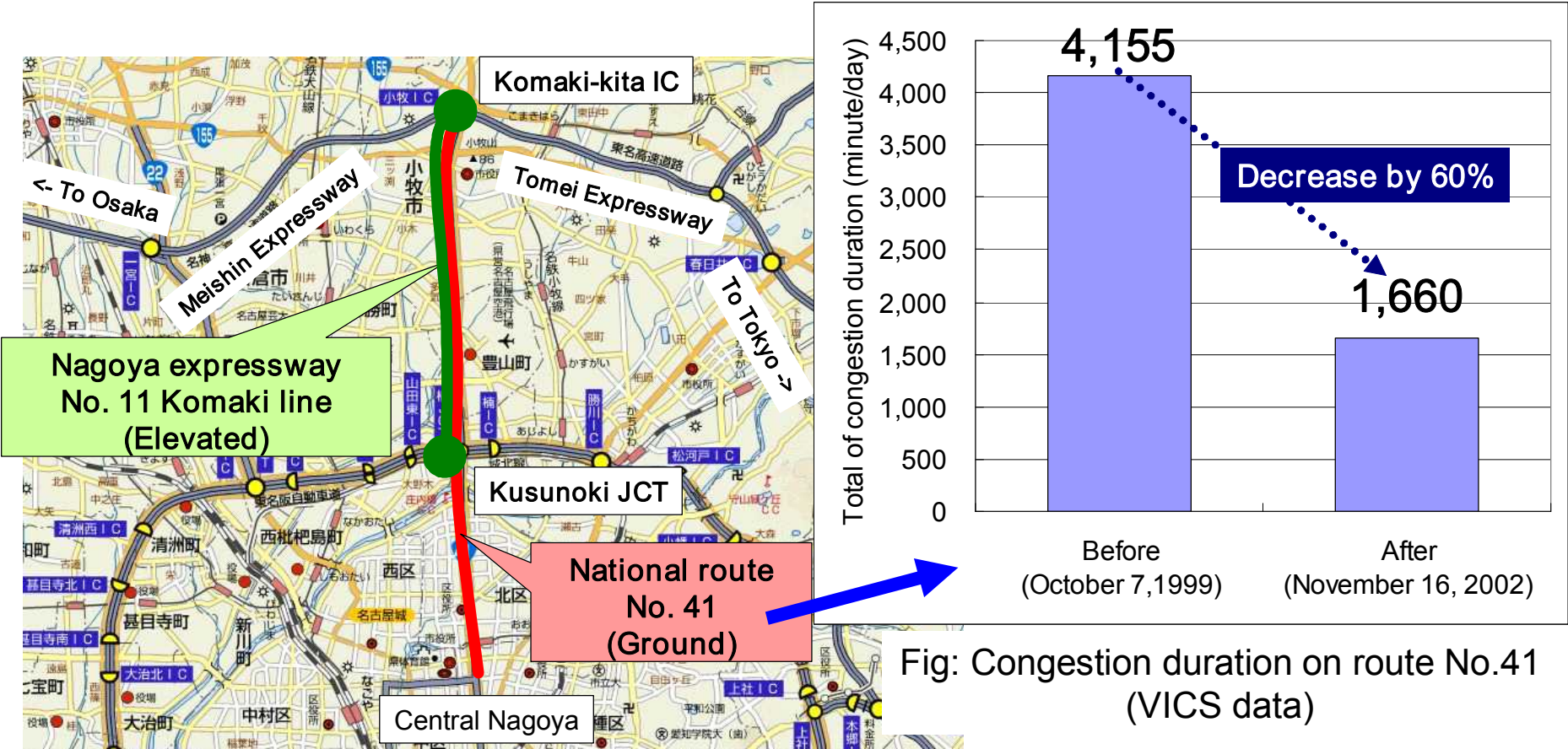


Fig: Congestion duration on route No.41 (VICS data)

(c) 2005 Alps Mapping K. K.

5. Verification of VICS Data Use for Road Administration

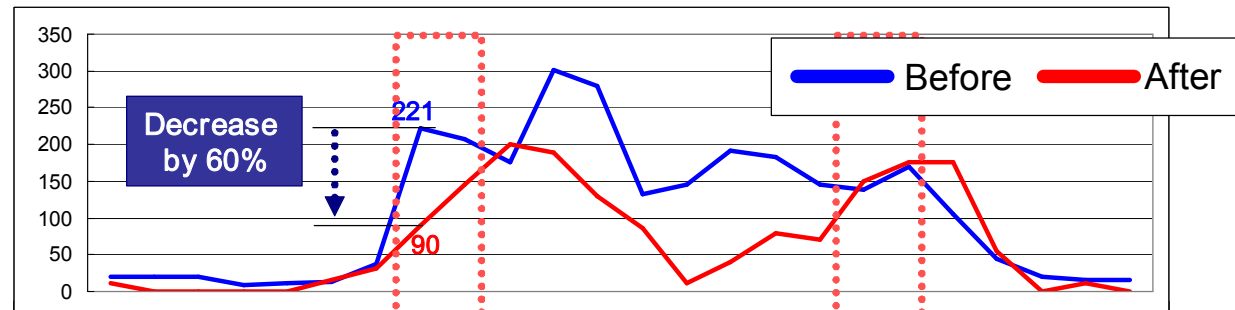
(2) Performance measurements before/after a project

2) Impact analysis on National Route No.41 (2/2)

- Congestion decreases by 60% during the hour of 0700
- Combined with travel speed improvement and traffic volume decrease, the positive impact reflects the new service operation of Komaki line

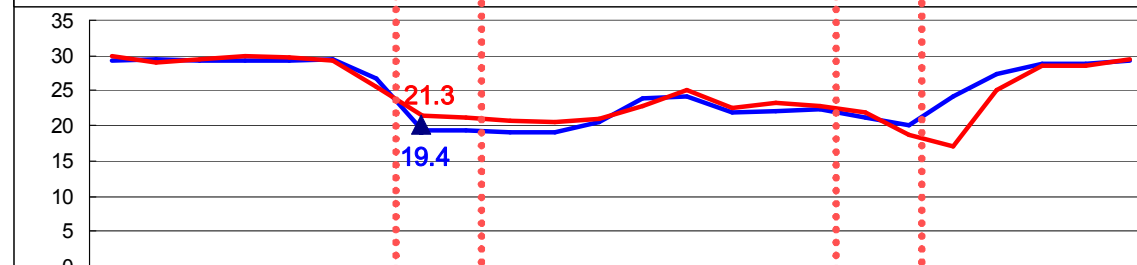
**Congestion duration
(VICS data)**

Unit:
Total of congestion
duration (minute/hour)



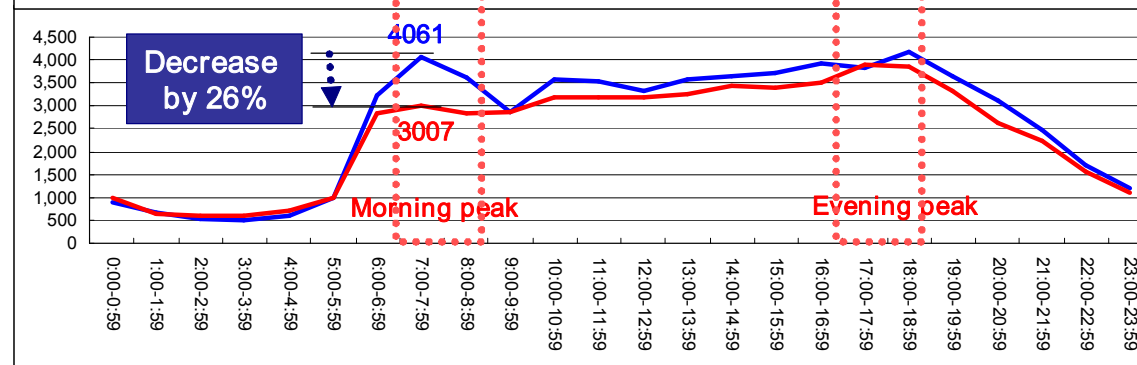
**Mean travel speed
(VICS data)**

Unit: km/h



**Traffic volume
(Manual counts)**

Unit: vehicles/hour



5. Verification of VICS Data Use for Road Administration

(2) Performance measurements before/after a project

3) Impact analysis over subject area (1/2)

- Total congestion duration over the subject areas decreases by half

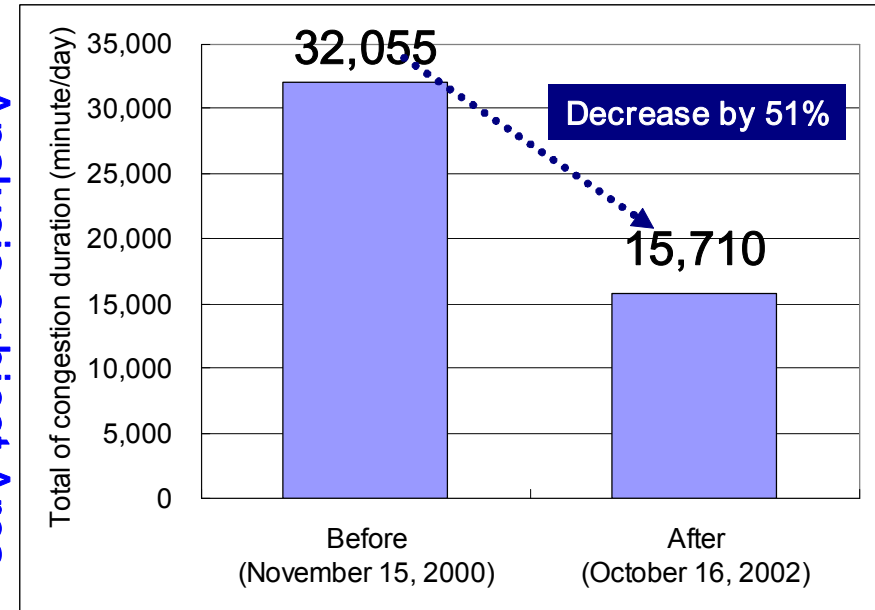
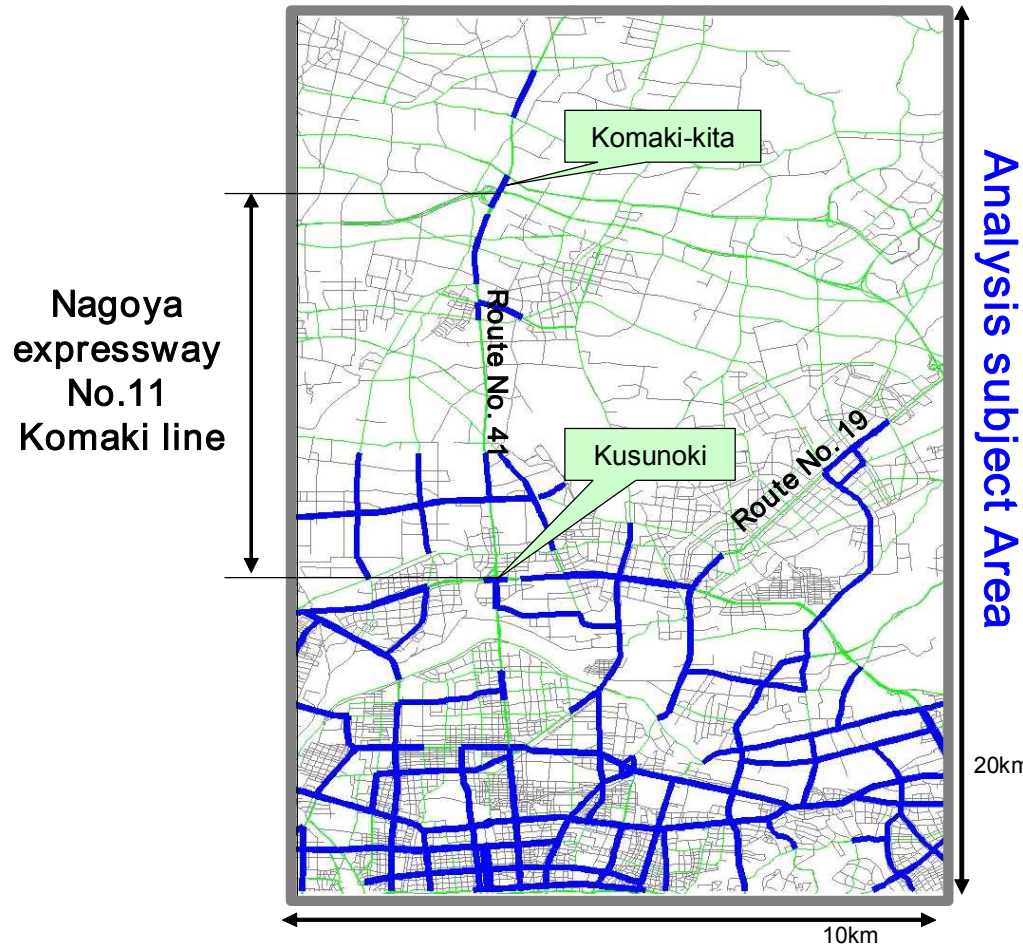
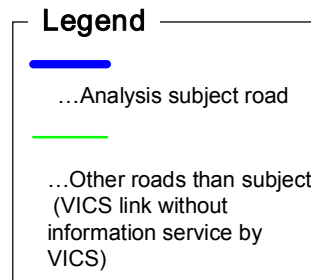


Fig: congestion duration over subject areas (VICS data)

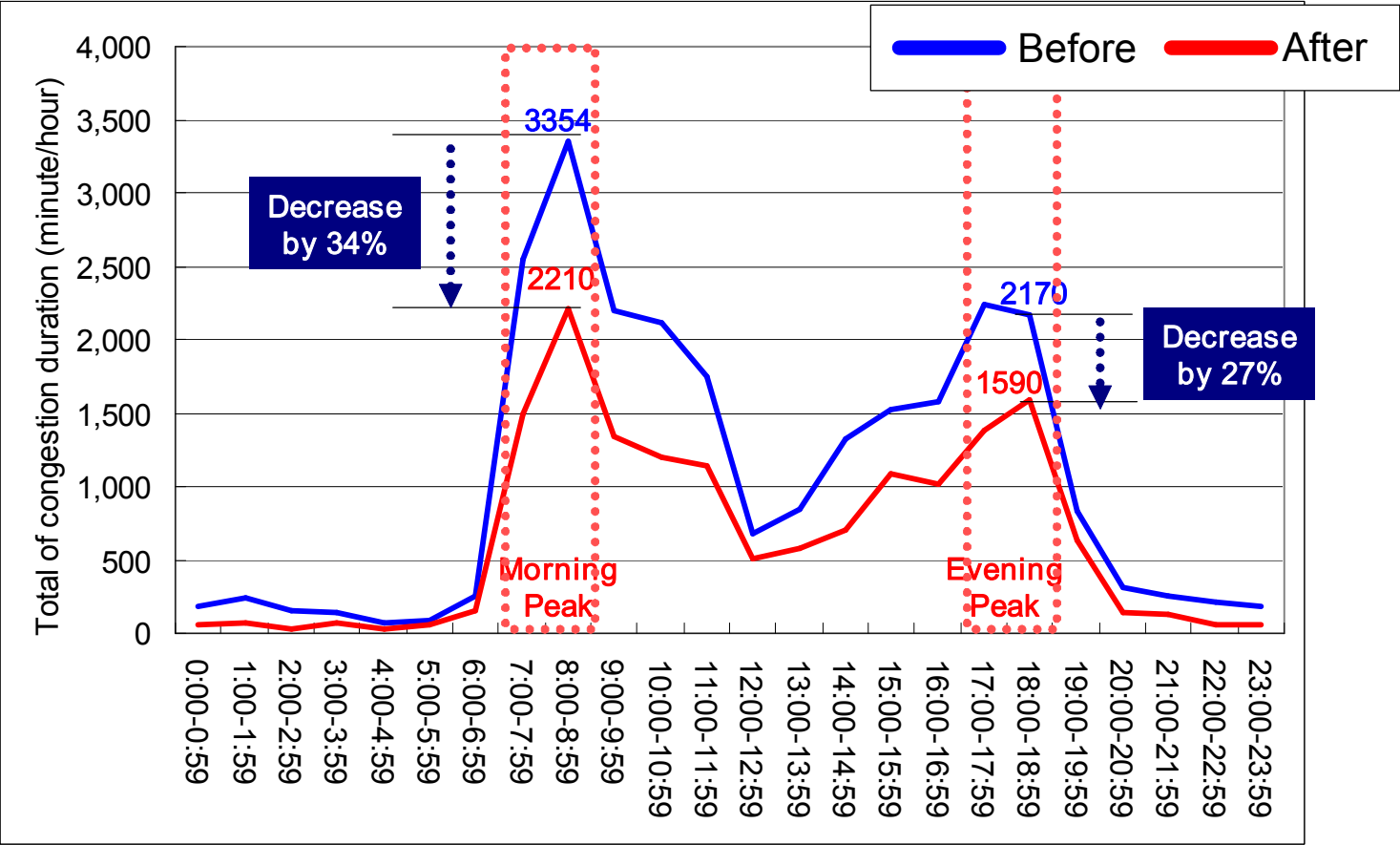


5. Verification of VICS Data Use for Road Administration

(2) Performance measurements before/after a project

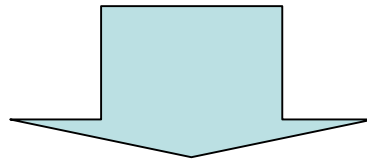
3) Impact analysis over subject area (2/2)

- Congestion duration decreases in each hour of day
- In particular, both lower peak rates are remarkable



6. Conclusion

- VICS data is suitable to use for understanding congestion conditions
- Performance measurement over extended areas is available when subject to a large scale road project
- Since data encapsulates values in each section (VICS link), traffic conditions are difficult to know in detail



Further R&D will follow to make appropriate use of VICS data for enhanced road administration