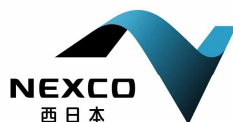


Countermeasures of Traffic Accidents on Expressways in Chugoku Region, Japan

West Nippon Expressway Company Limited,
Chugoku Regional Branch, Traffic Engineering Group
Group Leader Yasuhiro KUSUHASHI



Contents

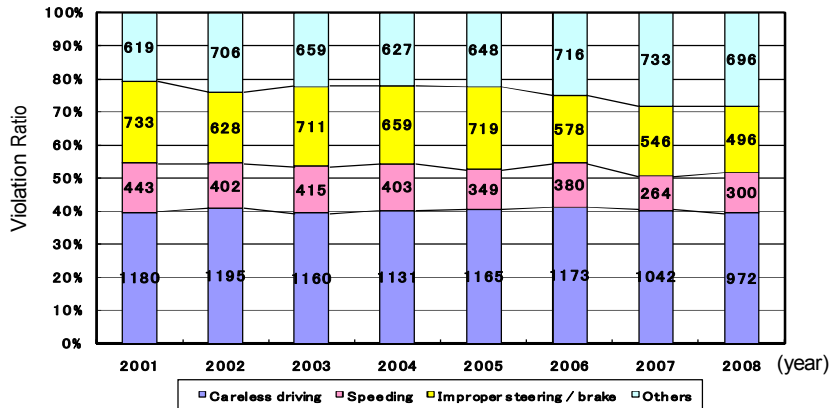
Countermeasures of Traffic Accidents on Expressways in Chugoku Region, Japan

1. Outline of Traffic Accidents in Chugoku Region
2. Traffic Safety Projects
 - (1) Urgent Traffic Safety Project (3-year plan)
 - (2) Speed Control Measures in Long Downward Sections
3. In-Vehicle Traffic Warning Information Provision by ITS
4. Countermeasures of Wrong Way
5. Traffic Information Provision on Expressway
6. Countermeasures of Congestion



1. Outline of Traffic Accidents in Chugoku Region ~ Causes of Traffic Accidents ~

- Careless driving and Speeding account for about a half of accidents.



Occurred on main track only. Investigated by W-NEXCO, Chugoku Regional Branch



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BRAND BOOK 4

2. Traffic Safety Projects

(1) Urgent Traffic Safety Project (3-year plan)

- A traffic safety project of the entire W-NEXCO for “Complete Safety and Ease”

In the Chugoku Regional Branch,

【Time】 2007 – 2009 fiscal year

【Place】 ① Steep alignment sections 24 sections

$R \leq 380\text{m}$ and $i \leq 4\%$

② Frequent occurrence of accident sections 27 sections

over 5 times/300m/year, or, 5 times the average accident rate of line

【Measures】 Water drainage pavement, Channelizing lane marking, High luminance lane marking, Caution sign, Visual guidance board, and so on.



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BRAND BOOK 5

2. Traffic Safety Projects

(1) Urgent Traffic Safety Project (3-year plan)

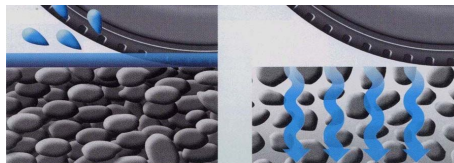
① Water Drainage Pavement



- Standard of Expressway pavement from 2000
- About 60% of Expressways have been improved to this type in Chugoku region, Japan

Dense-grade Pavement

- Spray rises back of car



Water Drainage Pavement

- Spray rises back of car is avoidable



BRAND BOOK 6

2. Traffic Safety Projects

(1) Urgent Traffic Safety Project (3-year plan)

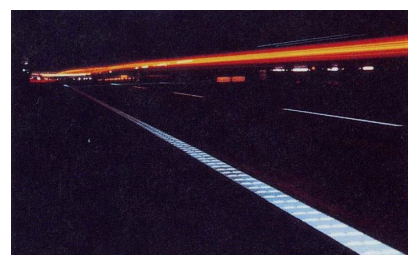
② Channelizing Lane Marking, High Luminance Lane Marking

Channelizing Lane Marking



- 【Place】
- Spots that speeding accidents occur frequently
- 【Effect】
- Driving with care

High Luminance Lane Marking



- 【Place】
- In Tunnel
- 【Effect】
- Spots that accidents occur at night frequently
 - Caution at night or dark spot



BRAND BOOK 7

2. Traffic Safety Projects

(1) Urgent Traffic Safety Project (3-year plan)

③ Caution Sign, Visual Guidance board

Attention Causing Sign in Downward Section



⇒ Refer to P13

Visual Guidance Board in Curve



- 【Place】
- At steep curve
- 【Effect】
- Visual Guidance

2. Traffic Safety Projects

(1) Urgent Traffic Safety Project (3-year plan)

④ Self-Illuminating Delineator, Reflective Seat

Self-Illuminating Delineator



- 【Place】
- Spots that fog lay frequently
 - At Steep Curve
- 【Effect】
- Visual Guidance

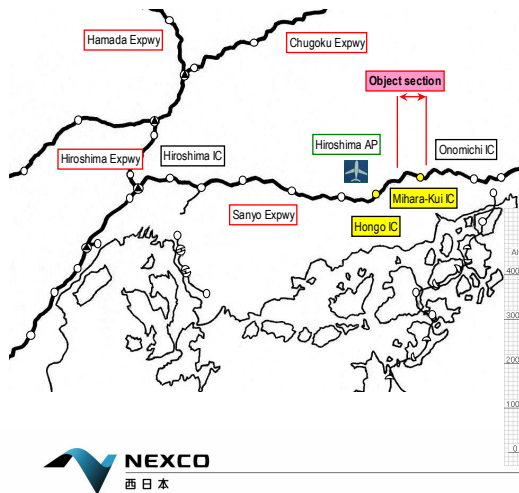
Reflective Seat



- 【Place】
- Spots that accidents happen at night frequently
 - At steep curve
- 【Effect】
- Caution at night and Visual Guidance

2. Traffic Safety Projects

(2) Speed Control Measures in Long Downward Sections

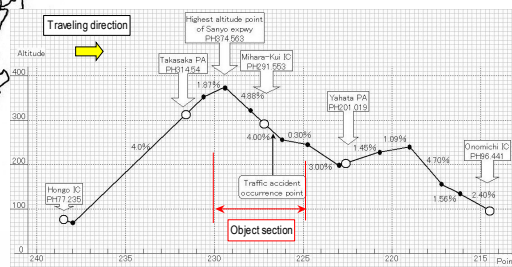


【Background】

- A truck collided with a minibus from behind, 21 crews were died or injured in May 2007.
- Causes of accident were speeding and looking aside while driving.

Traffic Safety Project

- Driving speed Investigation
- ⇒ Effective Speed Control Measures



2. Traffic Safety Projects

(2) Speed Control Measures in a Long Downward Sections

In Chugoku Regional Branch,

【Time】 In 2007 fiscal year

【Place】 Downward sections with over 4% gradient and 3 km length 9 sections

※ Selected by Prove survey (27 sections in Chugoku region)

【measures】 Speed Warning by LED Display Board, Channelizing Lane Marking, High Luminance Lane Marking, Enlargement of Caution Sign

※ After executing measures, we verified their effects by after driving speed investigation.

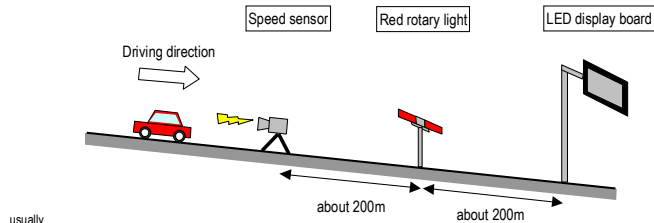
Downward slope sections with degree $\geq 4\%$ and distance ≥ 3 km	27 sections
<ul style="list-style-type: none"> ① over 25km/h + ② or ③ ① over 20km/h + ② and ③ 	Rank AA 3 sections
<ul style="list-style-type: none"> ① over 20km/h + ② or ③ 	Rank A 6 sections

① Excess degree than limited speed (Investigated speed exceeded 20km/h or 25km/h higher than limited speed)
 ② Accident density is higher than average accident density *
 ③ Accident rate is three times higher than average accident rate **
 *) Accident density (number/km) = 1.5/km·one way ⇒ Average density of accidents
 **) Accident rate (number/one hundred million vehicle-kilometer) ⇒ Accident rate of every expressways

2. Traffic Safety Projects

(2) Speed Control Measures in a Long Downward Sections

① LED Display Board & Red Rotary Light



LED Display Board

usually



at detects over speeded



- Speed sensor checks vehicle's speed
- When over-speeded vehicle is detected, red rotary light blinks first, then the LED display board gives warning.



Red Rotary Light



Contents of LED Display Board

BRAND BOOK 12

2. Traffic Safety Projects

(2) Speed Control Measures in a Long Downward Sections

② Enlargement of Caution Sign

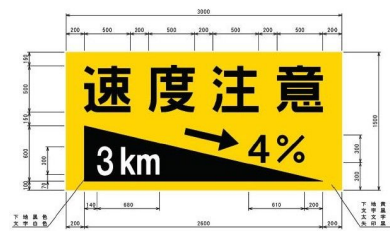
○ Enlarged board size and font size

【Board size】 1.2m × 2.5m ⇒ 1.5m × 3.0m

【Font size】 35cm × 35cm ⇒ 50cm × 50cm

○ Super-high luminance reflection seat is adopted.

○ Emphasize the downward slope by figure.



Before enlargement



After enlargement



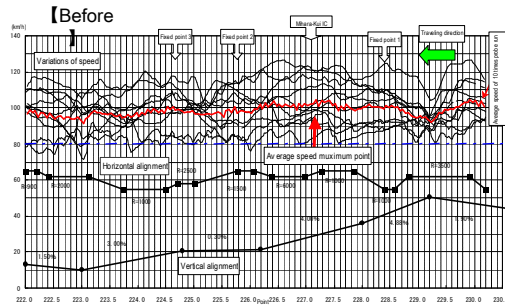
BRAND BOOK 13

2. Traffic Safety Projects

(2) Speed Control Measures in a Long Downward Sections

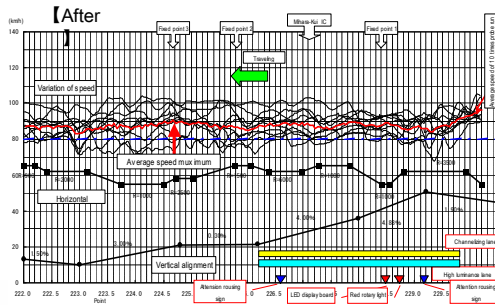
Effect of Countermeasures (sample)

① Results of Probe Car Survey



Compare with results of before and after investigation,

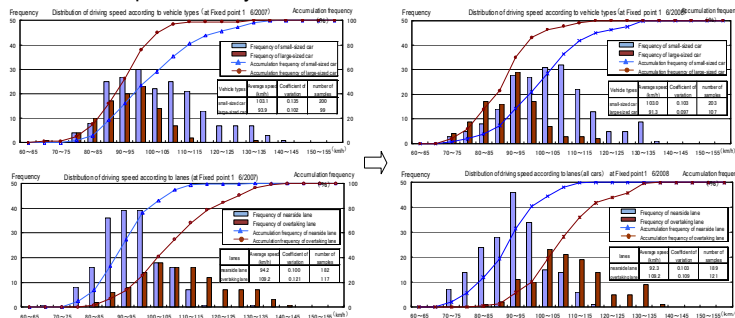
- Rapid increase of speed after crest is improved
- Difference between high-speeded and low-speeded is decreased



2. Traffic Safety Projects

(2) Speed Control Measures in Long Downward Sections

② Results of Fixed-point Survey



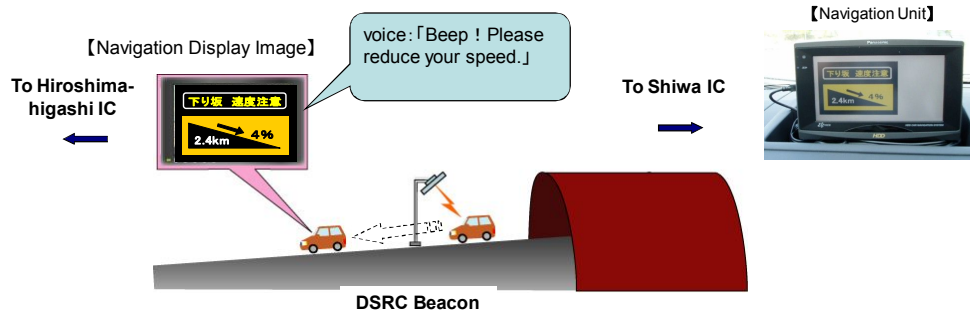
	Preliminary investigation (26/6/2007)			Posterior investigation (11/6/2008)			Fluctuation		
	Average speed (km/h)	σ (km/h)	number of samples	Average speed (km/h)	σ (km/h)	number of samples	Average speed (km/h)	σ (km/h)	
Vehicle types	small-sized cars	103.1	13.9	200	103.0	12.9	203	-0.1	-1.0
	large-sized cars	93.9	9.6	99	91.3	8.9	107	-2.6	-0.7
lanes	nearside lane	94.2	9.4	182	92.3	9.5	189	-1.9	0.1
	overtaking lane	109.2	13.2	117	109.2	11.9	121	0.0	-1.3

- The average speed of small-sized car decreased hardly.
- The average speed of overtaking lane hardly decreased.

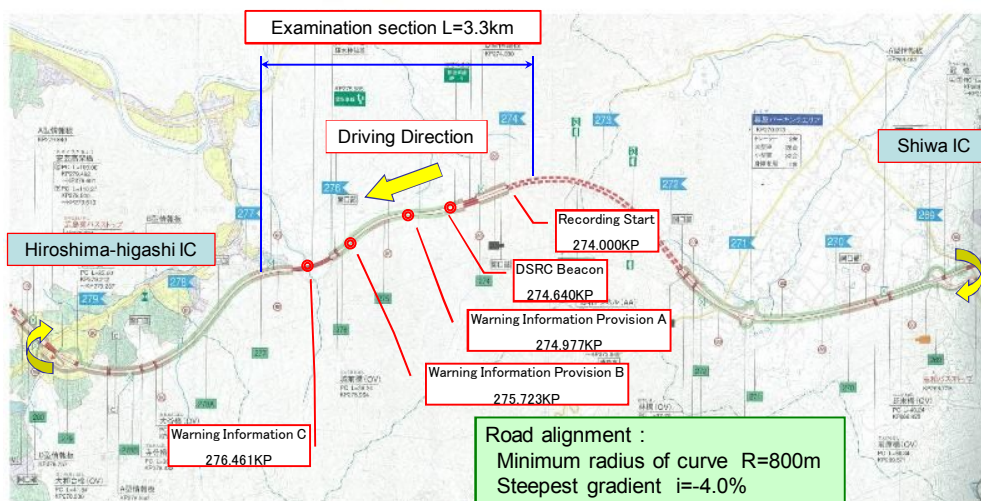


3. In-vehicle Traffic Warning Information Provision by ITS ~ Outline of In-vehicle Traffic Warning Information Provision ~

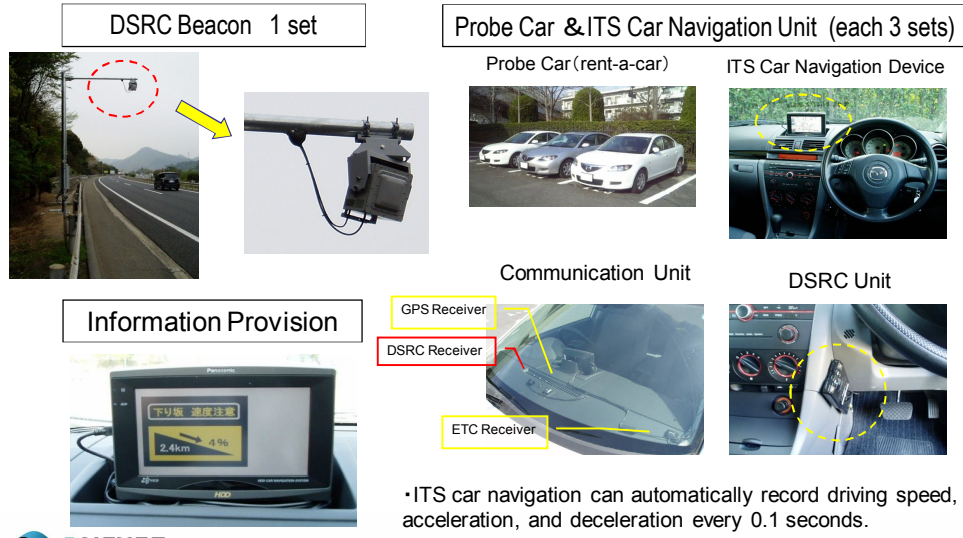
- At the beginning of downward section, limited speed information is communicated from a dedicated short range communication (DSRC) beacon at roadside to in-vehicle navigation unit.
- The unit judges driving speed at the beginning of downward section and before curves. When driving speed exceeds decided speed, it provides warning information. (voice-only or voice & image-based information)



3. In-vehicle Traffic Warning Information Provision by ITS ~ Layout of Examination ~

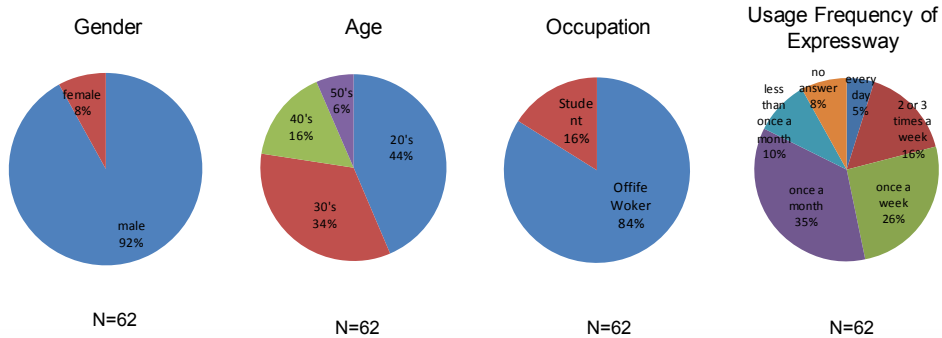


3. In-vehicle Traffic Warning Information Provision by ITS ~ Layout of Examination ~



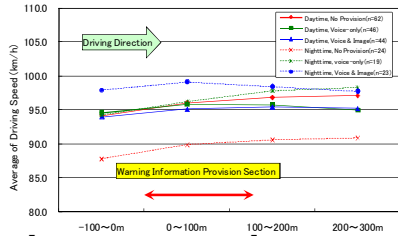
3. In-vehicle Traffic Warning Information Provision by ITS ~ Test Drivers ~

- 62 persons who were from twenties to fifties years old.
- 84% of drivers were employee of W-NEXCO group, and 16% were students.
- 47% of test drivers drove Expressway more than once a week, and 35% drove once a month.



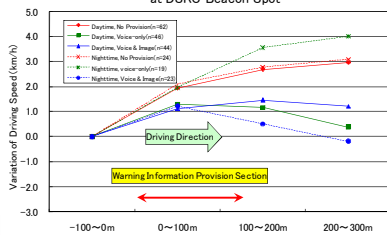
3. In-vehicle Traffic Warning Information Provision by ITS ~ Variation of Driving Speed (at DSRC beacon spot) ~

【Average of Driving speed】
at DSRC Beacon Spot



- In case of no warning provision, speed increased both daytime and nighttime.
- In case of warning provision, speed didn't increase.
- In daytime, speed decreased large by voice-only. And in nighttime, speed decreased large by voice & image.
- In case of nighttime, voice & image, speed was high before warning information provision. But after provision, speed decreased till same level of other case.
- Speed didn't decrease sufficiently in case of nighttime by voice-only

【Variation of Driving Speed】
at DSRC Beacon Spot



Voice & Image based In-Vehicle Traffic Warning Information Provision

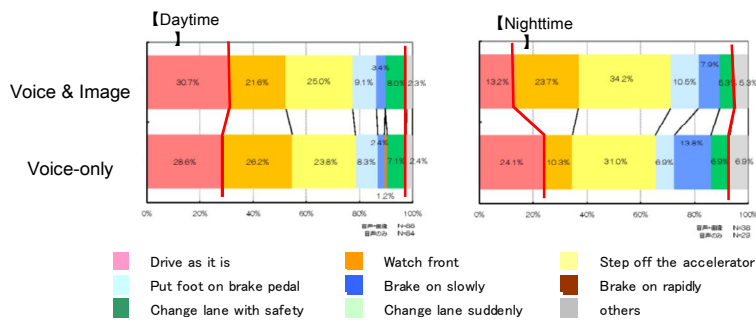
【under Provision】

【Provision finished】



3. In-vehicle Traffic Warning Information Provision by ITS ~ A sample of questionnaire by test driver ~

2) How did you behavior after traffic warning information provision?

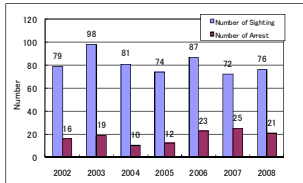


- By traffic warning information provide, about 70% of drivers conducted safe action such as “Watch front”, “Step off the accelerator”, “Put foot on brake pedal”.
- Especially, in case of voice & image at nighttime, about 80% of drivers conducted safely.

○ Traffic warning information provision by voice & image tends to safe action.

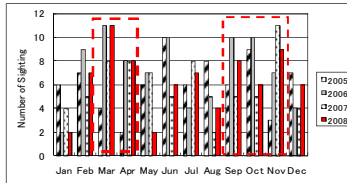
4. Countermeasures of Wrong Way ~ Trend of Wrong Way in Chugoku Region ~

Number of sighting



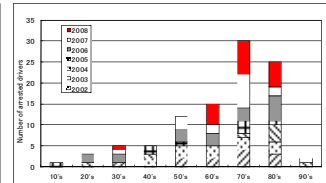
• About 80 sightings are reported every year.

Monthly



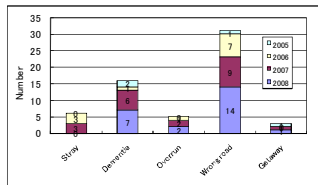
• A lot of wrong way tend to occur in March, April, and September to November.

Age



• The number of 70-year-old or more aged drivers is high.

Cause of Wrong Way



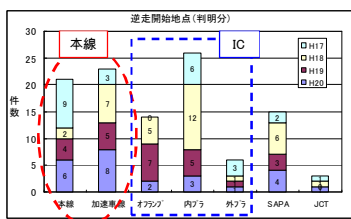
• Careless U-turn after noticing wrong route is main cause, but the case of Dementia is increasing recently.



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BRAND BOOK 22

4. Countermeasures of Wrong Way ~ Starting point of Wrong Way and countermeasures ~



• Many wrong ways started at IC, but started at main track is increasing recently.

Countermeasures

【Publicities, etc.】

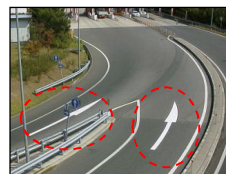
① Ordinary drivers

• Variable sign board, Highway radio, Leaflet, etc.

② Demented drivers

• Obstruction at Toll gate by employee

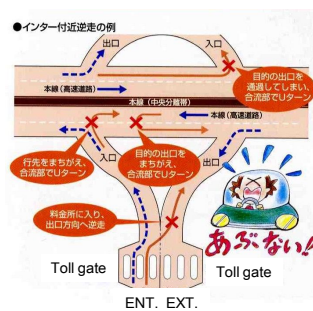
【Facilities】



Lane Marking



Lane Marking and Lane Divider



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BRAND BOOK 23

5. Traffic Information Provision on Expressway ~ Variable Message Sign Board ~

➤ Variable Message Sign Board

◀ Type ▶

- Variable Message Sign Board at an Exit (A type)
- Variable Message Sign Board at Entrance (B type)
- Variable Message Sign Board at Toll Gate (C type)
- Variable Message Sign Board at Entrance of Tunnel (D type)
- Tunnel Information Variable Display Sign Board (E type)
- Variable Message Sign Board at Junction (J type)
- Wide-Area Variable Message Sign Board (K type)

5. Traffic Information Provision on Expressway ~ Variable Message Sign Board at an Exit (A type) ~

- At an exit of Interchange
- In order to judge continuous drive on Expressway or provide traffic warning information until next Interchange.
- Display traffic information until 5 section ahead
(Firstly, it displays traffic warning information until next Interchange.)



5. Traffic Information Provision on Expressway ~ Variable Message Sign Board (B type and C type) ~

- Variable Message Sign Board at Entrance (B type)

In order to judge driving on Expressway, it displays traffic information until 5 section ahead.



- Variable Message Sign Board at Toll Gate (C type)

It displays traffic information until 5 section ahead. Firstly, it displays traffic warning information until next Interchange.



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5. Traffic Information Provision on Expressway ~ Variable Message Sign Board (J type and K type) ~

- Variable Message Sign Board at Junction (J Type)

- For route selection, it is placed before Junction.
- It displays traffic information within 5IC ahead or 100km.



- Wide-area Variable Message Sign Board (K Type)

- It is placed before Junction or weather changeable point.
- It mainly displays significant phenomenon such as road closed or large scale congestion within



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5. Traffic Information Provision on Expressway ~ Internet Device ~

【i-Highway】 (right upper image)

- This service provides Traffic Information on Expressways all over Japan by Internet devices. (via Personal computer or mobile phone)
- Contents
 - Traffic Information Map
 - Textual Information
 - Information of Road Closed
 - Email Service at the end of Road Closed
 - Road Image and so on.



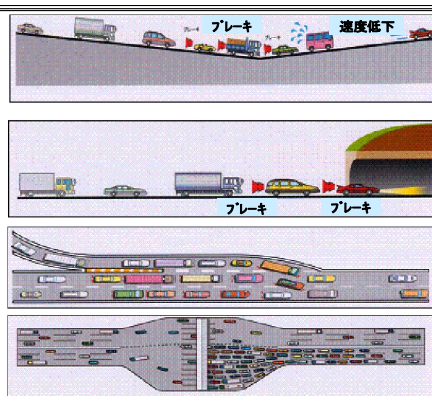
【Yukihiro.com】 (right lower image)

- This service provides Road Information on Expressway during winter.
- Contents
 - Road Information (Weather, Snow Depth, Temperature, Snow-Removing Information)
 - Road Image
 - Email Service (Weather, Snow-Removing and so on.)



6. Countermeasures of Congestion ~ Cause of Congestion ~

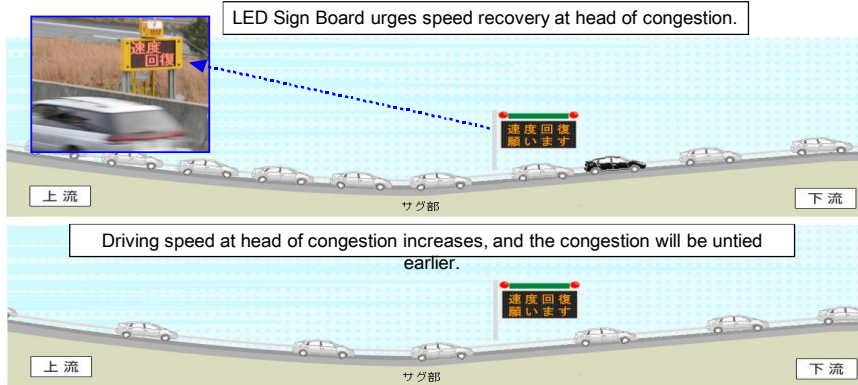
- (1) Up-Grade & Sag
 - Decline of Speed and Brake
- (2) Entrance of Tunnel
 - Brake
- (3) Merging Section of Interchange
 - Weaving
- (4) Toll Gate
 - Stop for Payment



6. Countermeasures of Congestion ~ Warning Information Provision for Decline of Speed ~

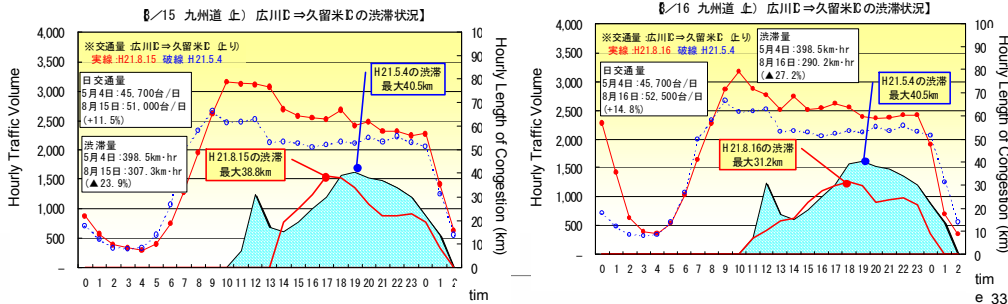
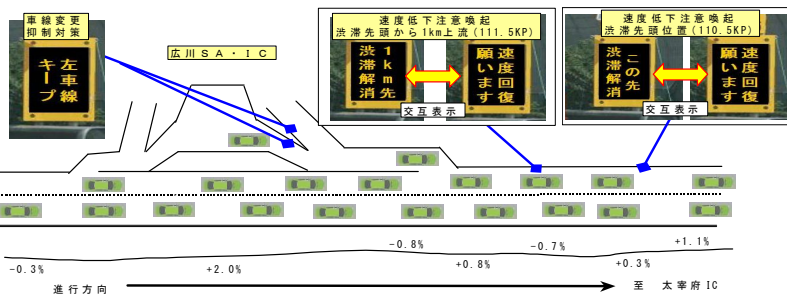
《Purpose of Countermeasure》

- LED sign board placed at head of congestion provides information about the end of the congestion and asks speed recovery.
- ⇒ Drivers will recover speed of cars and then traffic density will increase.



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6. Countermeasures of Congestion ~ Effect of LED Sign Board (Case of Kyusyu Expressway) ~



6. Countermeasures of Congestion

~ Information Provision of Predicted Congestion ~

- W-NEXCO's Website provides predicted congestion within 5 months, over 5km.
- When you click "Detail" button, you get hourly congestion length and required time to get through it.

2009年9月19日は107箇所での渋滞が予測されています

道路名	方向	区間(区)	区間(C区)	ボトルネック箇所	時間帯	時間	渋滞長さ
東名高速道路	上り	豊田JCT	豊田IC	豊田IC付近	前日22:00~8:00	8時	20km
		三ヶ日IC	三ヶ日IC	三ヶ日IC付近	9:00~11:00	10時	10km
		三ヶ日IC	三ヶ日IC	三ヶ日IC付近	9:00~11:00	10時	10km
		三ヶ日IC	三ヶ日IC	三ヶ日IC付近	9:00~11:00	10時	10km
		三ヶ日IC	三ヶ日IC	三ヶ日IC付近	9:00~11:00	10時	10km
		三ヶ日IC	三ヶ日IC	三ヶ日IC付近	9:00~11:00	10時	10km
		三ヶ日IC	三ヶ日IC	三ヶ日IC付近	9:00~11:00	10時	10km
		三ヶ日IC	三ヶ日IC	三ヶ日IC付近	9:00~11:00	10時	10km
		三ヶ日IC	三ヶ日IC	三ヶ日IC付近	9:00~11:00	10時	10km
		三ヶ日IC	三ヶ日IC	三ヶ日IC付近	9:00~11:00	10時	10km

渋滞予測リンダールTOP > 渋滞予測情報一覧 > 詳細

路線名(方向)	名神高速道路(上り)
区間	浜木IC ~ 京都東IC
日時	2009年9月19日
時間帯	05:00~13:00

ボトルネック箇所	京都東IC付近
ピーク時の渋滞長さ	30km (9時頃)
通常所要時間	00:23
渋滞所要時間	02:00(+ 01:37)

時間帯別渋滞情報

時間帯	渋滞距離
6時台	5km
7時台	10km
8時台	20km
9時台	30km
10時台	20km
11時台	10km
12時台	5km

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6. Countermeasures of Congestion

~ Toll and Route Search Site ~

- W-NEXCO's Website provides predicted arrival time considering congestions. over 5km, too. More over, when you input departure time, predicted congestion sections are displayed on map.

料金検索した後に、出発予定日時を入力。

「予測所要時間の推移を見る」をクリックすると、入力した時刻の前後3時間までの予測所要時間の変化を確認することができます。

9時に出発すると、通常44分で到達するところが、予測では渋滞により1時間35分かかっています。

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