The Possibility of Implementing the Management Cycle of Winter Road Maintenance by Performance Measurement

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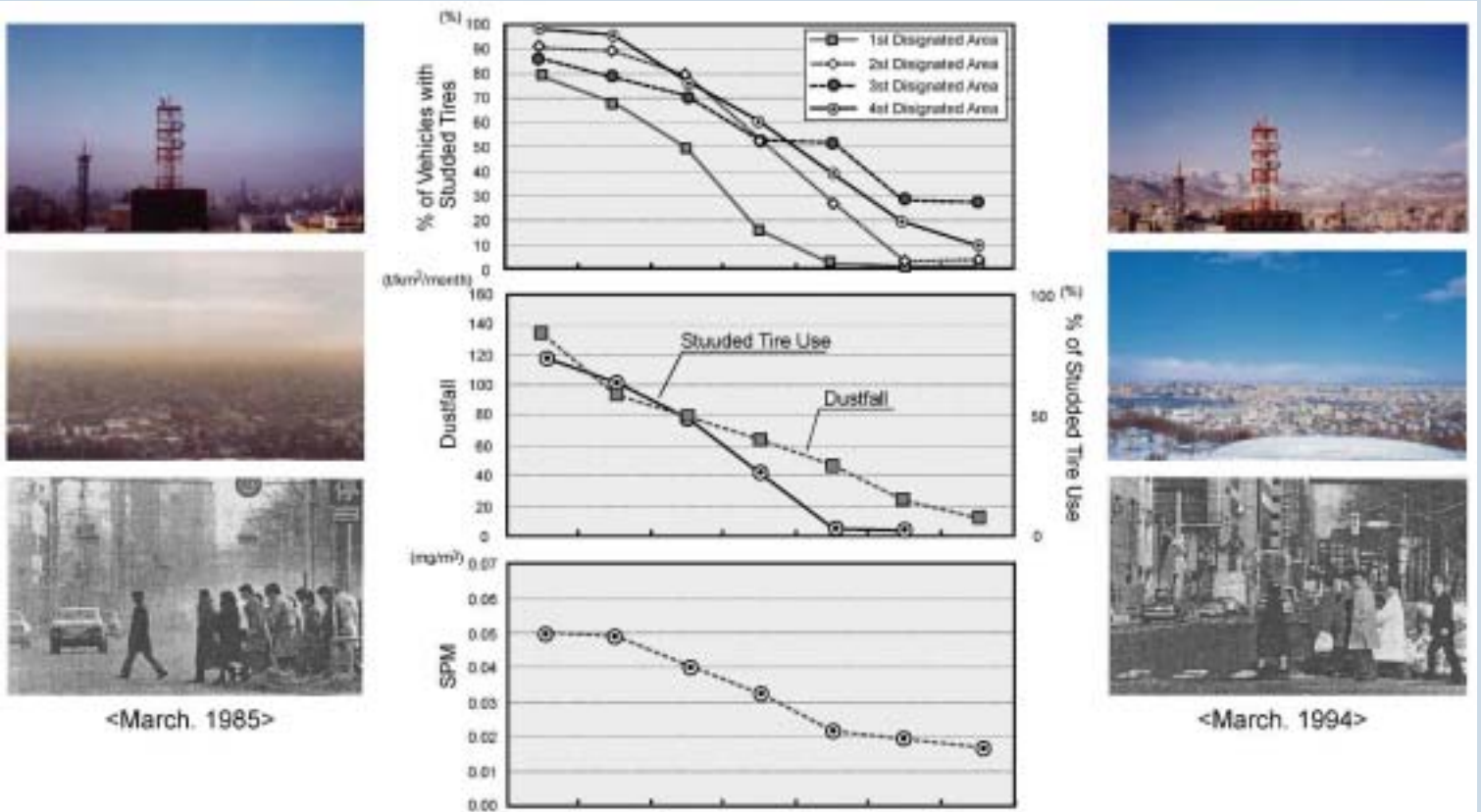
Outline

- 1. Background (from circumstances after the regulation of studded-tire use in Japan)
- 2. Examples of winter road management model in other countries
- 3. The Government Policy Evaluation Act (GPEA) in Japan
- 4. What is “outcome” of winter road maintenance?
- 5. A “Logic Model” of winter road maintenance evaluation using friction value
- 6. Experiments of friction value(HFN) measurement in the last winter (’07/08)
- 7. Relation between friction value and mobility (Q-V curve) from the experiments
- 8. Discussion from the viewpoint of Availability, Efficiency, and LOS evaluation of winter road maintenance by friction value
- 9. Conclusions

Background

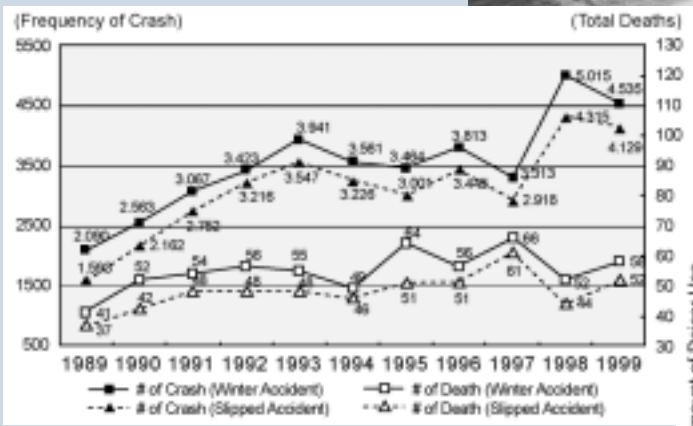
- Dust pollution caused by studded tire became a serious social concern since the late 70's in Japan.
- This leads to the enactment of the Studded Tire Regulation Law of 1990 in Japan, which prohibits the use of studded tires.
- The studded-tire regulation achieved preventing studded tire dust, that leads to air quality improvement.



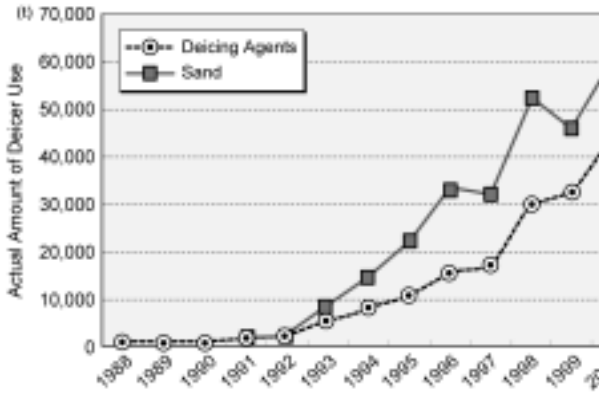
Background

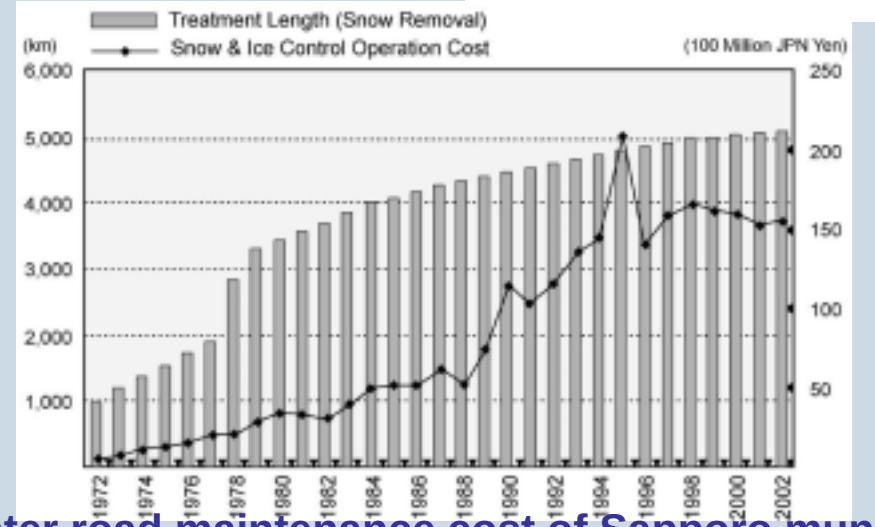
- The studded-tire regulation is generally accepted in the public because it achieved preventing studded tire dust.
- On the other hand, the road surface grip condition greatly worsened.
- Therefore, the regulation leads to some negative effects,
- such as increased winter accidents, worsened winter mobility, increased deicing chemical usage, and increased winter maintenance cost.

Most slippery condition



Injury and death number of winter-type (mainly slip) accident in Hokkaido





Volume o deicing- agent an abrasives in nationa highway i Hokkaido

Snow removal length & winter road maintenance cost of Sapporo municipality

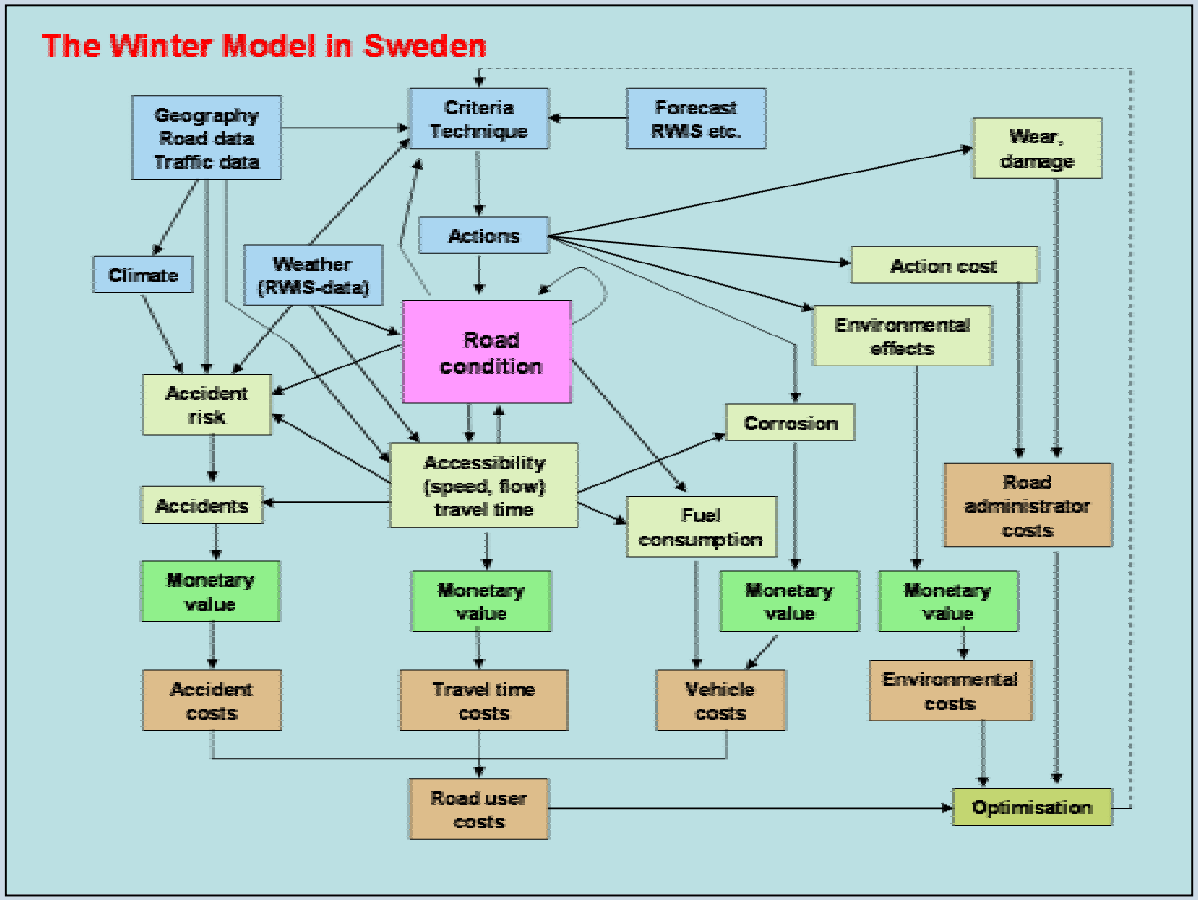
Background

- When the legislative vote on the regulation in the diet, the supplementary resolutions were adopted, that points out a necessary review of the state of circumstances after the regulation.
- This study proposes one of ways of the management of winter road maintenance with a “logic model” using road surface grip measurement.

The Supplementary Legislative Articles

- Take necessary action for research and development of alternative tires
- Consider that road administrator's effort, including snow and ice control operation, not to be excessively heavy
- Prevent to originate secondary pollution
- Take necessary action towards realization of non-studded tire society with reviewing the state of the measure against studded-tire dust, taking into consideration designation area, dust situation, and alternative tire development.

Examples of Winter Road Management Model



Sweden's Winter Model

- Sweden has developed the unique winter road management model called "Winter Model." This model is developed to evaluate winter road maintenance, with optimizing synthetically by converting any impacts to monetary value.

Examples of Winter Road Management Model

Alberta's presentation at 85th TRB annual meeting in 2006

- **Another unique study is one in Province of Alberta, Canada, which conducts performance measurement as asset management.**
- **In general, the invested resources is "input", involving monetary and humane resources and anti-icing application amount,**
- **and products including treatment length and amount of anti-icing operation can be considered as "output."**
- **The study in Alberta shows that performance measurement could evaluate mobility and reliability from the relationship between snowfall and traffic volume or travel speed.**
- **And, the study showed the importance of benchmark-based evaluation.**

The Government Policy Evaluation Act (GPEA) in Japan

- The government of Japan enacted the Government Policy Evaluation Act (GPEA) in April 2002.
- The national government administration organs are required to asses and measure and analyze the effects of their own policies
- themselves.

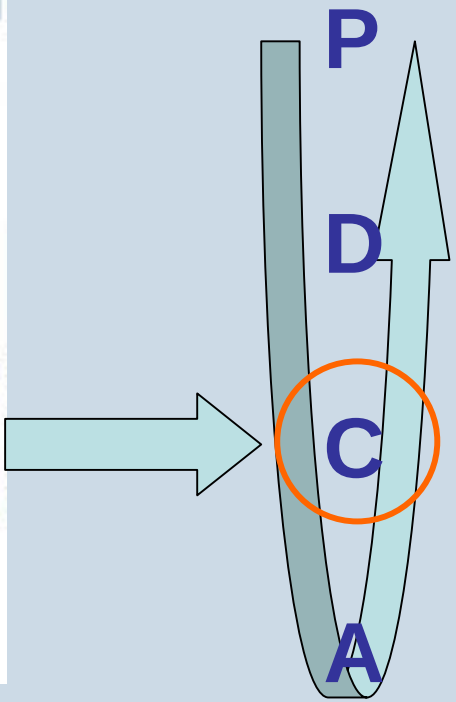
Road Administration Management in Japan

- The Ministry of Land, Infrastructure and Transport of Japan has promoted policy evaluation by framing “Management Cycle of policy” with carrying out three evaluations;
- “Policy Assessment,” “Policy Checkup,” and “Policy Review.”
- PDCA cycle is recommended.
- A numerical target is set up in advance (as Plan), necessary policies/programs are implemented (as Do), and evaluation of their achievements is done (as Check) , and result of check is reflected in the following administrative management (as Action).
- Therefore, it is meaningful work to study such management approach in winter road maintenance.

What is “Outcome” of Winter Road Maintenance?

- It is important to discuss what is the "outcome" of winter road maintenance.
- The outcomes might include winter traffic mobility (e.g. travel speed, traffic capacity, traffic congestion length, etc.), and winter traffic safety, reliability and road users' satisfaction.
- Those are considered to be the “final-outcome”
- However, those indexes are affected by traffic demand, traffic signal control and so on, which can be said the “external factors.”
- The such “final-outcomes” need to be made through the discussion among various stakeholders.
- For this reason, it needs to specify the outcome that is not affected by the external factors.
- This study is interested in friction value(HFN), which is a direct result of snow and ice control that can be measured continuously.

A “Logic Model” of winter road maintenance evaluation using friction value



- **This figure shows the logic model regarding to performance measurement of winter road maintenance. The model is thought to be used at “Check” point in the management cycle.**
- **In this model, “Input” and “Activity” include budget, humane resources, and facilities regarding to winter road maintenance**
- **Frequency of anti-icing activity and anti-icing agents volume can be recognized as the “Output.”**
- **Friction values on the roadway is provided as “Intermediate Outcome.”**
- **And, winter traffic mobility, traffic accident, and customer satisfaction etc. are “Final outcomes.”**

Experimental routes of friction value(HFN) measurement in the last winter (’07/’08)

We did the friction value measurement in two winters (’06/’07 and ’07/’08).

This figure shows test routes in the last winter(’07/’08).

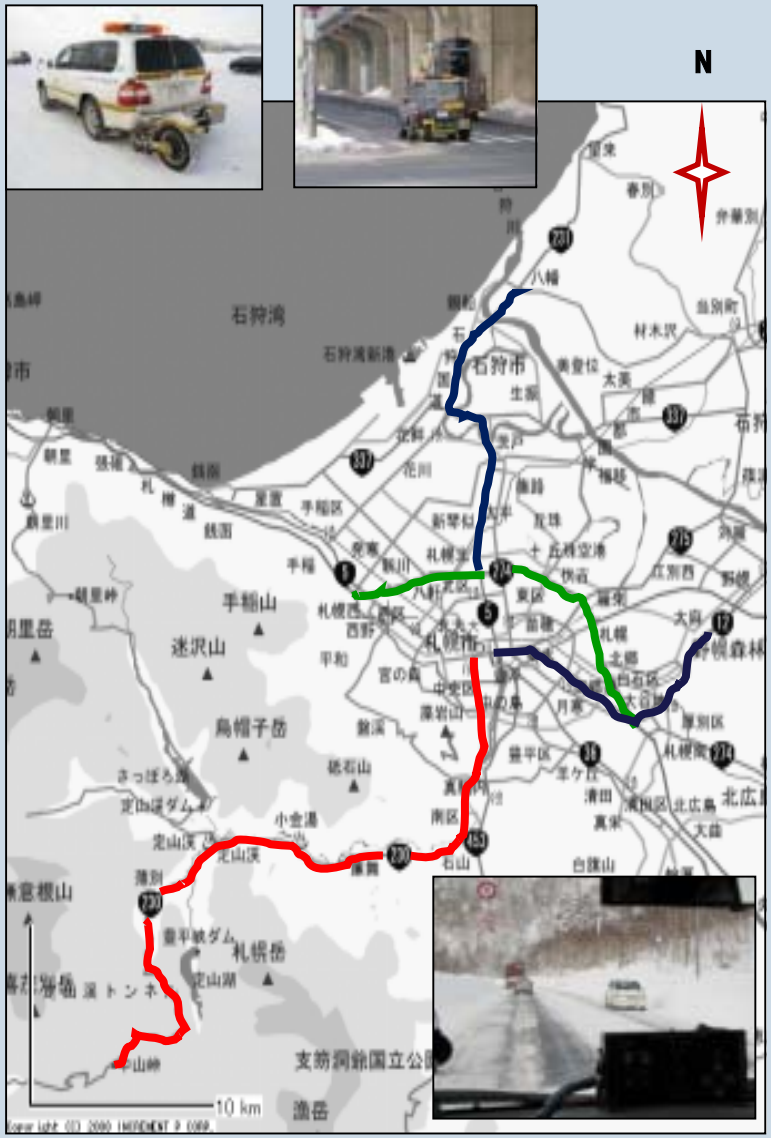
The measurement was done from mid Dec. ’07 to the end of Feb. ’08.

Measurement frequency is as followed.

Red, R230, 40 days, 2 times a day, to and from.

Blue, R12 & R231, 7 days, 4 times a day, to and from.

Green, R5 & R274, 7 days, 4 times a day, to and from.



Result of Friction Value Measurement on R230 in '07/08

HFN= 0-100 : almost f.c.= 0-0.80 or 0-0.85

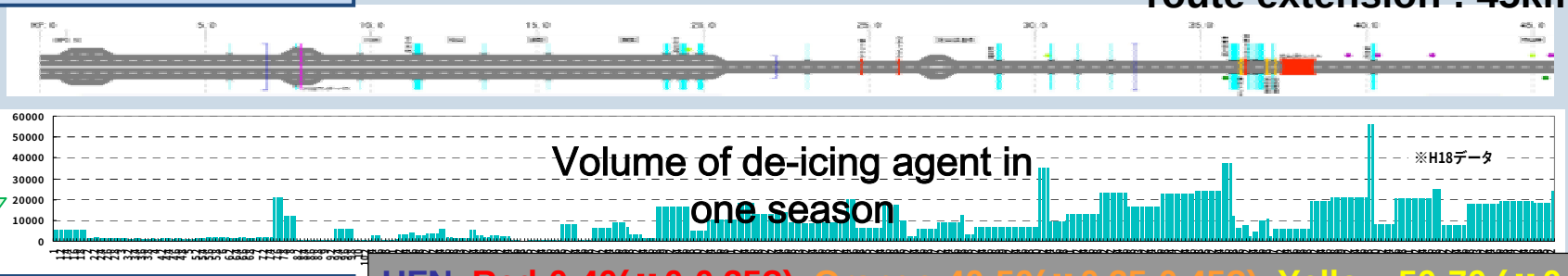
IPUT, ACTIVITIES

Budget : about $ 2 million,

Facilities : 2 Snow Removal Stations, 16 vehicles of plow and sampler, etc

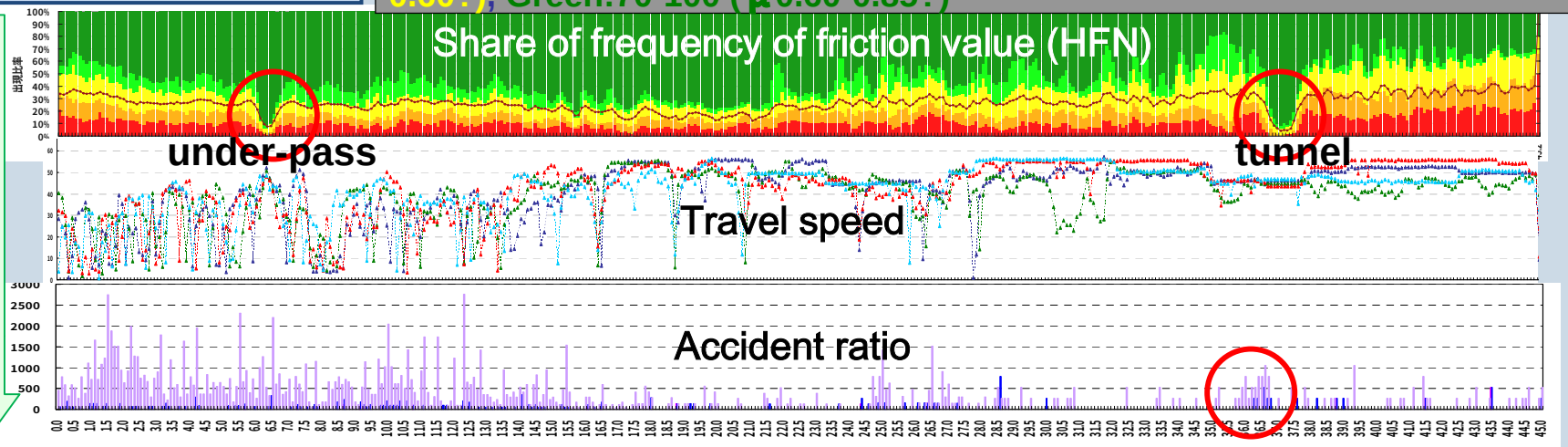
UTPUT

route extension : 45km



UTCOME

HFN Red:0-40(μ0-0.35?), Orange:40-50(μ0.35-0.45?), Yellow:50-70 (μ0.45-0.60?), Green:70-100 (μ0.60-0.85?)



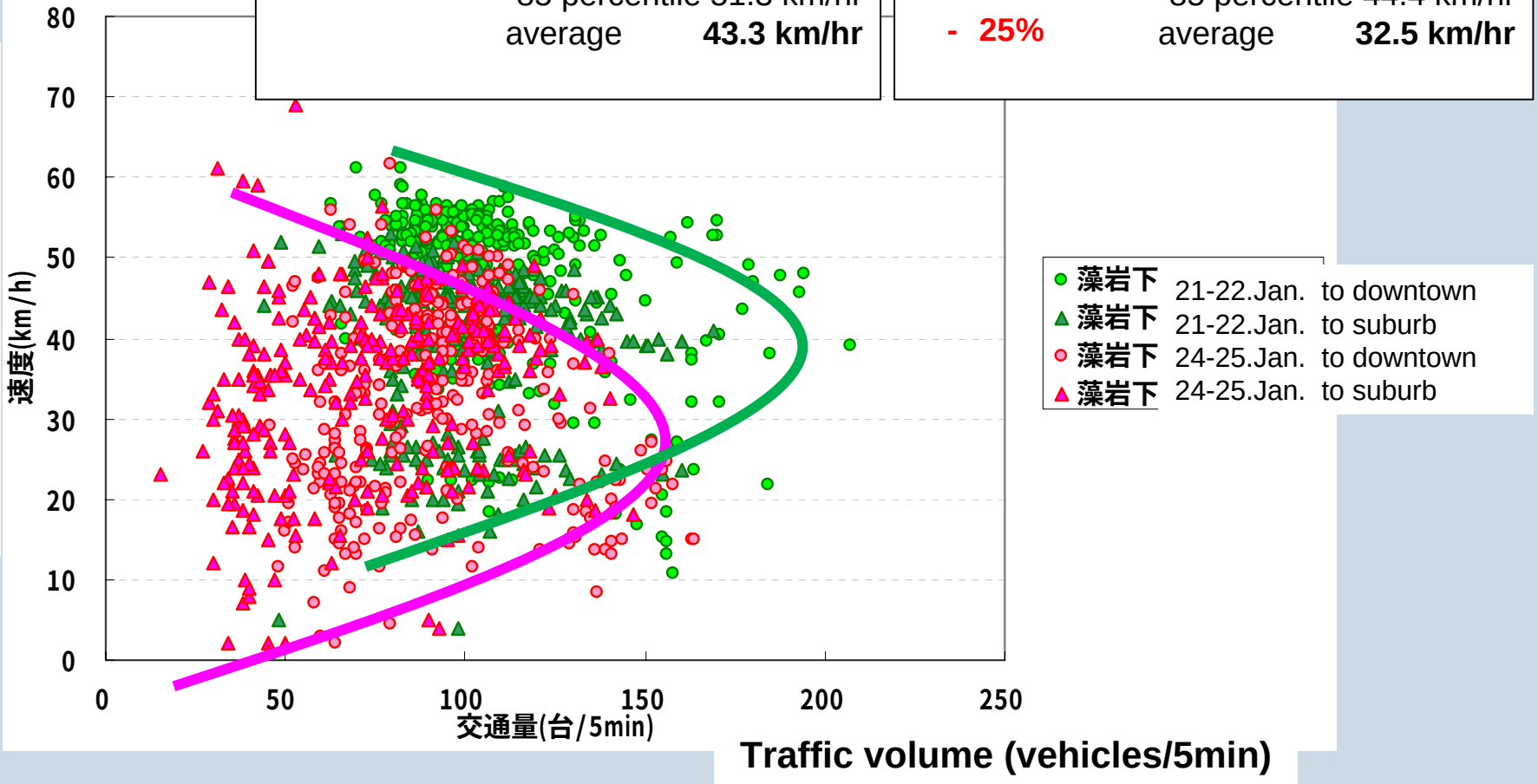
Trial performance measurement of winter road maintenance on R230 (45km in Sapporo-city)

Relation between friction value and traffic mobility(Q-V curve)

Q-V curve at one of observation point (Moiwa-shita) on R230

21.Jan.-22.Jan.
Average friction value (H.F.N) **74.4**
Travel speed 15 percentile 31.3 km/hr
85 percentile 51.3 km/hr
average **43.3 km/hr**

24.Jan.-25.Jan.
Average friction value (H.F.N) **41.7**
Travel speed 15 percentile 19.3 km/hr
85 percentile 44.4 km/hr
- 25% average **32.5 km/hr**



Q-V figure at two different friction resistance value

Discussion from the viewpoint of Availability, Efficiency, and LOS

evaluation of winter road maintenance by friction value

- **Viewpoint of Availability Evaluation of Winter Road Maintenance**
- **The friction value seems to show the availability of winter road maintenance intermediately, but objectively and quantitatively.**
- **Therefore, it seems to be a good index in fairness, reliability.**
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- **Viewpoint of Efficiency Evaluation of Winter Road Maintenance**
- **The efficiency is the ratio of the “input” to the “outcome”,**
- **and/or the ratio of the “output” to the “outcome”.**
- **In the viewpoint of efficiency evaluation, friction value maybe also works well as an index.**
-
- **Viewpoint of LOS of Winter Road Maintenance**
- **In the viewpoint of evaluation of LOS, how much the “final outcome” of the winter road maintenance should offer?**
- **and how many anti-icing application amounts are permitted from a viewpoint of environmental affairs?**
- **It is necessary to make sure of the appropriate level of friction value and final outcomes through the argument with authorities.**

CONCLUSIONS

- I try to line up remained issues.
-
- To clarify of the relationship between friction value and final outcomes
- To organize appropriate level of friction value and final outcomes
- in order to do above matters
- To study data in continuous years
- To comparison study with more routes
-
- In addition, in order to contribute to achievement of the accountability of winter road maintenance, following points are to be discussed among road authorities and road users.

- To begin with, what is the outcome of winter road maintenance?
- What is the point that should be improved?
- How much the level of service should be?
- How to achieve it?
- How to lower the cost?
- What is necessary technology to achieve it ?

Thank you for your attention.

If you have questions, please talk shortly and slowly.

- Motoki Asano

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