Québec 2010
AIPCR · PIARC

XIII INTERNATIONAL WINTER ROAD CONGRESS

QUÉBEC, FEBRUARY 8 TO 11, 2010

SUSTAINABLE WINTER SERVICE FOR ROAD USERS

ROAD HEATING USING HOT SPRING WATER AS THE RENEWABLE HEAT SOURCE

Hidenori Mogi

City of Sapporo, Japan

Chief, Snow Removal Planning Section,
Snow Management Office, Construction Bureau

Hidenori.mogi@city.sapporo.jp

WORLD ROAD ASSOCIATION
MONDIALE DE LA ROUTE
AIPCR · PIARC

Québec

OUTLINE

1. INTRODUCTION

2. LOCATION,CLIMATE AND SNOW REMOVAL OF SAPPORO

3. RENOVATION PROJECT IN THE JOZANKEI DISTRICT

4. NEW DIRECTIONS FOR ROAD HEATHING

5. CONCLUSION

Osaka

Nagoya

ABOUT SAPPORO CITY

- Overview of Sapporo

Topography

43 ºN. latitude

141 ºE. longitude

Population

1.9 million

Québec 2010
AIPCR · PIARC

CLIMATE OF SAPPORO

- Weather conditions

Avg. annual temp.

8.5 ºC

130 winter days

48 frost days

Annual snowfall: 6 m

WINTER ROAD MAINTENANCE OF SAPPORO

- Winter road maintenance

Length of roads maintained

5,400 km

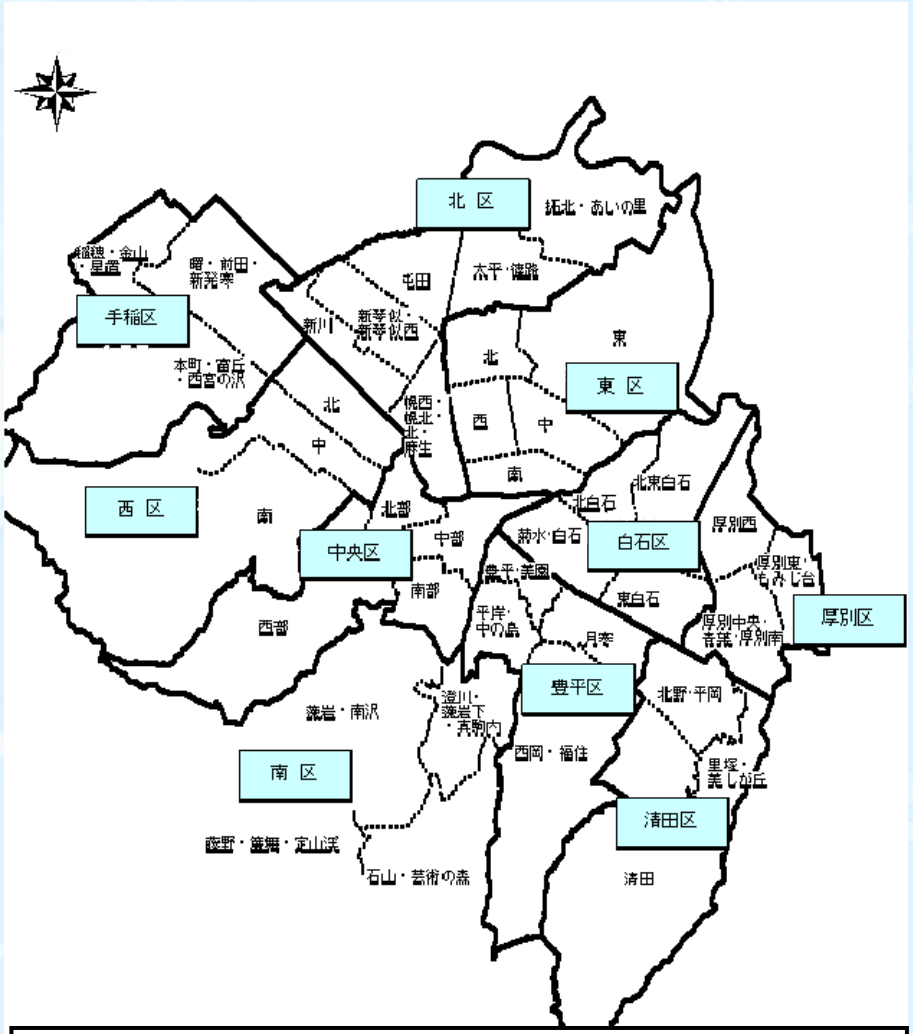
(trunk roads: 840 km)

Sidewalk snow removal

2,900 km

Annual snow removal budget

$143 million or €102 million



39 blocks of each United Neighborhood Association

WINTER ROAD MAINTENANCE OF SAPPORO

- During city-wide snow removal

  About 1,000 machines operate.

  About 3,000 people work.

  The cost is $1.2 million (€85 thousand).

- Amount of snow hauled

  about 8,000,000 m^3

Québec 2010
AIPCR · PIARC

WINTER ROAD MAINTENANCE OF SAPPORO

- Anti-freezing measures

Spreading of de-icing agents or sand

Road heating systems

Energy source	Number of systems	Coverage (m^3)
Electric	366	166,411
Gas	75	32,511
Other	2	7,995

ROAD HEATHING SYSTEM RENOVATION PROJECT

- The Jozankei hot spring district

  A popular retreat

  25 km southwest of downtown

  270 m above sea level

  2.5 ºC colder than downtown

  Steep and narrow roads

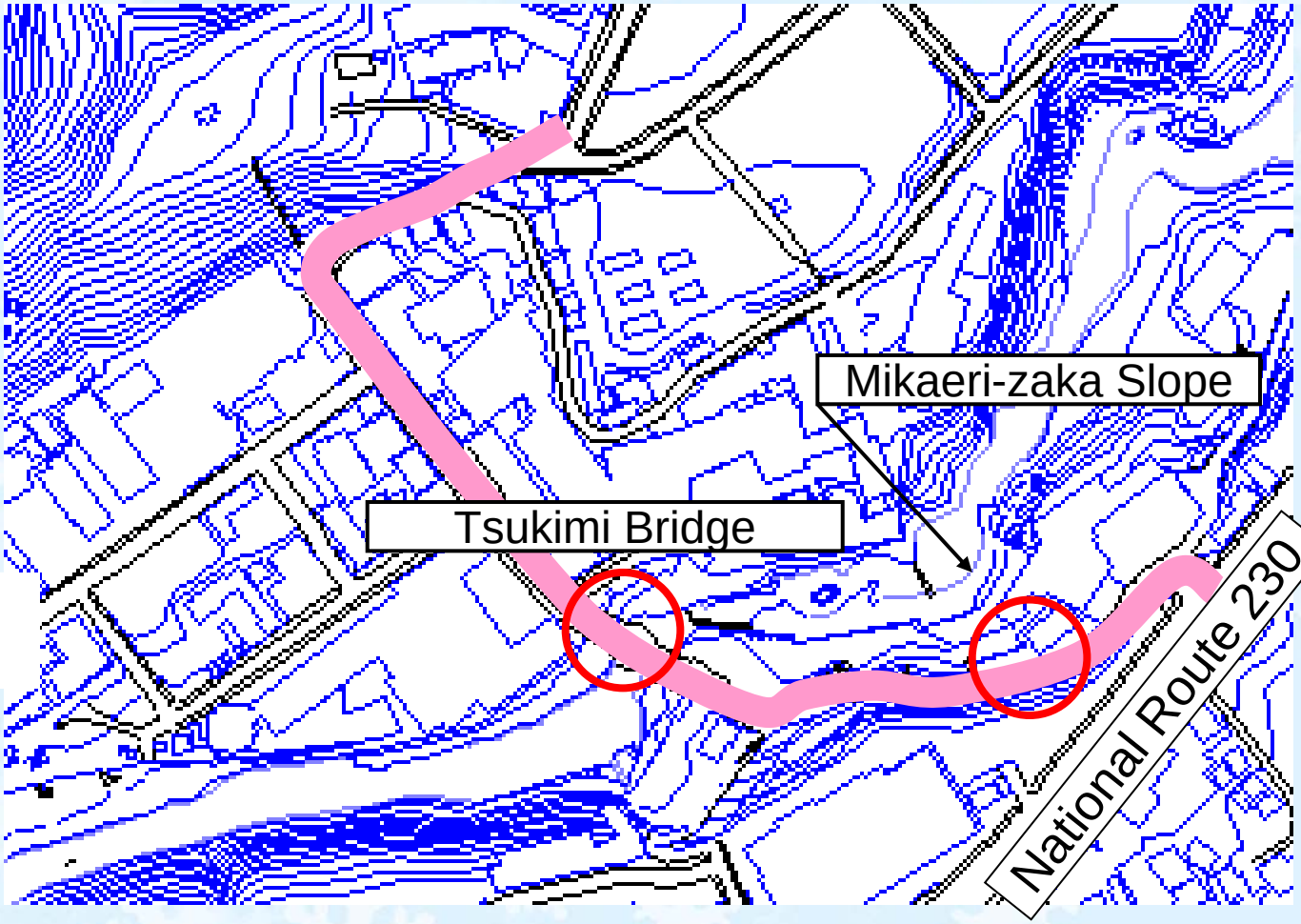
- Japan’s first road heating system using hot spring water

ROAD HEATHING SYSTEM RENOVATION PROJECT

- Renovation project

Length: 650 m
Width: 12.5 m
(roadway: 6.5 m)
(sidewalk: 3 m×2)

Pitch difference
20 m
Steepest gradient
10%



ROAD HEATHING SYSTEM RENOVATION PROJECT

- Chronology of Jozankei's road heating system

1966: Road heating is installed on Jozankei Chuosen St. (the first road heating in Japan).

1984: The system is converted to a heat pipe system (complete overhaul).

1998: Renovation is requested by the local community.

2004: Talks with local residents start.

2008: The improvement project starts.

2010: The project is scheduled to be completed in this year.

ROAD HEATHING SYSTEM RENOVATION PROJECT

- The hot spring

  A natural spring: 600 ℓ/min

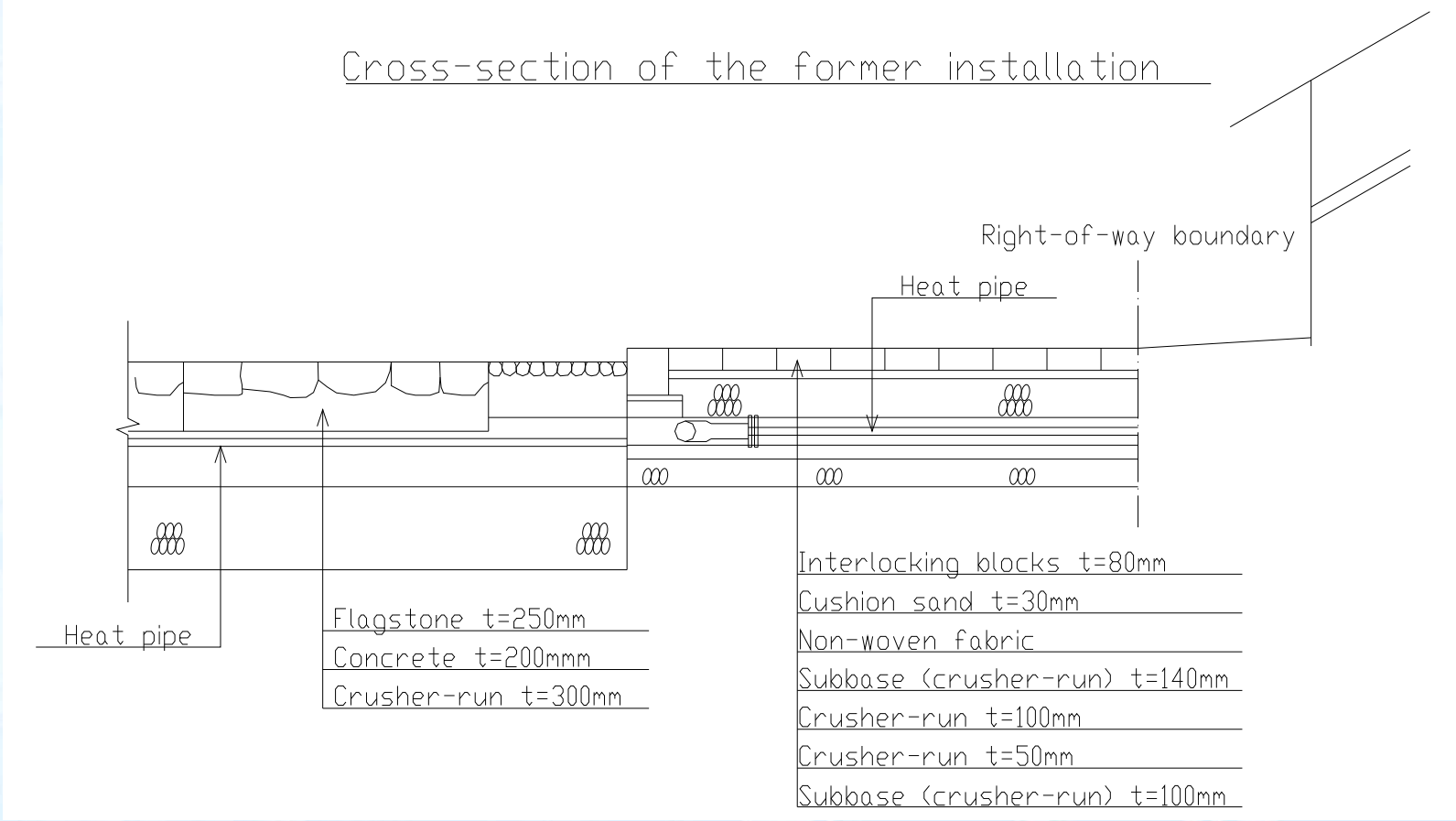
  Temp.: 80 ºC

- Design conditions

Snowfall density	3 cm/hr
Air temp.	-10 ºC
Snow density	50 kg/m^3
Wind velocity	3 m/sec
Heat load	207 W/m^2

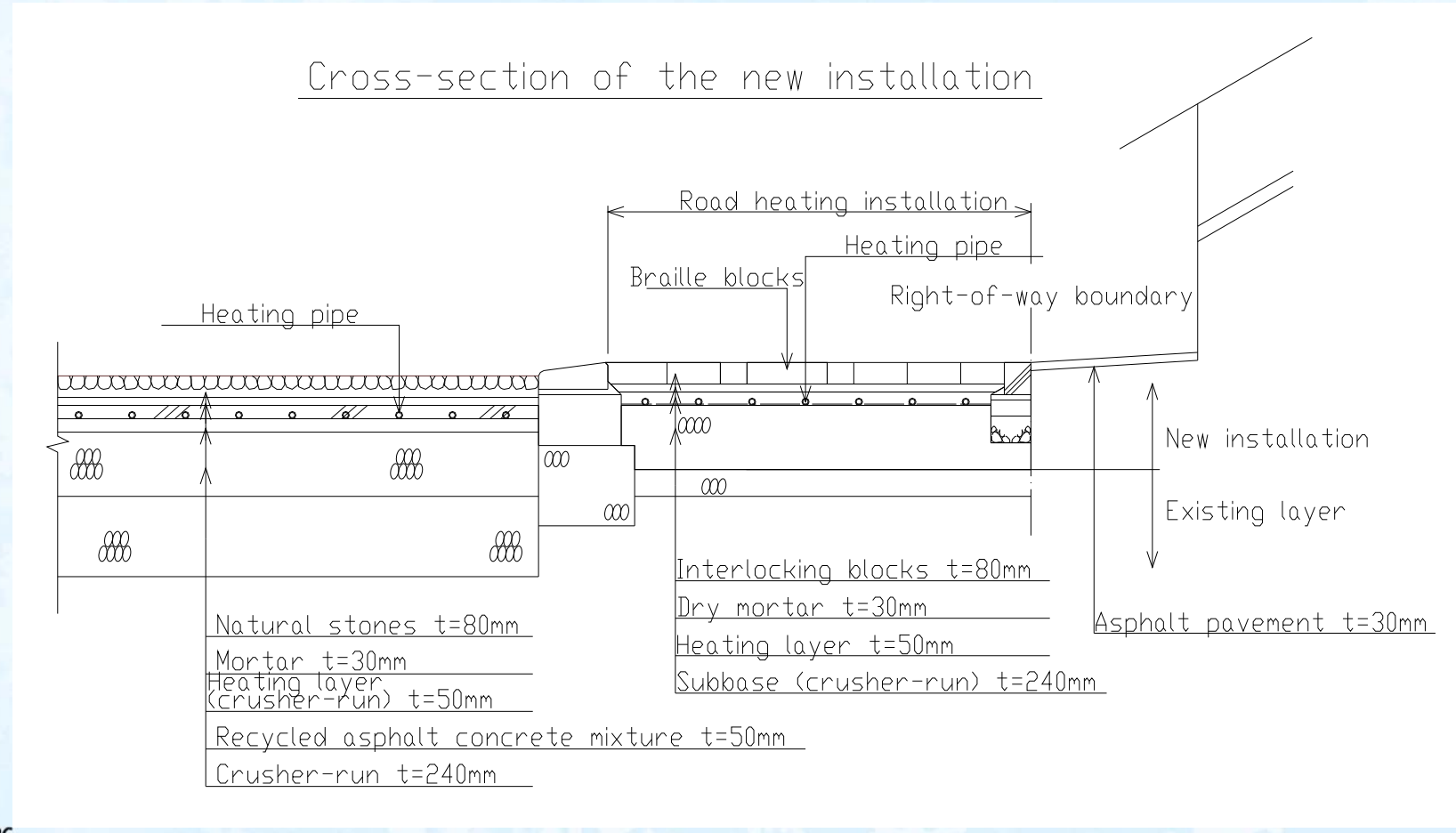
ROAD HEATHING SYSTEM RENOVATION PROJECT

- Cross-section (before renovation)



ROAD HEATHING SYSTEM RENOVATION PROJECT

- Cross-section (after renovation)



ROAD HEATHING SYSTEM RENOVATION PROJECT

Polybutylene pipes

Completed phase

ROAD HEATHING SYSTEM RENOVATION PROJECT

- Landscape planning

The project was discussed with hotel owners for 3 years.

Rectangular granite flagstones are to be used.

Street lamps are to create a Japanese spa atmosphere.

Trees that epitomize Jozankei are to be used.

NEW DIRECTIONS FOR ROAD HEATHING

- Pervasion of studless tires

The distant mountain range is visible without road dust

The emergence of very slippery road surface

NEW DIRECTIONS FOR ROAD HEATHING

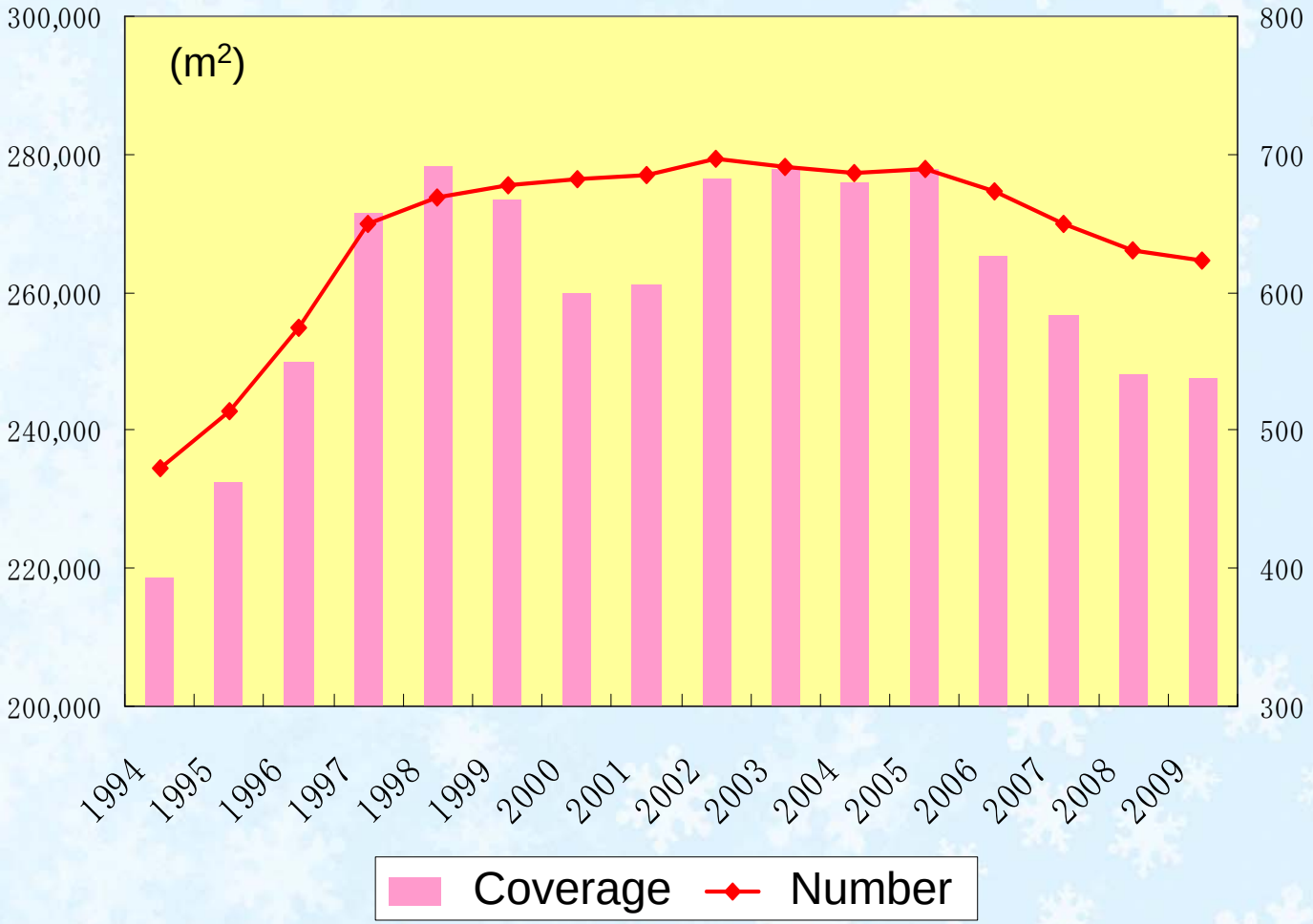
- Road surface conditions

Regular management

New management criteria:
Increased anti-freezing application and more frequent snow removal

NEW DIRECTIONS FOR ROAD HEATHING

Number of road heating systems and total coverage



CONCLUSION

- Reduction in heating costs is very important.
- Jozankei is an exception because a renewable, inexpensive energy source is used.
- We continue to develop safer, more effective winter road maintenance measures.

Attention!
No more road heating!