

SAPPORO WINTER ROAD MANAGEMENT PLANS

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ABSTRACT

The City of Sapporo developed the *Snow Sapporo 21 Plan* (1991)[1] and the *Master Plan for Snow and Ice Control* (2000)[2] as the primary mid- to long-term plans to promote snow and ice control. However, socioeconomic changes have exposed issues regarding 1) snow removal and snow hauling, 2) shortages of snow dumping sites, 3) shortages of snow removal contractors and 4) shortages of dump trucks and other snow removal machinery.

To address such new issues and to continue conventional snow and ice control operations, in 2009 the city made a new mid- to long-term plan: the *Sapporo Winter Road Management Plan*.

The action program established under the plan in 2010 specified four basic policies: 1) promoting cooperation among citizens, businesses and the city, 2) introducing various intangible measures and 3) establishing a system for determining project priorities to concentrate resources on prioritized projects. The program's six goals are as follows: 1) establish winter rules for residents' life, 2) reduce the amount of hauled snow, 3) secure a snow removal/hauling operation system, 4) prioritize certain roads and maintenance services in winter road management, 5) secure a safe transportation environment in winter and 6) create a winter culture.

This paper outlines the plan, its goals, projects to achieve those goals, and the performance indicators and their target values.

1. INTRODUCTION

Sapporo is a city of 1.9 million residents in a region of extreme snowfall: more than 6 m per year (which is not common among cities in the world of this size). The residents have been placing the highest priority on policies that make winter life more comfortable. To meet such needs, the city established two ten-year mid- to long-term plans for winter road maintenance. These plans focused on road snow removal. However, due the demographic trend of fewer children and more elderly, and the deterioration of the socio-economic situation, the environment for snow and ice control has become more difficult than ever.

In 2009, to address such issues and provide stable snow and ice control services to the residents, the city developed its third mid- to long-term plan, called the *Sapporo Winter Road Management Plan* (hereafter: the Plan). The objective of the Plan is to realize affluent winter life for the residents.

In 2010, an “action program” was established for the Plan, in order to control and manage winter maintenance and related activities. The program addresses project details and goals (including targets of performance indicators), and project implementation schedules.

This paper outlines projects being implemented under the Plan.

2. LOCATION AND OUTLINE OF SAPPORO

The city is at 43 degrees North latitude and 141 degrees East longitude. This is roughly the same as the latitudes of Vladivostok (Russia) and Changchun (China) in Asia, and Marseilles (France) and Rome (Italy) in Europe. The northern border of Sapporo is slightly more southerly than London (UK) and Paris (France). Regarding cities in the U.S.A, Sapporo is slightly more southerly than Boston, Chicago and New York, but more northerly than Washington, D.C. (Figure 1).

Sapporo hosted the 11th Winter Olympic Games in 1972. In anticipation of the Olympic Games, the new city hall building, the subway system, concert halls, underground shopping malls and other infrastructure were rapidly developed. The length of roads in the city was also greatly increased (Figure 2).



Figure 1 – Location of Sapporo

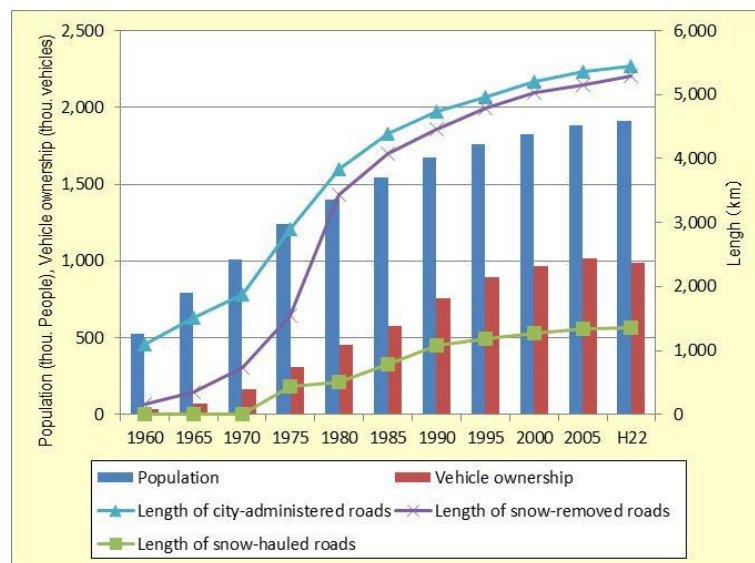


Figure 2 – Changes in length of city-managed roads, length of snow-removed roads, and the number of vehicle ownerships

3. BACKGROUND AND PURPOSES

The city's snow and ice control projects face four issues due to recent socio-economic changes.

1) Snow removal and snow hauling (Figure 3)

The increasing amounts of snow to be hauled and the increasing distances of hauling have caused snow removal operation efficiency to decline and costs to increase.

2) Shortages of snow dumping sites

It is becoming more difficult every year to secure enough snow dumping sites.

3) Shortages of snow removal contractors (Figure 4)

Shortages of snow removal contractors and skilled operators have emerged due to reductions in public works budgets. Many snow removal contractors (mostly construction companies) have gone out of business. Also, the aging of snow removal operators has been occurring.

4) Shortages of dump trucks and other snow removal machinery (Figure 5)

The dump trucks needed for snow hauling have become fewer each year. Also, snow removal contractors have lagged in updating their machinery. This has raised concerns over machinery deterioration.

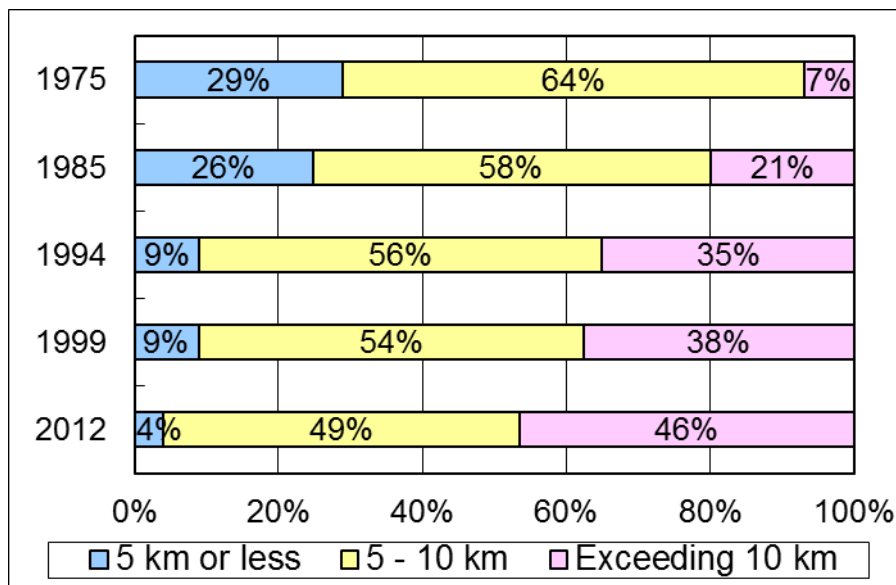


Figure 3 – Share of snow dumping sites by distance from the city center

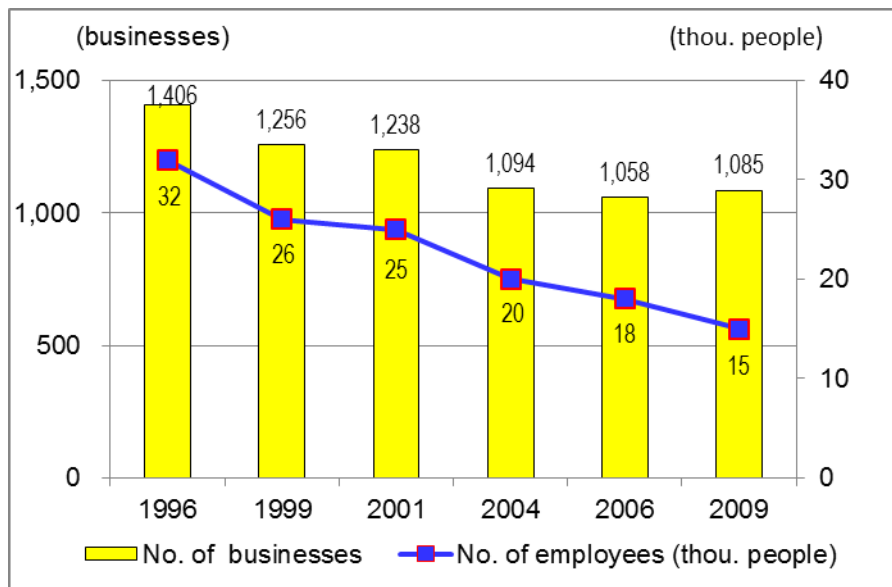


Figure 4 – Changes in numbers of construction businesses and their employees in Sapporo

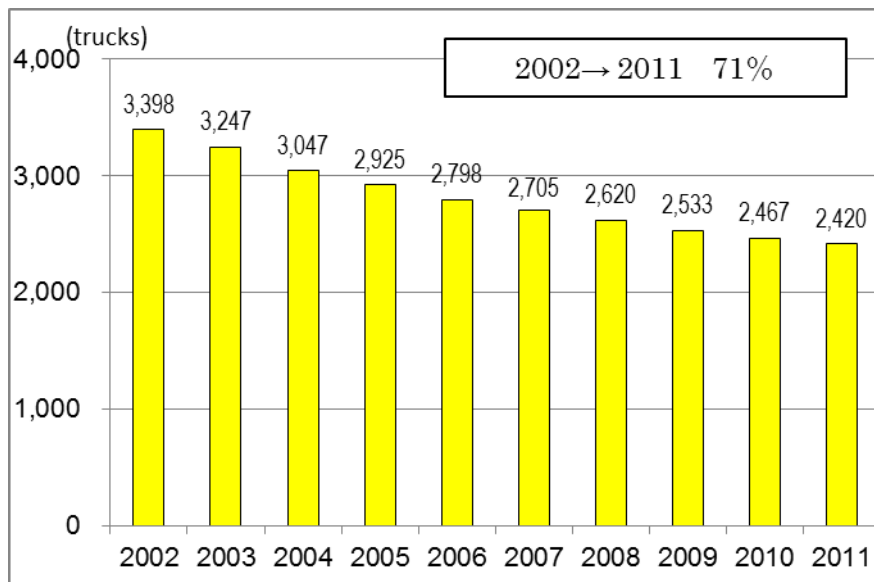


Figure 5 – Number of dump trucks owned by member businesses of the Sapporo District Truck Association

These are the main issues among the various issues of the city's winter maintenance undertakings. Despite budget constraints, the city has been securing sufficient snow and ice control budget (Figure 6). However, even if a sufficient budget is secured, the city will encounter difficulties in conducting sufficient snow and ice control operations in the near future if it fails to address these issues.

To secure stable snow and ice control in the future, the city decided to develop a new plan.

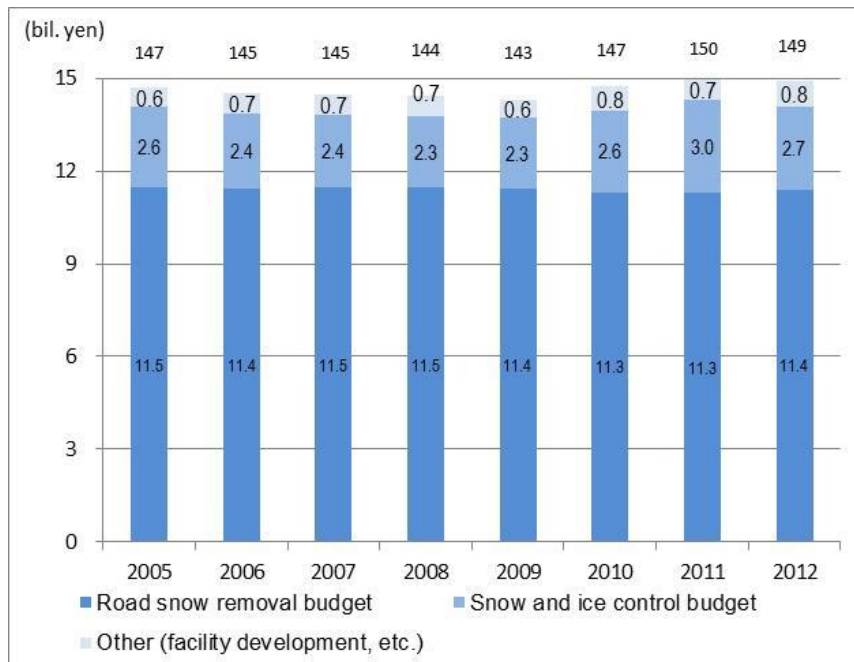


Figure 6 - Changes in the snow and ice control budget of the City of Sapporo

4. SYSTEM OF THE PLAN

In developing the Plan, the city received a proposal from the Sapporo Advisory Committee for Snow and Ice Control Basic Plan Development. Lead by Professor Atsushi Kasahara of Hokkaido Institute of Technology, the committee has 18 members. Committee meetings were held between October 2007 and December 2008. In addition, public hearings of residents' representatives were held for exchanges of opinions with the city. Based on these proposal and opinions, the following three basic policies were developed for the Plan. The basic polices aim to promote various undertakings under the Plan through cooperation among residents, businesses and the city, towards sustainable snow and ice control. Each party considered what they could do and what they should do.

<Basic policies>

- 1) Promoting cooperation among citizens, businesses and the city
- 2) Introducing various intangible measures
- 3) Establishing a system for determining project priorities to concentrate resources on prioritized projects

Based on the basic policies, six goals were set (Table 1).

Table 1 - Goals of Sapporo Winter Road Management Plan

Goals toward overcoming the issues	Goals toward continuing conventional efforts
Goal 1: Establishing winter rules for residents' life	Goal 4: Prioritizing certain roads and maintenance services in winter road management
Goal 2: Reducing the amount of hauled snow	Goal 5: Securing a safe transportation environment in winter
Goal 3: Securing a snow removal/hauling system	Goal 6: Creating a winter culture

5. GOALS AND PRIORITIZED PROJECTS

The projects to achieve the goals, and the performance indicators and their target values, and the expected outcomes of the action program are outlined as follows.

Goal 1: Establishing winter rules for residents' life

- 1) Project to promote good manners and consistent rules for winter life among residents. Residents' awareness will be raised on rules that residents are expected to observe, activities that residents are expected to work together on with the city, and roles that residents are expected to take.
- 2) Project to increase collaborative patrols to educate people on hindrances to winter traffic, such as those from pushing snow into the roadway and illegal roadside parking (Figure 7)

● Performance indicators

- a) The number of *chonaikais* (Japanese neighbourhood associations) that take part in the collaborative patrols.
Current (FY 2009): 175 *chonaikais*
Target (FY 2012): 220 *chonaikais*
- b) The number of vehicles parked at the roadside (Figure 8)
Current (FY 2009): 17,000 vehicles
Target (FY 2012): 8,100 vehicles
- c) The number of occurrences of snow being pushed into the roadway (Figure 9)
Current (FY 2009): 4,100 occurrences
Target: 2,100 occurrences (FY 2012)



Figure 7 – Collaborative patrol between the city and residents



Figure 8 – The snow removal hindrance of vehicles parked at the roadside



Figure 9 – Snow pushed into the roadway

● Outcomes: Decreases in the numbers of vehicles parked at the roadside and instances of snow being pushed into the roadway, thanks to collaborative patrols and other undertakings

Goal 2: Reducing the amount of hauled snow

1) Project to increase the use of public property, such as parks and stormwater reservoirs, for snow dumping (Figure 10)

● Performance indicator

a) The number of parks used as local snow dumping sites
Current (FY 2009): 545 sites
Target (FY 2012): 948 sites



Figure 10 – Cleaning a park that was used for dumping snow in winter

2) Project to reduce the amount of snow hauled from arterial roads (Figures 11-12)
The amount of hauled snow will be reduced by leaving snow unremoved from the 0.5 to 1.0 meters of road closest to curbs. Snow piled on such a strip had been hauled under the previous specifications.

● Performance indicator

a) The length of arterial road where the hauling of roadside snow is reduced
Current (FY 2009): 433 km
Target (FY 2012): 581 km

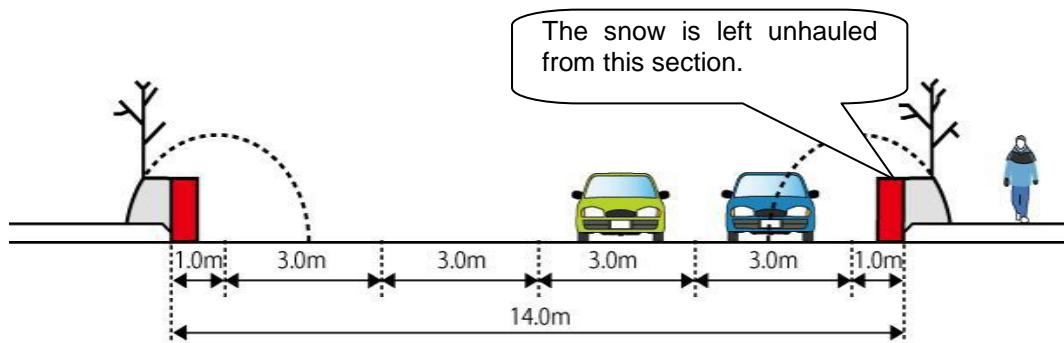


Figure 11 – Cross-section of reduced snow hauling



Before snow hauling



After snow hauling

Figure 12 – Before and after reduced snow hauling

● Advantages and disadvantages

Advantages

- Reduction in the number of dump trucks needed per deployment
- Reductions in the numbers of curb stones and roadside trees that require maintenance and repair

Disadvantages

- Increase in the number of operations for increasing the effective road width
- Difficulty of determining the exact boundary between snow to be hauled vs. snow to be left at the roadside
- Increase in difficulty of draining snowmelt from roads in early spring

● Outcomes: Disposal of snow within the district where it is removed

Goal 3: Securing a snow removal/hauling operation system

- 1) Project to secure operations and to promote the employment of workers throughout the year by year-round contracts with contractors
- 2) Project to improve the efficiency of personnel and machinery use through the integration of current multi-zone snow-removal areas, and to combine contracts for snow removal operation with those for management of snow dumping sites.
- 3) Project to promote the renewal of aged machinery by the private sector and the handing down of snow removal skills (fostering machinery operators for snow removal vehicles) by multi-year contracts (implementation planned in FY 2013 at the earliest)

Goal 4: Prioritizing certain roads and maintenance services in winter road management

- 1) Project to upgrade the snow removal and hauling criteria for narrow bus routes and bus-prioritized lanes of arterials to secure effective road width in winter (Figure 13)

- 2) Project to improve drivers' sight distance and to secure road width at intersections and other sites identified for high accident risk and for traffic congestion
- 3) Project to terminate operation of road-heating systems where other measures can secure traffic safety (Figure 14)

● Performance indicators

- a) Length of snow-hauling-improved bus-prioritized lanes
 Current (FY 2009): 54 km
 Target (FY 2018): 75 km
- b) Length of snow-hauling-improved narrow-road-width bus routes
 Current (FY 2009): 50 km
 Target (FY 2018): 162 km
- c) The number of sites where the road-heating system is switched off
 Current (FY 2009): 51 sites
 Target (FY 2018): 95 sites



Figure 13 – Narrowed bus route



Road-heating operation suspended at the intersection ahead.

Figure 14 – Road section where the road-heating system is switched off

Goal 5: Securing a safe transportation environment in winter

- 1) Project to apply anti-freezing agents on major arterials and other arterials not only for morning commuting traffic but also for evening commuting traffic (Figure 15)
- 2) Project to put higher importance on raising public awareness of preventing pedestrian falls on icy roads and of participation in sand spreading volunteer activities than on ice and snow control infrastructure improvements (Figure 16).
- 3) Project to increase the use of public property, such as elementary school grounds, as snow dumping sites

● Performance indicators

- a) Length of road where anti-freezing agent is applied for evening commuting
 Current (FY 2012): 197 km
 Target (FY 2018): 350 km
- b) Use of elementary school grounds as snow dumping sites
 Current (FY 2012): 40 sites
 Target (FY 2018): 50 sites



Figure 15 – Application of anti-freezing agent



Figure 16 – Spreading of sand on a sidewalk

Goal 6: Creating a winter culture

<Disseminating comprehensive information/knowledge of winter life>

- 1) Project to provide daily snow removal information to each multi-zone snow removal area by data broadcasting on TV or One-Seg TV broadcasting for mobile phones (in Japan only) (Figure 17).



Figure 17 – Provision of snow removal operation information by data broadcasting for TV

- 2) Project to disseminate information on snow-dumping sites and the probability that snow will need to be removed in each area on the following morning (Figure 18)

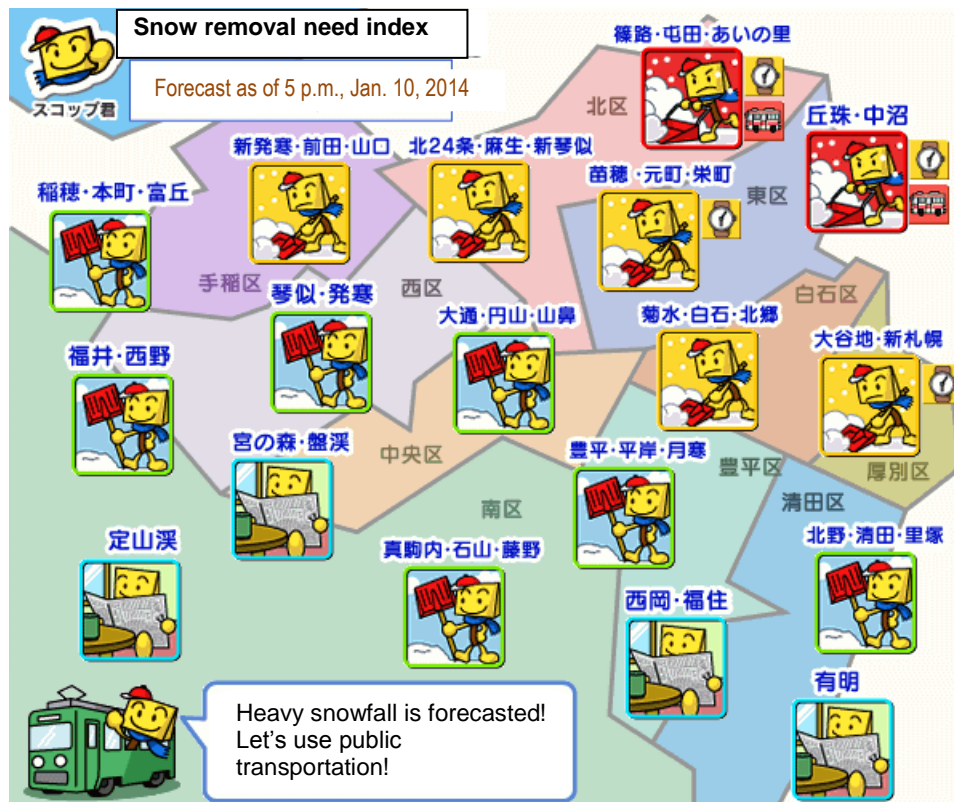


Figure 18 – The indexes of snow-removal necessity

- 3) Project to host the "Snowy Life" Story-Telling Meeting, where elementary children make presentations on what they studied about the snow and ice control operations of the City of Sapporo and winter lifestyles (Figure 19)
- 4) Project to increase and develop opportunities to learn about snow, such as by using "general study classes" of elementary school education



Figure 19 – "Snowy Life" Story-Telling Meeting

<Enhancing winter volunteer activities>

- 5) Project to invite the younger generation to join in "welfare snow removal" (Figure 20). "Welfare snow removal" is a city-organized volunteer system in which residents help each other. Participants visit houses of the elderly who have difficulty removing snow from their frontage by themselves. The members are recruited from local residents.
- 6) Project for elementary school children to spread sand by using PET bottles of sand bottled by volunteers at elderly-care facilities (Figure 21)



Figure 20 – “Welfare snow removal”



Figure 21 – Preparing PET bottles of sand (left)
 Enlisting elementary school children as sanding volunteers (center)
 Sidewalk sanding by elementary school children (right)

6. CONCLUSION

In recent years, due to deterioration in the social environment, snow and ice control projects face many challenges and issues. Toward tackling the snow- and ice-control issues that hinder residents' lives and by conducting various projects and undertakings, the City of Sapporo has made three mid- to long-term plans that address residents' needs for winter life.

While watching the changing social situation, we will continue to steadily implement the plan toward realizing “productive winter living,” while reviewing the Plan from all aspects, beyond the existing framework.

REFERENES

1. The City of Sapporo (1991). *Snow Sapporo 21 Plan*
2. The City of Sapporo (2000). *Master Plan for Snow and Ice Control*