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MANAGER'S REPORT NO.	15
COUNCIL MEETING	93/03/08

TO: CITY MANAGER **DATE:** 1993 03 03
FROM: DIRECTOR ENGINEERING **FILE:** 50-01-08
SUBJECT: WINTER ROAD DAMAGE ASSESSMENT
PURPOSE: To provide Council with the assessment results of damage to City streets caused by the recent cold weather and to outline the remedial program to repair the damages.

RECOMMENDATION:

1. **THAT** Council authorize \$361,000 to be drawn from the Stabilization Reserve to finance the Winter road damage remedial program.

SUMMARY

This report provides Council with a summary of the comprehensive review conducted by Engineering staff on damage to City streets caused by the recent cold weather. The Parks Department also carried out a similar study and their conclusions are also included in this report.

In this past winter, the Greater Vancouver area has experienced heavy snowfall and record setting low temperatures. As a direct result of these winter effects, winter road damage caused by the frost heaving action and the freezing/thawing cycle is evident throughout the Lower Mainland. Results of the engineering survey indicated that most roads in Burnaby withstood the impact of the extreme weather condition. Only a few streets have exhibited severe damage and an accelerated deterioration rate that requires immediate corrective action to avoid higher repair costs in the future.

To protect the City's investment in the roadway infrastructure, a program of repair work based on three remediation treatments has been developed and is included in this report for Council's consideration. This program addresses roads that are undergoing a rapid deterioration rate accelerated by the recent severe winter effect. The estimated cost of the program is approximately \$361,000 and funding authorization is required from Council for the execution of the remedial work. The review also identified other roads that have suffered only minor winter damage. These roads will be included in our ongoing pavement management system for monitoring and analysis. Any recommended improvement strategies for these roads arising out of the analysis will be included in future rehabilitation and overlay programs.

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REPORT

1.0 INTRODUCTION

At the regular Council Meeting held on 1993 01 18, Council made an inquiry regarding the condition of City streets following the prolonged period of frost and snow and requested a report from staff.

Pursuant to Council's request, staff have conducted a comprehensive review of the current state and condition of the City streets. The conclusions and findings of the evaluation are presented in this report for Council's consideration.

2.0 1992/1993 WINTER RECORDS

As background information for the winter road damage evaluation, a review of the weather records kept at the Burnaby Works Yard was conducted. The records indicated that heavy snowfall started on December 27, 1992. Sub-zero temperatures as low as -12°C were recorded for a period of 19 days from December 27, 1992 to January 14, 1993. Daytime high temperatures during that period never reached above the freezing mark. The extreme temperatures recorded are far below the normal average temperature for the same season and have set a new weather record for the Greater Vancouver area.

After the 19 days of severe weather condition, the weather pattern changed on January 15, 1993 to a milder and wetter condition.

3.0 FROST HEAVING AND FREEZING/THAWING CYCLE

Two principal damaging effects on street systems under severe winter conditions are:

1. Frost Heaving

Caused By: Formation of ice and ice lenses within the pavement base and/or subgrade.

Effect: Pavement joint separation and cracks.

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2. Freezing/Thawing Cycle

Caused By: Extreme cold weather with sub-zero temperature followed by a thawing (above zero) period combining with subgrade moisture problem.

Effect: Loss of support strength of the pavement subgrade during the thawing period leading to premature cracking, rutting, and eventually failure of the pavement structure under heavy traffic loading condition.

These two damaging effects often equate to the presence of pot holes, pavement joint separation and pavement cracks. With the record setting cold temperatures experienced recently, followed by a freezing/thawing cycle the winter damage effects are evident on a number of Burnaby streets. More specific details on the damage inspection are outlined in Section 5.0 of this report.

4.0 PAST EXPERIENCE - 1991 WINTER ROAD DAMAGE REPAIR PROGRAM

As Council may recall, the Greater Vancouver area experienced a period of unusual snowfall and cold temperature in the 1990/1991 winter season. In the spring of 1991, staff conducted a study to determine the extent of pavement damage caused by the cold temperature and to identify the remedial work required to mitigate the accelerated pavement deterioration problem.

Following the road inspection, a program of general patching, crack sealing and resurfacing was approved by Council and was subsequently carried out in the summer of 1991 at a cost of approximately \$392,000. An additional \$80,000 was provided for repair to parking lots in City recreational facilities.

The repair work was implemented successfully. Recent inspection of these streets has revealed that the remedial work has withstood the recent winter condition and prevented any premature failure and deterioration that may have occurred otherwise.

5.0 1993 ROAD DAMAGE INSPECTION

In January/February 1993, staff carried out a comprehensive review of the conditions of all arterial, collector and selected local residential streets with due respect to traffic safety, traffic volumes and costs.

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The inspection has identified many streets that require some form of treatment. Some of the streets noted have been deteriorating over the years and were identified by earlier pavement management studies. Therefore, these streets will be treated under the ongoing annual rehabilitation strategy and program. Specific attention was drawn to those streets which had not been included in the pavement management program and are now experiencing a more rapid deterioration rate or that have shown signs of premature failure caused by the frost heaving and freezing/thawing cycle.

Results of the survey indicated that most roads in Burnaby withstood the impact of the unusual weather condition. However, the inspection also revealed that a few streets have experienced severe damage which requires immediate corrective action to maintain public safety and to avoid higher reconstruction cost in the future.

6.0 POSSIBLE MITIGATIVE MEASURES

With the completion of the survey, two alternatives to address the winter road damage problem were considered as follows:

- *Alternative 1*

Include the repair/resurfacing work in the regular annual Street and Lane Rehabilitation Program.

Discussion:

This would displace some of the roads that have already been identified in the Pavement Management Program for treatment in 1993. Delay of these projects would slowly erode the current pavement standards and push these roads further down the pavement performance curve which would result in a higher rehabilitation cost in the future.

- *Alternative 2*

Provide additional resources to mitigate the winter damage problem.

Discussion:

This would allow staff to address the winter damage issue immediately without delaying the delivery of the needed rehabilitation program.

To protect the City's investment in the roadway infrastructure and to deliver the pavement management strategy in the most cost effective manner, it is recommended that Alternative 2 be adopted.

To put forward a cost effective program to address the winter road damage repair needs, 3 remediation treatments are recommended.

1. *Crack Sealing*

An increase in cracks at pavement joints and trench patches is noted on some City streets. These cracks should be sealed to prevent further water infiltration and moisture build up in the pavement structure that may lead to loss of pavement support strength. Crack sealing is the most cost effective means of preventing premature pavement deterioration problem at the early stage.

2. *Milling and Resurfacing*

As mentioned earlier, the freezing/thawing cycle is a primary contributing factor in low pavement strength problem. Rutting and cracking along the wheel path are often the sign indicating the loss of pavement strength which would eventually lead to a more severe pavement cracking problem and complete deterioration of the pavement.

To mitigate the problem, the affected surface must be milled out and repaved to reinforce the support strength of the structure.

3. *Reconstruction*

Curbed streets and major non-curbed collector streets are currently included and prioritized for rehabilitation through the pavement management system and annual overlay program.

The rehabilitation needs of non-curbed minor collector and residential streets are usually addressed through the Local Improvement Program and therefore have not been included in the overall pavement management strategy. Utilizing the LIP paving program as the means to rehabilitate and upgrade the needs of these non-curbed local streets has allowed the annual overlay program to concentrate on the arterial/major collector street requirements and also to maintain our investment in curbed streets.

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However, in our recent winter road damage assessment, we have come to the conclusion that there are some non-curbed residential streets that have undergone a rapid deterioration due to the frost and moisture problem. It is recognized that these streets have experienced a gradual deterioration over the years, but the recent extreme weather condition has accelerated the deterioration to the extent that they require immediate corrective action. Our preliminary analysis indicated that the road bases of these roads have been weakened and complete pavement reconstruction is required. With due consideration to public safety and to maintain an acceptable service level to the residents in the affected areas, we have included the reconstruction needs of these streets for consideration.

7.0 PROPOSED 1993 WINTER ROAD DAMAGE REPAIR PROGRAM

Based on the comprehensive winter road damage review, a list of arterial, collector and local streets that require immediate remedial work is compiled and given in Table 1. This list identifies roads that have exhibited severe cracking and damage caused by the frost heaving and freezing/thawing cycle. It is essential that repair work as described in the preceding section be carried out to prevent further deterioration and possible failure of these roadways.

The recent road condition survey also identified a number of Burnaby streets with minor winter damage. These streets will be included in our ongoing pavement management system for monitoring and analysis. Any recommended improvement strategies for these streets arising out of the analysis will be included as part of future street rehabilitation and overlay programs.

The Parks Department has also carried out similar evaluation on all parking lots in the City recreational facilities and identified a program of winter damage repair which is included in Table 1 (attached).

8.0 FUNDING

The estimated cost for the proposed winter damage remedial program is \$361,000 of which \$261,000 is capital in nature. It is recommended that \$361,000 be drawn from the Stabilization Reserve to cover the cost of this unanticipated and non-recurring expenditure and that approval be given prior to adoption of the 1993-1997 Capital and the 1993 Annual Operating Budgets.

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9.0 CONCLUSIONS

Having conducted a comprehensive review of the City streets following the recent record setting weather condition, it has been determined that most roads withstood the impact of the severe temperatures however, a number of streets are undergoing a rapid deterioration rate caused by the frost heaving and freezing/thawing cycle. The condition of these streets is such that immediate corrective measures are required to avoid higher repair cost in the future and to maintain public safety. The costs of the recommended rehabilitation needs are beyond the scope of the current pavement overlay program. Therefore, it is recommended that additional funds be provided to address the winter road damage issue.

Streets that have exhibited only minor winter damage will be included in the ongoing pavement management system for monitoring and analysis. Any recommended improvement strategies arising out of the study will be included in future years under the annual rehabilitation and overlay program.


DIRECTOR ENGINEERING

LSC:mp
Attach.

cc: Director Finance
Director Recreation & Cultural Services

TABLE 1

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CRACKSEALING

- Various Locations

\$ 40,000

MILLING AND RESURFACING

- Phillips Ave South of Halifax
 - Howard Ave - Meadedale to Tye Crt
 - Roberts East of Ledger
 - Lake City Way North of Lougheed
 - North Rd at Broadway
 - Gilley/Rumble Intersection
 - Various Locations

\$61,000
 33,000
 17,000
 20,000
 5,000
 14,000
20,000

170,000

RECONSTRUCTION

- 2nd Ave West of Gilmore
 - Carleton Ave North of McGill

\$66,000
45,000

111,000

PARKS

- Various Locations

40,000

TOTAL

\$361,000