

ITEM 7
MANAGER'S REPORT NO. 64
COUNCIL MEETING 85/10/15

RE: CONCRETE FINISH ON B.N.R. GRADE SEPARATION
CONTRACT #8305

MUNICIPAL MANAGER'S RECOMMENDATION:

1. THAT the recommendation of the Director Administrative & Community Services be adopted.

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TO: MUNICIPAL MANAGER 1985 10 10

FROM: DIRECTOR ENGINEERING

SUBJECT: CONCRETE FINISH ON B.N.R. GRADE SEPARATION -
CONTRACT #8305

RECOMMENDATION:

THAT this report be received by Council for information purposes.

SUMMARY

This report discusses the concrete finish on a portion of the deck of the B.N.R. Grade Separation and concludes that undertaking possible corrective measures aimed at improving the finish are neither warranted nor desirable.

INTRODUCTION:

The last two contracts to be awarded in the B.N.R. project were Contracts #8305 and #8401 awarded respectively to S.G.M. Construction Ltd. and Scandia Blacktop Ltd. At first both companies claimed to be non-union but Labour Relations Board hearings ruled that both were union companies. Scandia Blacktop Ltd. accepted the Board's ruling but S.G.M. appealed and continued to claim its right to use non-union labour. On 1984 June 13 the Board declined to interfere with the decision of the original panel but S.G.M. continued to employ non-union labour. Expert labour relations advice was obtained when dealing with labour problems as they arose.

Eventually, in November and December, it became obvious that disruptions and delays on the job site could seriously jeopardize utilization of available Provincial Revenue Sharing funds. On 1984 December 27, the Corporation signed an Agreement jointly with Jack Cewe Ltd., Scandia Blacktop Ltd. and the B.C. Provincial Council of Carpenters, culminating two Informal Hearings at the Labor Relations Board concerning the matter of making arrangements which would allow Scandia to get on with their work.

At that time, S.G.M.'s contract was substantially complete except for some outstanding work and deficiencies which were documented and formed part of the Agreement mentioned in the preceding paragraph. The cost of rectifying the deficiencies was deducted from the final payment to S.G.M. The classification and cost of the outstanding work and deficiencies were as follows:

1. Correction of deficiencies	\$15,000
2. Additional application of concrete protection	\$30,000
3. Concrete protection and crack filling deleted from S.G.M.'s contract to be completed by others	<u>\$70,000</u>

TOTAL DEDUCTIONS \$115,000

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Although the foregoing remarks are not directly pertinent to the matter of the quality of the finish on the concrete deck, they do show that there was a definite air of urgency in clearing out Contract #8305 in order to allow the work of Contract #8401 to proceed.

REPORT:

During the latter part of the work of Contract #8305, the resident engineer requested that S.G.M. Ltd. pay close attention to their concrete finishing. However, small discrepancies in the brushed concrete finish on the deck surface are extremely difficult to see with the naked eye. Only when traffic was allowed over the bridge at normal operating speeds was an unusual roughness noted on a relatively small portion of the total bridge deck.

The Contract specifications stipulate that the maximum allowable tolerance from an absolutely smooth plane is 6-mm (1/4 inch), as measured vertically from any high point to any adjacent low point; this is an almost universal industry standard used by engineers throughout North America. The reason for allowing a tolerance at all is that concrete technology is far from an exact science, especially in surface finishing. Concrete finishing differs substantially from asphaltic pavement finishing, and must be primarily because concrete mix is incompressible and must be fluid enough to "flow" and to move about. Asphaltic pavement mix, on the other hand, is a loose mix and is therefore compressible, which allows it to be tamped into position and grade.

With the existence of the allowed tolerance in the specifications, we can only require that the Contractor bring variances greater than the specification tolerance down to the allowed amount of 6-mm (1/4 inch) and not down to a zero amount.

A concrete surface is never "perfect" and the purpose of allowing a tolerance is to recognize the real world of the imperfect nature of concrete finishing while at the same time providing a roughness of surface which is acceptable in terms of safety and riding quality.

We requested that Associated Engineering carry out a three-metre straight-edge test on that section of the deck in order to check the six millimetre (1/4 inch) allowable tolerance as outlined in the specifications. We attach a copy of Associated's letter of reply and quote from it as follows:

"We have found a number of locations where the depth measured from the straightedge exceeds the 6-mm (1/4 inch) tolerance of the specifications. In general, readings averaged 9 mm (3/8 inch), which represents a variance from allowable of 3-mm (1/8 inch). The spacing of the readings results in a rougher ride on this section of the bridge as compared to the section to the north. The rougher ride, while perceived by some motorists as being uncomfortable or annoying, does not

reduce the safe driving conditions. Similarly, the structural integrity of the deck has not been affected.

"We have investigated what remedial work would be possible to improve the ride of the deck and have had discussions with various specialized contractors. It appears that the ride of the deck may be improved by grinding to remove the top of the ridge causing the rough ride. Although various machines are available, the selection of the best machine or combination of machines is important to ensure the resulting deck has a texture that provides proper skid resistance.

"Grinding by a milling machine commonly used for asphaltic concrete removal, while having a high production rate, leaves a deeply gouged, rough surface, that unquestionably would not be suitable for traffic. This type of milling machine is basically an excavator composed of a large number of teeth on a rotating drum about two metres wide.

"Grinding using a machine known as a diamond bump grinder provides a smooth surface texture, which in fact, may have to be roughened to provide a skid resistant surface. This machine, commonly used to remove high spots on warehouse floors, is more like a planer, but has a very low production rate in that it is only 0.3 metres (one foot) wide.

"A combination of these two machines may be practical. The milling machine would in effect produce a first rough cut to remove about one-half to three-quarters of the total depth required. The bump grinder would follow in behind to remove the rough texture left by the milling machine, and perform the final grading operation. As this proposed method is untested, a test section must be completed prior to any major works, to determine feasibility and production rates for cost estimates. Because of the excavating action of the milling machine, some surface damage of the concrete may occur. The depth of removal for the bump grinder must be set to ensure removal of any damaged areas.

"...Utilizing this information we have considered the implications of proceeding with remedial work, and whether remedial work is in fact necessary. The work under the Contract was accepted effective December 14, 1984. The Contract specifies a two-year guarantee period commencing from the date of the Notice of Acceptance. It may be possible for the Corporation to recover the cost of remedial work under Article 29, of the General conditions of Contract, Guarantee Period.

"...In determining whether or not remedial work is necessary or desirable, several factors must be considered. These include the disruption to traffic to undertake remedial work, the risk of damage to the concrete and of a resultant worse condition, the discomfort of the present roughness and the cost of remedial work.

"As stated earlier, the average depth of measurement below the straightedge is 9 mm (3/8 inch) or 3 mm (1/8 inch) greater than the specified tolerance. Considering the risks, at this time we believe little will be gained by removal of the 3 mm (1/8 inch) to achieve the tolerance limit. It is likely little improvement in ride will be registered. We therefore, do not recommend grinding all ridges which exceed specification."

Further to our receiving the Engineers' report, we met with our Consulting Engineers and Mr. S. Malekyazdi, President of S.G.M. Ltd., to discuss possible methods for improving riding qualities on those sections of the bridge where allowable tolerances had been exceeded. After the meeting the contractor was given a letter from the Director Engineering, the primary thrust of which was to remind him of the provisions of Article 29 of the Contract (Guarantee Period) and to request that he provide a written response as to possible methods of bringing the local surface irregularities with an average variance of 3-mm (1/8 inch) into line with the tolerance of 6-mm (1/4 inch) allowed in the specifications.

The contractor's reply reads as follows:

"We have ourselves undertaken riding tests on the different sections of the deck and find the ride on the sections referred to consistent with the other sections and in fact similar if not superior to other bridge decks in the Vancouver area.

"We feel that a "smoother" ride can only be obtained by a wearing course of asphalt or concrete overlay.

"We feel that any attempt to "improve" the ride by grinding down certain sections of the deck or other similar methods would not only not improve the ride but would impair the structural integrity of the deck by reducing the concrete cover to the deck itself.

"Additionally the considerable inconveniences caused to the public due to closures of traffic and the increased possibility of accidents at the time of such complete or partial closures would tend to support the conclusion that the best remedy to the situation is to leave the deck as it is."

CONCLUSIONS:

On-site measurements have established that an average variance of 3-mm (1/8 inch) from the 6-mm (1/4 inch) tolerance permitted in the Contract Specifications exists over a narrowly-confined area of approximately 3% of the total deck area constructed by S.G.M. Construction Ltd. under Contract #8305. In turn, the variance area represents approximately 1-1/2% of the total deck area (see attached sketch).

The utilization of possible remedial measures aimed at eliminating the variances from permitted specification tolerances have been carefully examined. The factors considered were:

1. Disruption to traffic and annoyance to the public of undertaking the remedial work.
2. Risk of damage to the concrete.
3. Risk of resultant worse condition.
4. Relative discomfort of the present roughness.
5. Cost of remedial work, which could be about \$100,000.
6. Possible litigation concerning the Applicability of Clause 29 of the Contract (Guarantee Period).
7. Passage of traffic wearing down the high points at a higher rate of wear than that for the low points.

When considering the foregoing factors within the context of an overall cost/benefit analysis and considering the risks involved, it is concluded that remedial measures not be undertaken.

Given the facts concerning the magnitude of variances from specifications and the nature of the possible remedial measures, the Ministry of Transportation and Highways have advised us that they concur with the conclusion reached in this report.

/cf

EE Olson

DIRECTOR ENGINEERING

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ASSOCIATED ENGINEERING (B.C.) LTD

4940 CANADA WAY, BURNABY, B.C. V5G 4M5
TEL.: (604) 293-1411, TELEX: 04-354757

September 12, 1985
File: V64F

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The Corporation of the
District of Burnaby
4949 Canada Way
BURNABY, B.C.
V5G 1M2

Attention: E. E. Olson, P.Eng.
Director Engineering

Dear Sirs,

Re: BNR Grade Separation
Contract No. 8305 - Concrete Deck-2

We submit herewith our report regarding the section of bridge deck constructed under Contract No. 8305 by S.G.M. Construction Ltd.

This report presents the results of a straightedge measurement survey and of investigations into possible methods to improve the ride of the deck. Straightedge measurements were taken along the centreline of each of the four lanes between the south abutment and Pier D, which is the expansion joint where the ramps meet the main structure. Measurements started at the abutment. The 3-m straightedge was then moved end to end, and measurements recorded.

We have found a number of locations where the depth measured from the straightedge exceeds the 6-mm (1/4 inch) tolerance of the specifications. In general, readings averaged 9 mm (3/8 inch), which represents a variance from allowable of 3-mm (1/8 inch). The spacing of the readings results in a rougher ride on this section of the bridge as compared to the section to the north. The rougher ride, while perceived by some motorists as being uncomfortable or annoying, does not reduce the safe driving conditions. Similarly, the structural integrity of the deck has not been affected.

We have investigated what remedial work would be possible to improve the ride of the deck and have had discussions with various specialized contractors. It appears that the ride of the deck may be improved by grinding to remove the top of the ridges causing the rough ride. Although various machines are available, the selection of the best machine or combination of machines is important to ensure the resulting deck has a texture that provides proper skid resistance.

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A MEMBER OF THE ASSOCIATED ENGINEERING GROUP OF COMPANIES

September 12, 1985
The Corporation of the
District of Burnaby

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Grinding by a milling machine commonly used for asphaltic concrete removal, while having a high production rate, leaves a deeply gouged, rough surface, that unquestionably would not be suitable for traffic. This type of milling machine is basically an excavator composed of a large number of teeth on a rotating drum about two metres wide.

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A combination of these two machines may be practical. The milling machine would in effect produce a first rough cut to remove about one-half to three-quarters of the total depth required. The bump grinder would follow in behind to remove the rough texture left by the milling machine, and perform the final grading operation. As this proposed method is untested, a test section must be completed prior to any major works, to determine feasibility and production rates for cost estimates. Because of the excavating action of the milling machine, some surface damage of the concrete may occur. The depth of removal for the bump grinder must be set to ensure removal of any damaged areas.

Producing a cost estimate for the work at this time is difficult as production rates and areas of milling are unknown. However, costs could be considerable.

Utilizing this information we have considered the implications of proceeding with remedial work, and whether remedial work is in fact necessary. The work under the Contract was accepted effective December 14, 1984. The Contract specifies a two-year guarantee period commencing from the date of the Notice of Acceptance. It may be possible for the Corporation to recover the cost of remedial work under Article 29, of the General Conditions of Contract, Guarantee Period.

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The Corporation of the
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In determining whether or not remedial work is necessary or desirable, several factors must be considered. These include the disruption to traffic to undertake remedial work, the risk of damage to the concrete and of a resultant worse condition, the discomfort of the present roughness and the cost of remedial work.

As stated earlier, the average depth of measurement below the straightedge is 9 mm or 3 mm greater than the specified tolerance. Considering the risks, at this time we believe little will be gained by removal of the 3 mm to achieve the tolerance limit. It is likely little improvement in ride will be registered. We therefore, do not recommend grinding all ridges which exceed specification.

We trust this is the information you require at this time. Should you have any questions, or wish to discuss this matter in more detail, please contact the writer.

Yours truly,



N. P.D'Andrea, P.Eng.
Project Manager

NPD'A/pe

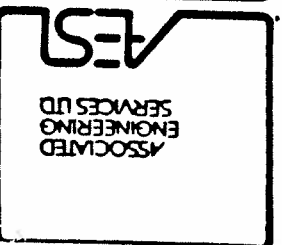
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