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HARVIE ROAD / HIGHWAY 400 GRADE SEPARATION

FUNCTIONAL PLANNING REVIEW

[Map showing the study area and surrounding areas, including Future Byrne Road, Mapleview West Industrial Park, South Barrie Business Park, and other roads and landmarks.]

McCORMICK RANKIN CORPORATION

March 2000
CITY OF BARRIE

FUNCTIONAL PLANNING REVIEW

HARVIE ROAD / HIGHWAY 400
GRADE SEPARATION

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PROJECT SCOPE

• Assess the feasibility of extending Harvie Road across Highway 400, with a view of identifying the property requirements associated with such a crossing (or crossing options). For the purposes of this assessment, it has been assumed that if Highway 400 is widened in the future, it will be done equally about the existing centre line.

EXISTING CONDITIONS

• Harvie Road (a two lane rural road within the City of Barrie) is an east-west roadway which does not currently cross Highway 400. On the west side of Highway 400, Harvie Road terminates via a cul-de-sac, while on the east side of Highway 400, Big Bay Point Road/Harvie Road turns north connecting to Fairview Road via a 90 degree turn, approximately 200 metres to the east of Highway 400.

• The elevation of Hwy. 400 is approximately 292.5 m, while the lands immediately adjacent to the highway are approximately 3 m lower, with the ground falling to the east and rising to the west.

• A Barrie rail spur crosses Big Bay Point Road / Harvie Road in a north-south direction approximately 350 metres east of Hwy. 400.

• The following utilities exist within the Harvie Road right-of-way:
  i) 400 mm water main,
  ii) 500 mm water main,
  iii) 600 mm sanitary sewer,
      (These lines are contained within a 2.6 metre tunnel under Hwy. 400, along the centre line of the roadway if extended across Hwy. 400).
  iv) Bell Canada Underground line is contained within a 0.3 m steel pipe, approximately 8 metres south of the existing centre line,
  v) Gas underground line is located approximately 28 m north of the centre line,
  vi) Bell Fibre Optic underground line is located along the west limit of the Hwy. 400 R.O.W. , running in a north-south orientation.
  vii) 600 mm sanitary sewer crosses Big Bay Point Road/Harvie Road immediately west of the Barrie rail spur.
  viii) Hydro Pole/Overhead plant is located within the R.O.W. along the south side of Harvie Road.

EXTENSION OF HARVIE ROAD ACROSS HIGHWAY 400

• Design Speed - A design speed of 70 km/h was assumed for Harvie Road.

• Horizontal Alignment - An alignment offset to the north, (see Attachment 1) was identified at the outset, as being preferred, as it i) potentially maintains accessibility to the underground services contained within the underground tunnel, and ii) provides for roadway drainage for a Harvie Road profile under Hwy. 400, without conflicting with the existing underground services and tunnel.
Note: Harvie Road crossing options under or over Highway 400 along the existing horizontal alignment, would result in significant property impacts on the south side of the r-o-w. In addition, the road side drainage with an under option would need to be directed to the east (via false grading), then to the north, under Harvie Road, and the underground tunnel/services would need to be relocated. As a result, plans along the existing alignment were not developed or assessed in further detail.

- **Profile** - Options developed (see Attachment 1) include taking Harvie Road over or under Hwy. 400, and are based on vertical clearance envelopes which allow for a variety of structure types as discussed elsewhere. The envelopes also accommodate an ultimate Highway 400 cross-section which includes a core collector system (or a total of 12 lanes plus auxiliary lanes), which has been assumed will be widened about the existing highway centre line.

- **Cross Section** - A minimum of four lanes was assumed on Harvie Road with a rural section west of Bryne Road and an urban 6-lane section between Bryne Road and Fairview Road. A normal crown was applied with a 2,000 m radii for a design speed of 70 km/h. It has been assumed that when Harvie Road is widened to six lanes west of Bryne Road, that it will become an urban cross-section.

**SIDE ROADS**

- Bryne Road - is considered to be a potential future road running north/south along the west side of Hwy. 400 as shown on the plans. The alignment of this road is considered conceptual only, as its location will be driven by land use proposals. Its inclusion on the plans is to ensure that plans for Harvie Road do not preclude the development/construction of such a future roadway.

- Fairview Road - it was assumed that this road will be extended to intersect Harvie Road at a "tee" intersection.

A standard 26 m ROW has been identified for these roadways, since it has been assumed that they will be constructed in parallel with development of the lands and therefore the original ground will be modified/flattened. If this is not the case, significant additional property will result due to grading requirements.

**STRUCTURE TYPE SPAN ARRANGEMENT**

**Harvie Road Under Highway 400**

A six lane cross section with a 1.0 m median a 3.0 m side clearance on each side (which meets the OHBDC requirements and will allow for a boulevard/sidewalk) requires a clear opening of at least 28.0 m. Both "closed" full-height abutments (similar to Molson Park Drive at Highway 400) and "open" perched abutments may be considered. However, the closed abutment structure may be preferable as it would result in the shallowest structure depth, thereby reducing the cut requirements for Harvie Road. The profile has been set based on a closed type structure.

A CPCI 1600 precast concrete girder bridge with piled abutments behind retained soil system walls will likely be the most economic structure type, although a reinforced concrete rigid frame may also be considered. The latter requires less vertical clearance (4.65 m vs 5.0 m for the girder bridge) and
a shallower structure depth. Our preliminary profiles are based on the girder structure to allow for both structure types.

Figure 2 (in Attachment 2) shows a preliminary elevation and cross section for the above.

**Harvie Road Over Highway 400**

Either a two span or three span structure may be considered for Harvie Road over Highway 400. A four span bridge is not considered viable because of the inefficient span arrangement required by the geometry/cross section of the Highway.

It is assumed that open, perched abutments will be adopted as this is generally favoured by the Ministry for structure over 400-series highways.

The two span alternative would have span lengths of approximately 53 m each. This would require a steel box girder superstructure.

For the three span alternative, the span lengths would be approximately 34-38-34 m. This would permit consideration of either precast concrete girders (CPCI 1900) or steel box girders. The steel girders would provide a shallower structure depth, however, the concrete girder alternative would be more economical, in our opinion. If this bridge is constructed prior to the expansion of Highway 400, some lane shifting will be required to provide a working space to construct a pier in the existing median.

Our preliminary profiles are based on the structure depth of the two-span steel box girder bridge and the three span precast concrete girder bridge which are approximately equal. The preliminary assumed cross section comprises of a 1.0 m median, three 3.5 m lanes in each direction, a 1.0 m side clearance and 2.0 m sidewalk on each side.

Figure 1 (in Attachment 2) shows a preliminary elevation and cross section for the two-span alternative.

**PRELIMINARY ASSESSMENT**

The pros and cons of the profile options developed are listed in Exhibit 1. It is important to identify that the purpose of this review is to determine the feasibility and preliminary impacts of various crossing options. Prior to identifying a preferred implementation alternative, a better understanding of i) the proposed construction timing, and ii) the adjacent land development plans is required. In addition, a detailed environmental assessment will be required.

However, given the information assessed to date, it appears that the option which takes Harvie Road under Highway 400 provides for the best operational conditions, minimizes conflicts with utilities, minimizes property requirements, provides the best flexibility with regards to connecting other roadways, and if constructed when Highway 400 is expanded, the costs associated with the Highway 400 detours will be applied to the highway project (and therefore borne by the province not the City of Barrie).
## EXHIBIT 1 - HARVIE ROAD PROFILE OPTIONS

<table>
<thead>
<tr>
<th>OPTION</th>
<th>PROS</th>
<th>CONS</th>
</tr>
</thead>
</table>
| Harvie Road **under** Highway 400 | • Highway 400 Structure for "core" lanes only  
• Minimizes Property Impacts  
• Maintains location and access to underground and tunnel/services  
• Provides reasonable grades for potential intersecting roads  
• Does not adversely affect the Barrie rail spur line | • Structure opening must be sized for the ultimate roadway width during initial construction  
• Construction must take place when Hwy. 400 is widened (to core/collector system) or extensive Highway 400 detouring will be required, which will increase the costs  
• Requires relocation of a Fibre Optic line. |
| Preliminary cost estimate is $5.1 M |                                                                      |                                                                      |
| Harvie Road **over** Highway 400 | • can construct at any time (i.e. independent of Hwy. 400 expansion plans).  
• Can initially construct 3 or 6 lane structure and widen in the future as required/desired. | • Significant property required  
• High embankment buries underground tunnel/services  
• Although the minimum stopping sight distance is provided, the sight distance to the intersection (i.e. crossing moves and right turn movements) is deficient which could be addressed by relocating Bryne Road approximately 30 m to the west and Fairview Road 150 m to the east.  
• Requires extensive regrading of the Barrie rail spur line which is not likely feasible, in terms of maintaining rail service to the buildings immediately to the north and south.  
• Results in a 3% grade through the Fairview Road intersection.  
• Requires protection or relocation of a Fibre Optic line. |
ATTACHMENT 1

Plans / Profiles / Typical Sections
ATTACHMENT 2

Structural Arrangement / Details
ATTACHMENT 3

Cost Estimates
HARVIE ROAD - COST ESTIMATE (for budgeting/comparison purposes)

<table>
<thead>
<tr>
<th>ITEM</th>
<th>Harvie Road UNDER Highway 400</th>
<th>Harvie Road OVER Highway 400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavement Structure</td>
<td>$600,000</td>
<td>$800,000</td>
</tr>
<tr>
<td>Earth Works / Intersections / Guide Rail</td>
<td>$1,300,000</td>
<td>$3,950,000</td>
</tr>
<tr>
<td>Six Lane Structure</td>
<td>$1,500,000</td>
<td>$3,775,000</td>
</tr>
<tr>
<td>Utilities - Relocation / Protection</td>
<td>$435,000</td>
<td>$810,000</td>
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<tr>
<td>Railway Line Relocation</td>
<td>$0</td>
<td>$500,000</td>
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<tr>
<td>Highway 400 Detour NBL/SBL</td>
<td>$800,000</td>
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<tr>
<td>Roadway Protection for Structures</td>
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<tr>
<td><strong>Sub-Total</strong></td>
<td><strong>$5,035,000</strong></td>
<td><strong>$9,835,000</strong></td>
</tr>
<tr>
<td>Miscellaneous (15%)</td>
<td>$665,000</td>
<td>$1,465,000</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$5,700,000</strong></td>
<td><strong>$11,300,000</strong></td>
</tr>
</tbody>
</table>

Assumptions:

1. Does not account for potential costs associated with maintaining rail service along spur line
2. Does not include property costs
3. The under option assumes construction prior to Highway 400 being widened
4. Bryne Road costs are not included beyond the intersection