4.3 Physical Requirements for HOV/Reserved Bus Lanes on the Don Valley Parkway

4.3.1 Introduction

The MTO's plans to relieve traffic congestion in the GTA include HOV lanes in the median of Highway 404. The HOV lanes consist of a single lane in each direction separated by a concrete barrier. However, according to MTO drawings, there will be no separator between the HOV lanes and abutting lanes for general purpose traffic. A functional design for the continuation of the HOV lanes from Highway 404, across Highway 401 and on the Don Valley Parkway is described in this section. There are, no doubt, variations of this alignment possible.

4.3.2 Crossing Highway 401

As the southbound HOV lane approaches Highway 401 from Sheppard Avenue, it will pass under the southbound through lanes, the North-East (N-E) ramp from Highway 404 to the Highway 401 eastbound collector lanes and, before connecting to the 401 westbound collector, the North-West (N-W) ramp from Highway 404 to the Highway 401 westbound express lanes.

As shown in **Figure 4.3-1**, to extend the southbound HOV lane across the 401 and on to the Don Valley Parkway, the HOV lane must pass over the East-South (E-S) ramp from Highway 401 to the DVP. To provide adequate clearance over the E-S ramp at an acceptable grade, the southbound HOV ramp from the 404 to the 401 would have to be raised and the bullnose separating the southbound and westbound HOV ramps shifted to the north. At a grade of 3.5%, the southbound HOV lane will cross the E-S ramp at a slightly higher elevation than the DVP/404 northbound lanes.

Crossing Highway 401, the HOV lanes would be located in the gap between the northbound and southbound through lanes connecting Highway 404 to the DVP. After clearing the 401, the HOV lanes will cross over the West-North ramp from Highway 404 to the northbound lanes on Highway 404 at a slightly higher elevation than the southbound through lanes.

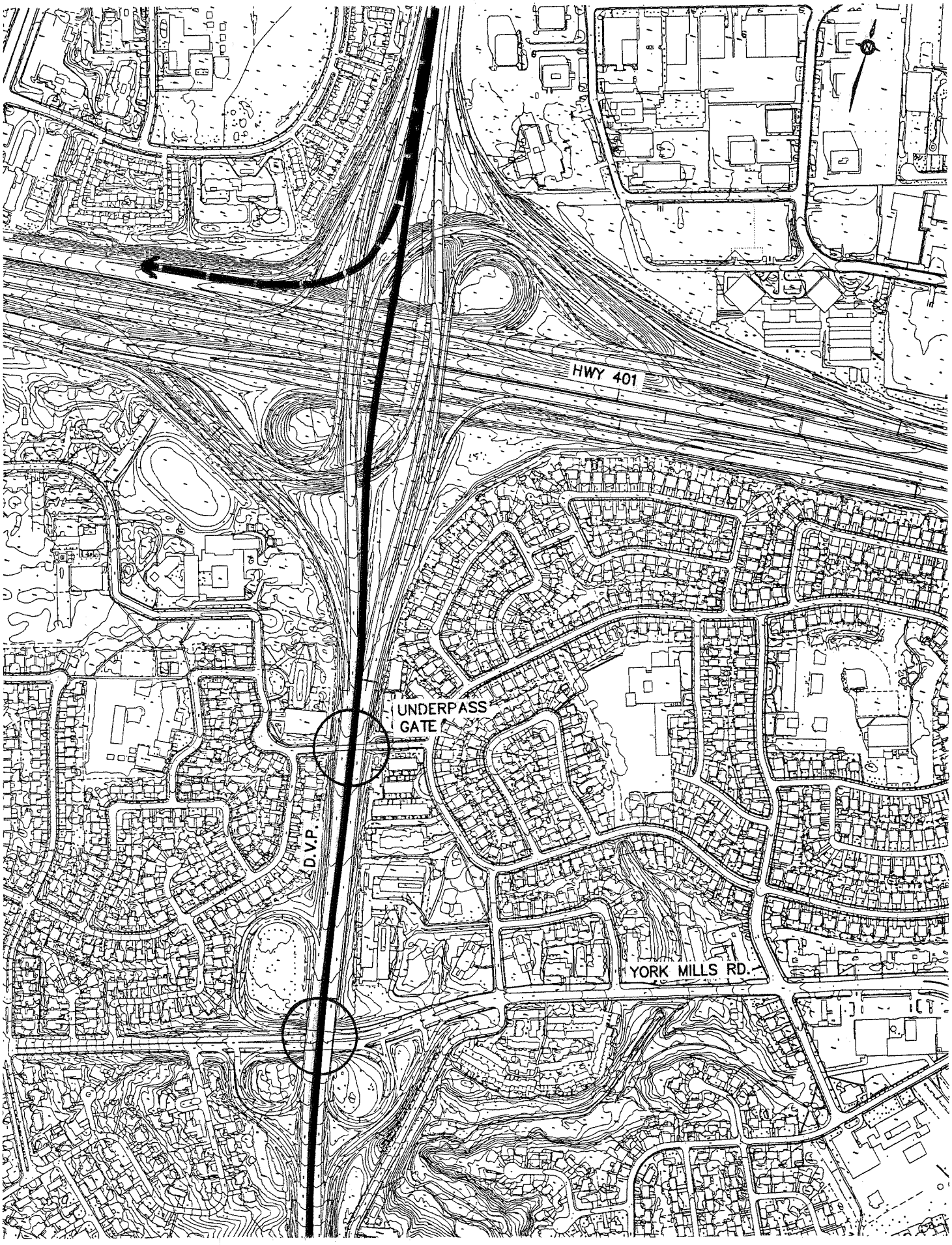
4.3.3 Don Valley Parkway from Highway 401 to York Mills Road

The width of the median on the DVP immediately to the south of the Highway 401/404/DVP interchange is about 10m. Since 13.5m is required to accommodate HOV lanes, an additional 3.5m, equivalent to one traffic lane, would be needed. The required road and bridge widening would be achieved by holding the DVP northbound lanes and inside shoulder, and shifting the two-way HOV lane configuration and the DVP southbound lanes westerly.

4.3.4 Don Valley Parkway from York Mills Road to Lawrence Avenue East (Figure 4.3-2)

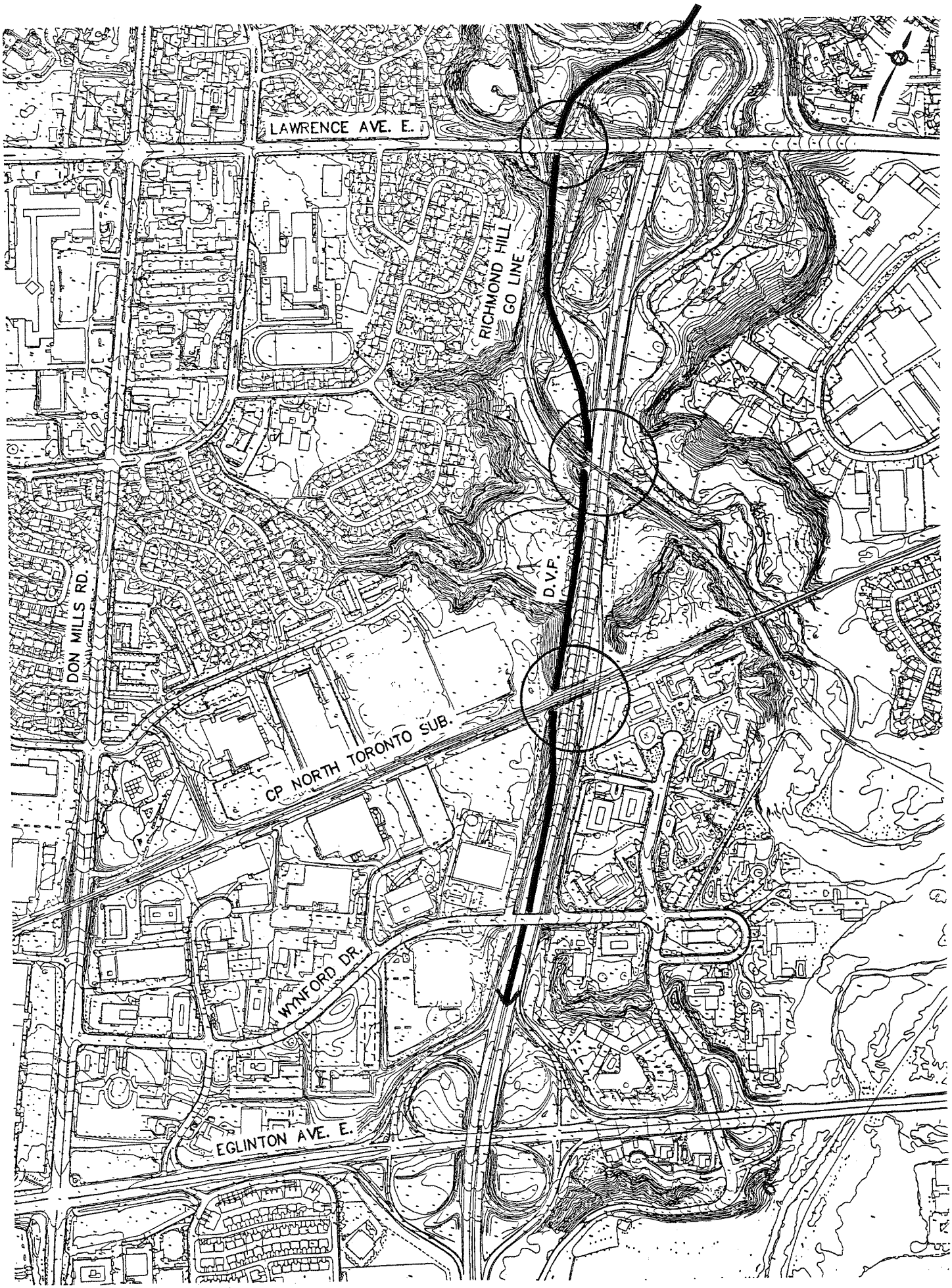
Approaching Lawrence Avenue E., it will be necessary to separate the HOV lanes from the DVP lanes in such a manner that a two-way HOV ramp can rise from the DVP grades and cross westerly over the southbound general purpose lanes and the south-west DVP/Lawrence interchange exit ramp. The HOV alignment will pass the interchange ramp/loop configuration along the outside perimeter in the northwest quadrant and then pass under Lawrence Avenue, just to the west of the Richmond Hill GO right-of-way. From there it would continue south between the GO right-of-way and the southwest quadrant of the Lawrence interchange.

This routing represents one option for the HOV lane continuity, since the existing Lawrence Avenue bridges spans over the DVP cannot accommodate additional lanes.



HOV LANES ON THE DON VALLEY PARKWAY,
HIGHWAY 401-YORK MILLS RD.

FIGURE 4.3-1



HOV LANES ON THE DON VALLEY PARKWAY,
LAWRENCE AVENUE E. TO WYNFORD DRIVE

FIGURE 4.3-2

4.3.5 Don Valley Parkway South of Lawrence Avenue East

South of the interchange the HOV lanes would follow the west side of the DVP. At the railway bridge a new underpass would be required to carry the HOV lanes under the Richmond Hill line, since the existing opening is not wide enough. Similarly, at the North Toronto Subdivision a new arch would be needed on the west side, similar to the arch on the east side for the northbound on ramp from Wynford Drive.

4.3.6 Summary of Major Constraints

It is estimated that the cost to construct HOV lanes from just north of Highway 401 to Wynford Drive could be in the order of $95 million, a distance of only about 4.5km. Much of this cost is required to build several new structures and to widen existing structures at Underpass Gate, York Mills Road and Three Valleys Drive. New structures would be required at the following locations:

- across Highway 401;
- to take the HOV lanes from the median to the west side of the DVP approaching Lawrence Avenue E.;
- to pass under Lawrence Avenue E.;
- to pass under the Richmond Hill GO alignment over the DVP; and
- to pass under the North Toronto Subdivison.

In addition to these new structures much of the DVP would have to be widened between Highway 401 and Lawrence Avenue within the existing right-of-way to accommodate the HOV lanes.

The HOV lanes could be extended south of Wynford; however, there are constraints at locations south of Eglinton (e.g. Don Mills Road interchange) that would attract significant costs. Therefore, in view of the very high cost of constructing HOV lanes between Highway 401 and Wynford Dr., it was decided, based on discussions with the City not to pursue this concept any further.

4.4 Physical Requirements for Reserved Bus Lanes on the Shoulders of the Don Valley Parkway

4.4.1 Introduction

As an alternative to constructing bus lanes in the median of the Don Valley Parkway, the feasibility of operating buses on the paved shoulders of the DVP was explored. According to the operating agreement with the MTO for bus use of the shoulders of Highway 403, buses would be allowed to operate on the shoulders at a maximum speed of 60 kmh and no more than 20kmh faster than traffic on the general purpose lanes.

The physical requirements for this concept were estimated by identifying:

- sections of the DVP where either the shoulders are wide enough for buses to operate safely;
- sections where the widths of the existing lanes/shoulders/median can be modified without widening the existing pavement; and
- those locations where the existing pavement would have to be widened.

The minimum width of pavement considered necessary to operate buses safely is 4.0m.

4.4.2 Highway 401 to Lawrence Avenue East

The pavement is wide enough to support bus use of the shoulders by re-striping the DVP lanes, thereby reducing the width of the inside shoulders and widening the outside shoulders from Highway 401 to Lawrence Avenue East.

The existing median gaps between the northbound and southbound structures would have to be filled in at the bridges over:

- Underpass Gate
- York Mills Road
- Three Valleys Drive

The opening under Lawrence Avenue E. is not wide enough to accommodate shoulder lanes for buses. Instead of constructing a new structure, the buses could operate on the existing north and southbound auxiliary lanes in mixed traffic.

4.4.3 Lawrence Avenue East to Eglinton Avenue East

Between Lawrence and Eglinton the DVP passes under:

- the bridge carrying the Richmond Hill GO rail line; and
- the North Toronto Subdivision.

In both cases the pavement is not wide enough to provide shoulders of adequate width. As an alternative to widening these structures, which would be very expensive, the buses could use the general purpose lanes at these locations.

The spans at the Wynford Drive bridge over the DVP would yield sufficient width for HOV lanes. Finally, the bridge over Eglinton Avenue East is wide enough to generate space for HOV shoulder lanes by re-striping the existing lanes.

4.4.4 Eglinton Avenue East to Don Mills Road

To the south of Eglinton there is sufficient pavement width as far as about Spanbridge Road From this point south the existing shoulders are approximately 2.5m wide and there are two bridges that would have to be widened:

- the bridge over the CN rail line south of the hydro corridor; and
- over a creek located north of Don Mills Road.

The opening under Don Mills Road is also not wide enough to allow bus use of the shoulders. Subject to a more detailed analysis, the following options could be considered at this location:

- reduce the width of the inside shoulder;
- reduce the width of the through lanes; and
- reduce the width of the bus lanes/outside shoulders.

Alternatively, buses could operate in mixed traffic to pass under Don Mills Road.

4.4.5 Don Mills Road to the Bloor Ramp

As explained in Section 4.2 (Don Mills BRT), between Don Mills Road and the Bloor ramp, the DVP is constrained by steep cut and fill slopes on both sides. The existing pavement edge should be held on the east side and any widening should occur on the west or valley side. To

provide shoulders of adequate width for two-way bus operation, the existing cross-section would have to be widened by approximately four metres.

4.4.6 Don Valley Parkway to Castle Frank Subway Station

The additional infrastructure required to permit bus use of the shoulders on the Bloor ramp in both directions between the Castle Frank Subway Station and use of the westbound shoulder only between the Bayview Extension and the DVP was outlined in Section 4.2. To accommodate buses on both shoulders between the DVP and the Bayview Extension would require the following infrastructure:

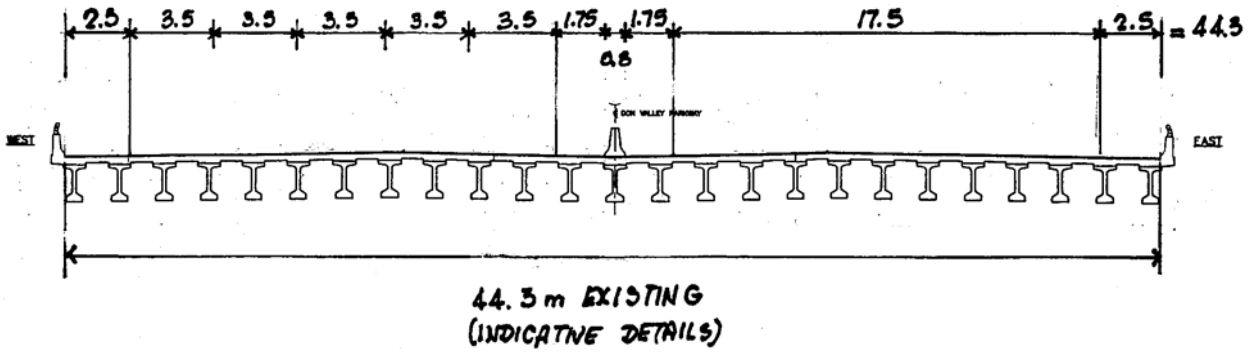
One of the major obstacles on the Bloor ramp is the CP viaduct. Where the Bloor ramp passes under the viaduct it is not possible to widen the pavement between the piers of the viaduct to permit buses to use the shoulders. Therefore, similar to the design option proposed in Section 4.2, two new lanes coming off the DVP could be constructed on the slope, supported by a retaining wall, around the outside of the north pier. One of these lanes would be reserved for buses going from the DVP to the Castle Frank Station and the other lane would be used for mixed traffic. The two existing lanes under the viaduct would be assigned to traffic in the reverse direction. Again, one lane would be assigned to mixed traffic and the other to buses. Alternatively, the buses could operate in mixed traffic under the CP viaduct.

To the west of the viaduct some widening of the road and bridges over the Don River, the CN rail line and the Bayview Extension would be required to accommodate the BRT lanes.

4.5 Improvements to the General Purpose Lanes of the Don Valley Parkway

4.5.1 Introduction

The section of the Don Valley Parkway (DVP) between Lawrence Avenue East and Highway 401 frequently experiences significant traffic congestion in both the southbound and the northbound direction. The reasons for the congestion are, by observation, different for each direction. The objective of this memo is to identify measures that could be implemented to improve traffic flow in this section of the DVP without having to widen the existing pavement. As shown below, the existing widths of the DVP overpasses at York Mills Road and Underpass Gate are adequate to accommodate one additional lane in each direction, providing the lanes shown below meet with the City's approval.



The additional lanes could be part of an extension of the MTO's plans to construct HOV lanes in the median of Highway 404. Alternatively they could be operated as reserved bus lanes or the additional capacity could be used by all types of vehicles.

4.5.2 The Don Valley Parkway Southbound

The congestion in the southbound direction is largely attributable to the lack of lane continuity and reduction in capacity for the high traffic volumes arriving from the eastbound and westbound 401 and from southbound Highway 404. This is exacerbated by the weaving section created by traffic entering and exiting the DVP at the York Mills Road interchange.

From north to south, there are several merge locations within 700 m.

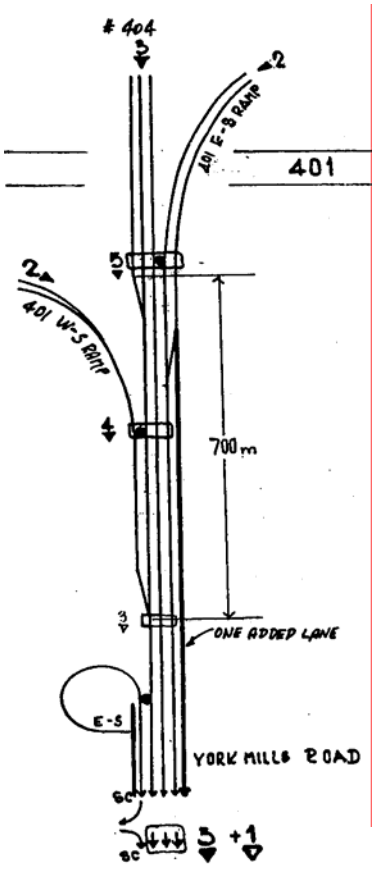
- just south of Highway 401 the DVP narrows from five to three lanes. This is as a result of the reductions on the 404/DVP from three to two southbound lanes and the east 401 off ramp from two lanes to one lane;
- further south, traffic carried on the west 401 ramp merges with the three southbound lanes on the DVP; and
- 777finally, at York Mills there are weaving conflicts created by traffic entering the DVP from York Mills and, to the south, traffic exiting the DVP on to York Mills Road.

The weaving and merging that occurs in this section contributes to back-ups, which can extend well north of the 401 – 404 interchange.

Measures that could be taken to improve southbound traffic flow along this section of the DVP are described below.

Adding One Southbound Lane

The City's current works program includes bridge rehabilitation work of the DVP from the 401 ramps south for approximately 700 m south of York Mills Road. The median gaps between the northbound and southbound bridges over Underpass Gate and York Mills Road will be filled in by deck structure. This will provide an opportunity to create an additional southbound lane, as shown below.



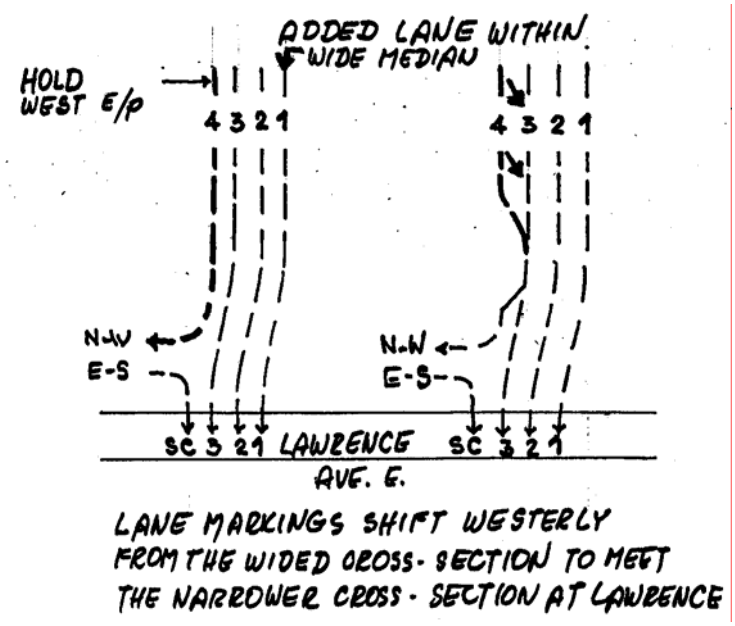
The most problematic lane merge appears to be the left-hand merge of the inside lane of the two (401) E – (DVP) S ramp lanes. Drivers can be observed on the inside shoulder for some distance before a courtesy gap will allow them to merge with southbound traffic.

To reduce the conflicts created by this merge, it is recommended that the inside E-S ramp lane be extended south to Lawrence Avenue East where the four southbound lanes will taper to the three existing lanes. This extension will provide more opportunity for traffic to make the transition from four to three southbound lanes.

This additional lane can be carried south to just north of Lawrence Avenue without having to widen the existing pavement. At Lawrence the opening accommodates three southbound lanes and an auxiliary lane. There is not sufficient width to accommodate an additional lane.

As the DVP approaches Lawrence Ave. the lane markings will need to be adjusted for the transition from four to three lanes so that the three through lanes remain continuous. As shown below, the outside shoulder lane may be discontinued essentially in one of two ways:

- with the assistance of appropriate signage, the outside shoulder lane becomes the N-W exit ramp lane; and
- again, assisted by appropriate signage and by pavement arrows pointing left, the outside shoulder lane is merged into the adjacent through lane.



Elimination of the York Mills East-South (E-S) Ramp

This ramp could be eliminated, by replacing the E-S traffic movement with an E-S left turn under signal control at the existing signalized intersection of York Mills Road/N-E/W and the W-S ramp. This improvement would eliminate the friction created by the weaving section.

The intersection on York Mills would have to be modified to accommodate left turns from westbound traffic on York Mills Road. This intersection operates at a LOS “A” in the weekday a.m. and p.m. peak hours. Currently there are two westbound through lanes on York Mills Road. LOS analyses were carried out for two alternative configurations for the westbound lanes:

- the left turns are made from a shared left/through lane; and
- the left turns are made from an exclusive left turn lane.

Although there is adequate capacity to accommodate the left turns with the existing lane configuration and no advance phase, the intersection will operate much better with a separate left turn lane and a westbound advance phase.

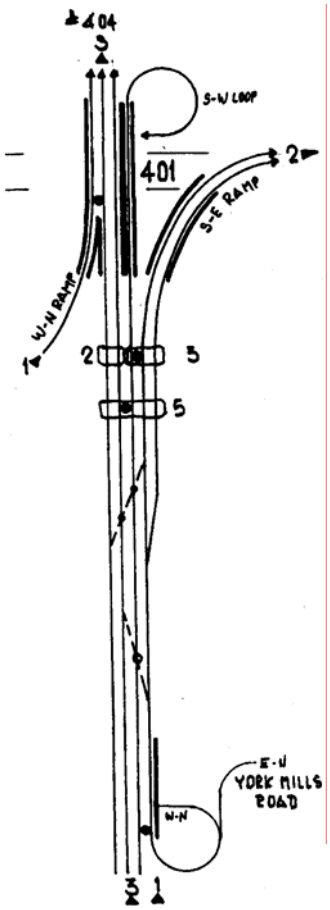
Conclusion

Implementing the design options identified above would improve the lane continuity and capacity of the southbound lanes of the 404/DVP from Highway 401 to Lawrence Avenue. They would also reduce the weaving that exists at the York Mills Interchange.

4.5.3 The Don Valley Parkway Northbound

There are three northbound lanes approaching York Mills Rd. on the DVP. As shown in Figure 4, the auxiliary lane created by the on-ramp at York Mills on-ramp forms a fourth lane and a fifth lane is added further north. At Highway 401 two of the five lanes continue north across the 401 to the 404 and the other three lanes lead to the ramps connecting the DVP to Highway 401 eastbound and westbound.

In spite of the additional northbound lanes between York Mills and Highway 401, back-ups on the DVP persist and observations suggest that the contributing factors are:



Weaving conflicts on the 404 between the 401 and Sheppard created by northbound traffic from the DVP and the W-N ramp from Highway 401 getting off at Sheppard Ave. and traffic from the 401 E-N ramp proceeding north on the 404. Avenue.

The northbound traffic destined for the 404 is much higher than traffic going to the 401; however, only two of the five lanes go to the 404.

The steep, positive grade on the DVP makes it difficult for trucks to maintain their speed. Consequently, this interferes with drivers in the median lane that need to change lanes to get to Highway 401.

Weaving created by traffic entering the DVP at York Mills and destined for Highway 404. Because of the back-ups on the DVP near the 404/401 bullnose, drivers may not be able to use the full weaving length of approximately 450 m to cross one lane before reaching the exit gore;

The existing northbound directional signage on the DVP is not sufficiently oriented toward "pre-sorting" the 404 and the 401 trips. Visibility of signs to drivers of "regular-size" automobiles are sometimes obstructed trucks and other high vehicles.

Measure to improve the northbound flow of traffic approaching Highway 401 include the following.

Adding One Northbound Lane

As shown previously, this could be accomplished along the median side without having to widen the DVP. This additional lane would have to be discontinued before reaching the 401, since neither of the existing ramp bridges across the 401 is wide enough to carry another lane. Therefore, it is concluded that this improvement would have little impact on northbound traffic flow in this section of the DVP.

Eliminating the York Mills Road E/W-N On-Ramp

The weaving that is created by traffic entering the DVP from York Mills Road and that is destined to Highway 404, could be eliminated by removing the ramp between York Mills and the DVP. Currently this ramp carries about 492 vehicles in the weekday a.m. peak hour and 223 vehicles in the p.m. peak hour. The diverted traffic has, depending on trip origin and distribution, the option of reaching the 401/or the 404 by using Leslie Street or Victoria Park Avenue. The origins and destinations of this traffic could be determined, for example, by carrying out a roadside interview surveys of a sample of vehicles using the ramp.

Alternatively, the City plans to close this ramp to traffic during certain times of the DVP-York Mills bridge rehabilitation works. This provides an opportunity for monitoring the impacts of the increase in traffic at various locations caused by the temporary closure of the ramp. It is recommended that a monitoring program be implemented and used as a basis for evaluating in detail the impacts of permanently closing this ramp.

Signage Improvements

The new variable message sign board on the DVP just south of York Mills Road should be programmed to direct drivers to select their destination lanes in this area as early as possible. By "pre-sorting" the northbound traffic on the DVP south of York Mills, the weaving that currently occurs north of York Mills will be reduced.

If this measure proves to be effective, a permanent-message sign or signs could be installed.

The 404-401 Physical Separator Placed South of York Mills Road

If advance signage does not reduce the weaving described above, then another option would be to construct a barrier on the DVP (along with advance signage) to physically separate northbound traffic destined for the 404 and the 401.

A physical separation would require a minimum of, say, 5.05 m (2.5 m right shoulder + 0.8 median barrier + 1.75 left side shoulder). The existing York Mills bridge will yield only an additional 3.5 m, after allowing for the new median and one 3.5 m wide southbound lane. The additional width required for the separator could be provided as follows:

- by not constructing a fourth southbound lane, as described previously;
- by widening the bridge over York Mills Rd. along the east side; and
- using the auxiliary northbound entry lane, which, if the on-ramp from York Mills was to be removed, would be available.

This measure would be most effective if the on-ramp at York Mills is removed or if traffic from York Mills is physically prohibited from going northbound on the 404. Otherwise a gap would still be needed north of York Mills Road for traffic destined for Highway 404 that gets on the DVP at York Mills. In this case the separator would not be completely effective in terms of eliminating the weave between the 401-destined traffic and the 404-destined traffic,

Conclusion

If the impacts during the temporary closure are considered acceptable, it is recommended that removing the on-ramp from York Mills and the signage changes be implemented first. The impact of these improvements in northbound traffic flow should be evaluated prior to any decision to construct a barrier to separate the 404 and 401 destined traffic.