



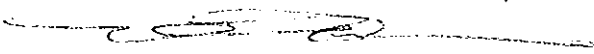
City of Richmond

Report to Committee

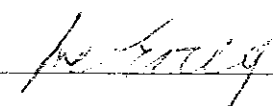
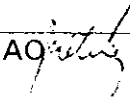

To: Public Works and Transportation Committee *To Public Works & Transportation - Feb 21, 2007* Date: January 23, 2007
 From: Victor Wei, P. Eng. File: 10-6350-07-07/2007-Vol
 Director, Transportation 01
 Re: BLUNDELL ROAD AND STEVESTON HIGHWAY INTERCHANGES -
 FINDINGS OF STUDY

Staff Recommendation

1. That the further planning and design of the Blundell Road Interchange and Steveston Highway Interchange improvements be deferred and incorporated into a future comprehensive improvement strategy for the Highway 99 Corridor, including the George Massey Tunnel.
2. That, until the Highway 99 corridor improvement strategy is developed, staff be directed to work with the Ministry of Transportation, TransLink, and the Fraser River Port Authority to examine implementing a partial interchange at Highway 91 and Nelson Road as an interim solution to enhance goods movements and road access to the Richmond southeast industrial area.
3. That a letter be sent from the City to the provincial Minister of Transportation and the Chief Executive Officer of the Greater Vancouver Transportation Authority to commend the efforts of their staff in working with the City to complete the study, and to request their continued partnership in:
 - a) examining the interim term implementation of the partial Nelson Road Interchange at Highway 91 within the next five years; and
 - b) developing a longer term improvement strategy for the Highway 99 corridor through Richmond including the George Massey Tunnel and a new Blundell Road interchange.


 Victor Wei, P. Eng.
 Director, Transportation
 (4131)

Att. 4

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Policy Planning	Y	<input checked="" type="checkbox"/>	N		
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Staff Report

Origin

At the June 26, 2006 regular Council meeting, the following resolutions were referred to staff regarding the Blundell Road and Steveston Highway Interchanges and George Massey Tunnel improvements:

“That staff continue to carry out joint discussions with the Ministry of Transportation and the Greater Vancouver Transportation Authority (GVTA) on the recommendations of the Richmond Sub-Area Transportation Study - Stage 2 study, upon completion of the respective internal review by these agencies, with a view to reaching a consensus on implementing highway improvements in the Fraserport area and negotiating the project funding and implementation arrangements.”

“That staff report to Committee periodically on the progress of pursuing the above initiatives with the Ministry of Transportation and Greater Vancouver Transportation Authority.”

As the *Richmond Sub-Area Transportation Study - Stage 2* study is now completed, with key findings accepted by the City, the BC Ministry of Transportation (MoT) and the Greater Vancouver Transportation Authority (GVTA), this report responds to the above referrals with a summary of the findings from the above-noted study and other subsequent technical analyses conducted to-date.

In addition, based on the findings of the technical works and consensus reached among City, MoT and GVTA staff, this report seeks endorsement from Council on the proposed next steps to be taken in pursuing a partial interchange connecting Nelson Road to Highway 91 to provide adequate access and enhance goods movements for the Richmond southeast industrial area.

Analysis

1. Transportation Planning Studies and Technical Analyses

Over the past few years, the City has been working with MoT and GVTA on the planning and preliminary design of a potential Blundell Road Interchange as well as the widening of the Steveston Highway Interchange at Highway 99. Below is a summary of the technical works conducted to-date and their key findings and interpretations.

1.1 Technical Works Conducted To Date

Richmond Sub-Area Transportation Study- Stage 2 (Blundell Road and Steveston Highway Interchanges) -- This study was jointly funded by the City, MoT and GVTA and initiated in October 2004. The objective of the study was to carry out planning analysis and preliminary design of the Blundell Road Interchange and the widening of the Steveston Highway Interchange at Highway 99. Key findings from the study when it was 95% completed were reported to Council on June 26, 2006 and resulted in the referrals noted above.

Subsequent to the last reporting, the following further analyses were conducted using more up-to-date land use information to validate the travel forecasts and resulting findings. The results of

these analyses, along with the key findings as outlined in the following section, have now been accepted by staff of the three funding agencies.

- Blundell Road Interchange Travel Forecasting and Modelling Study – Further traffic modelling work was carried out to verify the travel forecast outputs from the October 2004 planning study using the more up-to-date land use data. This work was completed in December 2006.
- Merging and Micro-Simulation Analyses – Based on the revised travel forecasts, city staff, as well as MoT and GVTA staff, conducted further technical analysis to validate the findings of the planning study. A summary of the technical works is included in **Attachment I**. Based on the results of these additional technical works, the key findings from the original transportation planning study have now adjusted to reflect the latest technical work.

1.2 Key Findings

The key findings from the above-noted technical studies and analysis are as follows:

- 1.2.1 A full Blundell Road interchange (**Attachment 2**) is recommended as it would provide an important connection (combined with the extension of Blundell Road) in providing access and enhanced goods movements for the Richmond southeast industrial area. Furthermore, such a highway connection would yield long-term net benefits for road users and support the federal and provincial Pacific Gateway initiatives and economic development in the region.
- 1.2.2 Preliminary cost estimates are in the range of \$33.6M to \$38.9M for the Blundell Road Interchange (including land costs) and approximately \$4.7M to \$6.2M for the Steveston Highway Interchange widening.
- 1.2.3 Existing southbound HOV lanes on Highway 99 to be retained.
- 1.2.4 A possible funding strategy would involve potential funding partners, including the Province of BC, GVTA, Fraser River Port Authority (or the future merged port authority), the Federal government, area developers, and the City.
- 1.2.5 Despite the proximity of the Blundell Road Interchange with the existing interchanges at Steveston Highway and Westminster Highway, the weaving related to the additional on- and off-ramp traffic with the through traffic along Highway 99 could be accommodated; however, potential safety and operational impacts may result due to the extreme congestion caused by the tunnel.
- 1.2.6 During the afternoon peak hours, Highway 99 (southbound) would be operating at capacity and this constrained condition would be exacerbated in the future due to traffic growth and limited tunnel and highway capacities, resulting in the further extension of traffic queues from the tunnel to beyond Blundell Road. The addition of any traffic from the Blundell Road Interchange would further deteriorate the performance of the highway.

1.2.7. Various mitigation strategies and measures have been reviewed (i.e., various highway/ramp laning configurations, ramp metering and traffic control, exclusive usage of the Blundell Road interchange by trucks, etc.) to reduce the impacts of the Blundell Road Interchange on the through highway traffic and alleviate the congested highway conditions (southbound) during the afternoon peak hours. However, it was concluded that the merging conditions at the new on-ramp would be unacceptable during the weekday afternoon peak periods without any major corridor improvements along Highway 99 and the George Massey Tunnel.

1.3 Staff Comments on the Key Findings

In essence, the key findings from the technical works indicate that a full Blundell Road interchange would provide an important connection and enhance goods movements for the Richmond southeast industrial area. However, as Highway 99 (southbound) would be operating at capacity during the afternoon peak hours, additional traffic from the Blundell Road Interchange would further deteriorate the performance of the highway, including both the general-purpose (GP) and high-occupancy-vehicle (HOV) lanes. The poor highway performance, coupled with the potential weaving conflicts associated with the high through traffic volume towards the tunnel, have resulted in operational concerns from MoT and GVTA staff.

As Highway 99, including the proposed Blundell Road Interchange, is entirely under the jurisdiction of MoT, any potential operational concerns must be addressed to their satisfaction. To this end, staff had been working very closely with both MoT and GVTA on examining means to alleviate the concerns over the poor performance of the highway for the southbound traffic during the afternoon peak hours.

To date, upon examination of various options, it was agreed among the three agencies that unless the extreme congestion of Highway 99 is mitigated for the southbound traffic towards the tunnel, there are no meaningful localized measures that could be implemented at the Blundell Road interchange to ensure adequate traffic operation during the weekday afternoon peak hours. It was further agreed that while it may be feasible to increase the highway capacity through the extension of the southbound counterflow lane to the Blundell Road Interchange, such a capacity improvement for the general purpose traffic is not advisable as it would be contrary to the regional objective of reducing the reliance on private vehicles (i.e., single-occupancy vehicles) and promoting the use of higher occupancy vehicles.

As such, it is recommended that improvements to the Highway 99 corridor, including the Blundell Road Interchange and Steveston Highway Interchange improvements, be deferred until a comprehensive strategy is established for the Highway 99 corridor and the George Massey Tunnel. Any major improvements as a result of this future review is not anticipated to commence prior to the completion of the Gateway Programs sometime in 2013. In the meantime, it is also recommended that an alternative interim highway connection be pursued in order to meet the pressing need to facilitate existing demands for truck movements in the Richmond southeast industrial area, as discussed in the following section.

2. Nelson Road Connection to Highway 91

In light of the technical challenges associated with the implementation of the Blundell Road Interchange and the pressing need to facilitate the demands for truck movements in the

Richmond southeast industrial area. It is necessary to pursue an alternative highway connection to improve highway access in the interim. One feasible solution would be to extend Nelson Road to the north from Westminster Highway and connecting it to Highway 91 as a permanent partial interchange with ramp connections to and from the west only (**Attachments 3 and 4**). Such a connection would:

Provide the much needed highway access for the southeast industrial area - The Richmond southeast industrial area is experiencing significant growth, with developments on the Fraser River Port (FRP) and Kingswood / Beedie properties. It is estimated that in five years (when Phase III of the Fraser River Port Development is complete), there would be approximately 2,100 vehicles per hour generated in the afternoon peak hour alone. The proposed highway connection would provide the much needed highway access, especially for the traffic and truck movements to/from the west.

Minimize impacts to adjacent properties and Agricultural Land Reserve (ALR) - While the adjacent properties and agricultural lands would be impacted by the potential partial Nelson Road interchange, it is anticipated that the area of impact will be significantly smaller than that of the full Blundell interchange (approximately 7-8 hectares) due to the smaller footprint of the partial interchange and an existing 10-metre wide road right-of-way along the Nelson Road corridor from Westminster Highway to Highway 91 that could be utilized. Based on a very preliminary assessment, the area of impact on the adjacent agricultural land resulted from the potential Nelson Road partial interchange is anticipated to be in the range of 0.3 to 0.6 hectares. Staff would also examine the feasibility of maintaining farm access under the proposed overpass to minimize the impacts of the affected agricultural property.

One of the key benefits of the Nelson Road partial interchange would be the reduced reliance by trucks and other industrial related traffic generated in the area on the use of the existing Westminster Highway west of Nelson Road to access Vancouver and the tunnel. The reduced truck traffic would minimize the conflicts with farm vehicles and improve accessibility to and from the abutting farm lands on both sides of Westminster Highway. If the Nelson Road partial interchange is supported, the City could also consider downgrading the classification of Westminster Highway from the current Major Road Network (MRN) status to local arterial with truck restrictions while upgrading the status of Nelson Road, and ultimately the extended Blundell Road, to MRN designation.

Reduce the cost of construction - As this connection involves the construction of a shorter road (as compared to extending Blundell Road to No. 6 Road) and a smaller partial interchange with only a short overpass structure (as compared to a full Blundell Road Interchange), the costs of construction would be significantly less.

Complement other current or future road infrastructure projects - This connection would tie in with the widening of the following roadways and provide four travel lanes for both eastbound and westbound traffic to/from Highway 91:

- Westminster Highway, between McMillan Way and the Hamilton Interchange (construction currently underway and slated for completion later this year);
- Westminster Highway, between Nelson Road and McMillan Way (identified in City's Major Capital Program, subject to funding availability); and

- Nelson Road, between Westminster Highway and Blundell Road (identified in City's Major Capital Program and to be cost-shared between the City (48%) and the Fraser River Port Authority (52%), as per Nelson Road Agreement).

Support the ultimate highway access strategy for the southeast industrial area - While the Nelson Road connection to Highway 91 would provide an adequate interim connection to the provincial highway system, it should be noted that staff still consider the Blundell Interchange option to be the best ultimate access strategy for the southeast industrial area as it would provide two points of highway access and ensure the reliability of goods movements in the long term. Nevertheless, pursuing the Nelson Road connection at this time as an interim improvement would still be consistent with this ultimate goal in providing two highway access points and this interim connection through Nelson Road would further enhance the traffic and truck movements to/from the west via Highway 91.

Should Council endorse this interim highway connection, staff would work with MoT and GVTA staff to conduct a business case study. If a suitable return rate of investment is achieved, a preliminary design study would follow, which would provide further details on the costs, property impacts, implementation strategies, etc., involved with this potential highway connection. Consultation with various stakeholders, as well as the Richmond Agricultural Advisory Committee, would also be conducted to minimize the impacts and address potential concerns.

3. Major Road Network (MRN) Implication

GVTA's current MRN network includes only Westminster Highway and excludes both Nelson Road and Blundell Road (see **Attachment 3** for the schematic illustration of the existing MRN network). Should the interim Nelson Road connection to Highway 91 proceed, staff would work with the GVTA to include both Nelson Road and Blundell Road as part of the MRN network, and at the same time, review the area road network for any need to adjust the MRN designation. Inclusion of these two roads within the MRN network would also be consistent with the Greater Vancouver Gateway Council's (GVGC) Major Commercial Transportation System, which recognizes these roads as among the key corridors in the region for goods movements.

4. Consultation with the Blundell Road Residents

Staff have met with the Chairperson of the Blundell Interchange Group (B.I.G.), which is comprised of residents, farmers, and property and business owners in the vicinity of the proposed Blundell Road Interchange. B.I.G. has expressed concerns and opposition towards the Blundell Road Interchange. While the B.I.G. Chairperson remains concerned about the Blundell Road Interchange, she has indicated the preference of the Nelson Road connection option. Should the Nelson Road connection option proceed, consultation with the affected parties would take place and comments/concerns would be solicited.

Financial Impact

The cost of conducting a business case study of the Nelson Road connection at Highway 91 is estimated at \$20,000 to \$25,000. It is anticipated that the study would be jointly funded by the City, MoT and GVTA, with the possibility of contributions from other agencies such as the Fraser River Port Authority. The funding remaining in the current *Richmond Sub-Area Transportation Study- Stage 2* budget would be sufficient for such a study. Should additional

funding be required, approval for such funding through the annual budget preparation process would be sought.

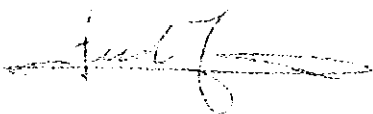
Conclusion

With the acceptance of the key findings from the planning study entitled "*Richmond Sub-Area Transportation Study- Stage 2*" and all the subsequent technical works conducted to date, it is evident that improvements along Highway 99 via the construction of the Blundell Road Interchange and widening of the Steveston Highway Interchange would be greatly beneficial in providing access and enhancing goods movement for the Richmond southeast industrial area. Such highway improvements would also yield long-term net benefits for road users and support the federal and provincial Pacific Gateway initiatives and economic development in the region.

Despite these benefits, without a comprehensive strategy for the Highway 99 Corridor including the George Massey Tunnel, it is anticipated that the Blundell Road Interchange and widening of the Steveston Highway Interchange would be challenging to implement, due to the lack of adequate main highway capacity to accommodate the additional traffic, which would further deteriorate the overall highway performance. As such, it is recommended that any further improvements to the Highway 99 Corridor (i.e., the Blundell Road Interchange and Steveston Highway Interchange improvements) be deferred until a comprehensive strategy is established for this highway corridor.

In the meantime, it is recommended that an alternative highway connection be pursued via the extension of Nelson Road northward to connect to Highway 91 as an interim solution. This connection would provide relief on the pressing need to accommodate increased truck movements in the southeast industrial area and complement the ultimate access strategy to provide two highway access points for the area. Should Council endorse this highway connection, staff would work with MoT and GVTA on a business case study as a first step to determine if an adequate rate of return could be achieved.

In response to the referrals, staff also recommend that the City write a letter to the BC Ministry of Transportation, with copy to the Greater Vancouver Transportation Authority, commending their staff on the efforts to date and requesting their participation in pursuing the implementation of Nelson Road connection to Highway 91 within next five years.



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Blundell Road Interchange: Merging Analysis

Introduction

In October 2004, the City of Richmond, BC Ministry of Transportation (MoT) and Greater Vancouver Transportation Authority (GVTA) jointly retained ND Lea Inc. to conduct a transportation planning study entitled *Richmond Sub-Area Transportation Study- Stage 2*. The objective of the study was to identify the necessary road network improvements along the Highway 99 corridor to enhance access and goods movements for the Richmond southeast industrial area, and to carry out planning analysis and preliminary designs of the Blundell Road Interchange and widening of the Steveston Highway Interchange. The draft report of the study was submitted to the three funding agencies in June 2006. Subsequently, more up-to-date regional land use information was made available. As the study and its findings are based on the land use data available at the time of commencing the study approximately two years ago, it was recommended that further modelling and validation work be conducted with the more up-to-date land use information, in order to validate the travel forecasts and the resultant findings.

In September 2006, Halcrow Consulting Inc. was retained to carry out further EMME/2 model runs, using the more up-to-date regional land use information. A technical note summarizing the EMME/2 model outputs entitled *Blundell Interchange Traffic Impact Assessment* was submitted to all three agencies in December 2006.

Based on the latest EMME/2 outputs, the City then conducted a merging analysis on the performance of the southbound on-ramp traffic to Highway 99 at the Blundell Road Interchange for the 2021 PM peak period. The merging analysis was conducted using the Highway Capacity Software based on the methodology as described in the Highway Capacity Manual.

This document describes the merging analysis conducted by the City, outlines the methodology and assumptions made, and summarizes the findings from the analysis.

Options for Merging Analysis

The following five options were analyzed as part of the merging analysis:

- Option 1: Assumes the southbound shoulder-side High Occupancy Vehicles (HOV) lane is terminated and converted to a General Purpose (GP) lane just north of the Blundell Road Interchange and extended to the Steveston Interchange. Southbound on-ramp traffic at the Blundell Road Interchange would directly merge to the mainline traffic in the three GP lanes.
- Option 2: Assumes southbound on-ramp traffic at the Blundell Road Interchange merges to the shoulder-side HOV lane. The GP traffic in the HOV lane would further merge to the mainline traffic in the two GP lanes.
- Option 3: Assumes southbound on-ramp traffic is controlled by ramp metering devices at the Blundell Road Interchange on-ramp before entering and merging to the shoulder-side HOV lane. The GP traffic in the HOV lane would further merge to the mainline traffic in two GP lanes.

- Option 4: Assumes four southbound through lanes (three GP's and one HOV) are provided by extending the counterflow lane to the north to the Blundell Road Interchange or by widening the highway. Southbound on-ramp traffic at the Blundell Road Interchange would first merge to the shoulder-side HOV lane. The GP traffic in the HOV lane would further merge to the mainline traffic in the three GP lanes.
- Option 5: Assumes the existing shoulder-side HOV lane is converted to a median-side HOV lane. Southbound on-ramp traffic at the Blundell Road Interchange would merge to the mainline traffic in the two GP lanes. HOV traffic in the GP lanes would then merge further to the median-side HOV lane.

Description of Assumptions

Points of Merging:

One merging analysis was undertaken for Option 1 (i.e., ramp traffic merges to GP lane) while two merging analyses were undertaken for Options 2 through 4 (i.e., ramp traffic merges to shoulder-side HOV lane and once in the HOV lane, GP traffic further merges to the GP lanes). For Option 5, merging analyses were undertaken for ramp traffic merging to the GP lanes first, followed by HOV traffic merging to the median-side HOV lane. Halcrow's December 2006 technical note provided the traffic volumes for Options 1 to 3. Traffic volumes for Options 4 and 5 were derived from the Option 2 volumes and recalculated to reflect the assumptions under consideration.

Due to the limitation of Highway Capacity Software for options involving merging to a single HOV lane (i.e., requiring a minimum of two highway lanes for merging analyses), it was assumed that two upstream HOV lanes are provided and the HOV volumes are doubled.

Length of Acceleration Lane:

The acceleration lane for the merging analysis is assumed to be from the point at which the left edge of the ramp lane and the right edge of the highway lanes converge to the end of the taper segment connecting the highway. For the southbound on-ramp merging to the Highway 99 through lane(s), the acceleration lane is assumed to be 150 m in length. For GP traffic merging from HOV lane to GP lanes, only dash line pavement marking is provided. The acceleration lane is assumed to be 400 m in length.

Traffic Speed:

The highway free-flow speed for Highway 99 traffic is assumed to be 90 kilometres per hour (kph). The free-flow speed for the merging area (i.e., from on-ramp to Highway 99) is assumed to be 50 kph while the free-flow speed for merging from HOV to GP lanes (or GP to HOV lanes in Option 5) is 70 kph.

Ramp Volumes:

A partial interchange at Blundell Road was assumed in all of the Halcrow analyses. To reflect the traffic volumes for a full interchange at Blundell Road, a sensitivity analysis was conducted, which examined when either 25 or 50 percent of southbound off-ramp traffic at the Steveston Highway Interchange diverts to the Blundell Road Interchange. This assessment also resulted in a reduction of the southbound Highway

99 traffic by an equivalent 25 or 50 percent of southbound off-ramp traffic at the Steveston Highway Interchange.

Measure of Performance:

Two types of level of service (LOS) performance were determined as part of the merging analysis, one based on density and the other based on capacity. According to the Highway Capacity Manual, the LOS criteria for the merging influence area is determined by density (i.e., passenger car per kilometre per lane (pc/km/ln)), for all cases under stable operations and represented by LOS A through LOS E. LOS F exists when the total flow departing from the merge area exceeds the capacity of the downstream highway segment.

Findings

Option 1: No Southbound HOV (by converting the HOV lane to a GP lane)

The merge area from southbound on-ramp to Highway 99 is expected to operate at LOS D, indicating a relatively high density in the merge area. The total flow departing from the merge area is lower than the capacity of the downstream highway segment.

Remarks: The merging performance is acceptable.

Option 2: Existing Configuration

The merge area from southbound on-ramp to shoulder-side HOV lane is expected to operate at LOS C, indicating the density of the merge area is moderate. On the other hand, the merge area from HOV lane to GP lanes is expected to operate at LOS E (density) or LOS F (capacity), indicating the downstream highway segment does not have adequate capacity for the total flow of the upstream highway and on-ramp GP traffic. GP traffic on HOV lane is required to slow down for limited merging gaps. Operation of through traffic in HOV lane is also affected by merging vehicles.

Remarks: The merging performance from HOV lane to GP lane is not acceptable.

Option 3: Existing Configuration with On-Ramp Metering

The merge area from southbound on-ramp to shoulder-side HOV lane is expected to operate at LOS C, indicating the density of the merge area is moderate. On the other hand, the merge area from HOV lane to GP lanes is operating at LOS E (density) or LOS F (capacity), indicating the downstream highway segment does not have adequate capacity for the total flow of the upstream highway and on-ramp GP traffic. GP traffic on HOV lane is required to slow down due to limited merging gaps.

Remarks: The merging performance from HOV lane to GP lane is not acceptable.

Option 4: Extend Counterflow Lane to Blundell Road

The merge area from southbound on-ramp to shoulder-side HOV lane is expected to operate at LOS C, indicating the density of the merge area is moderate. The merge area from HOV lane to GP lanes is also operating at LOS C. The downstream highway segment has adequate capacity for the total flow departing from the merge area.

Remarks: The merging operation is acceptable.

99 traffic by an equivalent 25 or 50 percent of southbound off-ramp traffic at the Steveston Highway Interchange.

Measure of Performance:

Two types of level of service (LOS) performance were determined as part of the merging analysis, one based on density and the other based on capacity. According to the Highway Capacity Manual, the LOS criteria for the merging influence area is determined by density (i.e., passenger car per kilometre per lane (pc/km/ln)), for all cases under stable operations and represented by LOS A through LOS E. LOS F exists when the total flow departing from the merge area exceeds the capacity of the downstream highway segment.

Findings

Option 1: No Southbound HOV (by converting the HOV lane to a GP lane)

The merge area from southbound on-ramp to Highway 99 is expected to operate at LOS D, indicating a relatively high density in the merge area. The total flow departing from the merge area is lower than the capacity of the downstream highway segment.

Remarks: The merging performance is acceptable.

Option 2: Existing Configuration

The merge area from southbound on-ramp to shoulder-side HOV lane is expected to operate at LOS C, indicating the density of the merge area is moderate. On the other hand, the merge area from HOV lane to GP lanes is expected to operate at LOS E (density) or LOS F (capacity), indicating the downstream highway segment does not have adequate capacity for the total flow of the upstream highway and on-ramp GP traffic. GP traffic on HOV lane is required to slow down for limited merging gaps. Operation of through traffic in HOV lane is also affected by merging vehicles.

Remarks: The merging performance from HOV lane to GP lane is not acceptable.

Option 3: Existing Configuration with On-Ramp Metering

The merge area from southbound on-ramp to shoulder-side HOV lane is expected to operate at LOS C, indicating the density of the merge area is moderate. On the other hand, the merge area from HOV lane to GP lanes is operating at LOS E (density) or LOS F (capacity), indicating the downstream highway segment does not have adequate capacity for the total flow of the upstream highway and on-ramp GP traffic. GP traffic on HOV lane is required to slow down due to limited merging gaps.

Remarks: The merging performance from HOV lane to GP lane is not acceptable.

Option 4: Extend Counterflow Lane to Blundell Road

The merge area from southbound on-ramp to shoulder-side HOV lane is expected to operate at LOS C, indicating the density of the merge area is moderate. The merge area from HOV lane to GP lanes is also operating at LOS C. The downstream highway segment has adequate capacity for the total flow departing from the merge area.

Remarks: The merging operation is acceptable.

Option 5: Provision of a Median-side HOV Lane

The merge area from southbound on-ramp to GP lanes is expected to operate at LOS E (density) or LOS F (capacity), indicating the downstream highway segment does not have adequate capacity for the total flow of the upstream highway and on-ramp GP traffic. On-ramp traffic has difficulty in finding any merging gaps, resulting in significant delays and a long traffic queue on the southbound on-ramp. The merge area from GP to HOV lanes is operating at LOS B, indicating the density of the merge area is relatively low.

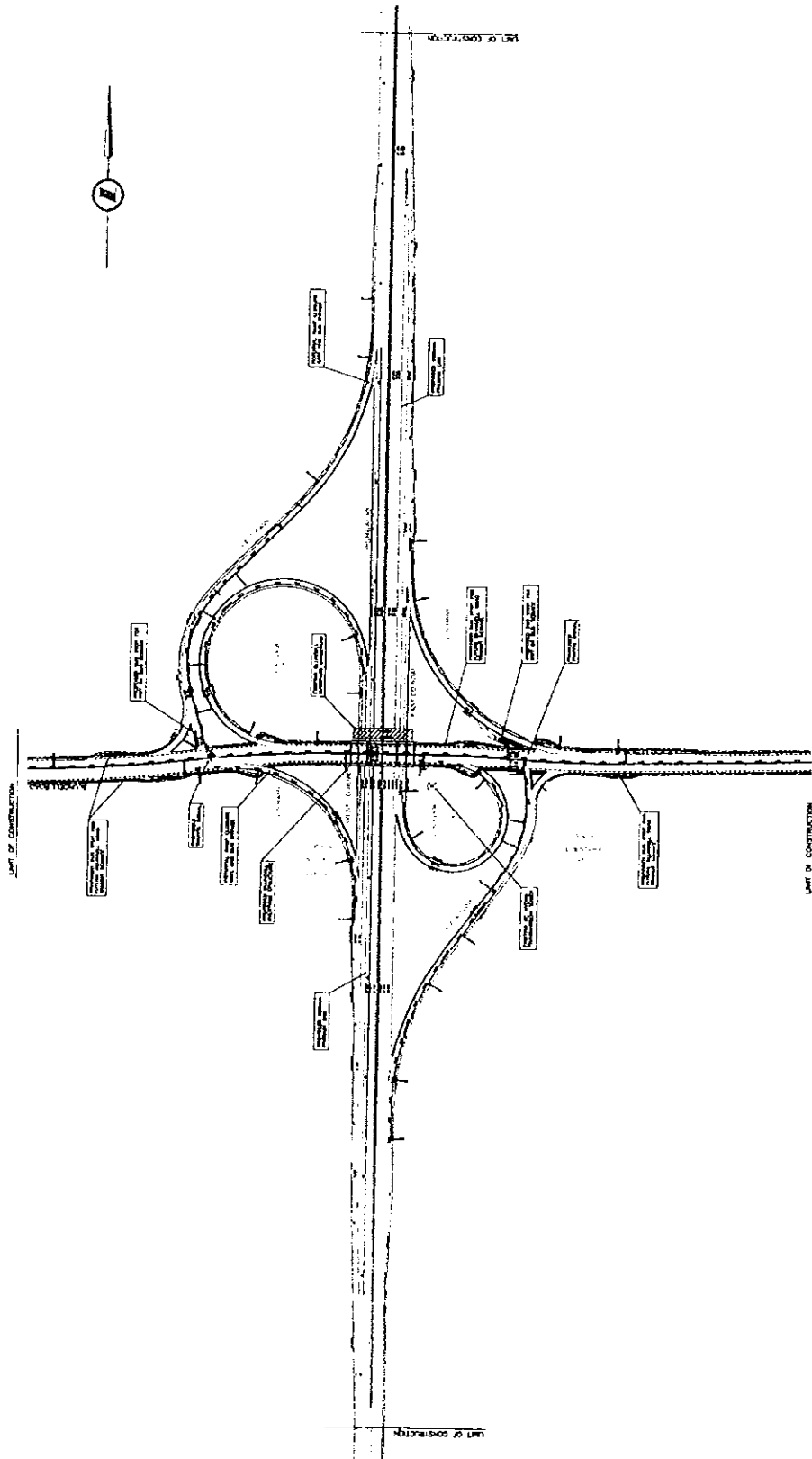
Remarks: The merging operation from on-ramp to the highway GP lanes is not acceptable.

Sensitivity Analysis

The analysis indicated that, with 25 or 50 percent of southbound off-ramp traffic at the Steveston Highway Interchange diverted to the Blundell Road Interchange, the results are similar for both interchange options (i.e., partial- vs. full-interchanges). For Options 2 and 3, the merging operations from the HOV lane to GP lanes are expected to improve from LOS E to LOS D based on the density in the merge area. However, due to the inadequate capacity of the downstream highway segment, the merging operation is still expected to operate at LOS F.

Remarks: Even in the best case scenario where southbound volume on Highway 99 is reduced by 50 percent of the southbound off-ramp traffic at the Steveston Highway Interchange, Highway 99 would still be operating at capacity and not improving merging performance.

Proposed Blundell Road Interchange Configuration



Context Map- Blundell Road/Nelson Road Corridor, East Richmond Area

