
200th Street Interchange Review

September 7, 2001



**BRITISH
COLUMBIA**

Ministry of Transportation

200th Street Interchange Review

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September 7, 2001

Dan Doyle
Deputy Minister

Dear Sir:

I respectfully submit the report arising from the 200th Street Interchange Review for your consideration. The results of the panel's considerations and recommendations are contained in this document.

A panel of experts, consisting of an independent traffic and geometric expert and a process expert, worked with me to review the design. The ministry's Acting Senior Traffic Engineer supported the panel. The conclusion is that the project will result in a safe and effective interchange.

Dirk Nyland, P.Eng.
Chief Engineer

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200th Street Interchange Review

Executive Summary

The 200th Street Interchange connects Highway 1, 200th Street and 88th Avenue. It provides a major connection to Langley for vehicles travelling west of the Port Mann Bridge and from North Surrey to the Township of Langley and the City of Langley.

A July 30th, 2001, Langley Township Council Meeting resolution, *200th Street Interchange Design Issues*, raises 18 points about the design of the proposed new 200th Interchange. In response, the Deputy Minister of Transportation directed the ministry's Chief Engineer to review the current 200th Street Interchange design work.

A review panel was assembled to review the complex technical issues associated with the design concept. The panel members included independent process expert Tim Stevens P.Eng., Stevens Engineering, and independent traffic and geometric engineering expert, Ross Walker P.Eng., (retired, formerly with Delcan Corp.). Robert Cheng P.Eng., Senior Traffic Engineer with the Chief Engineer's Office, supported Walker.

The panel was asked to determine whether the design will result in a safe, effective interchange that meets ministry design policies and guidelines and stakeholder expectations. The review panel was also asked to consider concerns raised about the design work in a July 26th, 2001, e-mail from a Ministry of Transportation Traffic Engineer.

In general, the panel found that the design and related processes being used to deliver this project will result in a safe and effective interchange, capable of serving general traffic needs. The panel members concluded that the interchange configuration conforms to ministry design guidelines and policy and will meet design criteria established in the Request For Proposal.

Because interchange design work is not yet complete, it was not possible to review all aspects of the design in detail. The panel members made recommendations to ensure detailed resolution of any technical issues that they identified as being critical to the success of the design. While these issues would have been addressed as part of the project process, panel members believe their recommendations will provide focus in areas the panel consider critical to the success of the design.

The panel believes the design and related development approval processes used to deliver this project will result in a safe and effective interchange capable of meeting traffic mobility and commercial development access needs within the area of the interchange.

Glossary of Terms

Access – An intersection, driveway, or opening on the right-hand side of a roadway. An entry on the opposite side of the roadway or an opening in the median barrier can also be considered an access.

Access management - The regulation of the location and nature of driveways and roads, to enhance safety and mobility. The Ministry of Transportation has some legal powers for this.

Approach – A set of lanes leading up to an intersection and which accommodate all left-turn, through and right-turn traffic movements from a given direction.

Arterial – A signalized continuous major urban street that primarily serves through-traffic. Direct access to abutting properties is not a priority.

Auxiliary lane – An additional lane on a freeway that connects an on-ramp and an off-ramp.

Capacity - The number of vehicles per hour that a road or other facility can serve.

Demand – The number of vehicles per hour or passenger cars per hour that wish to use a particular highway system.

Design-build-develop agreement - where the contractor agrees to design and construct a facility with payment involving the signing over of surplus Crown land to the contractor as part of the compensation package. The land is then developed by the contractor for resale.

Development Approval Process – the ministry process for the approval of all land subdivisions outside municipalities, as well as the approval of all access to and use of provincial highways.

Diamond interchange – This is a common type of interchange. It has two off-ramps from the freeway and two-on ramps to the freeway. These ramps create a ‘diamond-shape’ when viewed from above. Intersections are created where the ramps meet with the arterial road (forming two closely spaced intersections).

Direct access – access from a private or commercial property directly onto a high-speed facility.

Flow rate – The number of vehicles per hour passing a given point in a roadway or other traffic facility.

Freeway – a multi-lane, divided highway with access only via grade-separated interchanges.

Geometrics – The spatial characteristics of a facility, including approach grade, the numbers and width of lanes, lane use, and parking lanes.

Merge – A movement in which two separate lanes of traffic combine to form a single lane without the use of traffic signals or other right-of-way controls.

Off-ramp – A ramp that allows traffic to leave a freeway.

On- ramp – A ramp that allows traffic to enter a freeway.

Platoon – A number of vehicles traveling together as a group, either voluntarily or involuntarily, because of signal control, geometrics, or other factors.

Queue – A line of vehicles, bicycles, or persons waiting to be served by a roadway system. For example, a line of vehicles waiting at a stop light. Slowly moving vehicles joining the rear of the queue are usually considered part of the queue. A faster-moving line of vehicles is often referred to as a moving queue or a platoon.

Ramp – A short segment of roadway between an arterial road and a freeway. They form the main components of an interchange.

Red time - The period of time, in seconds, during which a traffic signal is red.

Request for Proposal – an invitation to contractors to bid on a project. The Request for Proposal outlines the project requirements.

Right in/right out access – access that allows vehicles to restricts vehicles to right turns in and right turns out of a property, but does not permit left turns in or left turns out of the property.

Single-point interchange (SPI) – A single point interchange (SPI) configuration combines the two separate intersections of the conventional diamond interchange into a single intersection. This compressed diamond is typically used to minimize property requirements.

TAC (Transportation Association of Canada) – TAC is a non-profit association of transportation stakeholders in government, private industry, and educational institutions. It is a neutral forum for gathering or exchanging ideas, information and knowledge in support of technical guidelines and best practices. Almost all of the British Columbia Ministry of Transportation's geometric design guidelines are taken directly from TAC, with some British Columbia-specific modifications.

Through lane – A lane for vehicles passing directly through a section of road without turning.

Geometrics – the vertical and horizontal alignment of a road (the curves and ‘bumps).

Trip generation rates – the number of incoming and outgoing vehicles created by a commercial development.

Volume to capacity ratio (V/C) – The number of vehicles wanting to use to route compared to the number of vehicles the route can theoretically serve.

Weaving – The crossing of two or more traffic streams traveling in the same direction along a significant length of highway, without the aid of traffic control devices (except for guide signs).

Yellow-time – the period of time, in seconds, during which a traffic signal is yellow.

Chronology: Past and Future

Phase	Year	Activity	Agencies Involved		
			Ministry	BCTFA	LANGLEY
Project Development					
	1996	Terms of reference (TOR):Planning and design study	✓		✓
	1996	Proposal Selection	✓		✓
	1997	Review and adopt Ward Study	✓	✓	✓
	1997	Review and adopt conceptual interchange design drawing	✓	✓	✓
	1998	Term Sheet (agreement in principal between the three parties involved)	✓	✓	✓
	1999	Project Agreement (a legal agreement flowing from the Term Sheet)	✓	✓	✓
Contract Procurement	1999				
		TOR for Owner's engineer (independent engineer who ensures the procurement process is objective and without bias)		✓	✓
		Select the Owner's Engineer		✓	✓
		Develop/approve Request for Expression of Interest	✓	✓	✓
		Proponent selection	✓	✓	✓
		Approve to shortlist	✓	✓	✓
		Develop/approve Request for Proposal	✓	✓	✓
	2000	Develop pass/fail criteria	✓		✓
		Develop value added criteria	✓		✓
		Evaluate technical proposals	✓		✓
		Recommend lead proponent (technical perspective))	✓		✓
		Evaluate financial proposal		✓	
		Recommend lead proponent	✓	✓	✓
		Approve to award contract	✓	✓	✓
Bunt Study	2000				
		Develop TOR for the study		✓	✓
		Review draft report		✓	✓
		Presentation - draft report	✓	✓	✓
		Receive final report	✓	✓	✓
Bunt 2001	2001				
Bunt Study (addendum)	2001	Develop TOR		✓	✓
		Review draft report		✓	✓
		Receive final report	✓	✓	✓

ACTIVITIES TO COMPLETE PROJECT
Design:
Contractor to issue 100% detail design drawings
Safety auditor review 100% design for safety
MOT/Langley quality review of design
Construction:
Initiate construction
MOT/Langley quality review during construction
Complete construction
Safety auditor review 100% construction
BCTFA issue contract completion certificate
Contractor 2 year warranty

Scope of Review

The review panel was asked to determine whether the design work underway will result in a safe, effective interchange that meets ministry design policies and guidelines and stakeholder expectations.

The panel was also asked to consider concerns about the standard of design work as brought forward in a July 26th, 2001, e-mail from a Ministry of Transportation Traffic Engineer. This e-mail had been sent to the Chair of a Township of Langley special interest committee.

In doing so, the panel looked at process (i.e. who has been involved, their roles, and how the results of their reviews were incorporated into the design) and traffic geometrics.

This helped:

- determine the quality of engineering in the design; and
- determine if sufficient effort has been made to identify, manage or resolve any negative aspects of the design.

Review Rationale and Nature

A July 30th, 2001, Langley Township Council Meeting resolution titled 200th Street Interchange Design Issues, raises 18 points regarding the design of the proposed 200th Interchange. In response, the Deputy Minister of Transportation directed the ministry's Chief Engineer to review the proposed interchange's engineering design.

A panel of independent, qualified engineering experts, as well as a ministry representative, was assembled to review a range of technical issues associated with the design concept.

The Ministry of Transportation's Chief Engineer Dirk Nyland P.Eng led the panel. Two independent transportation engineers supported him: Tim Stevens P.Eng. and Ross Walker P.Eng. Stevens, Principal of Stevens Engineering Ltd., reviewed the process being followed by the 200th Street Interchange Project. Walker (retired, formerly with Delcan Corp.), reviewed traffic and geometric issues. Robert Cheng P.Eng., Acting Senior Traffic Engineer with the Chief Engineer's Office, aided Walker.

Further details of the review process appear in Appendix A

Purpose of the 200th Street Interchange Project

The 200th Street Interchange is located on the Trans-Canada Highway (Highway 1) in the northwest corner of the Township of Langley. It is the major connection to Langley for vehicles travelling west of the Port Mann Bridge and from North Surrey to the Township of Langley and to the City of Langley. The interchange connects three major routes: Highway 1; 200th Street; and 88th Avenue.

Land development has increased traffic volumes in the area in recent years. The daily traffic on 200th Street immediately south of the proposed interchange increased from 21,700 in 1987 to 32,000 vehicles in 1991. Traffic congestion at the interchange creates travel delays and safety hazards. The intersections at the 200th Street interchange are some of the highest traffic accident locations in the Township of Langley. One of the main causes is constriction at the two-lane overpass.

An ongoing series of improvements have upgraded 200th Street to four-lanes between Highway 10 and 84th Avenue. This has increased traffic capacity ahead of the interchange, putting more pressure on the interchange itself. It was determined that the existing interchange should be replaced to meet current and future traffic volumes. Constructing the new interchange is the fourth and final phase of the upgrades.

The Provincial Government and the Township of Langley entered a partnership agreement to build the new interchange. The partners agreed to provide a combination of cash and land to fund the project. The design-build-develop agreement with the Contractor assigns a value to surplus provincial land in the vicinity of the interchange (land not required for the highway) that offsets the Contractor's costs for constructing the interchange. These lands are available for use by the Contractor for commercial development. Without these agreements, which include a commitment to a design-build-develop process, fiscal constraints would not permit this project to take place.

Review of Township of Langley Council Concerns

The panel looked at each of the issues raised by Langley Township Council. For clarity, the Council's questions appear here in the original wording and in the same order in which they were raised in the Council's original resolution.

1. Will the design meet the ministry's standard for volume to capacity (V/C) ratio?

Panel Response: Yes, based on the Bunt 2001 Report¹, the design will meet the ministry's standards for 2021.

¹ This review uses the traffic volumes in the Bunt 2001 Report.

The Bunt 2001 Report looked at projected traffic operations in 2003 (the anticipated opening day of the interchange), in 2006 (the medium term) and 2021 (the long term). Good levels of service are expected for both opening day and for the long term.

The medium term assessment was done to test worst case conditions. This worst case scenario assumes that the proposed commercial development would be fully built but none of the anticipated system improvements to the surrounding road network completed. Under these conditions, the V/C ratio at the single point interchange (SPI) intersection would not meet the ministry's standards. If medium term problems were to arise, the stakeholders (the ministry, Township of Langley) have agreed to consider the appropriate medium term contingencies identified in the Bunt Report.

Panel Recommendation: To alleviate potential medium term capacity problems, provision should be made to allow for the future widening 200th Street at the Highway 1 overpass, as suggested in the Bunt Report.

2. Are the assumptions used in the volume to capacity analysis, such as the yellow and red time phasing, realistic?

Panel Response: While the general assumptions are realistic, this question cannot be properly answered at this time. The panel believes Council is asking if the value for design parameters used in the traffic analysis process are realistic. Assessing whether these values are realistic requires the intersection detailed design drawings, but these drawings are not yet available. They are expected to become available during the detailed design. When complete, details, such as yellow and all red traffic signal times, must comply with the guidelines laid out in the ministry's Electrical and Traffic Engineering Manual. Review processes are in place to ensure this happens.

Panel Recommendation: none

3. Are the assumptions used for level of operation such as future network improvements consistent with what TransLink and Ministry of Transportation proposals?

Panel Response: Yes, in general the assumptions for level of operation are consistent with ministry and TransLink proposals for future network improvements. However, not all future network improvements are known. Some are only in the conceptual stage of planning. They are not supported by a commitment to design or construct. Those that are known or are in the conceptual stage are included in the Bunt 2001 Report. (See panel response under #1 for further details.)

The program of upgrades for this area began in 1999, but the anticipated future network has been evolving since that time. The assumed location of the possible future Fraser River crossing to Maple Ridge is one potential major change in the future of this network. Previously it was thought that such a crossing would be aligned with 216th Street. However, current TransLink proposals suggest a connection with 200th Street.

The 200th Street Fraser River crossing is only a concept. It has not been approved, and there is no guarantee, at this time, that it will proceed to construction. Since the 216th Street location was considered in the Bunt 2001 Report, the panel believes it prudent to review the impact this proposed change might have on the operation of the 200th Street Interchange.

Recommendation: The panel recommends that the proponents of any new Fraser River crossing project ensure that the associated network changes will handle the traffic impact on the 200th Street Interchange.

4. Will the angle of the westbound off-ramp to southbound 200th Street allow the intersection to be safely signalized?

Panel Response: Yes, based on the limited details available at this time, the panel believes the SPI intersection can be safely signalized. The panel believes Langley Council is asking whether the relatively sharp angle between the ramp and 200th Street will confuse drivers.

As part of the original design concept review, the Contractor retained a recognized traffic safety expert who specifically reviewed the geometry of the SPI and fully endorsed that concept.

The original concept design has evolved considerably. Once the detailed design drawings are complete, an independent traffic safety expert will undertake a safety audit. Review processes are in place to ensure this happens.

Recommendation: See recommendations under 2. Safety Audits, in the Review of Project Processes chapter.

5. Will the level of service and safety be compromised for the through traffic on 200th Street as a result of merging downstream of each traffic signal?

Panel Response: The panel believes Langley Council is asking whether the capacity along 200th Street will be realistic, given that the auxiliary lane terminates just downstream of the intersection. In this case, safety will not be compromised as a result of traffic merging downstream of each traffic signal. The design concepts reviewed meet guidelines.

Adding an auxiliary lane will improve the level of service, compared with not adding such a lane, but will not be as effective as a lane that continues without merging. That is, the auxiliary lanes will not carry as much traffic as a continuous through lane.

It is common practice to add lanes through an intersection, so the street can handle higher traffic volumes. This concept has been proposed in the interchange design work in order to increase the capacity of both the 88th Avenue intersections. It includes tapering to merge the three lanes back into two, in accordance with Transportation Association of Canada (TAC) guidelines.

Recommendation: The panel recommends that the designers consider lengthening the auxiliary lanes as much as is practical without impacting the overpass over Highway 1.

The traffic capacity (level of service) analysis will need to reflect the effect of the auxiliary lane.

6. Can operation be effectively coordinated, given the geometry, intersection spacing, approach storage, multi-directional demand, and queue management requirements?

Panel Response: Bunt's March 28, 2001 analysis considered a coordinated traffic signal system. While McElhanney Consulting Services Ltd.'s Traffic Analysis Design Report, dated February, 2000, included analysis based on a coordinated traffic signal system, it did not provide enough detail for a thorough review.

Recommendation: The panel recommends updating McElhanney's Traffic Analysis Design Report. It should include details of the coordinated signal system analysis, using finalized traffic volumes based on actual zoning approved by the Township of Langley Council.

7. Will there be a significant increase in delays to the off peak traffic;

Panel Response: Off peak analysis is not normally conducted for infrastructure projects. However, since the design is intended to reduce peak traffic delays, it would follow that delays will also be reduced for off peak traffic.

Recommendation: none.

8. Will the design be pedestrian and cyclist friendly?

Panel Response: Yes, when finalized the design will be friendly to both pedestrians and cyclists. Pedestrian volumes are not expected to be high across Highway 1. A 1.5 metre-wide pedestrian sidewalk has been included on the east side of 200th Street. The signal phasing will allow pedestrians to cross at the intersections. A 1.5 metre-wide shoulder along the east and west sides of 200th Street will accommodate cyclists.

Recommendation: none.

9. Will the design be friendly to truck traffic?

Panel Response: Yes, although the project design criteria allow for a six per cent maximum grade on the on-ramps and 200th Street, the design grade on 200th Street and the ramps is not more than four per cent. These low grades will assist trucks.

The heavy movement of trucks at the 200th Street/ 88th Avenue East intersection will be accommodated by an extended southbound to westbound right-turn lane.

Recommendation: none.

10. Is proper guide signing possible, given the complexity of intersections, proximity of multiple exits and spacing constraints?

Panel Response: Yes, the panel examined the 1:2000 scale layout of the interchange and found that signing should not be a problem for the following reasons:

- The plan does not call for multiple exits in any one location;
- There is ample distance between the intersections to provide adequate signing along 200th Street;
- Signing on the ramps and the approaches to 200th Street will be very simple (i.e.: 200th Street North and 200th Street South);
- The westbound and eastbound ramp exits from the freeway are single exits and will be easy to sign².

Recommendation: none.

² Drivers first decide what street they want and then, when they are on the ramp, have time to decide whether to go north or south.

11. Will development at the intersection quadrants confuse drivers and create a potential for unsafe weaving maneuvers?

Panel Response: No, the proposed commercial development at the interchange is not expected to confuse drivers or cause unsafe weaving maneuvers. The development is for businesses and destination retail stores. The type of users accessing services at this kind of development are generally travelling specifically to that destination and know where they are going. This type of access design works well in similar situations throughout British Columbia.

Recommendation: none.

12. Will safety be compromised by mixing: standing queues, high speed traffic, platoons of merging traffic, multi-lane weaving, given the complexity of the intersection, proximity of multiple exits and spacing constraints?

Panel Response: No, safety will not be compromised. All but one of these situations are addressed in responses to other questions. The issue of standing queues is addressed in the response to question 18. Multi-lane weaving is addressed in the response to question 16. The complexity of the intersection is discussed in the responses to questions 4 and 5, and spacing constraints are discussed under question 6. There are no multiple exits in the design concept. (see listing below).

In response to Langley Council's concern about platoons of merging traffic, the panel noted that an interchange with traffic signals is normal design practice. The concept of the intersection at the top of the ramps along 200th Street follows accepted practice in North America. The intersection will not be exposed to high-speed traffic and will not pose a safety concern. The panel identified some potential concerns regarding platoons of traffic entering Highway 1 from this interchange. However, those concerns could be addressed by extending the merging lanes.

Recommendation: The panel recommends that merge lane lengths should be reviewed, and adjusted as necessary, at the detailed design stage.

13. Are there design deficiencies that will lead to or contribute to collisions?

Panel Response: No, the design concept will meet TAC and Ministry of Transportation design guidelines. This should result in proper operation with no more collisions than is normal in any other properly designed intersection. The design process includes a review of the detailed design drawings when they are submitted. Review processes are in place to ensure this happens.

Recommendation: See recommendations under 2. Safety Audits, in the Review of Project Processes chapter.

14. Have any ministry highway design policies or procedures been unsafely compromised in this project?

Panel Response: No, the design concept reviewed conforms to Ministry of Transportation and TAC guidelines. A process is in place to ensure that the detailed design drawings of the current concept, when complete, are reviewed to make certain they also meet the guidelines.

Recommendation: (see discussion under 1. Quality Assurance Process and recommendations under 2. Safety Audits in the Review of Project Processes chapter).

15. Are the proposed accesses for private development from freeway off and on-ramps consistent with ministry policy?

Panel Response: The proposed accesses are consistent with ministry policy.

There are no development accesses proposed on the Highway 1 off-ramps.

There are two accesses proposed on extensions of 88th Avenue west and 88th Avenue east, accessing the southeast and northwest quadrants respectively. The on-ramps would start downstream of these accesses, so there are no accesses to the development on the on-ramps, which is consistent with ministry policy.

Access to new developments will be addressed as part of the ministry's development approval process, which ensures that any proposed access is suitable and safe.

Recommendation: none.

16. Will access to development have sufficient weave distances to allow for safe lane changes and not obstruct through traffic?

Panel Response: Access to the northwest quadrant should not cause any weaving or capacity concerns as long as traffic volumes are expected remain relatively low for the proposed development³.

³ The total traffic turning into this development is shown as 26 vehicles per hour.

The southeast quadrant is expected to generate much higher traffic volumes. Access to this quadrant has two potential weaves: one along the 88th Avenue west extension and another southbound along 200th Street between the eastbound off-ramp and 88th Avenue west. Weaves must be addressed in the final design submission in order to receive ministry approval through the development approval process.

Recommendation: none.

17. Will on-ramp signalized access to development be safe, given queues being forced on the ramp and merging with high speed through traffic?

Panel Response: There is no on-ramp signalized access to the proposed commercial development. The on-ramps would start downstream of accesses.

The development approval process will address the type and level of access given to the development. Access signalization will be permitted only if safe. More details are provided in the segment regarding platoons of merging traffic, which appears in the response to question 12.

Recommendation: none.

18. Will off-ramp accesses to development be safe given queues backing up to high-speed traffic exiting the freeway.

Panel Response: The proposed project does not include off-ramp accesses to development.

Recommendation: none.

Other Technical Issues Noted by Panel

During the review, panel identified some additional issues that were not raised in the Township of Langley's resolution or the July 26, 2001, e-mail.

Future Expansion of the Highway 1 Overpass:

Point: The panel has identified a number of issues that might affect future traffic operations on 200th Street at the Highway 1 overpass:

- A potential future Fraser River Crossing would likely add some traffic volume;
- Traffic forecasts are estimates only and could be low or high. If forecasts are low, then traffic operations at the SPI intersection may degrade to an undesirable level; and

- The Bunt 2001 Report's worst case analysis for the SPI intersection suggests that, if planned future network improvements are not implemented prior to completion of adjacent development, traffic operations at that intersection could degrade to an undesirable level in the medium term.

The Bunt 2001 report suggests three ways to alleviate the potential for medium term traffic to cause unacceptable congestion in the interchange:

- Make provision for widening the 200th Street/Highway 1 overpass from four lanes to six lanes;
- Widen 208th Street from two lanes to four lanes to divert from 200th Street; and
- Construct a partial interchange at 216th Street and Highway 1 to divert traffic from 200th Street.

Recommendations: In the reviewer's opinion, it would be prudent to adjust the current overpass design and reserve the necessary space to facilitate future construction of a fifth and sixth lane on 200th Street at the Highway 1 overpass. This approach would keep this option, among others, open for future implementation.

Internal Traffic Circulation:

Point: With respect to the design of the proposed commercial development's internal traffic circulation, the entrance road into the development should not allow drivers access to parking until they are at least 30 metres from the intersection. If access were allowed before that point, vehicles stopping to enter an aisle just after leaving the road might cause a backup into the intersection.

Recommendation: The panel recommends that the internal traffic circulation design issue be carefully considered during the development approving process.

New 201st Street Proposal:

Point: The Township of Langley is considering adding a new street to the south of the southeast quadrant development access. This would create a four-legged intersection. The amount of traffic turning left into the proposed development at this point, may require double left-turn lanes. This should only be considered if it becomes necessary to ensure that left-turning vehicles don't overflow into the through traffic lane.

Recommendation: none.

Additional Safety Audit Items:

I. Geometric and Traffic Operations at the Intersection:

Point: The panel recognizes that there are a number of concerns associated with the geometry and traffic operations throughout the interchange area. Most of these concerns have been reviewed against the concept drawings and commentary is provided elsewhere in this report.

Recommendation: The panel recommends that the safety audit(s) that takes place at the detailed design drawings review stage, additionally review the geometry of traffic operations for the intersection on the overpass at the end of the off-ramps.

II. East-Bound to South-Bound Traffic Weave:

Point: The panel examined the potential weave between the eastbound off-ramp at 88th Avenue, south of Highway 1, for traffic wishing to access the proposed commercial development in the southeast quadrant. This potential weave is at a different location from those mentioned by Langley Council.

There are no clear guidelines for this type of movement on an arterial street with signals. How this weave operates will be highly dependent on the amount of traffic wishing to access the commercial development.

Recommendation: The panel recommends that the potential weave at this location be carefully considered by the development approving authority during the development approving process.

Point: The concepts reviewed included direct right-in/right-out access from 200th Street to the parcels in the southeast and northwest quadrants.

Recommendation: The panel recommends that the location or existence of these accesses be carefully reviewed during the development approval process to ensure they do not cause unacceptable weaving.

Review of Additional Points, July 26 Email

The July 26 e-mail made comments about the project in six general technical areas. These were:

- The Traffic Impact Study (TIS);
- Design;
- Operation;
- Signing;

- Safety; and
- Legal Issues.

A list of the e-mail concerns considered by the panel appears in Appendix B.

A number of the technical concerns raised by the Langley Township Council Resolution of July 30th were also raised in the e-mail⁴. Where the concerns overlapped they are covered in the responses to the Council concerns. The following reviewer comments respond to the additional concerns raised in the e-mail.

I. **Traffic Impact Study (TIS):**

Point: Concerns were expressed regarding the V/C benchmarks given in the ministry's Site Impact Analysis Requirements Manual and in the project's detailed design criteria (as laid out in the Request For Proposal).

Panel comments: The ministry's Site Impact Analysis Requirements Manual, which is a province-wide guideline for intersection operations, requires that the V/C = 0.85. The application of that ratio must be carefully considered for each individual situation. In urban areas, such as the Lower Mainland, traffic is much denser than in more outlying areas, like Kamloops, so a higher V/C ratio can be used while maintaining reasonable traffic mobility and infrastructure cost. In this case, the appropriate project specific V/C requirements were set in the Request for Proposal.

Recommendation: none.

Point: Concerns were expressed regarding trip generation rates and what traffic volume the development would generate.

Panel comments: Trip generation rates depend on zoning. The zoning has not been finalized. The Bunt 2001 Report takes into account the best prediction of zoning and the type and extent of development that the Contractor is contemplating. Traffic volumes from this report were used for this review. Once zoning is in place, traffic generation can be calculated, impacts determined and McElhanney Consulting Services Ltd.'s Traffic Design Analysis Report updated.

Panel comments on concerns about the Ministry of Transportation, the District and Township of Langley's input into the TIS Terms of Reference appear in the Development Approval Process discussion on page 22 of this document.

Recommendation: none.

⁴ The e-mail also commented on a number of additional technical issues and provides some of the e-mail author's opinions on other projects and project delivery processes. It is not within the scope of this review to comment on those other projects and project delivery processes.

II. Design:

Point: Concern was raised regarding the design-build-develop project delivery process and design concept accepted.

Panel comments: The design-build-develop project approach balances the financial aspect of public works with the need for infrastructure improvement by cooperating with developers. The result is a win-win situation. The people of British Columbia get needed infrastructure and safety improvement now by vending surplus land in partial payment for this much-needed project. Without this approach, the 200th Street Interchange project would not be possible because of the high costs involved.

Recommendation: none.

III. Legal Issue

Point: Concern was raised regarding the ministry's ability to permit direct access on a controlled access facility.

Panel comments: Section 54 of the *Highway Act* permits direct access under permit onto a controlled access facility, so the access envisioned for this interchange is supported by legislation.

Recommendation: none.

Review of Project Processes

Reviewing the processes being used in this project has helped the panel to:

- Determine the quality of engineering in the design; and
- Determine if sufficient effort has been made to identify, manage or resolve any negative aspects of the design.

1) Quality Assurance Process

Point: The Contract includes a process to ensure the 200th Street Interchange is designed and constructed to appropriate standards. The Quality Assurance Process was designed in consultation with the ministry and will be executed under the direction of the project director. The ministry and Township of Langley staff will play an important role in the quality assurance process. The ministry will be the operator of the facility upon completion and final acceptance.

Recommendation: none.

2) Safety Audits

Point: Safety audits identify any significant safety concerns within an interchange. Safety audits for the 200th Street Interchange are included in the Contract and will be completed at the 100 per cent design phase and again after construction is complete. A number of the panel's responses to Langley Council concerns refer to this audit.

Recommendation 1: It is understood that an independent safety engineer, paid by and reporting to the Contractor must undertake safety audits. However, it is recommended that another safety auditor, independent of the project, be retained to review the interchange at the 100 per cent (detailed design drawings) stage and again after construction is complete to ensure that the completed interchange operates as expected.

Recommendation 2: The panel suggests four further specific roles for a second safety auditor, who is independent of the project. These include:

Recommendation 2.1: This independent safety auditor should be selected by and report to a committee comprised of the following:

- Township of Langley – Director of Engineering
- Ministry of Transportation – Chief Engineer
- Ministry of Transportation – South Coast Region Director
- Ministry of Transportation – Partnerships Branch, Assistant Deputy Minister or designate
- B.A. Blacktop Ltd. – President
- McElhanney Consulting Services Ltd. – President

Recommendation 2.2: All safety issues raised by this independent safety auditor at the 100 per cent design stage should be resolved before construction on the interchange is authorized to start.

Recommendation 2.3: All safety issues raised by this independent safety auditor at the completion of construction should be resolved prior to issuance of a Final Completion Certificate.

3) Development Approval Process

The zoning approval process is controlled and approved by the Township of Langley. The ministry, through its development approval process, is required to approve the zoning bylaws for zoning that occurs within 800 metres of an intersection with a controlled access highway. All the proposed developments in the 200th Street Interchange meet this criteria.

The Contractor, through its engineer (McElhanney Consulting Services Ltd.), issued a document titled Highway 1/200th Street Interchange Project – Traffic Analysis Design Report, dated February 2000. The ministry's Lower Mainland – Howe Sound District Office has accepted the Traffic Analysis Design Report as reasonably meeting the requirements of a Traffic Impact Study according to ministry guidelines. The panel believes there are some outstanding issues that must be resolved before it can be properly reviewed:

- The land use has not been fixed or accepted by the Township of Langley. This must be in place, along with final concerns on background traffic volumes, before the TIS can be finalized and reviewed.
- Some information required by the ministry was not provided in the report. The Township of Langley, the Contractor and the Ministry of Transportation District staff should meet and confirm what is required in order to complete the document.

In the panels' opinion, a review and critique of the Traffic Impact Study through the development approval process could not be reasonably completed without the final, up-to-date traffic information and interchange design.

Conclusion

The review findings cover the points raised by the July 30, 2001, Town of Langley Council resolution and the July 26, 2001 e-mail. The panel members also considered additional concerns that they felt needed to be raised.

In general, the panel found that the proposed interchange configuration conforms with ministry policy and with ministry and TAC design guidelines.

Interchange design work is not yet complete, so it was not possible to review all aspects of the design in detail. Where the panel members determined that detailed resolution of the technical issues reviewed is critical to the success of the design, they have made recommendations to ensure these issues are addressed. These issues would have been addressed as part of the normal project process, however, the panel members believe their recommendations will provide focus in areas the panel consider critical to the success of the design. These recommendations appear throughout the body of this text.

The panel believes the design and related development approval processes being used to deliver this project will result in a safe and effective interchange capable of meeting traffic mobility and commercial development access needs.

Appendix A

REVIEW PROCESS

An expert panel was assembled to work with the Chief Engineer to review the 200th Street Interchange design. Panel members included a traffic and geometric engineering expert and a project process expert. The panel members were: Tim Stevens P.Eng., Stevens Engineering and Ross Walker P.Eng., (retired, formerly with Delcan Corp.). Stevens carried out the process review while Walker carried out the geometric and traffic review. Walker was aided by Robert Cheng P.Eng., Senior Traffic Engineer with the Chief Engineer's Office. Ministry of Transportation Engineering Branch staff supported the team.

The Chief Engineer's role was to:

- identify scope of review;
- identify issues raised and whether they are in scope;
- work with the panel to review the processes the project is using to arrive at an appropriate design, respond to issues raised, and determine if improvements are necessary and make appropriate recommendations; and
- write the report.

The panel's role was to provide technical expertise, and to assist the Chief Engineer with the writing of the report.

The panel interviewed the Project Director, the Traffic Engineering Consultant to the project (Bunt and Associates), the Project Design Consultants (McElhanney Consulting Services Ltd.) and a Ministry of Transportation Development Approval representative.

Appendix B

JULY 26TH EMAIL POINTS REGARDING 200TH STREET INTERCHANGE PROJECT

An anonymous e-mail containing comments about the project was obtained by the news media in late June 2001. The panel responses provided in the main body of this report address the substance of the comments contained in the e-mail.

Traffic Impact Study (TIS):

- There was no input into the TIS Terms of Reference by the district nor the Township of Langley.
- The trip generation rates were left open to speculation. There was no agreement as to what type of development might be expected, hence the traffic generated from the development could be somewhat less than assumed, or somewhat more.
- The traffic volumes used in the analysis were not current.
- The volume to capacity benchmarks for intersection capacity were lowered. The project only had to achieve a volume to capacity ratio of 0.90 instead of the standard 0.85 for intersection capacity. Volume to capacity benchmarks for individual movements were not required. These are typically 0.90 for individual movements.
- The traffic volumes used in the analysis were not current.
- The analysis looked at individual intersection operation rather than the entire network as a coordinated system.
- Assumptions used in the analysis favored achieving the required volume to capacity ratios. For example: the yellow and all red time was assumed to be 4 seconds per phase. In reality, they could be two to three times that dependent upon the size of the intersection. A SPI intersection could have yellow and all red times of 10 to 11 seconds.
- The TIS does not even meet its own standards for opening day. We are designing a supposed brand new interchange that will fail on opening day.

Design:

- This design is a design which facilitates private access not traffic flow. In order to maximize the potential for land development a SPI diamond interchange design was chosen, roadway design standards were minimized and unhindered access facilitated.
- Five signalized intersections will replace the current two. The interchange will operate much like 200th Street at the Langley Bypass, poorly. The public should expect the uninterrupted flow that a proper interchange design provides. They may in fact ask where the benefit to traffic flow is. Delays will be relatively the same during the peak periods and significantly greater during off peak periods.

- The angles between the eastbound Route 1 off-ramp to northbound 200th Street and the westbound Highway 1 off-ramp to southbound 200th Street at the signalized SPI intersection are not to standard. The CalTrans design manual says that the angle between the off-ramp and the through lane should be no less than 60 degrees. The proposal for this SPI is closer to 50 degrees. It is questionable whether or not this type of intersection can be safely signalized. There will be confusion as to which signal heads govern which movements. Motorists unfamiliar to the area may proceed down the off-ramp mistaking it with an onramp.
- In order to accommodate the traffic volumes through the signalized intersections, extra laning was added. The result is a large road cross section across which vehicles wishing to access the development must weave. The weave distance is minimal which will result in unsafe lane changes, possible side swipe and rear end collisions and obstruction of through traffic.
- The structure can only accommodate 4 lanes. Through traffic on 200 St. must merge downstream of each traffic signal which will not lend itself to balanced lane utility at the traffic signals and congestion downstream at the merge. Level of service and safety will be further compromised.
- The developer has requested signalized access on the Route 1 westbound onramp as well as the Route 1 east bound onramp. The Ministry has consistently resisted this practice from a design perspective as it forces queues on the ramp. The queues are subsequently released as platoons of traffic to merge with high speed through traffic on the highway. This practice is very unsafe and leads to the possibility of high speed side swipe collisions at the merge point and high speed rear end collisions on the highway.
- Signalization of the off-ramps is also undesirable. As queues form down the offramp, the back end of the queue comes into proximity with high speed traffic exiting the highway. This practice increases the possibility of a high speed rear end collision on the off-ramp.

Operation

- Delay to the motoring public will remain relatively unchanged during the peak periods, however, delay to the motoring public will increase significantly during the off peak periods.
- SPI's are generally not pedestrian friendly. It is recommended in the Cal Trans design manual for SPI's that separate facilities be designed for pedestrians and cyclists.
- Future expansion of the interchange will be impossible.

Signing:

- Guide signing for this type of design is very difficult because of the multiple exits in close proximity to one another compounded by signalization. It is very difficult to develop good guide signing without adequate spacing.

Safety:

- Safety to the motoring public has been compromised at this location. Standing queues on off-ramps mixed with high speed exiting traffic, platoons of traffic merging with high speed through traffic, additional signalization versus free flow conditions, multi-lane weaves, congestion, additional access, poor signing, motorist uncertainty and confusion are not features of a well designed interchange. All of these deficiencies will lead to or contribute to collisions.

Legal Issues:

1. The ministry will have to look at ways to circumvent its own legislation which prohibits direct access to a controlled access facility and private development within Crown right-of-way.

Appendix C:

Township of Langley Council Resolution, July 30, 2001

July 30, 2001
Regular Council Meeting

R.	OTHER BUSINESS
2. 200 th Street Interchange Design Issues	Moved by Councillor Richter, Seconded by Councillor Long, Whereas Council has received public input and criticism on design issues related to the 200 th Street interchange and council requested that the highways Ministry review the concerns expresses, and Whereas we have received a response from BCTFA (letter dated July 11, 2001 from Don Fraser) indicating that no audit has yet been done of the safety aspects of the design, and Whereas the Minister's letter of July 3, 2001 addresses the level of service of the design from a general capacity perspective only, Therefore be it resolved, that the Township of Langley request the Minister of Transportation to specifically address and provide ministry audit assurances regarding the safety and functionality of the design of the 200 th Street / Freeway intersection including such matters as: <ol style="list-style-type: none">1. Whether the design will meet the Ministry's standard for volume to capacity ratio;2. Whether the assumptions used in the volume to capacity analysis are realistic such as the yellow and red time phasing;3. Whether the assumptions used for level of operation such as future network improvements are consistent with what TransLink and the Highways Ministry are proposing;4. Whether the angle of the west bound off-ramp to south-bound 200th Street allows the intersection to be safely signalized;5. Whether level of service and safety are compromised for through traffic on 200th Street as a result of merging downstream of each traffic signal;

6. Whether effective coordination of operation can be achieved given the geometry, intersection spacing, approach storage, multi-directional demand, and queue management requirements;
7. Whether there will be a significant increase in delays to off peak traffic;
8. Whether the design will be friendly to pedestrians and cyclists;
9. Whether the design will be friendly to truck traffic;
10. Whether proper guide signing is possible given the complexity of the intersection, proximity of multiple exits and spacing constraints;
11. Whether development at the intersection quadrants will add confusion to navigation with potential for unsafe weaving and maneuvers;
12. Whether safety is compromised by mixing standing queues, high speed traffic, platoons of merging traffic, multi-lane weaving, given the complexity of the intersection, proximity of multiple exits and spacing constraints.
13. Whether the design has deficiencies that lead to or contribute to collisions;
14. Whether any Ministry highway design policies or procedures have been compromised in this project that would affect public safety;
15. Whether the proposed accesses for private development from freeway off and on-ramps are consistent with Ministry policy;
16. Whether accesses to development have sufficient weave distances to allow for safe lane changes and not obstruct through traffic;
17. Whether on-ramp signalized accesses to development will be safe given queues being forced on the ramp and the merging with high speed through traffic; and
18. Whether off-ramp accesses to development will be safe given queues back up to high speed traffic exiting the freeway.

CARRIED

Councillors Arnason and Kositsky opposed

Appendix D:

