Session 6 B Development Approvals

Changes in the Design and Review Process for Development Approvals in BC

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Abstract

This paper presents new guidelines for transportation design required for development approval on highways under Provincial or joint Provincial/municipal jurisdiction in BC.

The paper focuses on three key areas and identifies several important issues that will be addressed using the Ministry's 2007 revision of the **Site Impact Analysis Requirements Manual**.

1. Design vs. Mitigation – in the past many submissions have been made at the "last minute" of the design process. We need to identify issues that should be resolved early in the design and mitigate these issues rather than trying to improve fundamentally poor designs too late in the approval process.
    a. Transportation issues must be identified and included in the design from "day 1" of the project with an agreed Terms of Reference
    b. Mitigation must be built into the design
    c. The submitted design report must be complete and address all issues as agreed with the Road Authority in the terms of reference
    d. A qualified Professional Engineer. must seal the Design Report.

2. Technical Issues – key technical issues are identified relating to both on- and off-site design that impact the operation of the road system or user safety.
    a. Access within the Intersection Functional Area must be fully justified and shown to work without significant roadway conflicts
    b. Sensitivity analysis must be used to show the impact of differing assumptions since no site will actually produce "average" traffic volumes. The design must be shown to be robust in respect of volume changes, safety and functionality.
    c. The needs of all transportation system users must be addressed in a manner that promotes non-car access and provides a high level of safety

3. Manual Format – the manual is now a fully searchable and indexed PDF document available on-line. This permits easy updating and the ability for users to easily find all references to a given keyword.

Background

The British Columbia Ministry of Transportation (MoT) is responsible for managing access to the provincial highway system to ensure that reasonable safety and mobility are maintained for through movements on highways, and for movements entering and leaving connecting roads and adjacent land uses. Related to this is the responsibility to review various types of proposals relating to land uses in municipalities, the main ones being:

- Land rezoning in "controlled areas", i.e. within an 800m radius of intersections on designated Controlled Access (CA) Highways in municipalities, as per section 52 of the *Transportation Ac*t,
- Development permit applications for commercial and industrial sites with over 4500 square metres gross floor area per section 924 of the *Local Government Act*,
- Subdivisions of land adjacent to CA Highways per section 80 of the *Land Title Act*, and
- Requests for access permits onto CA Highways per section 49 of the *Transportation Act*.

The development and redevelopment of residential, commercial and industrial sites impacts highways, hence MoT produced the Site Impact Analysis Requirements Manual (SIARM) in 1997 to guide all participants in the process. The 2007 SIARM update represents a significant advance in outlining the process changes, and in confirming the technical analysis, necessary for successful developments such that they do not unduly compromise road performance.

Policy and process

The review process involves six steps whereby MoT:

1. Advises the developer of the requirements as outlined in the SIARM,
2. Determines the level of design (simplified or detailed) and advises the developer of the degree of expertise required,
3. Reviews and approves the Terms of Reference (ToR),
4. Reviews and approves any changes to the ToR that become necessary along the way, and reviews preliminary concepts where necessary to confirm that the design is on the right track,
5. Reviews the finalized design and advises of any required changes, and
6. Approves the design and obtains assurance from the developer's consultants that due diligence was applied.

Through all of the above steps, MoT staff typically need to collaborate with municipal staff. A detailed design involves a greater level of traffic analysis and design work than a simplified report. It usually relates to larger projects, or where there are significant road capacity or safety issues present. It is triggered by the generation of the greater of:

a) 100 new two-way peak hour trips, or
b) An increase in two-way peak hour trips of more than 20%.

However, specific conditions may require a detailed design for volume increases lower than these 2 cases.

Terms of Reference

Every project needs a well considered ToR that lays out key requirements, warns of particular problems to avoid, and provides a means by which MoT development approvals (DA) staff can review the design to see that important issues have been addressed. MoT DA staff can assist and provide direction (typically with the assistance of MoT district or regional engineering staff) so long as they are involved up front. A written and agreed (MoT, and if applicable, municipal) ToR is required for all projects requiring MoT approval. A ToR development meeting is often essential for "detailed design" projects or for "simplified design" projects with unique circumstances. The SIARM provides forms for simplified and detailed ToR statements. A feature of the 2007 update is a detailed check list in the appendix which can assist in developing the ToR and for following up to ensure that the design report addressed all of the requisite areas and issues.

Professional responsibility

The 2007 SIARM update includes an appendix with templates for Letters of Assurance (LoA) to be completed and sealed by the professionals involved in the site design. The LoA indicate that the professional work is in substantial compliance with the specific manuals and procedures required by MoT.

The inclusion of LoA is an important addition to the SIARM. Where previously it may have been assumed that MoT staff were responsible to "find all errors and omissions", the onus is now clearly on the developer's consultants to provide due diligence and vouch for the quality of all work done. MoT staff will continue to provide direction and carry out checks for quality assurance.

The professionals involved usually include a transportation engineer responsible for assessing travel demand and carrying out traffic engineering work, as well as a design engineer. The importance of this role can't be overstated, as engineering professionals need to be involved from the earliest stages to ensure success, i.e. before the access locations and building(s) layout are established. Architects may not require engineering input for very simple work. An architect often plays a role as a co-ordinating professional. The SIARM provides specific guidance on what is appropriate.

Design reports must contain all assumptions as well as clearly show the calculations used to arrive at key decisions, and drawings must clearly show existing conditions and proposed design changes.

Design domain

Safe road design requires appropriate consideration of vehicle, operator and roadway parameters. "Design to the minimum" may compromise the development's safety if the interaction between elements is not appropriately considered. The Transportation Association of Canada *Geometric Design Guide for Canadian Roads* uses the "design domain" approach whereby the interaction between design elements is understood and applied when making decisions. For example, using a minimal turning radius is likely to require wider lanes to compensate for the reduced manoeuvrability etc. created by the radius.

A "cookbook" approach rarely works. Very low impact developments may be designed without a detailed evaluation where appropriate, but the design must still comply with TAC guidelines and the associated B.C. Supplement. The design domain process is to be outlined in the design report submitted to MoT.

Who does what

All activity is co-ordinated through the MoT district DA staff member responsible for the project. DA staff may refer issues to district or regional engineering staff who in some cases may wish to discuss issues with the developer's consultant, but DA staff should still be involved in this. The DA staff are responsible for issuing approval, assuming that the design report is acceptable and that LoA's have been provided. The typical roles of the consultant professionals were outlined above (transportation engineer, design engineer, co-ordinating professional). Municipal and/or regional district staff may also be involved in the process.

Structure of the Manual

The manual comprises 6 sections and includes material from the former Parking and Trip Rates Generation Rates Manual (now superseded):

1. Introduction
2. Things you must Do (New)
3. Parking and Trip Generation Rates (Parking and Trip Gen Manual included)
4. Traffic Analysis (2 sections combined)
5. Important Design Issues - Off-site
6. Important Design Issues - On-Site

Appendices

A Terms of Reference forms
B Letters of Assurance
C References
D Technical Background Material

The manual outlines several "Things you must Do" including discussion of:

- Qualified Persons
- Determine Jurisdiction
- Determine Process (Full or Simplified)
- Define Terms of Reference
- Comply with "Good Practice" and Standards
- Comprehensive Reporting of Assumptions, Process, Options and Recommendations

The technical section of the manual address 5 key areas:

1. Traffic Impact
2. Road Design
3. Access
4. On Site Design
5. Other issues

and 4 key issues:

1. Intersection functional area
2. Sensitivity analysis
3. Onsite access and manoeuvrability
4. Operational analysis

The key issues are reviewed in the following sections of this paper.

Technical issues

This update to the manual discusses a number of issues that have caused Road Authority's concerns in the past, or are expected to do so in the future. However, it is not a complete and exhaustive treatment of transportation engineering and those issues relevant to providing safe and effective access to development projects. Rather it is a guideline to provide a context for the review by road authorities to ensure that the developer's professional advisers are acting in both the interest of the developer and the general public as represented by the road authorities that own and manage the road and Highway system of the province.

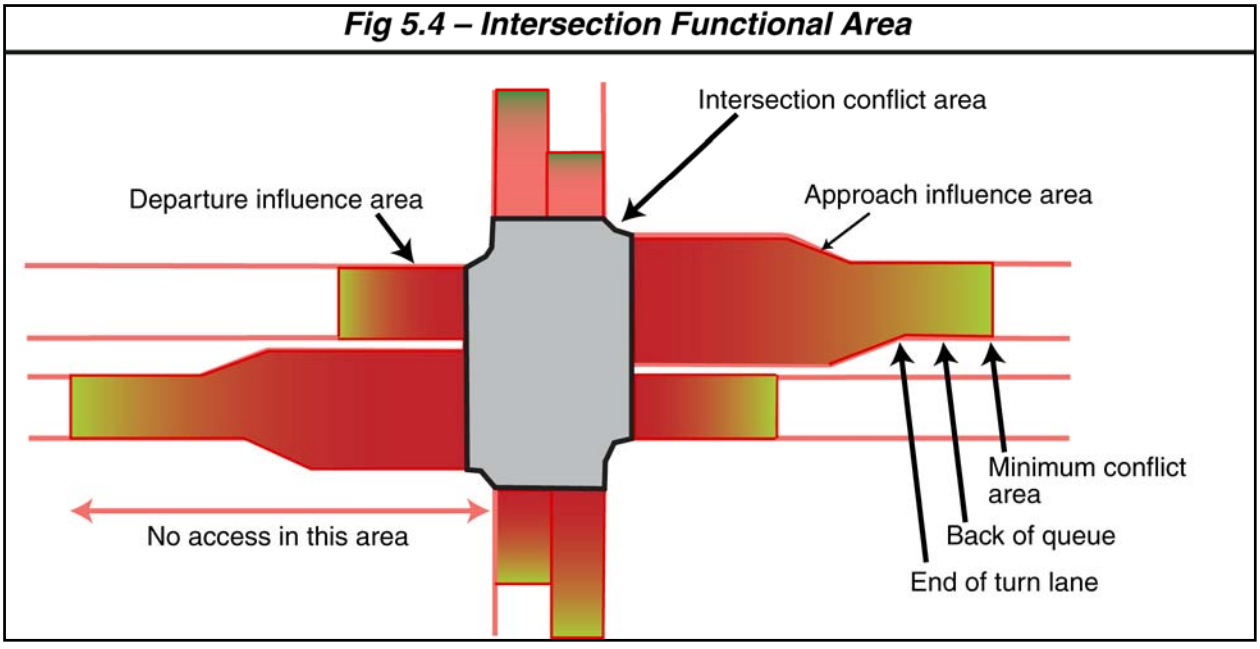
In this paper we discuss some of the key issues covered in the manual. These are illustrated with figures from the manual.

Intersection functional area

Except on grade-separated facilities, roadway operations in urban areas are dominated by the operation of the intersection. A key parameter in designing effective and safe intersections is to define the area of the roadway where the operation of the intersections impacts traffic flows. This area is described as the "intersection functional area".

This area is defined by the maximum extent of the back of the queue in any one lane plus a conflict area approximating the safe deceleration distance to the back of that queue. It generally includes the full extent of all turn lanes or auxiliary lanes on the approach side of the intersection. It would include any areas on the downstream side impacted by auxiliary right turn lanes or lane drops in the vicinity of the intersection and may also include that area where side-street traffic would have difficulty leaving or joining the flow of traffic under saturated signal conditions, particularly where this applies on both the through and cross street legs.

Figure 1 Intersection functional area.



Providing safe and efficient access to development within the intersection functional area is often problematic and should be avoided if at all possible. This may mean restricting access to right-in/right-out only at the lot line furthest from the intersection, or, ideally providing alternative access from a parallel road system or shared access through the adjacent lot. Having an approved access management plan in place greatly assists all parties in understanding what is required.

If access is permitted within this area, a number of situations are likely to arise including:

1. Conflicts between vehicles slowing to enter a driveway with those expecting the vehicle ahead to be turning or passing straight through the intersection
2. Conflicts between vehicles exiting the driveway and attempting to access the through lane (if there is an auxiliary right turn lane), or the left turn lane, either of which may be occupied by queued vehicles
3. Excessive queuing on the site due to the inability of vehicles to exit, which may also result in blockage of entering vehicles

Since queuing is dependent on future traffic volumes as well as intersection operation parameters it is essential that the intersection functional area be determined for both present and future volumes with the site and other adjacent developments considered.

All of these situations result in disruption of traffic on the public road, which should receive priority over traffic accessing specific developments. This can severely compromise the operation of the entire street in the vicinity of the site.

Sensitivity analysis

In the review of traffic volumes for transportation engineering projects, we are faced with a significant number of uncertainties. Many of these revolve around exactly what is the current traffic volume, and what is the likely range of future volumes with and without the specific site in place. Since it should be clear that no individual development is "average" in terms of traffic generation and that traffic volumes counted on one day will not be the same as those on a different day, either in the same week, or the same day in a different week and that both traffic generated by the development and on the street system will change over time, we are faced with analysing a range of possible outcomes and determining the robustness of our proposed engineering solution in the context of these ranges.

It is important to understand that in this discussion we are not suggesting that every development be designed for the highest possible trip generation and volumes on the adjacent street. Rather, we are showing that it is more than appropriate to consider a successful development in a successful marketplace in a growing and vibrant community and to assess what engineering measures are needed to maintain the value of the public investment in the road and highway infrastructure in order to give that, and other adjacent developments, an appropriate level of access so that they can succeed in their business endeavours.

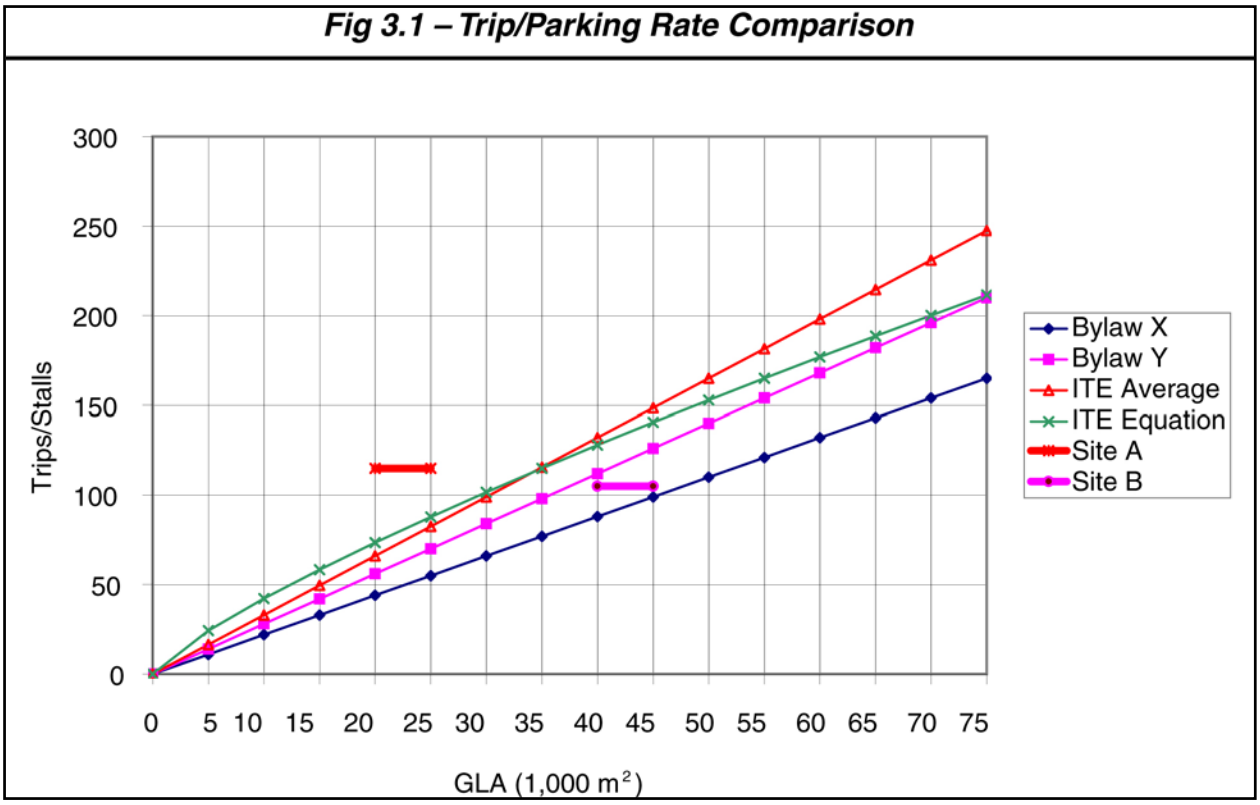
At the site traffic level, we need to consider the trip generation rate and alternative distributions of that traffic to the street system, which may depend on potential changes in market area served, as well as changes in the configurations of the road network such as adding a new link or restricting turns at the adjacent or remote intersections.

In many land-use categories trip generation rates for individual sites may vary from around one half to around two times the average rate so it is appropriate to use different rates that may also vary depending on the size of the site within that category (non-linear relationship).

Trip generation rates are dependent on multiple factors that are often not amenable to detailed analysis. Some data is reasonably well documented, such as the ITE trip and parking generation rates for a large number of categories, while others are either not documented or not documented sufficiently well to provide reliable statistical analysis, or referred to in municipal zoning bylaws, where the origin of the numbers quoted is often unknown and of little real value. Care must be taken to distinguish between "average" (ITE) rates and "minimum" (often municipal) rates which are not comparable.

In the following example (Figure 2), we show "minimum rates" from two municipal bylaws, the ITE average and equation for the land-use and two actually measured sites. Clearly the best data is that actually measured at the subject site.

Figure 2 Trip generation rates



The factors that influence trip generation rate for a given site, other than the basic unit of measure for the land use (i.e. dwelling units for residential), would include the general level of economic activity in the market area, the size of the market area, other competing land uses within the market area, and possibly the demographic makeup of the area in terms of age ranges. Since in general, these are not readily measurable, and more importantly will vary over time, we have to take a different approach to assess the overall impact of these changes. One possible approach is to "always" use the 85th percentile rates from the ITE documentation. Another alternative is to use a higher (or lower) rate based on the range of rates in the ITE data.

A similar approach is used for traffic volumes on the street that would be present without the site in place. These results can then be presented in a comparative manner with a worst case or combination of cases selected for detailed analysis The results of that analysis are then compared with the results using the average rate assumptions.

This comparison will then indicate the robustness of the proposed design, and the need to identify “what if” alternative solutions and to assess the need to build that alternative at some stage during the development of the project.

There is increasing interest in "greener" developments whose attributes reduce usage of the private automobile. MoT is fully supportive of this objective. However, mode choice is dependent on many factors including local economic conditions, whether the area is urban or rural, the types and mixes of land uses on site, transit service frequency and proximity, cycling and pedestrian facilities including secure cycle storage, whether there is an actively managed employer TDM program, and many other factors. The rationale for reduced parking requirements has to be fully explained, and there should be a "Plan B" to provide more parking and/or improved access, if parking or traffic demand is seen to be problematic over time after the development opens.

Onsite access and manoeuvrability

In providing access to the site it is in the best interests of both the developer and the road authority to ensure that traffic operations on the site in the immediate vicinity of the access point do not interfere with the safe and effective operation of that access point. Further within the site it is in the developer's best interests to ensure that the operation of the circulation and parking system is both safe and easy to use by customers, and potential customers of the businesses, or residents of the site. This requires careful planning and design from the very early stages of the project to ensure that it can be achieved.

It is not appropriate to simply locate the buildings, and then fit the access, circulation and parking around them. This inevitably leads to significant compromises, poor operation, unsafe design features, and ultimately reluctance by customers to use the site, which is of course to the detriment of the developer and his tenants.

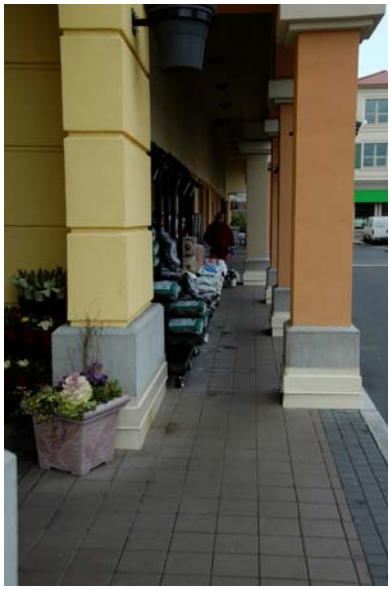
Given the discussion regarding intersection functional area it should be clear that the first task is to identify the most appropriate access points to the site so that the access is safe, convenient and operates well. The overall parking requirement (number of stalls) provides guidance on how much of the site area needs to be devoted to parking and whether structure parking is also required. If this is the case, this adds additional complexity, as users of the non-residential component generally prefer surface to structure parking, which can lead to circulation problems on the site.

On-site circulation inevitably produces conflicts between vehicles and pedestrians. This needs to be carefully considered, particularly in the vicinity of major access points to the buildings and transit stops, and to ensure that adequate sidewalks or designated walkways are available to guide pedestrians to routes with minimal conflicts with vehicles.

Key design issues include:

1. The first intersection on the site should have free flowing traffic in both the inbound and outbound direction to the access point (no four way stop signs) and must provide adequate queue storage for entering and leaving traffic (inadequate lane widths, corner radii and queue storage in this case).

2. The area in the vicinity of major building access points must have adequate sidewalk space to accommodate pedestrians waiting to cross (especially with grocery carts) and should lead directly to a sidewalk on the other side of the circulation aisle that distributes pedestrians to the parking aisles without them having to cross at random, or walk along the main circulation aisle (sidewalks obstructed, inadequate space outside grocery store entrance).



3. Circulation and queuing space around drive-through food outlets, and subsequent conflicts with pedestrians accessing the building entrance needs careful design, including the provision of adequate queuing space.

4. Corner radii on the circulation aisles must be adequate to ensure the design vehicle for that particular aisle and movement can safely make the turn without conflicting with opposing traffic. There must also be adequate side clearance to obstructions greater than curb height to insure that vehicle drivers can follow the design path safely (inadequate and obstructed sidewalk, obstruction at curb on corner with inadequate radius and lane width – this damage, broken concrete, occurred within days of the site opening)

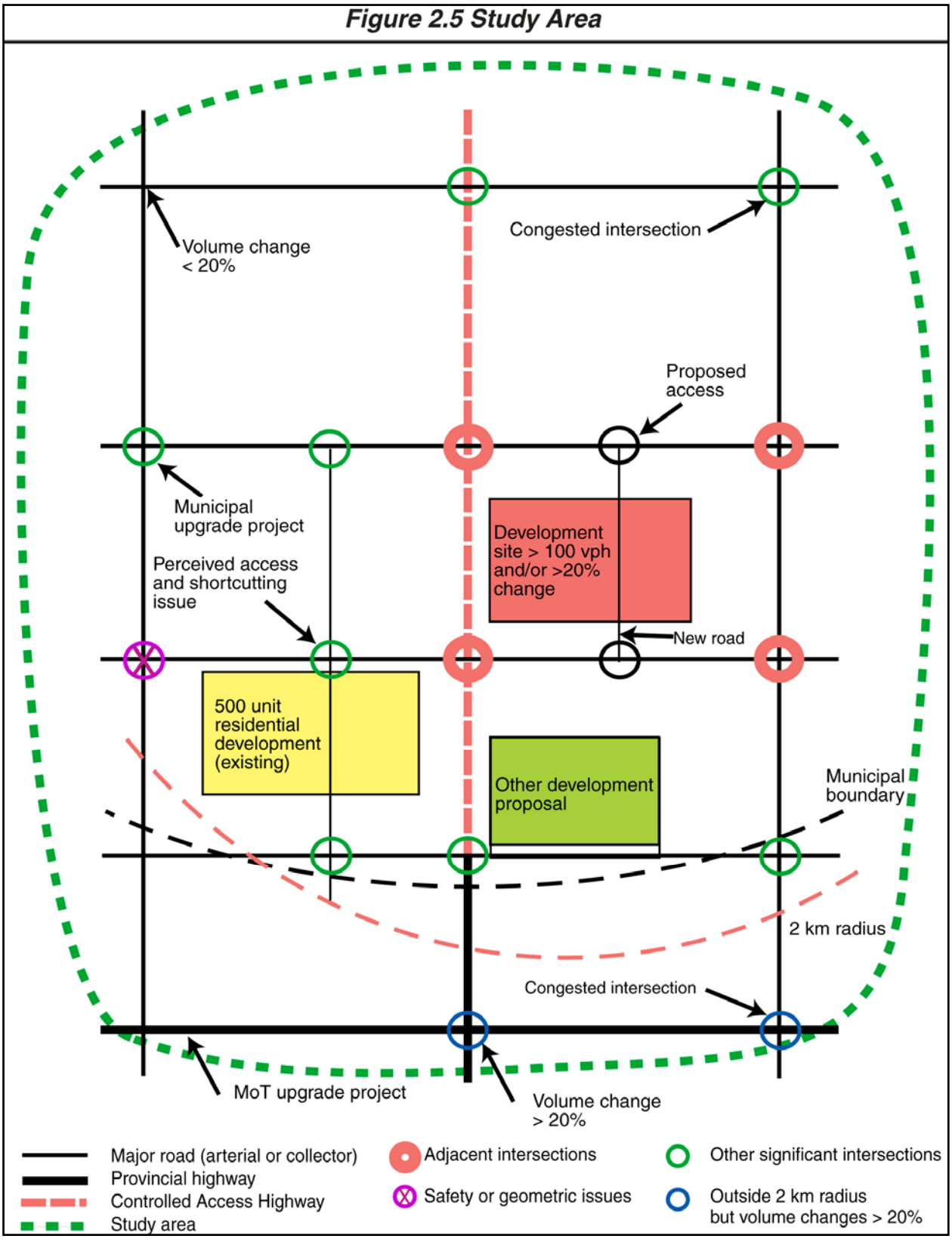
If an adequate number of appropriately sized stalls is not provided, that is consistent with the transportation demand management objectives for the site, then congestion will occur with vehicles that are unable to park circulating looking for stalls. Eventually this will lead to customer dissatisfaction, and they will seek other destinations.

Operational analysis

Operational analysis covers both the analysis of the operation of the intersection and the review of how the geometric features of the design function together as an entity to provide a “forgiving design”.

The study area for a given project is heavily dependent upon both the size (and thus the relative impact) of the project as well as the configuration and present functional characteristics of the adjacent road network. It cannot be simply defined as a fixed distance from the site or a proportion of traffic volumes. The appropriate general criterion is to analyse those intersections where the impact of the site would be sufficient that mitigation may be required. Some key criteria are identified in Figure 3.

Figure 3 Study area criteria



Design hour volumes

Care must be taken to ensure that the "design hour" analysed is actually the critical combination of volumes for each particular movement during the peak hour. It is thus possible that multiple analyses are required to adequately document queue lengths in each lane group, and the overall timing plan that is most appropriate for the peak period under consideration.

The operational analysis must be carried out to recognize the limits identified in the sensitivity analysis, and the results of the various scenarios compared with the base "design case". The analysis needs to be performed for the existing situation without the site, the existing situation plus the site (opening day), and one or more horizon years, both with and without the site and other adjacent developments as well as regional growth. In this way, the analyst can identify what is likely to happen without the site, and what happens as a direct consequence of the site. In this way, future improvements that are appropriately addressed by the proponent can be clearly identified from those that may be needed, but are not a direct consequence of the development.

The road authority will generally define acceptable level of service, delay and progression criteria that are appropriate to their facilities that are being analysed.

The road authority may also specify analysis methodology or approved software to be used in the analysis. In general, signal systems are to be analysed using software that recognizes signal progression even though it may not be currently in place on the facility (it may need to be tested).

Design – safety – forgiving design

Identifying the intersection functional area enables a number of operational issues to be addressed. In addition, the geometric elements of the access point must conform to the road authority's design criteria that in BC are generally the TAC Design Guidelines, which may then be more closely defined by the road authority's guidelines. In the case of the BC Ministry of Transportation, it is their supplement to the TAC Design Guidelines that provides this additional guidance.

Notwithstanding that, individual elements that comply with the requirements of these guidelines must be carefully reviewed as an entity to ensure that when all the elements are taken as a whole they follow the intent of the guidelines, which is as safe, operationally effective and cost effective design for the future traffic volumes.

A key feature of the TAC Design Guidelines is the "design domain" approach to design, where the designer must review each particular issue and determine the appropriate design criteria rather than simply “pick numbers from a table”.

The ultimate objective is to produce a “forgiving design” with adequate capacity to effectively deal with the transportation demands of all modes of travel, pedestrian, bicycle, transit as well as cars and trucks.

Signability

An often-overlooked aspect of access design is signability (including pavement markings) especially on higher speed and higher volume facilities or where complex manoeuvres are required. There must be sufficient spacing between decision points (intersections and other driveways) to allow the driver to perceive the required information, make the required decisions, and to execute them safely. This is a fundamental issue that must be considered as part of the initial access location decision process, not treated as an afterthought after the design is complete.

Reporting format

The manual now identifies an appropriate reporting format, based on the design domain approach and a clear comparison of traffic operational analysis through the use of summary tables prepared from the analysis software. These tables bring together all the key parameters, showing the result of the operational analysis and leaves the details of signal timing plans to the analysis output in an appendix.

The objective of the reporting format used to present the project to the road authority's reviewer is a concise yet clear explanation of how the design and analysis decisions were made and that the proposed design is appropriate, robust and safe.

Implementation

Ministry staff as well as Municipal and consultant staff were invited to participate in workshops in the initial stages of the review and their comments have been considered in the revised manual.

The Ministry is in the process of launching the SIARM to the internet as a draft, inviting external input and comments.

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