CITY OF VANCOUVER

CITY CLERK'S DEPARTMENT
Access to Information & Privacy Division

File No.: 04-1000-20-2021-117

June 8, 2021

s.22(1)

Dear s.22(1)

Re: **Request for Access to Records under the Freedom of Information and Protection of Privacy Act (the "Act")**

I am responding to your request of February 20, 2021 for:

1) **The Clark-Knight Corridor Whole Route Analysis, completed between 2003-2005; and**
2) **The Corridor Plan that was developed based on the Whole Route Analysis, in Point one, above.**

For part one of your request, please see responsive records attached.

For part two of your request, please see links to publicly available Council Agendas which link to reports and minutes pertaining to the Clark-Knight Corridor Plan and Clark-Knight Corridor Whole Route Analysis, below:

https://council.vancouver.ca/20070724/ag20070724.htm - see item 8

https://council.vancouver.ca/20050329/tt20050329.htm - see item 5

https://council.vancouver.ca/20041102/tt20041102.htm - see item 1

https://council.vancouver.ca/20030410/cs20030410.htm - see item 1

Under section 52 of the Act, and within 30 business days of receipt of this letter, you may ask the Information & Privacy Commissioner to review any matter related to the City's response to your FOI request by writing to: Office of the Information & Privacy Commissioner, info@oipc.bc.ca or by phoning 250-387-5629.

If you request a review, please provide the Commissioner's office with: 1) the request number (#04-1000-20-2021-117); 2) a copy of this letter; 3) a copy of your original request; and 4) detailed reasons why you are seeking the review.

Yours truly,

[Signature on file]

Barbara J. Van Fraassen, BA
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*If you have any questions, please email us at foi@vancouver.ca and we will respond to you as soon as possible. Or you can call the FOI Case Manager at 604.871.6584.

Encl.

:ag

Clark-Knight Corridor
Whole Route Analysis

BACKGROUND AND ISSUES

City of Vancouver
Community Services and Engineering Services
March, 2003

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INTRODUCTION AND BACKGROUND

INTRODUCTION

Clark Drive and Knight Street provide a vital transportation corridor through the City. This eight-kilometre route, which extends from the Port of Vancouver on Burrard Inlet to the Knight Street Bridge at the Fraser River, carries between 38,000 and 55,000 vehicles per day. It is the most heavily used truck route in the City and is a key regional connection between Vancouver and Richmond, Delta, Surrey and the United States.

While a major transportation route, the corridor runs through single-family residential neighbourhoods for the majority of its length. There are schools, parks, small-scale commercial areas, and a community centre along the route that make travel on and across the corridor essential for local residents. Reconciling the street's transportation function with neighbourhood liveability is the focus of the Whole Route Analysis.

POLICY DIRECTIONS: PLANNING FOR THE NEXT 20 YEARS

Three policy initiatives have prompted and are guiding the Whole Route Analysis for the Clark-Knight corridor: The 1997 Transportation Plan, the Industrial Lands Strategy, and the Community Visions programs. These initiatives build on CityPlan, Vancouver's policy framework.

The Transportation Plan includes a direction to make improvements on Knight Street for goods movement, subject to a Whole Route Analysis of the corridor. The **Whole Route Analysis** will review conditions and issues on the corridor, in a holistic manner, so that transportation, land use and environmental considerations can be better integrated into any major goods movement initiatives or other planning for the corridor. The transportation plan also established a city-wide hierarchy of transportation priorities, which is, in priority order, walking, cycling, transit, goods movement followed by private automobiles. The plan also supports the continuing role of Clark-Knight as a major goods movement and commuting arterial.

Community Visions are planning guides, based on CityPlan and developed with communities, which contain local directions related to land use, transportation, safety and services, housing, public places and other community priorities. They describe the kind of community residents and businesses want in the next 10 to 20 years. Council has approved Visions for three areas on the Clark-Knight corridor: Kensington-Cedar Cottage (KCC), Sunset and Victoria-Fraserview/ Killarney. All three Visions call for an improved street environment and increased safety for residents, pedestrians and transit users. The Visions also propose increased housing variety along much of the street.

A planning program to implement the neighbourhood centre at Kingsway and Knight, recommended in the KCC Community Vision, was initiated in July of 2002.

The northern part of the corridor has yet to have Community Visions developed. This area is a mixture of residential uses and industries in the Clark Drive and Powell Street Industrial Areas.

THIS PAPER

This paper summarises four key issues in the Whole Route Analysis for the Clark-Knight corridor. These include land use, existing transportation conditions, future transportation issues, and environmental conditions. The issues identified in this paper will be used as a basis for developing a work plan to improve conditions along the corridor.

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A CORRIDOR CONNECTING COMMUNITIES

Figure 1 shows that Clark-Knight connects seven established neighbourhoods: the Downtown Eastside, Strathcona, Grandview-Woodlands, Mount Pleasant, Kensington-Cedar-Cottage (KCC), Sunset and Victoria-Fraserview. The corridor lies on the boundary of all these neighbourhoods, except KCC.

HISTORICAL CONTEXT

From the Port Road south to the diversion at 14th, the corridor follows Clark Drive. Between 14th and SE Marine the road is called Knight Street. Since the 1920s, the Clark-Knight corridor has been designated as a major regional transportation corridor. The 1929 Vancouver Major Streets Plan established the current 24 metre wide right-of-way to accommodate a six-lane road.

The regional importance of the corridor was secured in 1974 when the Knight Street Bridge to Richmond was built to replace a 1905 bridge at Fraser Street. This new link provided a direct connection to the Vancouver Port lands and resulted in a major shift of regional traffic from Fraser Street to Knight Street. The land uses along Knight were already well established by the time the bridge opened. The opening of the Alex Fraser Bridge in 1986, with its link to Knight Street via Highway 91, further reinforced the importance of Clark-Knight in the regional network.

Today, TransLink, the regional transportation authority, recognises Clark-Knight as a key transportation route. The corridor is designated as part of the Major Road Network for Greater Vancouver and the City receives funding contributions from TransLink for maintenance and major projects. This designation also brings with it regional responsibilities in terms of design, operation and planning.

Figure 1 Communities along the Clark-Knight Corridor

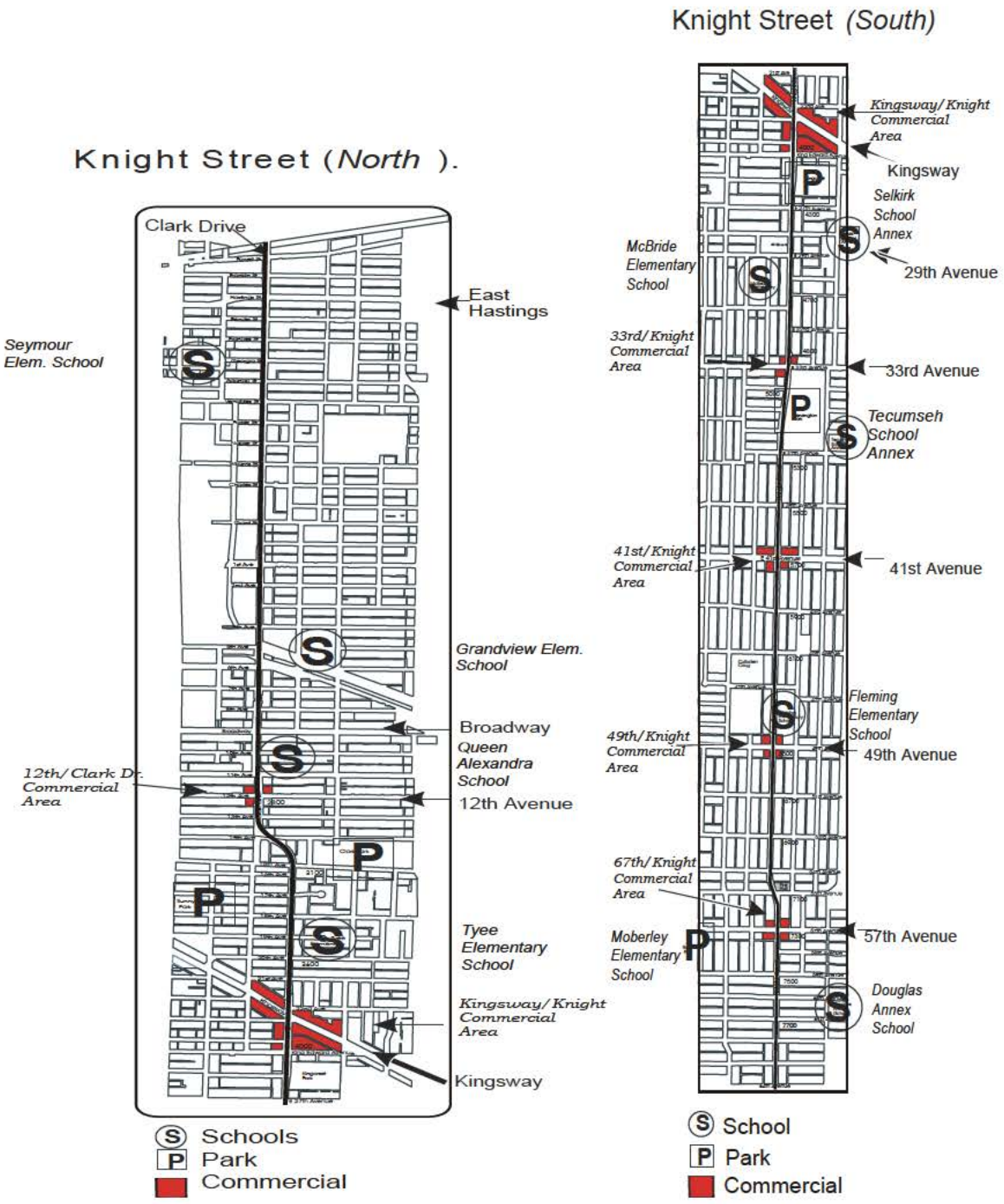


Figure 2 Map of the Clark-Knight corridor indicating schools, parks and commercial areas

CHAPTER 1
LAND USE AND COMMUNITY

AN INTRODUCTION TO LAND USE AND COMMUNITY ON KNIGHT STREET

The land uses along Clark Drive and Knight Street vary considerably as one travels the corridor. The northern section of Clark Drive to 7th Avenue is mainly industrial and zoned mostly for light industry (I-2 zoning), but there are a couple of blocks just south of the port zoned for heavier industry (M-2, MC-2 and MC-1). South of 7th Avenue, Clark and Knight are mostly residential. There is multi-family housing (RM-3), between 7th and Broadway, and single or two family to the south (includes RS-1S, RT-2, RT-5). There are two blocks of multi-family (RM-2) between 62nd Avenue and 64th Avenue, near the Knight Street Bridge.

Unlike most arterials in the city, Knight Street has few commercial or institutional uses. There are small plazas or individual stores at the major intersections of 33rd, 41st, 49th and 57th Avenues. The largest commercial concentration on the corridor is found in the Kingsway and Knight Neighbourhood Centre. A study to enhance this area, centred on a former Safeway store, is underway.

The pattern of development on Knight Street is largely a consequence of it never having been a streetcar route, unlike Fraser Street to the west or Victoria Drive to the east. As such, the street was not fully built-up until the 1960s and commercial development was limited and more automobile-oriented.

The opening of the Knight Street Bridge in 1974 redirected traffic from Fraser to Knight and led to the traffic volumes experienced today. While Knight does not have heavy traffic conflicting with heavily used pedestrian-oriented commercial areas, as on Kingsway, the street lacks the activities and appearance that help to make other arterials more characteristic of urban streets.

The north end of Clark Drive is a major industrial area. Trucks make up a larger portion of traffic on Clark and Knight than on most other city streets.

CHAPTER CONTENTS

INDUSTRIAL AREAS AND SERVING VANCOUVER PORT: THE CLOSE LINKS BETWEEN LAND USE AND TRANSPORTATION

Knight Street is a major link in the region's truck network. It connects the Port and many of the city's industrial areas to the region and beyond. Knight Street's role in the regional economy is of great importance.

The **Port of Vancouver** is Canada's busiest port. While much growth in container traffic has been at Delta Port, the Vancouver container terminals are also experiencing increased traffic. Major container storage and repair yards are located on Mitchell Island and along the Fraser River in Richmond. Many truck movements on Knight Street are associated with these facilities, as well as with warehousing and trading operations.

Container traffic at the Port is projected to double in ten years. It is not clear how this will affect the number of truck trips on Knight Street. Containers for distant markets are typically shipped by train. As the Port expands its dockside facilities, there is likely to be more demand for container storage sites away from the Port. Locations close to the Port would help reduce the growth in truck movements on City streets. New industrial uses for the Port lands east of Victoria Drive are being examined and may include additional container handling and storage.

Industrial lands at the north end of Clark Drive are within the Powell Street, Clark Drive, and False Creek industrial areas. These areas contain a wide range of industrial and service industries serving the Port, the Downtown and the city. They are particularly well positioned to provide services to the Port and this role may increase in the future. Serving Downtown from these close-in areas may also help to limit growth in truck movements on Knight Street and other city truck routes.

***Key Questions and Issues**: What would encourage more businesses with close ties to the Downtown and the Port to locate in these areas?*

HOUSING AND REDEVELOPMENT: PROBLEMS AND OPPORTUNITIES OF A BUSY STREET

About 2,800 people live on Knight Street in 1,011 dwelling units. Of these, 710 units are in single and two family dwellings, including suites, and about 300 units are in apartments.

Single and two family housing is the predominant land use on Knight Street, especially south of Broadway. There are about 462 houses in all, 295 (64%) built before 1960, and 129 (28%) built before 1946. Some of these houses are in relatively poor condition. BC Assessment information shows that about 190 (42%) had improvements (the buildings) valued at less than $20,000. Altogether, 85% of single and two-family houses had improvement values of less than $100,000 per dwelling.

About half of the houses on Knight Street have at least one suite, although some have more. Altogether, there are 710 dwelling units. Most of the houses (about 80%) appear to be owner occupied. A higher proportion of dwellings are rented north of Kingsway.

Housing is the major land use south of 6th Avenue

The average value of a lot on Knight Street is about $211,000. Lot values are generally lower north of Kingsway, and higher between Kingsway and 41st Avenue. Lot values on Knight Street are generally between 10% and 20% lower than off Knight Street and are up to 20% lower than comparable lots on nearby arterials such as Fraser Street and Victoria Drive, where traffic and noise conditions are less severe.

About 30% of the total dwelling units on Knight Street are contained in **multiple-family housing**. These 300 units include apartments in buildings with Knight Street addresses, although the units themselves may not face Knight. Apartments can be found north of Broadway on Clark, and south of 62nd Avenue. There is also some social housing, including Spirit Lodge at the north-west corner of 10th Avenue, and non-market housing at Culloden Court, on the west side of Knight, between 47th and 49th Avenues.

Eighteen houses on Knight Street have been demolished since 1996. These houses included about 10 suites, for a total of 28 dwelling units. In their place, are 27 new houses, with 19 suites.

Table 1 Characteristics of the people living on the Knight Street Corridor

Characteristic (% of population)	Knight Street Corridor (1)	The three local areas (2)	Vancouver south of Broadway
Age			
0 to 14 years	19%	18%	16%
65 and over	11%	12%	13%
Size of family			
2 persons	37%	37%	38%
5 persons or more	14%	14%	20%
Place of Birth			
-- Canadian born	42%	42%	50%
-- Born elsewhere	57%	57%	50%
	Labour force		
in labour force	63%	62%	65%
employed	55%	54%	59%
Income			
Average income	$20,337	$21,580	$28.087
Av. family income	$44,473	$44,001	$61,469
Av. Value of dwelling	$329,800	$361,200	$446,305

Source: Statistics Canada, 1996. Notes: (1) Area between Argyle/Dumfries and Fraser, south of Broadway. (2) Local Areas of Kensington-Cedar Cottage, Sunset and Victoria.

These 46 dwellings represent about a 60% net gain in dwelling units.

There is a steady rate of replacement of old houses. Most new houses include at least one secondary suite.

The selling prices for new houses on Knight Street have been around $360,000 to $380,000. The style of development (slab-at-grade, no basement) is typical of other developments in this part of Vancouver. On small lots (33 ft), most of the allowable FSR can be built above ground. Developments are generally low cost, presumably to keep the selling price competitive with the area.

Residential liveability has been reduced over the years by road widening and increased traffic. Front yards have been narrowed in some locations to accommodate turn bays. Consequently, some houses are especially close to the street. Noise levels and air quality are of concern and are considered further in Chapter 4.

Key Questions and Issues: *Within the framework of CityPlan and the Community Visions, how can more liveable housing be developed along Knight Street?*

Some front yards have been narrowed where left turn bays have been installed.

COMMERCIAL AREAS: STILL THE FOCUS OF COMMUNITY ACTIVITY

The commercial areas on Knight Street are small and oriented to local needs as well as to passing motorists. Located at the intersections of 33rd, 41st, 49th, and 57th, they contain between two and eight stores, mostly gas stations, convenience stores, and small take-out restaurants. Pedestrian access and public space for these developments is typical of this type of commercial use across the city. Convenience stores are mostly tied to gas stations and carry a narrow range of goods. The recent Community Vision for Sunset considered expanding commercial development on the west side of Knight Street at 41st, 49th and 57th Avenues, with 4 to 6 storeys of residential above retail. This proposal received significant support, but not enough for the policy to be adopted at this time.

The commercial area at Knight and 49th Avenue includes small food stores, take-out restaurants and flower shops.

The commercial area at Knight and Kingsway is more substantial. This neighbourhood centre is now subject to detailed planning as part of the CityPlan's Kensington-Cedar Cottage Community Vision.

PARKS AND RECREATION

There are four parks along the length of Clark Drive-Knight Street.

China Creek South Park (1.6 hectares) is located on the west side of Clark at 10th Avenue. Facilities include a children's playground, a childcare centre, a skateboard bowl, a half-court for basketball and two grassy areas. The park has about 80 m of frontage along Clark Drive. Residents living east of Clark Drive can access the park by crossing at Broadway (regular traffic signal), 10th Avenue (via the central median), 11th Avenue (via the central median) and 12th Avenue (regular traffic signal). This park will be upgraded in the 2003-05 Capital Plan cycle.

Kensington Park between 33rd and 37th is the largest park on Knight Street.

Cedar Cottage Park (0.5 hectares) is located on the east side of Clark Drive at 11th Avenue. Facilities include a children's playground, a basketball court, a roller-hockey court and a grassy area. The park has about 40 m of frontage along Clark Drive. Residents living west of Clark Drive can reach the park by crossing at 11th Avenue (via the central median) and 12th Avenue (regular traffic signal).

Kingcrest Park (2.5 hectares) lies along the east side of Knight Street just south of King Edward Avenue. Facilities include a children's play-ground, sports fields and a large grassy area. The park has about 140 m of frontage along Knight Street. Residents living west of Knight Street can

most easily reach the park by crossing at King Edward Avenue. Kingscrest Park will be upgraded in the 2003-05 Capital Plan cycle. The vacant property connecting the park to the intersection of Knight and King Edward is not part of the park – it is owned by the City and managed by Real Estate Services.

Kensington Park (5.8 hectares) is located on the east side of Knight between 33rd and 37th. Facilities include a children's playground, sports fields, a large grassy area, Kensington Community Centre and Kensington Pool. The park offers panoramic views over the city to the North Shore mountains. The park has about 360 m of frontage along Knight Street. Residents living west of Knight Street can access the park by crossing at 33rd Avenue (regular traffic signal), 35th Avenue (marked crosswalk) and 37th Avenue (pedestrian traffic signal).

The Ridgeway Greenway, a linear parkway across the city, crosses Knight at 37th.

Schools, which are important community anchors, are discussed in the next chapter given their particular relationship to transportation.

Key Questions and Issues: *How can park edges be designed to reduce traffic noise, while maintaining safety, access, mountain views, and existing park facilities?*

FUTURE DIRECTIONS:

MAINTAINING HEALTHY COMMUNITIES ON KNIGHT STREET

The broad planning framework for land uses on Knight Street south of Broadway is outlined in the CityPlan Community Visions for Kensington Cedar Cottage (12th Avenue to 41st), and Sunset and Victoria-Fraserview (both south of 41st).

The KCC Vision identifies the area around Knight and Kingsway as a neighbourhood centre. It supports further planning and consultation to provide new housing choices in this area, such as townhouses, 2-, 4-, and 6-plexes. Knight Street near Kingsway may be an opportunity for new housing choices that better address liveability on a busy city-serving arterial.

As a neighbourhood centre, the area will provide a range of shops, services, jobs and housing choices. Further work will focus on shopping area improvements that address both the viability and vitality of the business areas and the safety and amenity of its crossings, sidewalks and public places.

SUMMARY

Knight Street and part of Clark Drive face unique challenges as a result of past development and transportation decisions that have placed high traffic volumes on a street consisting mainly of single- and two-family houses. Commercial activity along the Clark-Knight corridor consists mainly of industrial uses at the north end; shopping areas are small and sparsely located and generally lack strong associations with the community. The corridor benefits from several parks along its length but the relationship of these to the street could be more effective.

Key issues to be considered in the future include ensuring that future development responds to its major street context and making better use of park edges to give the street a greater sense of enclosure and enhance the park experience.

CHAPTER 2
EXISTING TRANSPORTATION CONDITIONS

INTRODUCTION

This chapter examines existing transportation conditions and highlights issues related to transportation modes, general traffic, goods movement, transit, cycling, pedestrians, school crossings and the street environment. The most prominent issues identified relate to safety and accessibility, travel time and travel time reliability, amenities for pedestrians, cyclists and transit users, and the condition and appearance of the streetscape.

TRANSPORTATION MODES: A PROFILE OF NEIGHBOURHOODS ALONG CLARK-KNIGHT

Travel mode habits, particularly for regular trips such as travel to work, provide insight into how people use transportation infrastructure. **Table 2** summarises the percentage of people driving, taking transit, walking and cycling to work in the neighbourhoods along Clark-Knight. Mode choices are influenced by a number of factors in each area including access to transit, housing density, proximity to major employment centres (such as the Broadway corridor, Downtown and the industrial areas), average family incomes and personal transportation values.

In many ways, the mode splits in **Table 2** are a reflection of past land use and transportation decisions. KCC, Sunset and Victoria-Fraserview (VF), which consist primarily of single-family residential housing and have few employment centres, have notably higher car usage than the areas north of 16th, which consist mainly of two-family and multi-family housing units, located closer to major employment centres. The neighbourhoods north of 16th also have a significantly greater percentage of people walking and cycling to work when compared to the areas in the south and the city as a whole. The steep grades in Sunset and VF may also be influencing people's choice to cycle and walk.

GENERAL TRAFFIC: THE CHALLENGE OF ACCOMMODATING A GROWING NUMBER OF VEHICLES

As the number of vehicles on the City's roads increases, the ability of the road network and signal system to accommodate growth without increased delays is limited. This section reviews the characteristics of general traffic, including traffic volumes, origins and destinations, traffic growth, and traffic operations, and discusses two issues for general traffic, congestion and travel time.

CHAPTER CONTENTS

Clark and Knight are primary arterials within the City. Daily traffic volumes vary by location along the corridor, but generally range from 18,000 to 55,000 vehicles per day. As shown in **Table 3**, the traffic volumes are heaviest in the southern portion of the corridor, near the Knight Street Bridge. These traffic volumes are similar to the daily volumes carried on other major corridors within the City, such as Broadway (22,000-44,000 vehicles/day), Cambie (36,000-57,000), Granville (33,000-54,000) and Boundary (23,000-57,000)[1].

Origins and destinations for traffic are diverse. Most of the traffic on Knight, south of King Edward, is coming from or destined to the Knight Street Bridge. Significant origins and destinations for this traffic include Downtown and the Broadway corridor. North of King Edward, Clark-Knight acts as a distributor to major east-west-corridors including King Edward, Kingsway, Broadway, Great Northern Way, and Powell.

Traffic growth has been most stable in the northern part of the corridor, where the annual growth rate is less than 1%. **Table 4** shows that growth rates on the corridor are less than the regional traffic growth rate of 2.7% per year[2].

Daily traffic volumes are typical of major arterials in the City.

Traffic operations are typical of other major arterials within the City. Parking restrictions exist along most of the corridor for the morning (7:00 to 9:30 am) and/or afternoon (3:00 to 6:00 pm) peak periods, allowing for three travel lanes in each direction when traffic volumes are heaviest. There are two exceptions, the blocks from Hastings to Adanac and 16th to 20th, which have two travel lanes in each direction and full time parking lanes. The blocks between 13th and 15th also have two travel lanes, but no parking lanes.

Table 2 Mode Choice Characteristics of the Neighbourhoods along the Clark-Knight Corridor

Travel mode to work	City-wide	Grandview Woodlands	Downtown Eastside	Strathcona	Mount Pleasant	Kensington-Cedar Cottage	Sunset	Victoria-Fraserview
Vehicle driver	55.1%	48.1%	12.1%	34.9%	44.3%	57.0%	62.6%	67.8%
Vehicle passenger	6.1%	6.2%	8.4%	5.5%	5.9%	8.5%	9.5%	8.6%
Transit	23.6%	30.7%	32.1%	28.0%	32.6%	29.6%	21.3%	20.0%
Walk	10.7%	8.2%	40.0%	22.6%	9.9%	2.5%	3.8%	1.8%
Bike	3.3%	4.9%	6.3%	6.6%	6.1%	1.7%	1.4%	0.8%
Other	1.2%	1.8%	1.1%	1.8%	1.1%	0.5%	1.4%	0.7%

Source: Census of Canada, 1996

[1]Source: Automatic Count Program, City of Vancouver, 1998 -2000.

[2]Source: Translink Council of Councils Background Paper #1 - Regional Traffic Growth Trends, 1996-1999

Intersection performance analyses and a preliminary travel time survey indicate that the main congestion points occur at Venables, 12th, 49th, and 57th. While congestion at Venables, 49th and 57th stems from high left-turn demand, congestion at 12th is related to heavy traffic in all directions. General traffic congestion is a concern, particularly in terms of the delays it creates for goods movement and transit and shortcutting on residential streets by impatient motorists. Short-cutting problems, which are clearly related to congestion on Clark-Knight and the east-west cross streets, have been identified by residents and police on the residential streets south of 57th and north of 1st.

Congestion and travel time are challenging issues to address in an urban environment where capacity is limited and traffic growth continues to occur. Options for addressing congestion, which do not require additional lane capacity, could include modifications to signal timing plans and signal co-ordination to make traffic operations as smooth as possible. Although most signals along the corridor are already co-ordinated, the co-ordination does not always give priority to Clark-Knight. Some modification may be possible, however, additional co-ordination for Clark-Knight would have consequences for east-west routes, such as Broadway and Powell, which also play critical roles in the road network.

While left-turn bays can, in some instances, reduce congestion by providing a reservoir for left-turning vehicles that frees up the through lane, they will not always reduce congestion. In situations where there is a left-turn signal phase, the level of service for the left-turning vehicles can be improved although most often this results in a reduced level of service for through traffic.

As discussed in the safety section of this report, the main benefit of left-turn bays is a reduction in vehicle collisions and the associated delays. However, while left-turn bays can significantly improve vehicle safety, they create longer pedestrian crossing distances, and may impact adjacent properties where the required widening has occurred. The appropriateness of this measure must be considered on a situation-by-situation basis.

Table 3 Daily 2-way Traffic Volumes on the Clark-Knight Corridor

Location	South of	24-Hr Volume	Date
Clark	Franklin	18,000	Sep 98
	Napier	33,700	Jun 98
	3rd	42,800	Sep 98
	7th	41,700	Sep 98
	10th	44,500	Sep 98
	13th	34,900	Feb 98
Knight	23rd	36,000	Nov 00
	31st	39,000	Nov 00
	39th	37,000	Nov 00
	43rd	44,900	Nov 00
	51st	43,400	Nov 00
	60th	55,000	Nov 00
Knight Street Bridge	mid-span	110,500	Nov 00

Source: Automatic Count Program, City of Vancouver, 1998 - 2000

Table 4 Annual 24-hr Traffic Growth Rate along Clark-Knight Corridor 1990-1998

Corridor	Annual Growth Rate
North section (at 3rd)	0.88%
Central section (at 31st)	1.68%
South Section (at 60th)	2.16%
Region-wide	2.7%

Source: Clark-Knight Corridor – Existing Transportation Context, Mobility Solutions, 2002

A detailed review of signal plans and a more comprehensive travel time study are required to gain a better understanding of traffic operations and to set realistic objectives for dealing with the travel time and congestion issue.

Key Questions and Issues: *There are locations along the corridor where congestion is an issue. Given the physical limitation of the road right-of-way and the priority needs of pedestrians, cyclists, transit and goods movement, ahead of private vehicles, improvements for general traffic must be balanced with the needs of other road users. What measures could ease congestion and neighbourhood short-cutting, particularly with continuing traffic growth along the corridor?*

GENERAL TRAFFIC SAFETY: TAMING A MAJOR ARTERIAL

Safety on Clark-Knight has long been an issue. The high collision frequencies on Clark-Knight, relative to other streets within the City, give this corridor an undesirable notoriety. According to ICBC data, collisions on the corridor cost over $20 million per year between 1996 and 2001. This section provides background information on safety studies and improvements undertaken since 1990 and identifies several specific safety issues related to erratic driving behaviour, speeding, on-street parking and red-light-running. Truck, transit, cyclist and pedestrian safety issues are discussed in later sections.

A study of safety issues on Clark-Knight was commissioned by ICBC in 1994[3]. The most common collision types identified were left-turn (32% of all collisions), rear end (27%) and sideswipe (9%) collisions. Inadequate left-turn facilities were identified as one of the primary causes of collisions on the corridor. The study reported increased lane changing, weaving and erratic driving behaviour between intersections (as drivers attempt to avoid being caught behind a left-turn vehicle) as contributing factors. The report also indicated that left-turn related collisions were exacerbated by the volume of traffic passing through intersections during the yellow and red signal phases.

Following this report, a number of safety initiatives were undertaken, including the installation of a third signal head at all intersections (to help drivers see the signal when they are driving behind a large vehicle), new, more reflective pavement markings, increased enforcement and a number of left-turn bay installations at 1st (2001), Broadway (1996), Kingsway (1995), 41st (1999), and 57th(eastbound and westbound) (1997). While these initiatives have reduced collisions at specific intersections, safety continues to be a major issue. In 2001, five of the top ten City-wide collision locations were on the Clark-Knight corridor. The problem locations are at the Knight Street Bridge (ranked 1st), Knight and 49th (ranked 3rd), Knight and 33rd (ranked 6th), Knight and Kingsway (ranked 9th) and Clark and 1st (ranked 10th).

Although 33rd does not have the highest number of collisions on the corridor, it has the highest collision rate (2.74 collisions per million entering vehicles)[4]. This collision rate exceeds the critical collision rate (based on average province-wide collision rates) by a factor of 1.47 and is related to the frequency of left-turn and angle collisions (36.4 collisions/year).

Erratic and impatient driving behaviour is another issue identified by ICBC, the Police, truckers, car drivers and residents. Aggressive lane changing, to by-pass short queues or left-turning vehicles, is common. Aggressive weaving around large trucks is of particular concern since trucks do not have the same response time or stopping/manoeuvring ability as smaller vehicles. In addition to contributing to sideswipe collisions, frequent weaving can contribute to rear-end collisions.

Speeding is another a concern. The 85th percentile speeds (speed below which 85% of drivers are travelling) on Knight range from 54 to 60 km/h during peak periods and 57 to 60 km/h during non-peak periods.

Although these speeds are above the 50 km/h limit, as shown in **Table 5**, they are typical of other major arterials. For the past two years, Clark-Knight has been identified by ICBC as a priority corridor for addressing speeding. ICBC will be funding a Targeted Enforcement Program, which provides an additional 30 hours of focused

[3] *Knight Street Corridor Traffic Operations Review*, Hamilton and Associates, 1994.

[4] *Knight Street Corridor Traffic Operations Review*, Hamilton and Associates, 1994.

Table 5 85th Percentile Speeds for Knight, Granville and Fraser

Location	North of	Direction	Am Peak (7:00-9:00)	Mid-day (9:00-16:00)	PM Peak (16:00-18:00)	Evening (18:00-22:00)
Knight	29th	NB	60	58	60	60
	45th	SB	55	57	54	59
Granville	22nd	NB	-	56	-	58
	29th	SB	57	58	-	57
	45th	SB	57	60	-	61
	56th	NB	57	54	-	56
Fraser	53rd	-	-	58	-	-
	55th	SB	-	60	-	-

Source: Photo Radar Program, RCMP, 2001

enforcement. Locations where speeding is of particular concern include southbound Knight, south of 61st, and northbound Knight, north of 37th.

On-street parking has been identified as a source of motorist conflict. Except in the commercial blocks of Knight near Kingsway, King Edward, 33rd, 41st, 49th, 57th, the parking demand is very low. The curb lane is therefore often used by traffic during non-peak periods. At several locations, the curves and hills make it difficult to see parked cars ahead. These blind spots mean that drivers travelling at or above 50 km/h are making sudden weaving manoeuvres to avoid parked cars. This sudden weaving presents a safety concern.

It should also be noted that parking on Knight is perceived as undesirable due to heavy traffic volumes and relatively high speeds. As well, most residences along Knight have parking via the lane. Even at locations on the corridor where parking is permitted full time (between 16th and 20th), the parking demand is low.

Three red light camera stations have been installed at 12th, 33rd and 49th to address red-light-running, street racing and the associated collisions. The year 2000 data shows that most red light events (RLE) occur on weekdays during non-peak periods. Clark and 12th has the highest frequency of violation along the corridor, 10 RLE per 10,000 entering vehicles.

In addition to the negative impacts on persons and private property, and the resultant costs to individuals and society, the frequency of collisions on Clark-Knight is disruptive to general traffic operations and the reliability of traffic conditions on the corridor. This is a concern for transit and goods movement in particular, which are highly reliant on consistent and predictable travel times.

Key Questions and Issues: *Safety is a pressing issue. Conditions at 49th, 33rd and Kingsway, in particular, require further investigation to understand how collision frequency and severity could be reduced. Reducing conflicts related to on-street parking should also be investigated.*

Poor driver behaviour including aggressive driving, speeding and red-light running, although not unique to this corridor, is an issue. How can infrastructure and streetscape design, traffic controls, education and enforcement be combined to discourage these risky behaviours?

GOODS MOVEMENT: A LINK BETWEEN TRANSPORTATION, LAND USE AND THE ECONOMY

TransLink estimates that approximately 8% of the region's economy is directly related to goods movement. That translates into approximately $1 billion per year in revenue within the Lower Mainland. On a regional level, the Clark-Knight corridor is a critical link for goods movement that connects Vancouver to Richmond and the Highway 99 and 91 corridors, which in turn connect to Delta, Surrey and the USA. It is also the busiest truck route in Vancouver. This section reviews truck traffic generators, volumes and

peak periods, and examines three important goods movement issues, travel time, travel time reliability and safety.

Trucks account for 8-9% of daily traffic on Clark-Knight.

Truck activity on Clark-Knight is generated by the Port; construction sites around the City; and the Powell, Clark, False Creek Flats, Marine Drive and Fraserview industrial lands. The Port is the largest generator of truck trips on the corridor.

Most Port-related truck traffic is generated by cargo container transport and servicing. Container services include stuffing/de-stuffing, cleaning/repair and storage. Most stuffing/de-stuffing takes place in Richmond, Surrey, Burnaby and Coquitlam. Due to limited container storage at the Vancouver Port and the proximity of Richmond to both the Vancouver and Delta ports, the majority of containers are stored either at Mitchell Island or in Delta.

Truck Volumes and the light/heavy truck distribution at several major intersections are given in **Table 6**. In 2001, on a typical fall weekday, trucks accounted for 8-9% of the total daily traffic volume. As shown in **Table 7**, this represents a high concentration of trucks, when compared to other major goods movement corridors in the City.

The peak period for trucks is different from the twice-daily peaks experienced for general traffic. **Figure 3** shows that truck volumes peak only once. The peak hour occurs between 10:00 and 11:00 am, at which time trucks account for 13% of the total vehicle volume. In the afternoon from 4:00-5:00 p.m. when traffic volumes are at their highest, trucks represent 5.5% of the total vehicles.

Table 6 Day time (08:00-17:00) Truck Volumes on the Clark-Knight Corridor (2001)

Screenline north of	Total Truck Volume	Light Trucks (2 axles, no pick-ups/ vans)	Heavy Trucks (3 axles or greater)
Hastings	1400	40%	60%
Great Northern Way	2500	53%	47%
Broadway	2600	46%	54%
Kingsway	2300	44%	56%
41st	2700	40%	60%

Source: Truck Count Program, City of Vancouver, 2001

Table 7 Daily Truck Volumes on Goods Movement Corridors in the City (1999)

Corridor	Total Vehicle Volume	Total Truck Volume	% trucks
Knight at 41st	37,900	3,000	7.9%
Marine at Boundary	49,200	2,700	5.5%
Boundary at Kingsway	42,600	2,400	5.6%

Source: Lower Mainland Truck and Freight Study, TransLink, 1999

Travel time and travel time reliability are important issues for goods movement. The logistical planning involved in receiving, transporting and delivering goods and services efficiently and in a cost-effective manner is highly reliant on predictable travel times. As indicated in the general traffic section, from an operational standpoint, the key delay locations can be fairly easily identified. In order to assess the reliability of the corridor, a more comprehensive travel time survey is required.

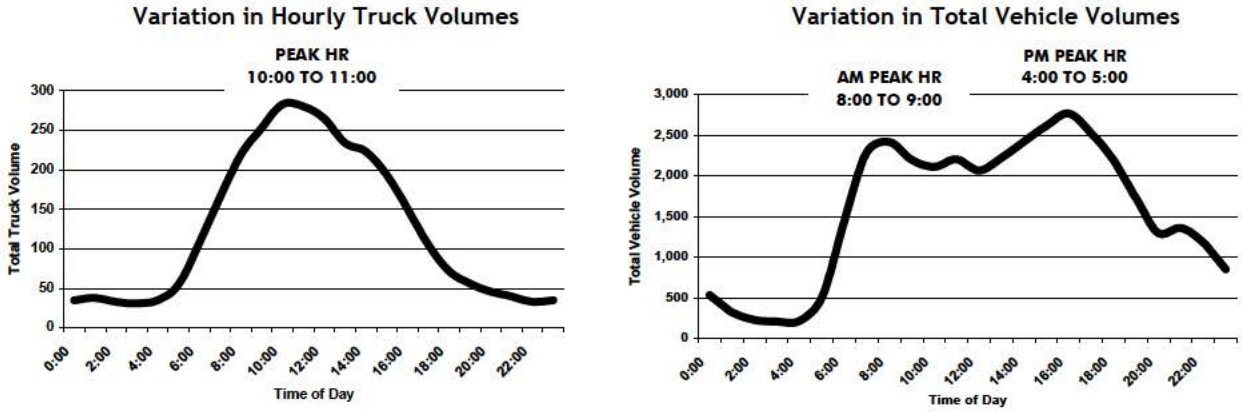


Figure 3 Peak periods for Trucks and General Traffic at Knight and 41st (1999)
Source: Lower Mainland Truck and Freight Study, TransLink, 1999

Truck collisions represent only a small proportion of the total collisions along the corridor. Between 1990 and 2001, at the top truck collision location on the corridor (Clark and Broadway), only 14 (3.6%) of the 389 collisions documented involved a truck. The highest truck collision locations include Broadway and 41st (1.2 collisions/year), 1st (0.9 collisions/year), 12th and Great Northern Way (0.8 collisions/year), Hastings (0.7 collisions/ year), and 33rd (0.7 collisions/year).

While the number of collisions is low, eight intersections on the corridor are among the City's top 10 truck collision locations. While these high rankings are partly a reflection of the concentration of trucks on Clark-Knight, they are nevertheless an indication that safety is an issue. The majority of collisions involving trucks are rear-end type collisions. The installation of additional signal heads at signalized intersections on the corridor in the mid-1990s, and the recent installation of a number of left-turn bays, was done to help reduce rear-end collisions.

Other goods movement issues relate to engine-brake use, load securement, overloading, speeding, and drivers failing to slow down and stop when approaching an intersection during the yellow and all-red phases. While the Vancouver Police Department's Commercial Vehicle Unit has noted that the majority of truck drivers are driving responsibly, they must dedicate significant resources to deal with a minority of less responsible drivers.

***Key Questions and Issues:** Given Clark-Knight's importance to local and regional truck networks, how can travel conditions for trucks be improved, particularly during the non-peak periods when truck volumes are greatest? What measures could be considered to improve safety and travel time reliability?*

TRANSIT: CONNECTING COMMUNITIES

Transit is an important transportation mode along the corridor, particularly north of 12th. The number 22 bus provides connections to employment areas, Vancouver Community College, express bus services, and other local transit services. In the future, it will connect to a new Millennium Line SkyTrain Station planned for Glen Drive off Great Northern Way, one block west of Clark. This section provides an overview of bus routing, amenities for bus users, service frequency and ridership, and examines several issues, including travel time, travel time reliability, and safety.

The number 22 bus route travels along Clark-Knight between Venables and Marine. At Marine, the route connects to transit services running along Marine to the airport and across the Knight Street Bridge to major employment centres in Richmond. At Venables the bus leaves the corridor and heads downtown through Chinatown via Pender and Burrard Streets before continuing to the west side of Vancouver.

Bus stops are provided about every other block along the corridor. Of the 65 bus stops, 23 (35%)

have shelters and 8 (12%) have litter receptacles. Litter at bus stops continues to be an issue despite the presence of litter bins at key locations. A new street furniture program, established in August of 2002, is expected to expand the availability of amenities for transit users along the corridor.

Bus service frequency is slightly lower than other major arterials (such as Victoria, Fraser and Main). During the morning (6:00 to 9:00 a.m.) and afternoon (3:00 to 6:00 p.m.) peak periods there are buses running about every 7 minutes. Outside peak periods, buses run every 15 minutes.

Daily ridership on Clark-Knight, as shown in **Table 8**, is low compared to other major corridors. The 1996 Census data, given in Table 2, shows that transit usage is lower than the city average in neighbourhoods along Knight Street. The private automobile is the dominant mode of transport in these areas. The perceived safety, comfort and convenience of the pedestrian environment and pedestrian crossings, as well as the limited connectivity of the route to Richmond, may be discouraging transit use. The lack of a good connection to SkyTrain may also be a factor in encouraging transit riders to choose the parallel services on Victoria and Fraser over Knight.

Ridership by time of day is highlighted in **Table 9**. These figures indicate that the bus capacity exceeds the demand. Only during the morning peak period, between 28th and Broadway, do northbound buses typically have standing room only (39-43 passengers).

Reliability is an important level of service indicator. Travel time reliability is important for both passengers and the transit operator since it allows consistent schedules to be met. Initiatives that improve safety and reduce collisions on the corridor may help reduce unpredictable delays and increase the reliability of transit operations.

Table 8 Transit Ridership on Major Corridors in Vancouver (2000)

Corridor	Daytime Boardings South of Broadway
Clark-Knight	**3,600**
Fraser	6,900
Victoria	6,700
Cambie	4,900

Source: Fall Ride Check Program, TransLink, 2000

Collisions involving buses on Clark-Knight are low compared to the total number of collisions, but high relative to city-wide bus collisions. Knight and 41st was the highest collision location for buses city-wide (1.5 collisions/ year) between 1990 and 2001. These collisions, however, represent only a small component of the total collisions (34 collisions/year) at 41st during the same period. Clark and 1st, Venables, Broadway and 12th all shared the number two rank city-wide (Average of 1.3 collisions/year). Safety concerns related to merging and weaving at the north end of the Knight Bridge have also been raised.

An Area Transit Plan will be undertaken by TransLink and the City and starting in the spring

Table 9 Peak Ridership per Bus on No. 22 Bus along Clark-Knight Corridor (2000)

Passenger Load	Northbound	Location of Peak Load	Southbound	Location of Peak Load
Maximum desirable load	*60*		60	
Seating capacity	*38*		38	
AM Peak (06:00 –09:00)	43	Clark at 11th	15	Knight at 37th
Mid-day (9:00-15:00)	27	Clark from 11th to 12th	23	Clark at Broadway
PM Peak (15:00-18:00)	16	Knight at 20th	32	Clark at Broadway

Source: Fall Ride Check Program, TransLink, 2000

of 2003. The purpose of this plan is to review existing services and identify improvements for the system. A new express bus between Richmond City centre and Metrotown in Burnaby is proposed for 2004. A stop on Knight at 49th and/or Marine would connect the corridor to this new route. As part of the Area Transit Plan process, Community Shuttle options will be considered throughout Vancouver including the Fraser Lands area.

Key Questions and Issues: *Transit ridership on Clark-Knight is relatively low. How can the safety, comfort and convenience of transit travel - both on transit and in the journey to/from transit - be improved? What route and service changes would encourage greater transit use?*

CYCLING: PROVIDING SAFER AND MORE ACCOMMODATING ALTERNATIVES

Clark-Knight is intimidating for many cyclists. High traffic volumes, heavy trucks and relatively narrow lanes make the road an undesirable cycling environment. This section reviews cyclist volumes, bikeways near the corridor, and bicycle facilities on the corridor. Cyclist issues include the availability of north-south alternatives to Clark-Knight, safety and the availability of bike racks at major destinations on the corridor.

Cyclist volumes are low. **Figure 4** shows that there are generally fewer than 15 cyclists at most intersections in the morning peak (7:50-8:50 am) and afternoon peak (4:20-5:20 pm) periods. Cyclist volumes are highest north of Broadway, with distinct peaks at both Venables and 3rd.

The higher cyclist volumes in the northern portion of the corridor reflect the 1996 Census findings (detailed in Table 2), which show that cycling represents a higher percentage of travel in the Downtown Eastside (6.3%), Strathcona (6.6%) and Grandview-Woodlands (6.1%) than what is typical both City-wide (3.3%) and in the other neighbourhoods on the corridor (0.8% - 1.7%). The density of employment north of Broadway is considerably greater than in the central or southern portions of the corridor, which makes short trips to work by bicycle more attractive.

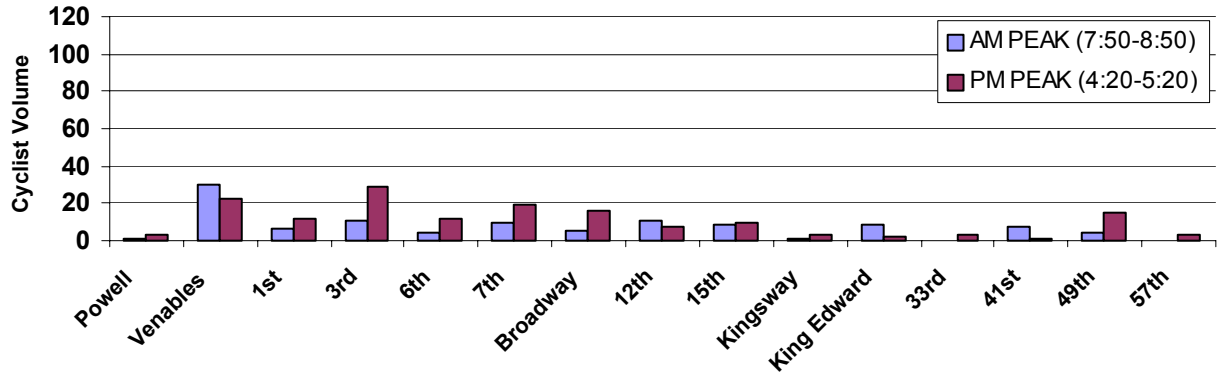
The volume of cyclists on the corridor is highest north of Broadway.

The nearest north-south alternative to Clark-Knight is the Inverness Bikeway (from SE Marine to 41st), which was established in 2002. The bikeway is on a local street that has traffic calming and cyclist-actuated signals at major cross-streets, including 41st, 49th and SE Marine. A second new route, the Windsor Bikeway, will continue north between 41st and 6th. Although these bikeways provide a significantly quieter alternative to Clark-Knight, cyclists have advocated for another route, east of the corridor and west of the bike lanes proposed for Victoria Drive in the 1997 Transportation Plan.

Three designated east-west bikeways cross the Clark-Knight corridor: Adanac, BC Parkway (at 7th) and Midtown/Ridgeway (at 37th). **Figure 4** shows crossing volumes. Peak crossing locations are at Adanac, 49th, Venables, 7th and 37th. Desirable crossing locations have been identified at several intersections including 10th, 20th and 43rd. A bikeway along 10th is being developed. 53rd and 61st are also desire lines, although the existing pedestrian signals are not convenient, as cyclists must dismount to activate them.

High collision locations are detailed in **Table 10** and include Clark at 12th, Hastings, Broadway and 57th. Despite relatively low cyclist volumes, these locations rank fairly high in terms of City-wide

Volume of cyclists on Clark-Knight



Volume of cyclists crossing Clark-Knight

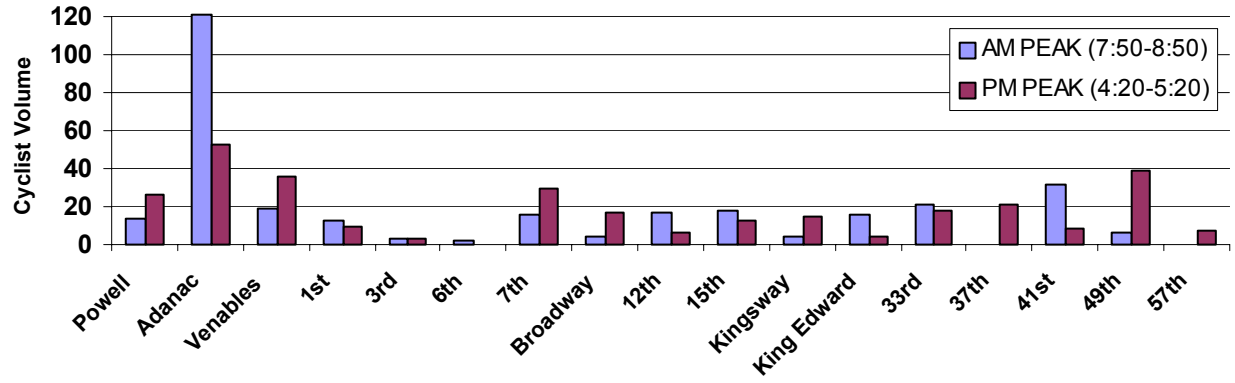


Figure 4 Volumes of Cyclists on and Crossing the Clark-Knight Corridor during Peak Periods
Source: Manual Intersection Count Program, City of Vancouver, 1999-2001

Table 10 Top Cyclist Collision Locations (1990-2001)

Location	No. of collisions	Average no. of collisions per year	Percent of total cyclist collisions on corridor	City-wide cyclists collision ranking
Clark and 12th	11	0.9	8.8%	7th
Clark and Hastings	8	0.7	6.4%	10th
Clark and Broadway	7	0.6	5.6%	11th
Knight and 57th	7	0.6	5.6%	11th

Source: Collision Records, City of Vancouver Police Department, 1990-2001

cyclist collisions. A review of collision data from 1990-2001 indicates that a majority of collisions at 12th (61%) and Broadway (57%) involve vehicles making a left-turn. Collisions involving cyclists at Hastings are related to a combination of left-turn, right-turn and through vehicle movements.

Facilities for cyclists along the corridor, such as bike racks, are very poor. The only bike rack on the street right-of-way is on Knight at 23rd, in front of the library. All of the buses on the number 22 route, however, are equipped with bike racks.

Facilities for cyclists along the corridor, such as this bike rack in front of the Kensington library, are poor.

Key Questions and Issues: *The Clark-Knight corridor is not conducive to cycling. What alternative routes would provide access to major destinations on the corridor and to the existing bicycle network? What options exist for improving cyclist amenities at destinations along the corridor, particularly near commercial areas, parks, schools and community centres?*

PEDESTRIAN ACTIVITY: CONNECTING PEOPLE WITH THE STREET

The pedestrian experience and environment are important elements of the transportation network and the sense of place and connection within a community. This section reviews existing conditions, including pedestrian generators, sidewalks, signalized and unsignalized crossings, pedestrian volumes, crossing demand and collision history. The pedestrian issues identified for Clark-Knight relate to safety, accessibility, comfort and enjoyment, and are fundamental to the quality of the pedestrian experience.

Pedestrian generators include:

Commercial areas	at Kingsway, 33rd, 41st, 49th, and 57th;
Parks	at 10th (China Creek South Park), 11th (Cedar Cottage Park), King Edward to 27th (Kingcrest Park) and 33rd to 37th (Kensington Park);
Community centre	at 37th (Kensington Community Centre);
Library	at Knight and 23rd;
Elementary schools	at Broadway (Queen Alexandra) and 49th (Sir Sandford Fleming). Grandview Woodlands and Seymour are not on the corridor but have catchment areas that cross it; and
Transportation hubs	at Broadway, Hastings and 41st. A 99 B-line Express stop exists at Broadway. A Millennium SkyTrain station planned for Great Northern Way, west of Clark, will increase pedestrian activity in this area.

The boulevard space available for sidewalks is narrow along most of the corridor.

There are sidewalks on both sides of the road on all but one section, the east side of Clark between Franklin and Hastings. Although sidewalk widths are generally at least 1.8 m, a small proportion of the corridor (3%) has sidewalks that are less than 1.5 m. Narrow sidewalks are a concern not only in terms of

limited manoeuvring space but also capacity and comfort for pedestrians passing each other.

Signalized pedestrian crossings exist at 25 of 69 intersections (36%), providing a signalized crossing opportunity every 3 to 4 blocks. These include the 15 major signalized intersections and an additional 10 pedestrian signals. 32% of the signals have an audible tone to assist visually impaired pedestrians. In April of 2002, Council approved a policy to reduce pedestrian waiting times at pedestrian-actuated signals. This policy has been implemented at 37th, 47th, 53rd, and 61st.

Unsignalized, marked pedestrian facilities along the corridor include a special crosswalk with zebra striping on Clark at Frances, which gives access to Seymour School, and a standard marked crosswalk on Knight at 35th, adjacent Kensington Park and Community Centre.

Pedestrian volumes on and crossing the corridor are generally low (less than 40 pedestrians in the peak hours) except at a few key locations. As shown in **Figure 6**, Broadway, Kingsway, Hastings, Venables, and 49th experience the greatest pedestrian activity, much of it likely related to schools and bus stops. While these volumes provide an indication of pedestrians using the corridor, the data is limited because the counts were done during the peak automobile period. **Figure 5** shows daytime pedestrian counts on Knight at 23rd, south of Kingsway.

Pedestrian crossing demands have been identified on Clark at Charles and Knight at 17th, although these locations have not met the City's criteria for a signal or special crosswalk. A pedestrian crossing between the signal at 61st and Marine would be desirable to reduce the walking distance between signals and to improve accessibility for pedestrians who may find it difficult walking up or down the steep slope. Between 1990 and 2001, there were 7 collisions involving a pedestrian trying to cross in this section, one of which was fatal.

The top collision locations are given in **Table 11**. **Table 12** compares collisions, injuries and

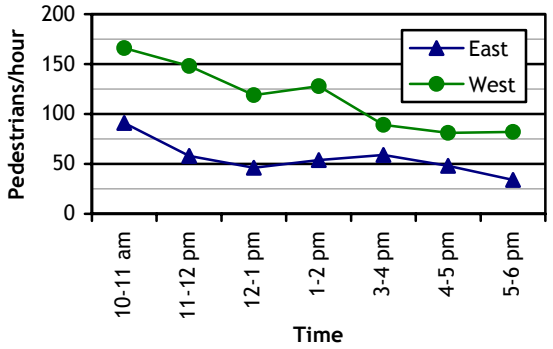


Figure 5 Daytime pedestrian volumes on the east and west sidewalks of Knight, south of 23rd (Thursday, June 20, 2002)
Source: Pedestrian Count Program, City of Vancouver, 2003

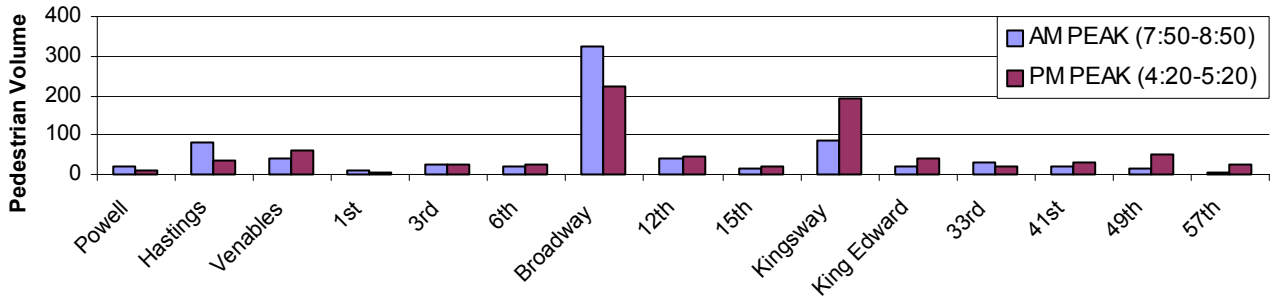
fatalities on Knight with those occurring City-wide and on other major corridors.

While the majority (85%) of collisions between 1990 and 2001 have occurred at intersections, 15% have occurred mid-block. Although mid-block pedestrian crossings occur on arterials around the City, they are of particular concern on Clark-Knight. Limited traffic gaps, high traffic volumes and speeds, combined with a six lane crossing distance and the reality that drivers do not expect to yield to pedestrians mid-block increase the risk of mid-block crossings. Locations with the highest incidence of mid-block pedestrian collisions include Clark, south of 8th, and Knight, south of 41st.

Universal accessibility is an important issue for the corridor. As in other areas of the City, several pedestrian crossings (mostly at local streets and lanes) do not have curb ramps for pedestrians with mobility difficulties, strollers or scooters.

While all the major intersections have curb ramps, some are not aligned with the crosswalks, making it difficult to manoeuvre into the crosswalk. At Broadway and 49th, for example, the misaligned crosswalks limit pedestrian accessibility and comfort.

Volume of pedestrians on Clark-Knight



Volume of pedestrians crossing Clark-Knight

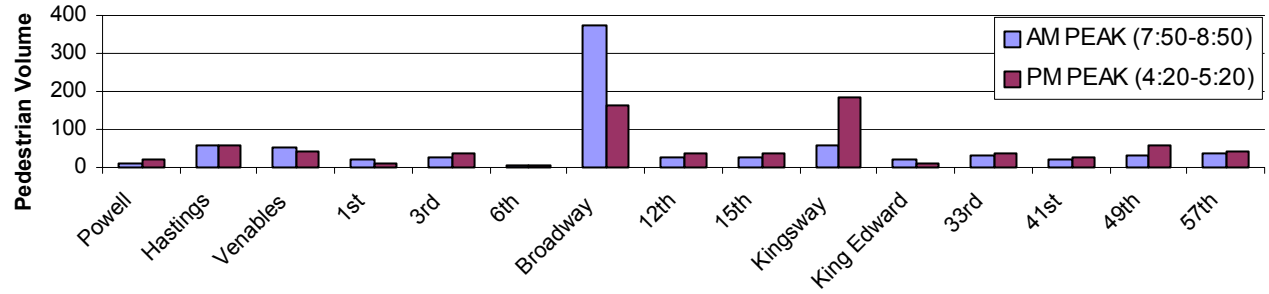


Figure 6 Pedestrian Volumes On and Crossing the Clark-Knight Corridor (2000-2001)
Source: Manual Intersection Count Program, City of Vancouver, 1999-2001

Table 11 Top Pedestrian Collision Locations

Location	No. of collisions	Average no. of collisions per year	Percent of total pedestrian collisions along the corridor	City-wide rank
Clark and Broadway	31	2.6	10.6%	8th
Knight and 41st	26	2.2	8.9%	11th
Knight and 49th	16	1.3	5.5%	21st
Knight and Kingsway	15	1.3	5.1%	22nd

Source: Collision Records, City of Vancouver Police Department, 1990-2001

Table 12 Pedestrian Collisions on Major Corridors in the City (1990-2001)

Corridor	Pedestrian Collisions	Pedestrian Injuries	Pedestrian Fatalities	% Fatalities
City-wide	7795	7679	167	2.1%
Clark-Knight	***291***	***294***	***5***	***1.7%***
Granville	457	451	13	2.8%
Cambie	205	205	4	2%
Boundary	40	37	1	2.5%
Hastings	529	506	17	3.2%
Broadway	553	551	9	1.6%

Source: Collision Records, City of Vancouver Police Department, 1990-2001

The proximity of sidewalks to the road reduces the appeal, comfort and perceived safety of the sidewalk. Along just over half (55%) of the corridor, sidewalks are located directly adjacent to the curb. Considering the limited on-street parking demand (except in commercial areas), and the no-stopping regulations in effect during peak periods, the pedestrian area is often separated from moving traffic by only the curb. Fortunately, where the sidewalks are particularly narrow (less than 1.5 m) there is a grass boulevard between the sidewalk and the road to provide some buffer.

The majority of the boulevard area on Clark-Knight is not particularly comfortable or attractive for pedestrians. Typically, there is less than 1.5 m of boulevard behind the sidewalk, which limits the amount of space available for landscaping. Plantings would enhance the street environment and provide a less wide-open feeling to the road. Greenery would also reduce the dominance of vehicles in the streetscape.

Key Questions and Issues: *Clark-Knight has narrow and often unkempt boulevards, sidewalks close to traffic, missing curb ramps, heavy traffic, noise and a high concentration of diesel vehicles, making for an undesirable pedestrian environment. How can pedestrian safety, comfort and accessibility be improved? How should improvements be prioritised?*

SCHOOL CATCHMENTS AND CROSSINGS: A NEED FOR INCREASED SAFETY

For the most part, the Clark-Knight corridor is used as a boundary between catchment areas for elementary schools. However, four elementary schools, Seymour, Grandview, Queen Alexandra, and Sir Sandford Fleming, have catchment areas that require some students to cross Clark-Knight. The enrolment of these schools is detailed in Table 13. All the schools were established before the street became a major traffic route.

Table 13 Elementary Schools along the Clark-Knight Corridor

School	Year first built	Enrolment (2000-01)
Seymour	1900	232
Grandview	1926	182
Queen Alexandra	1909	364
Sandford Fleming	1913	568

For Seymour, a substantial part of the catchment is east of Clark Drive while the school is on the west side. Children mostly cross at Frances, where there is a marked crosswalk, but no signal. The closest pedestrian signal is two blocks south at Adanac. Pedestrian collisions at Frances have been very low, with only one collision recorded between 1990 and 2001.

For Grandview, the catchment area west of Clark Drive is mostly an industrial area, although there are a few residential blocks southwest of Clark and 6th. The closest signalized crossings are at 3rd and 6th, which both have had 5 pedestrian collisions (not necessarily involving school children) between 1990 and 2001.

Many school children from Queen Alexandra Elementary cross Clark at Broadway.

For Queen Alexandra, about half of the catchment area is on the opposite side of Clark Drive (the west side). The intersection at Broadway is very busy with many left and right turning vehicles. Some children and children with parents cross at 10th Avenue where there is a landscaped median and crossing, however, the school encourages children to cross at Broadway where there is a signal. This location has had the highest number of pedestrian collisions along the

corridor (29 collisions between 1990 and 2001) To what extent these collisions involve school children must be investigated.

For Sandford Fleming the intersection of Knight and 49th is very busy. Pedestrian traffic is high both before and after school. The intersection at 49th and Knight ranks number three in terms of pedestrian collisions on the corridor (15 collisions between 1990 and 2001). The extent to which these collisions involve students is not known. Some children are crossing 49th a block east of Knight where there is a median.

Children crossing Knight at 49th in front of Sir Sandford Fleming Elementary.

The elementary school crossings at Frances, 3rd, 6th, Broadway, and 49th require special attention to the needs and safety of young children. In addition to education initiatives undertaken by the schools, engineering measures, including guard rails along the curb and at school exits, painted lines to show children where to wait, changes to signal timings, and designs in the sidewalk reminding children to look before they cross, have been used to improve safety. While these measures have been useful, both Broadway and 49th continue to have high pedestrian collision rates. Further investigation is required to assess options for improving safety at these important school crossings.

Key Questions and Issues: *There is a need to look for improvements in access for the schools whose catchment areas cross the corridor What opportunities are there for improving pedestrian crossings to the schools on the corridor?*

THE STREET ENVIRONMENT: SEARCHING FOR A BETTER BALANCE

Heavy traffic is a dominant factor in the life of the street. Most commercial areas on the corridor are small and there is little pedestrian activity. Narrow boulevards and sparse street trees reinforce the atmosphere of the street as a busy arterial. This section reviews existing landscaping and boulevards, and raises issues related to the hard appearance of the street, litter and graffiti problems, and the contribution of the street environment to the feel of the driving environment and the neighbourhood.

Existing landscaping along the corridor is limited. A well-landscaped median exists at 10th Avenue, where the 31 m wide road right-of-way is greater than the typical 24 m. This median significantly improves the look and feel of Clark and provides a refuge that helps both pedestrians and cyclists cross the street. The median also creates a landscaped link between Cedar Cottage Park on the west side and 10th Avenue on the east side. While this type of treatment would be desirable on other sections of the corridor, the typical 24 m right-of-way on the corridor cannot accommodate six travel lanes, sidewalks and a median. Other means of improving the look and feel of the street, such as landscaping on the boulevards and private property, as well as more careful placement and design of buildings along the corridor, may help achieve a similar effect.

The boulevards (land behind the sidewalks) along the corridor are narrow (less than 1.5 m), which limits substantial landscaping. The boulevards are even narrower at some intersections where the road has been widened. In a few blocks along the corridor, planting and landscaping on private property improve the street appearance. Although not many blocks are well planted, the trees that exist help soften the hard edges of the street. While good planting would do little to reduce noise for residents, it could reduce some of the visual impact of the busy street.

The attractive median at 10th facilitates pedestrian and cyclist crossings of Clark Drive.

The lack of greenery and the narrow grass boulevards along the corridor create a hardened streetscape that emphasizes the visual elements of the asphalt road and traffic. The hard appearance on Clark at 8th, for example, is magnified by concrete block retaining walls installed when the street was widened several years ago.

Litter and graffiti, which detract from the quality and appearance of the street environment and the pedestrian experience, are common, particularly north of 16th.

Graffiti reduces the appeal of the street.

There is little neighbourhood feel to street, although the housing and other uses are generally much the same as in other parts of the adjoining neighbourhoods. Knight lacks a number of major commercial centres to mark the neighbourhoods and there are few places where buildings abut the sidewalk. As a result, Knight lacks the visual cues that emphasise neighbourhood character. A richer and stronger neighbourhood feel to a street may help to calm traffic, creating a more positive community environment.

Key Questions and Issues: *The look and feel of the corridor is that of a busy urban highway; it lacks the street animation found on most other City arterials. How could visual interest be added to reduce the visual impact of heavy traffic and make the street less conducive to speeding?*

SUMMARY

Many of the conditions and issues discussed in this chapter call for improvements that will better serve the needs of pedestrians, goods movement and transit, and reduce the impact of this major urban arterial on the adjacent residents, businesses and institutions. The major issues identified revolve around safety, travel time, travel time reliability, amenities for pedestrians, cyclists and transit users and the visual character of the streetscape.

CHAPTER 3
FUTURE TRANSPORTATION ISSUES

INTRODUCTION

Clark-Knight will remain a major traffic and goods movement artery into the future. Transportation conditions along the street will be affected by land use changes in the City and neighbouring municipalities, as well as by the development of other transportation infrastructure. This Chapter reviews future changes to population and employment, land use within and outside of Vancouver, Port activities, traffic growth and the transportation network that will influence transportation conditions on the corridor.

POPULATION AND EMPLOYMENT CHANGE

Vancouver and the Greater Vancouver Regional District are expected to experience significant population growth in coming years. As shown in **Table 14**, the City of Vancouver is projected to grow by nearly 20%, which represents approximately 11% of regional growth to 2021. In terms of employment, Vancouver is expected to contribute a significant 20% of the new jobs in the region.

Table 14 Population and Employment Growth in Vancouver and the Region

	1999	2021	Change	%
Greater Vancouver Regional District				
Population	1,876,240	2,720,000	843,760	45%
Total employment	957,150	1,435,050	477,900	50%
City of Vancouver				
Population	528,360	624,780	96,420	18%
Total employment	356,670	451,000	94,330	26%

Source: Clark/Knight Corridor - Future Transportation, Mobility Solutions, 2002

Employment and population changes anticipated for the Clark/Knight corridor are detailed in **Table 15**. Land use changes along and near the corridor over the next 19 years are expected to contribute substantially to new employment in Vancouver, representing 32% of the total employment growth in the City. The contribution of new housing and densification along the corridor is expected to make a modest contribution to population growth in Vancouver, at approximately 12%.

The relatively low population growth along the corridor suggests that increases in travel demand from residences along the corridor will be modest. The significant employment growth in the northern part of the corridor, however, will generate new trips within Vancouver and along

Table 15 Population and Employment Growth on the Clark/Knight Corridor

	1999	2021	Change	%
Population				
North	34,753	39,698	4,945	14%
Central	30,574	35,725	5,151	17%
South	20,583	22,372	1,789	9%
Total	***85,910***	***97,795***	***11,885***	***14%***
Employment				
North	38,092	66,265	28,173	74%
Central	5,267	6,739	1,472	28%
South	4,991	5,605	614	12%
Total	***48,350***	***78,609***	***30,259***	***63%***

Source: Clark/Knight Corridor - Future Transportation, Mobility Solutions, 2002

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the corridor. The following sections on land use provide a context for this population and employment growth, and provide insight into how land use changes could influence trip demand along Clark/Knight.

LAND USE CHANGE IN VANCOUVER

Changes in land use patterns in the City and suburbs will affect the volume and types of traffic found on the Clark-Knight corridor. New residents and new jobs both contribute to a growth in trips, some of which may take place in the corridor.

Major land use changes in Vancouver include the continuing development of downtown and the evolution of some of the City's industrial areas to industrial uses with higher employment densities. In addition, some changes may occur along the **Clark-Knight corridor** as Community Visions are implemented. Modest increases in population can be expected from Vision directions to increase housing options near transit routes and to permit multi-family housing in the Kingsway and Knight area.

Growth in **Downtown Vancouver** is expected to continue in the future, with current trends in population growth already exceeding projections. In the last ten years the population living downtown has increased 54% and this may increase by another 34% by 2021. Downtown employment is also expected to increase by about 30% to 2021. As a consequence of this growth, downtown is expected to have 100,000 residents and 175,000 jobs by 2021.

While expectations are that most Downtown residents will work Downtown, some will work elsewhere and may use streets such as Clark-Knight to reach their jobs.

The 308-acre **False Creek Flats** currently consists mainly of transportation, warehousing and produce distribution industries. However, some high-tech uses are developing and City policies will encourage more such development, bringing more jobs to the area and increasing travel demand.

105 acres in the False Creek Flats were rezoned to a new I-3 zone in 1999. This zone is tailored to high-tech use and supports land uses that could increase the number of jobs in the Flats to somewhere between 21,300 and 33,000. This amounts to a six-fold increase over the estimated 4,500 jobs present in 1994. Whether this increase will be realised, and at what pace, will depend partly on the recovery of the high-tech economy. Just under 20 acres of the I-3 area will be used by four post-secondary institutions (UBC, SFU, BCIT and Emily Carr) as a technology-based academic campus.

The development pattern being pursued on the Flats will reduce the demand for some truck trips on Clark-Knight, as heavier industrial uses move out, but will likely increase commuting demands due to the large number of jobs created. The planned extension of the SkyTrain Millennium Line to the Flats, and the future construction of a Vancouver-Richmond rapid transit line, should help reduce the automobile commuter demand to the redeveloped Flats.

In the extreme south-east corner of the city, new uses for the former **Weyerhaeuser** (MacMillan Bloedel) sawmill site are being examined. This development, located between Marine Way and the Fraser River, will also include some City-owned land adjacent to the Weyerhaeuser site. Consideration is being given to developing the 170 acre site with about 5,000 dwelling units and 20 acres of commercial development. This development may house up to 9,400 people.

While Knight Street is a potential access route to central Vancouver from the Weyerhaeuser site, it is more likely that commuters will use other routes, especially since there is not a direct connection between westbound Marine Drive and northbound Knight Street. It may also attract people who would otherwise have commuted from the suburbs by routes such as Knight.

LAND USE CHANGE OUTSIDE VANCOUVER

The Knight Street Bridge is a key road link between Vancouver and **Richmond**. In recent decades, Richmond has become a net importer of employees. In 1996 Richmond had 1.4 jobs for each resident in the labour force, generating a substantial population of reverse commuters from Vancouver. Growth projections for Richmond

anticipate that employment will continue to increase more rapidly than the city's population.

In addition to existing employment centres, Richmond has designated land in the south-east part of the municipality, next to the Main Arm of the Fraser River, for a wide range of industrial uses, including high-tech. This area, as well as currently developed areas across the North Arm of the Fraser River from Vancouver, will continue to attract reverse commuters from Vancouver, many of whom will likely find Clark-Knight the best route.

Richmond's **Mitchell Island**, located in the North Arm of the Fraser River and reached by the Knight Street Bridge, is planned for continued heavier industrial uses such as manufacturing and distribution. These uses typically have lower employment densities than high-tech uses and thus will create fewer trips than more office-rich areas. Concert Properties is currently marketing the 100 acre Mitchell West Industrial Park on un-developed land at the west end of Mitchell Island.

PORT ACTIVITY

Much of the truck traffic in the Clark-Knight corridor is related to the container port facilities (Centerm and Vanterm) on the Burrard water-front. This traffic may increase in the future as The Vancouver Port Authority (VPA) projects that container traffic on the West Coast could reach 4 million TEUs (twenty-foot equivalent units, a standard measure of container traffic) in the next 20 years while other traffic remains strong. This represents a quadrupling in traffic over the 1.15 million TEUs handled in 2001.

While the suburban Deltaport container terminal was expanded in 2001 to handle 850,000 TEUs per year, improvements have also recently taken place at the Centerm and Vanterm terminals on the Vancouver waterfront, allowing them to handle 850,000 TEUs per year in total. The Port plans to further increase the combined capacity of Centerm and Vanterm to 1,135,000 TEUs by 2005. This increase will be accommodated by the use of new technology within the existing terminal footprints.

Table 16 Annual container capacity at Vancouver Port Authority facilities (2002 and 2005)

Terminal	TEUs (2002)	TEUs (2005)
Centerm	340,000	600,000
Vanterm	440,000	535,000
Deltaport	850,000	850,000
Total	1,630,000	1,985,000

Source: Vancouver Port Authority

A key concern for Clark-Knight relative to growth at the Port is container storage. Containers are currently stored at a couple of waterfront sites in the Port but these may be required to accommodate growth in Port activities. There are already major container storage facilities on Mitchell Island and north Richmond. Growth in these facilities could result in more containers being moved to and from the Port via Knight Street and Clark Drive. Finding suitable sites for container storage closer to the port, such as in the Powell and False Creek Flats industrial areas is problematic due to relatively high land values and poor availability of large sites.

Container traffic at terminals on the Burrard waterfront is expected to grow, potentially generating more truck trips on Clark-Knight

TRAFFIC GROWTH

Traffic growth along Clark-Knight is expected to be modest, and similar to the growth trends observed in the period between 1996 and 1999. **Table 17** summarizes traffic growth estimates for 2021 from the GVRD's EMME trip generation model. It should be noted that this model esti-mates demand and does not provide a clear indication of how well the existing network capacity accommodates this demand. Further

analysis is required to assess the impact of the estimated traffic growth on traffic operations.

Table 17 AM Peak Hour Traffic Volumes

	1999		2021		% Change	
	NB	**SB**	**NB**	**SB**	**NB**	**SB**
North (S of Great N Way)	1,630	1,020	2,210	533	36%	-22%
Central (S of 33rd)	1,530	1,190	1,620	1,250	6%	4%
South (S of 49th)	1,630	2,150	1,690	1,928	4%	-13%
Bridge	3,540	3,670	4,270	4,340	21%	16%

Source: Clark/Knight Corridor – Future Transportation, Mobility Solutions, 2002

The significant increase in northbound traffic, south of Great Northern Way is linked to the anticipated development of the False Creek Flats. The model suggests that the bulk of the traffic growth will occur on Clark between 12th and Great Northern Way and that most of the trips in this section will originate from major east-west corridors, such as Broadway and 12th.

More analysis of truck trips and further consultation with the Port is required to provide a better understanding of truck traffic growth and the role of rail transport in accommodating the Port's anticipated growth in container transport.

THE TRANSPORTATION NETWORK

The route choice and mode choice of people currently using the corridor, as well as new users, will be influenced by a variety of changes to transportation infrastructure and traffic operations.

The City's road network is not expected to experience many major changes. The 1997 Transportation Plan stipulated that, apart from the Port Road, the road network would not be expanded. The only major change proposed near the corridor was the re-designation of 57th, between Main and Argyle, from secondary arterial to collector status.

The most likely influence on driver route choice is congestion. Further investigation and simulation using traffic growth estimates are required to better understand how congestion will change in the future. Although annual traffic growth, particularly in the central and southern parts of the corridor, is expected to be modest, delays at intersections that already experience congestion, such as 1st and 57th, may increase and could result in new or intensified short-cutting problems.

Geometric changes recently approved by Council include a left-turn bay on Clark at 6th and the removal of a right-turn channel at 57th and Argyle. While the left-turn bay has not yet been constructed, changes at 57th and Argyle have recently been completed. Removing the right-turn channel will reduce turning speeds, improve pedestrian conditions and make it difficult for trucks currently using 57th (which is not a truck route) to access the Knight Street Bridge.

There are no imminent plans to alter **truck routes** in the City, however the Victoria-Fraserview/Killarney Community Vision proposes that Argyle and Victoria be removed from the truck route network. This direction needs to be assessed more carefully, since this would put a four-kilometre gap between the north-south truck routes on Boundary and Knight. This could have major implications for goods movement and result in additional trucks on Fraser since westbound trucks on Marine cannot turn on to northbound Knight. While Boundary Road, combined with Highway 1 and the Port Roadway, provides an alternative truck route between the Fraser River and Burrard Inlet Port facilities, it is relatively circuitous for trips using the Knight Street Bridge to enter Vancouver. It is, however, a more viable route for trips from Annacis Island and north Delta and Surrey.

The transit network is likely to experience many changes. As traffic congestion increases, and transit service and connectivity are improved, new trips by transit will be generated. Transit projects that are likely to influence path choice and mode choice include:

- A Millennium Line station on Great Northern Way, one block west of Clark. Plans to extend the Millennium Line west to Central Broadway would increase the utility of this connection.

- A Richmond-Metrotown Express Bus service.
- A possible rapid transit connection between Richmond and Downtown Vancouver, via the Cambie corridor.

Although an assessment of how these new services will attract new transit users and influence trips along the corridor has not been done, it is likely that the proposed rapid transit route between Richmond City Centre and Downtown Vancouver will result in an increase in east-west bus service, to feed into the rapid transit line.

The bicycle network will likely see the development of a number of routes that will connect to the Clark-Knight corridor. These include a new bikeway along 10th between Victoria and Trafalgar, bike lanes on Victoria between Marine and Powell, and the recently implemented Inverness and Windsor Bikeways to the west of Clark-Knight. Although the 1997 Transportation Plan did not highlight a north-south route between Clark-Knight and Victoria, many cyclists have indicated that one would be desirable.

SUMMARY

New jobs and, to a lesser degree, new housing along the corridor will contribute to traffic growth on Clark Knight. The most significant changes to trip generation and mode choice along the corridor will stem from significant growth in employment in the northern part of the corridor and improvements to transit service and accessibility. Although private vehicle growth will be relatively low in the central and southern parts of the corridor, increases in traffic will contribute to increased congestion, which may have undesirable consequences for goods movement, transit and local neighbourhood streets along the corridor.

CHAPTER 4
ENVIRONMENT

AN INTRODUCTION TO ENVIRONMENTAL ISSUES ON CLARK-KNIGHT

This chapter explores two primary environmental issues, noise and air quality, for the Knight Street corridor. It presents some preliminary information on the environmental impacts of Knight Street traffic on nearby residential and institutional uses.

NOISE PRIMER

Noise is generally defined as "unwanted sound". Noise levels are measured in decibels (dB). Since the decibel is based on a logarithmic rather than a linear scale, a doubling of sound intensity is reflected in a 3-decibel increase. For example, if we have a fan (Table 18) that produces a sound level of 60 decibels and we add a second identical fan producing 60 decibels, the resultant sound level is not 120 decibels, it is 63 decibels. This is the way the human ear responds to sound - the noise from the two fans would sound only slightly louder than the single fan.

Noise is monitored with sound level meters. There are a number of ways of measuring noise - the two most frequently used are the maximum noise level (Lmax), which is the highest level measured over a period of time (usually 15 minutes), and the energy averaged noise level (Leq), which is a better measure of community response to noise. This document reports noise levels in terms of Leq, for ease of comparison with Canadian and International guidelines for community noise.

Environmental noise can result in various negative health and social effects. Hearing impairment is the most obvious health effect, but typically occurs only in occupational environments. Excessive noise also affects the way we hear and discern speech. For example, children in an excessively noisy environment may have difficulty understanding the teacher, resulting in negative behavioural changes and personal learning handicaps.

Deep, uninterrupted sleep is essential for proper physical and mental functioning. Noise can cause loss of sleep and disturbances during sleep that affect the depth of sleep and quality of rest.

Table 18 Sound Pressure and Decibel levels

1 Noise Source = 60dB	2 Noise Sources = 63 dB	4 Noise Sources = 66dB	8 Noise Sources = 69 dB

Notes: Doubling the noise source increases the total decibel by 3 decibels. Thus 8 times the sound pressure level leads to an increase of only 9 decibels. Source: Adapted from *An Introduction to Sound Basics*, Minnesota Pollution Control Agency.

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People living near noisy streets, airports or industries for extended periods can show temporary or even permanent changes in their physiological health. These effects can include high blood pressure and heart disease. There are a number of other psychological and annoyance effects associated with exposure to noise.

Both the World Health Organization and the Canada Mortgage & Housing Corporation have established ambient sound level **guidelines** for residential developments next to traffic (See Table 19). The City of Vancouver has applied the CMHC guidelines to new developments along some high-traffic corridors, but not Clark-Knight.

Table 19 Community Traffic Noise Guidelines

Interior and exterior guidelines	*Noise Level (24hr Leq) (dB)*
Interior noise guidelines	
Bedrooms (1)	35
Living, dining, recreation rooms (1)	40
Kitchens, bathrooms, hallways, utility rooms (1)	45
Classrooms (during lessons) (2)	35
Daycares (during sleep time); hospitals (2)	30
Exterior noise guidelines	
Outdoor recreation areas (1)	55

Sources:
(1) CMHC - Road & Rail Noise - Effects on Housing
(2) WHO Guidelines for Community Noise

Table 20 Typical Traffic Noise Level

Typical Location	*Noise Level at façade (24hr leq) (dB)*
Quiet residential subdivision	<55
Residential artery, typical two-lane road, non truck route (16th Avenue east of Oak Street)	55-60
Significant residential artery, four-lane road, some trucks (Davie Street, East Pender off Boundary)	60-65
Commuter roads and truck routes(Broadway, Hastings, Main, Kingsway, 12th Avenue, Victoria)	65-70
Heavily travelled commuter road/cross city connector /most highways, beyond right of way (6th Avenue, SE Marine Dr., Knight St.)	70-80+

Source: City of Vancouver, Urban Noise Task Force Report data provided by Barron Kennedy Lyzun & Associates

NOISE ON KNIGHT STREET

Noise measurements at various locations and times of day along Knight are summarised in **Table 21**. Noise readings at reference locations on Fraser Street and Victoria Drive are presented for comparison.

Noise levels along Knight are significantly elevated for the majority of its length, with severe noise impacts south of 41st Avenue downhill to the Knight Street Bridge. Although there is some relief from the high daytime and rush hour levels in the evening, the levels in excess of 70 dB (Leq) can reduce the liveability of nearby residences. The obvious differences between Fraser, Victoria and Knight can be attributed to a combination of higher volumes on Knight, the predominance of heavy diesel traffic (mostly trucks) and the effect of grades on engine and braking noise.

As expected, noise levels drop off as one moves back from Knight, with approximately 15 decibels of reduction at 61 m (200 feet) from the street, without any intervening shielding. This still places the outdoor environment 5 to 10 decibels above the CMHC guidelines for outdoor recreational spaces. An estimate of the shielding effect of houses fronting on Knight would put back yards marginally above the 55 dB criteria. Noise fences may hold promise as a means to reduce the noise but must continuous to be effective and pose safety and aesthetic concerns.

The schools on Knight are significantly affected by traffic noise. It would be a challenge to meet the relevant criteria (<35 dBA) in classrooms, even with the windows tightly closed.

Key questions and issues: *How can new building design be adjusted to improve residential liveability along the corridor? Should new dwellings be required to meet noise guidelines? Are noise fences appropriate and/or workable in the corridor?*

Table 21 Noise Monitoring results

Monitoring Locations	*Daytime (dB)*	*Rush Hour (dB)*	*Evening (dB)*
22nd & Knight	78.4	78.9	--
33rd & Knight	76.5	79.6	--
37th & Knight	79.5	81	70.3
41st & Knight	80.2	77.3	--
49TH & Knight	82.1	81.8	--
55th & Knight	80.3	--	74.3
61st/63rd & Knight	82.3	--	76.6
Victoria & 22nd	74.3	--	--
Fraser & 22nd	73.1	74.5	--

AIR QUALITY

Emissions affecting air quality are generated by point sources such as industrial activities and combustion in residential furnaces and water heaters, and by mobile sources such as motor vehicles, trucks, buses and railways. The predominant sources of emissions along the length of the Clark-Knight corridor are mobile sources, with a higher than average contribution from heavy diesel trucks and a smaller number of buses.

The common air pollutants of concern are carbon monoxide, ozone, nitrogen oxides, sulphur dioxide and fine particles. Of these, the ones that have the most pronounced impact on health are ozone and fine particles. Ozone is a secondary air pollutant, in that it is not emitted from tailpipes directly, but generated from nitrogen oxides and hydrocarbons in the atmosphere in the presence of sunlight. Because of its secondary nature, its impacts are not normally observed near the source (i.e. on Clark-Knight), but further up the Fraser Valley in Chilliwack and Abbotsford as a result of prevailing winds.

Fine particles can be subdivided into two portions: the fine fraction and the coarse fraction. The coarse fraction is particulate matter that measures between 2.5 and 10 microns across. (A micron is one millionth of a metre, or one thousandth of a millimetre.) Fine particulate or $PM_{2.5}$ is the finest fraction of PM_{10}; they are particulates that measure less than 2.5 microns across and are the most likely particles to penetrate into the deepest parts of the lungs. Approximately one half of inhalable particulate emissions belong to the fine fraction.

Trucks make up almost 9% of the traffic on Knight Street and raise specific noise and air quality concerns.

Pedestrians are directly exposed to noise and air emissions.

Recent studies have raised concerns over adverse health impacts from exposure to roadside levels of diesel particulate matter (DPM), prompting California to declare DPM a toxic air contaminant. Various researchers are considering further studies into DPM levels on City streets, such as Knight and Granville, and any associated health effects.

HEALTH EFFECTS OF AIR POLLUTANTS

Inhalable particulates affect lung function both acutely and chronically. They also aggravate existing lung and cardiovascular diseases. High PM_{10} levels inhibit our ability to remove other contaminants from our lungs. Average Greater Vancouver levels of PM_{10} for 2000 were 10 to 14 $\mu g/m^3$. Maximum levels were measured between

29 and 58 µg/m^3 over 24 hour periods. The current GVRD objective for PM_{10} is 50 µg/m^3 over a 24-hour period. $PM_{2.5}$ levels averaged 8 to 10 µg/m^3 in 2000, with 24-hour maximums of 30 µg/m^3 at three monitoring sites. The recently adopted 2010 Canada Wide Standard for $PM_{2.5}$ is 30 µg/m^3 averaged over 24 hours.

Sir Sandford Fleming Elementary School at Knight and 49th is adjacent to heavy traffic.

AIR QUALITY ON KNIGHT STREET

A limited survey of 3 air quality parameters was carried out along the Knight Street corridor, consisting of short-term measurements of PM_{10}, $PM_{2.5}$ and carbon monoxide. Average PM_{10} levels along the corridor were 35 µg/m^3, which is within the current GVRD objective for a 24-hour period, while average $PM_{2.5}$ levels were 41 µg/m^3, which would exceed the Canadian 2010 standard. Further analysis would likely confirm that the predominant component of the $PM_{2.5}$ fraction is diesel particulate matter (DPM).

Carbon monoxide levels marginally exceeded the 8-hour criterion of 5 parts per million at the major intersections on Knight Street.

Snapshots of how particulate concentrations vary with changes to the concentration of diesel vehicles and distances from Knight are summarized in **Figure 7** and **Figure 8**.

These results should be interpreted with caution given the short duration of measurement and the limitations of the instrumentation, which is less precise than the GVRD air quality monitoring instrumentation. Comparisons to 24-hour standards should be made cautiously since these measurements were taken only during peak truck traffic periods only. Nevertheless, the results highlight some areas of concern and suggest further study, perhaps by the GVRD, of average and peak levels of these contaminants along the corridor.

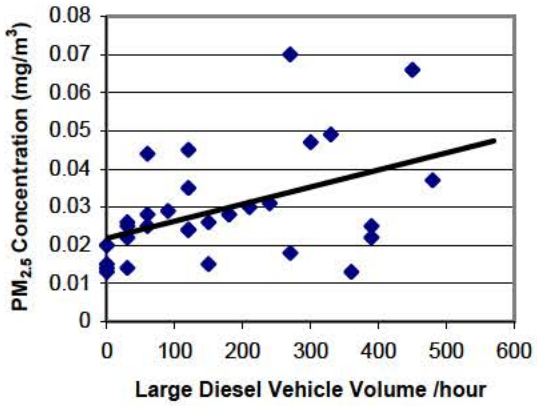

Figure 7 Relationship between PM2.5 concentrations and large diesel vehicle volumes

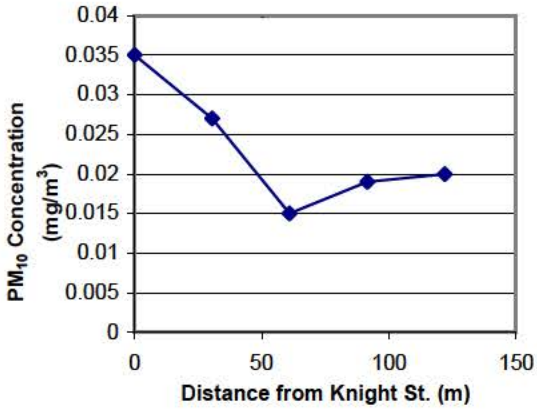

Figure 8 Relationship between PM10 concentration and distance from Knight Street

***Key Questions and Issues:** How can the City work with other agencies and levels of government to address air quality issues?*

SUMMARY

Like in many urban centres, noise and air quality are impacting liveability. In the case of Knight, those impacts are heightened by topography, the concentration of diesel vehicles and the proximity of dwellings and other sensitive land uses, such as schools, to the street. While the City itself may not be able to eradicate these problems, efforts to improve environmental conditions on Knight may become a catalyst for broader improvements in Vancouver and the region.

SUMMARY AND NEXT STEPS

The Clark-Knight corridor provides a critical transportation function to the city but presents many challenges as a consequence. The impacts on the local community in terms of noise, air quality and the barrier effect created by a heavily-travelled street are significant. The transportation function itself works relatively well, considering that it is a busy urban street.

Key land use issues include dealing with traffic volumes and noise, implementing Community Visions directions to increase housing choice, mitigating traffic impacts on parks, and using land use to create a street that feels less like a highway. Reducing the barrier effect of the street to better connect the neighbouroods on each side is also important.

Prevailing themes in the transportation issues identified include safety, travel time, and travel time reliability, amenities for pedestrians, cyclists and transit users and the visual character of the streetscape. The environment for pedestrians is in particular need of improvement. The efficiency of goods movement on Clark-Knight also requires further examination in order to better accommodate this essential function of the corridor.

Environmental issues focus on the need to reduce the impact of air quality and noise on liveability, particularly for schools, residents, pedestrians and businesses along the corridor who are most sensitive to these conditions.

The overview of issues in this report provides a context for establishing a work plan with the various stakeholders, including the local community, industry, TransLink, ICBC and others within the City and the region, to address key issues. The next steps in the Whole Route Analysis include conducting more detailed analysis of specific issues and developing and evaluating options to address the priority issues. In the final stage, an overall assessment of the benefits, costs and stakeholder support for various options will be compiled, followed by a report to Council on the findings of the Whole Route Analysis and a plan for short and long-term projects and initiatives for the corridor.

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For updates and public events related to this project, refer to the project website at:
www.city.vancouver.bc.ca/knight