REPORT ON

STUDY OF MAJOR ROAD CROSSING OF ROGERS CREEK

CITY OF PORT ALBERNI

REPORT TO

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ON

STUDY OF MAJOR ROAD CROSSING OF ROGERS CREEK

N. D. LEA & ASSOCIATES LTD.

SEPTEMBER 1980

8311

Lea Associates transportation consultants

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September 12, 1980 Ref: 8311

Mr. J. Sawyer
City Manager
City of Port Alberni
4850 Argyle Street
Port Alberni, B.C.
V9Y 1V8

Dear Sir:

Re: Major Road Crossing of Rogers Creek

We have pleasure in submitting twenty copies of our study on the proposed crossings of Rogers Creek. Our findings are not as clearcut as we would like. The engineering aspects are fairly straightforward and we find both the 10th Avenue and 21st Avenue locations can provide a satisfactory bridge crossing. The traffic aspects are also fairly straightforward, with the centroid of traffic desire about midway between Gertrude and 10th Avenue, so that a 10th Avenue location would help relieve Gertrude the most. However, a 21st Avenue crossing could also provide useful relief. The social planning aspects favour the 21st Avenue location.

While our initial conclusion was to recommend the 10th Avenue location, further consideration tends to equalize the two locations in that, in the long run, the 21st Avenue location could be of more benefit to the City provided 21st Avenue is extended southwards to complete the street network in the mid term future (say 5 - 8 years after bridge completion). As a decision on this would require municipal consideration, we have left our recommendation open.

We hope that the data presented herein will be useful in reaching that decision. We would be pleased to assist further in review of the contents of the report and any subsequent work required.

Yours truly,

for J. A. C. Andrews, P. Eng.
President

JACA:aa

Enclosures

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SUMMARY

1. Two locations for a further crossing of Rogers Creek have been considered by the City, namely at 10th Avenue and at 21st Avenue. The purpose of the study is to examine the suitability of each location, to select a preferred location and to recommend timing of construction of each crossing location.

2. Two locations for a crossing at 21st Avenue and one location at 10th Avenue were selected from study of topographical mapping and were surveyed and located in the field. Field examination showed all locations to be feasible.

3. To provide detailed information on existing vehicular movements across Rogers Creek, a traffic survey was carried out. The response was excellent with 42 percent of drivers mailing back the questionnaire. Results were summarized in the form of an origin-destination table.

4. At the same time as the O-D survey, traffic counts were carried out by the Ministry of Highways. These indicate that 28,000 vehicles cross Rogers Creek per day, with 3,160 in the peak afternoon rush hour.

5. Forecasts of traffic growth were made with traffic forecast to increase 35 percent over the next 20 years. An additional two-lane bridge would accommodate this growth.

6. Geotechnical survey and preliminary soil borings were taken on the 21st Avenue route and the previous results of the 10th Avenue route reviewed. No major problems are foreseen due to soil conditions.

7. An environmental survey of the Rogers Creek area was carried out. Its main potential is as a natural recreational park for walking.

8. Preliminary bridge designs for each location in both steel and concrete were undertaken and the costs at 1980 construction figures estimated.

9. Road construction costs connecting the bridges to existing routes at Johnston Street and Roger Street and 10th Avenue intersection were estimated.

10. Total construction cost is estimated to vary, according to route and options, from $2.7 million to $3.0 million for the most likely choices.

11. An evaluation process was carried out that considered factors such as: social impact, economic impact, environmental impact, engineering impact and traffic impact. The result of this evaluation favoured a 10th Avenue route. However, it was recognized that a 21st Avenue route could be equally favoured in the longer run provided that 21st Avenue was continued south as planned in the street network system.

12. It was recognized that the choice of 10th Avenue could greatly increase traffic flow on 10th Avenue making it the major north-south arterial, which could bring objections of local residents.

13. The recommendation of the study is as follows:

- For short run benefit, a 10th Avenue crossing is the best.

- For long term benefit, a 21st Avenue route is preferred provided that the municipality commits development of 21st Avenue street system in the mid term future.

- A two-lane crossing should suffice for the twenty-year forecast period.

Chapter 1

INTRODUCTION

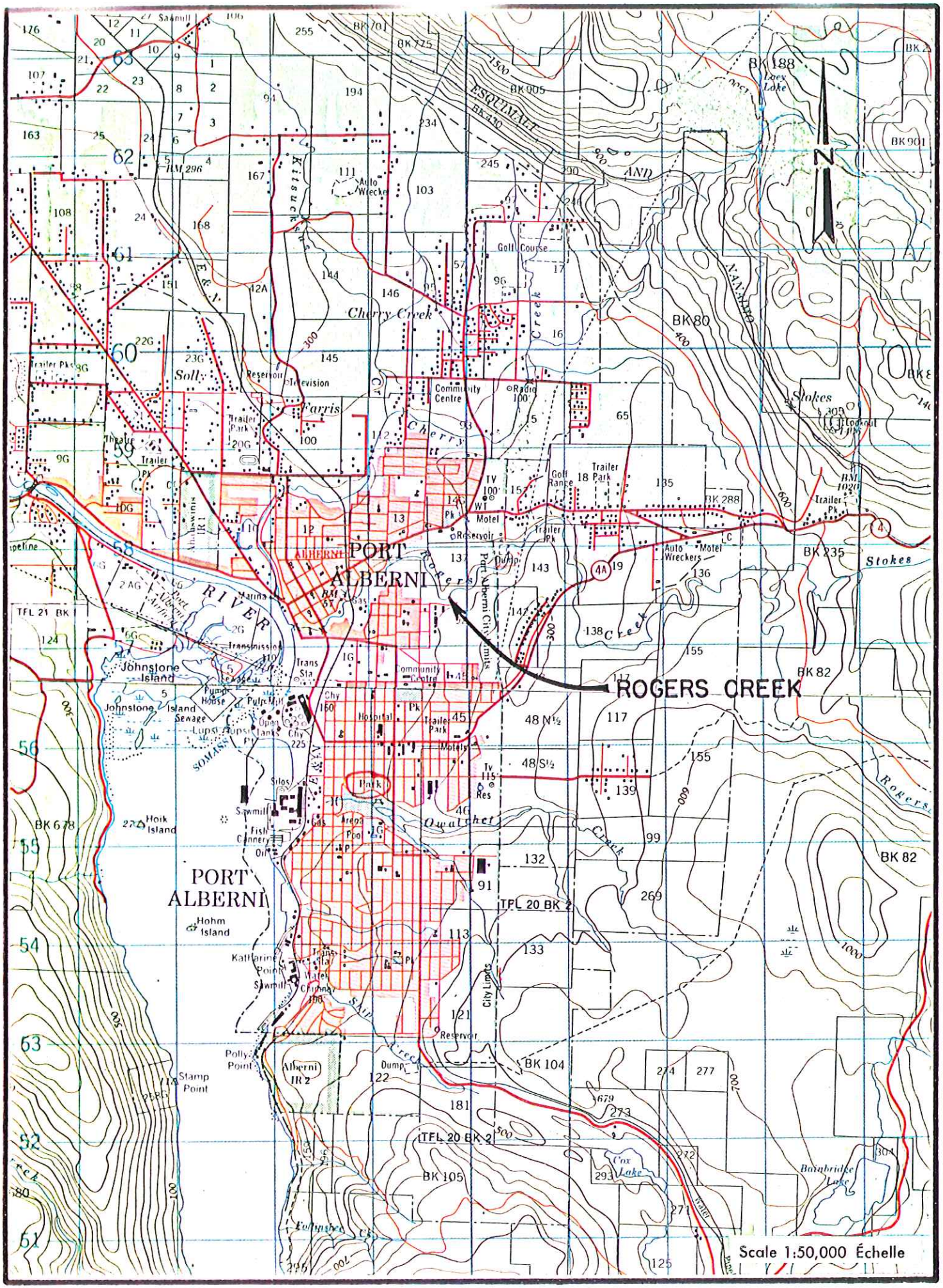
In January 1980 the City of Port Alberni, in conjunction with the Provincial Government Ministry of Transportation and Highways commissioned N. D. Lea & Associates Ltd. to carry out a study on "Major Road Crossing of Rogers Creek."

The prime objective of the study was to determine which of two crossing locations, namely 10th Avenue or 21st Avenue, should be chosen and at what time in the future a further crossing may be required. The selection was to be based on an assessment of social and environmental implications and the cost effectiveness of each route. Cost estimates and particulars are to be sufficient for referendum and funding purposes.

During the last eighteen months, the City of Port Alberni, the Ministry of Transportation and Highways and the Regional District of Alberni-Clayoquot have been meeting to determine the major street network for the Alberni Valley, which is required under the Revenue Sharing Act for provincial financial participation in non-primary road systems. Both 10th Avenue and 21st Avenue crossings of Rogers Creek are shown as future connections in this study (note the Alberni Valley network plan is still to be finalized). One of the points still to be settled is the route continuing north of Johnston Road on the 10th Avenue alignment.

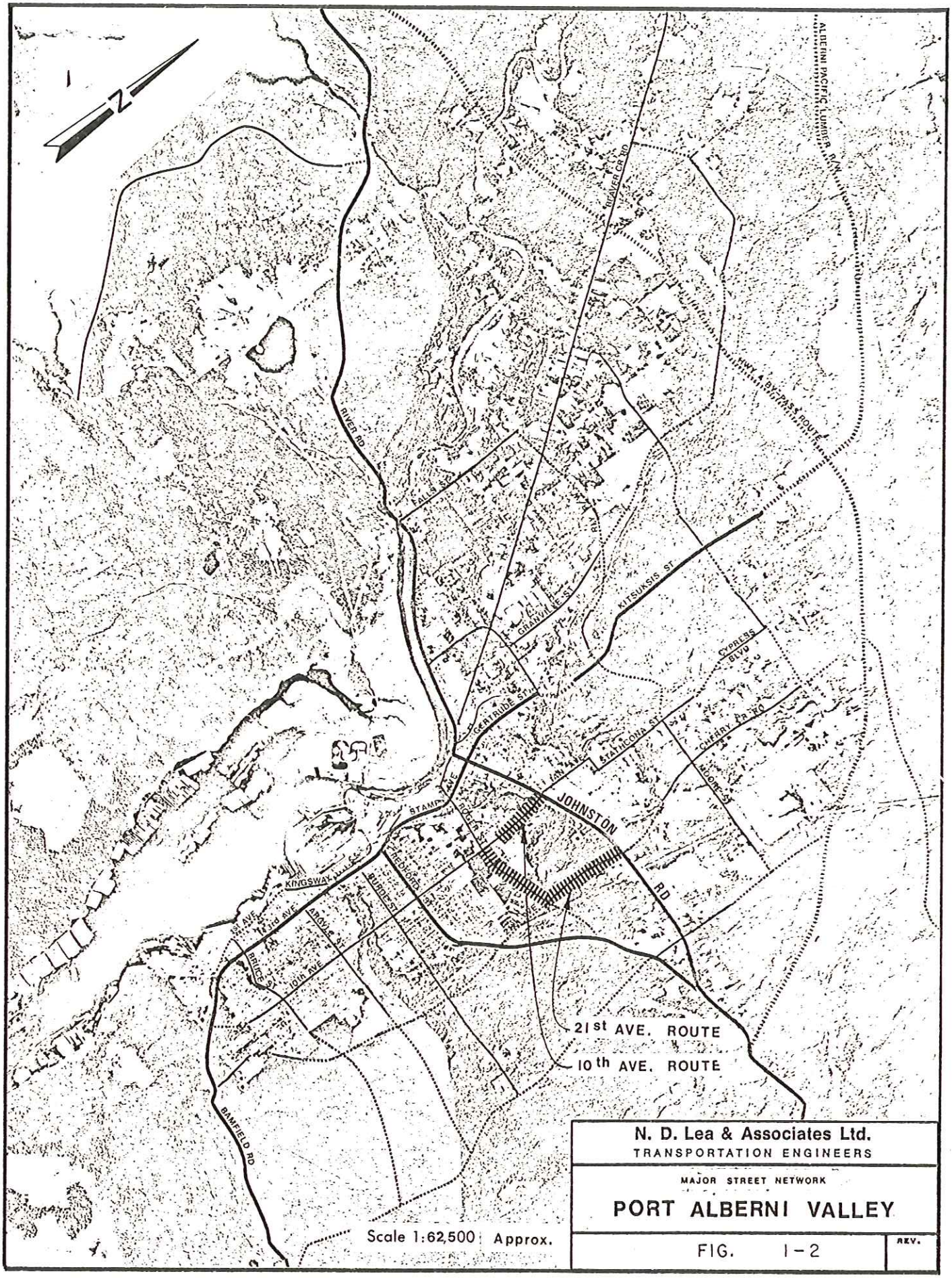
Figure 1-1 shows the general layout of provincial highways with respect to Port Alberni. The development of Port Alberni is clearly divided by the three creeks: Cherry, Rogers and Owatchet. However, Rogers Creek shows the crossings confined only to the western end of the creek, hence the desire for a further crossing more to the east.

Figure 1-2 is an excerpt of the tentative major street network previously described. The 10th Avenue and 21st Avenue crossings of Rogers Creek as they fit into the proposed network are shown thereon.



KEY MAP

FIG. 1-1


N
ALBERNI PACIFIC LUMBER RD
BEAVER CREEK RD
HWY 4 BYPASS ROUTE
RIVER RD
FALLS ST
GRANVILLE ST
KITSUKSIS ST
CYPRESS BLVD
GERTRUDE ST
STAMFORD AVE
STATHCONA ST
CHERRY CREEK RD
MOORE ST
JOHNSTON RD
KINGSWAY
REDFORD ST
BURDETT
1st AVE
Third AVE
BRIDGE ST
10th AVE
BANFIELD RD
21st AVE. ROUTE
10th AVE. ROUTE
Scale 1:62,500 Approx.
N. D. Lea & Associates Ltd.
TRANSPORTATION ENGINEERS
MAJOR STREET NETWORK
PORT ALBERNI VALLEY
FIG. 1-2
REV.

Chapter 2

ALTERNATE ROUTES

2.1 Previous Studies

Two previous studies by Associated Engineering Services Ltd. provided the initial location for study of the 10th Avenue and 21st Avenue routes. (Reports dated November 1966 and November 1970)

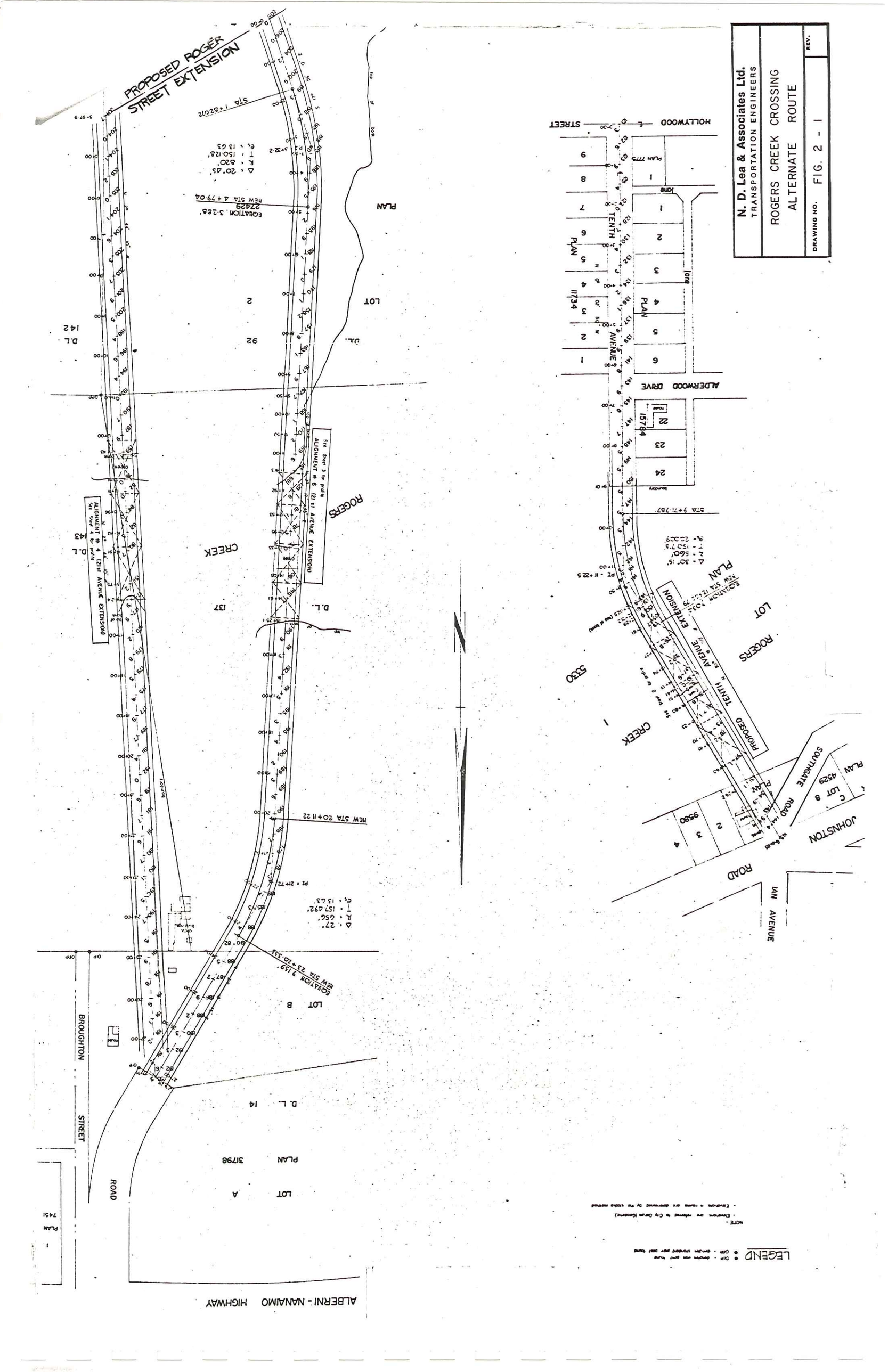
Topographic mapping at a scale of 1" = 400' was provided by W. J. Blakely & Associates, who are the consulting planners for Port Alberni. This mapping was studied to select alternate routes. (Figure 5-1 shows the topo mapping.)

2.2 Route Standards

The crossings are to be designed for a four-lane urban road. However, the desirability of construction staging of the bridge with two lanes initially would be examined. We have selected a 70 kph design speed, although the actual posted speed limit would be 50 kph. Maximum grades should be 8 percent. Bridge design should be to current Ministry of Transportation and Highways loading, i.e. H25S20. Hydraulic discharge of Rogers Creek should be for a 100 year flood, but a 200 year flood should be capable of being safely passed through the structure.

2.3 Routes Surveyed

Several routes were studied in the office from the aerial mapping, although they were all minor variations of the 10th Avenue and 21st Avenue routes. After examination, these were reduced to three in number and these were surveyed and cut in the field by the surveyor. They are shown in Figure 2-1 and are numbered:



N. D. Lea & Associates Ltd. TRANSPORTATION ENGINEERS	REV.
ROGERS CREEK CROSSING ALTERNATE ROUTE	
DRAWING NO. FIG. 2 - 1	

Alignment 1	10th Avenue Route
Alignment 4	21st Avenue route (eastern location)
Alignment 6	21st Avenue route (westernmost location)

2.4 10th Avenue Crossing

The 10th Avenue alignment connects to Ian Avenue (at Johnston Road), which is the street selected in the network plan. The selected route requires the acquisition of one property in the southeast corner of the intersection (see photo 1)(Note: all photos are located in Appendix A). The bridge crossing is mainly on tangent resulting in a more economical structure with the shortest distance between the opposite banks of the ravine.

The crossing location is on a straight section of the creek and no creek course change is evident nor likely. Photos 2, 3, 4 and 5 show the proposed creek crossing location.

2.5 21st Avenue Crossing

The route 4 alignment is located close to the City boundary. The creek crossing utilizes a narrow spur of higher land on the north side and crosses to a steep shale rock bank on the south side of the river. Photographs 6, 7 and 8 show the crossing location, although trees and terrain make an overall view difficult.

The route 6 alignment crossing is about 600 feet farther downstream and on a straighter section of river. The south side alignment is along the top of the creek ravine. The north side alignment has the flexibility of joining either to the east or west of the shopping centre, i.e. to the existing Cherry Creek Road intersection or the new proposed route to the east. We have selected the latter as being preferable and in line with the long range planning. Photos of the crossing location are shown in photos 9, 10, 11 and 12.

2.6 Existing Bridges

The two existing bridges are a four-lane bridge on Gertrude Street and a two-lane bridge on Victoria Quay. Photos 13 and 14 show these two locations. Both bridges are in adequate condition.

2.7 Continuing Routes North of Johnston Road

Consideration is to be given to the routes north of Johnston Road. One route is Ian Avenue (photo 15) and its connection across Kitsuksis Creek, which is presently crossed on Strathcona Street by a small timber bridge (photos 16 and 17). The other route is Cherry Creek Road, which is an existing through route also with a bridge over the Creek (photos 18 and 19).

Chapter 3

TRAFFIC PRESENT AND FUTURE

3.1 Origin/Destination Survey

In order to obtain some basic data on the travel patterns of vehicles crossing Rogers Creek, a roadside origin/destination survey was conducted on Wednesday, February 19, 1980, between 12 noon - 2:00 p.m. and 3:00 - 5:00 p.m. A percentage of the vehicles crossing the creek in both directions at each of the three existing crossings, viz. Victoria, Gertrude and Maebelle, were stopped and handed a questionnaire (see copy shown in Appendix C), which was to be completed by the driver and mailed back to City Hall in a prepaid envelope. (See locations in Figure 3-1 and photographs 23 and 24.)

Of the 3,810 questionnaires distributed during this period, 1,598 or 41.9 percent were returned, this comparing favourably with similar surveys we have carried out in Burnaby. Of these responses, 1,470 were subsequently coded with all addresses being placed in one of the 14 study area zones within the City or 10 zones outside the City, keypunched on to cards and processed using a standard statistical analysis package called S.P.S.S. (abbreviation for Statistical Package for Social Sciences). Figure 3-2 shows the area zones used. The resultant trip table (for 1980) showing the distribution of origins and destinations of vehicles crossing the creek is given in Table 3-1 (factored to reflect the total 24-hour period). This 24-hour table was obtained by simply expanding the resultant survey trip table by the ratio of 24-hour creek crossing volume (27,973) divided by number of valid responses (1,389). (The 1,470 was further reduced because trips beginning and ending on the same side of the creek were eliminated.)

Although a more detailed expansion methodology could have been developed based upon the number of responses at each location, direction, time of survey, and rate of response by origin and destination zone, this amount

of detail was felt to be unjustified for this study, and therefore the simple expansion was adopted.

The results, however, are logical, and if questionnaire returns were biased, would most likely tend to favour those residents living in the area that would be served by a new crossing, i.e. zones 4 and 17. This would overemphasize crossings from these areas.

The number of crossings of the Rogers Creek screenline per capita per day is as follows:

Zone No.	Population 1980	Destination Trips	Trips Per Capita
1	800	660	0.82
2	991	1,060	1.07
3	1,623	3,240	2.00
4	1,847	3,920	2.12
15	1,717	920	0.54
16	3,725	1,620	0.43
17	3,206	1,600	0.50
		Average	0.85

A complete set of the S.P.S.S. computer output has been given to the clients and a copy of some of the tables is given in Appendix C.

Some of the results are:
Purpose of trips: Work - 28%; Shopping - 16%; Recreational - 10%
Number of persons per vehicle: 1.5
Percent commercial trucks: 3.2%
Trips by bus: (even)
Comments.

3.2 Traffic Counts

During the week of the survey, traffic counters were located adjacent to the roadside survey sites as well as on other key roads in the study area, e.g. Redford Street, Johnston Road, Ian Avenue, Cherry Creek Road, and Beaver Creek Road. These counts, which were taken separately for each direction, covered at least three days and provided 15-minute traffic flows throughout the day. A summary of the peak hourly volumes on the three crossings during both the morning and evening peak periods, as well as for 24 hours, is given in Table 3-2 and a comparison with similar counts taken during the earlier 1970 study is also given in Table 3-2. It is apparent from the flows shown in Table 3-2 that many vehicles travelling southbound on Victoria Quay in the morning return on Gertrude - this is no doubt because of the existing signal phasing at the intersection of Gertrude Street and Roger Street.

Turning movements at the key intersections of Gertrude Street/Stamp Avenue/ Roger Street and Roger Street/10th Avenue were also taken during the peak periods on Thursday, February 20, and Wednesday, July 15, respectively, and these results are included in Appendix C.

3.3 Present Traffic Crossing Rogers Creek

At the present time there are some 27,970 vehicles crossing Rogers Creek west of the junction of Redford Street and Johnston Road in a typical weekday 24-hour period (or 3,160 during the peak hour). Of this traffic, 26,260 or 94 percent use either Victoria or Gertrude, with 20,180 crossing at Gertrude and 6,080 crossing at Victoria. Of this 6,080 at Victoria, 4,424 or 73 percent travel southbound. The remaining six percent of creek crossings occur at Maebelle in the east, and because traffic is so light, this crossing will be ignored from here on.

If the traffic and capacity of Maebelle is therefore ignored, there is a maximum one-way flow of 1,757 vehicles in the peak hour (northbound p.m. flow) crossing at either Victoria or Gertrude and this is comfortably within the combined capacity of the two bridge links of 2,500 v.p.h.

(one-way). The limiting factor here, however, is the intersection of Gertrude/Stamp/Roger and to a lesser extent the intersection of Gertrude/Johnston.

Based upon Table 3-1, it is apparent that the highest number of crossings are between zones 4-12 (2,040 trips), 3-12 (1,780 trips), 4-10 (1,620 trips and 3-10 (1,360 trips). There are 160 possible zonal pairs, and of these, 4 zonal pairs account for some 24 percent of the total crossings. This would appear to indicate that the primary trip generating zones on the north side of the creek are zones 3 and 4, and on the south side of the creek they are zones 10 and 12. Although the mills are located in zones 6 and 11, other high generators such as commercial activities are located in zones 10 and 12. The next four highest pairs are 3-7 (920 trips), 4-7 (880 trips), 4-9 (740 trips) and 2-12 (680 trips), which make up 12 percent of the total of 27,420.

3.4 Travel Time Survey

At the time of the O-D survey, a travel time survey was also carried out. This was done by measuring the average vehicular travel time, in seconds, between major road intersections for all street links in the area bounded by Johnston Road and Redford Street. Beyond these two limits, average travel times on the respective streets were measured in miles per hour.

The centroid of each zonal area was then estimated and located on a map and the travel time from each zone to each of the bridge locations (existing or proposed) was calculated. Results are given in Table 3-3.

TABLE 3-1

24-HOUR ORIGIN/DESTINATION TRIP TABLE 1980

Origin Zone	Destination Zone 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
1	-	-	-	-	40	60	60	80	140	220	80	180	0	40	-	-	-	-	900
2	-	-	-	-	20	180	240	80	60	200	80	380	20	40	-	-	-	-	1300
3	-	-	-	-	60	200	440	120	300	720	220	1160	200	140	-	-	-	-	3560
4	-	-	-	-	60	300	380	120	300	760	140	1020	280	180	-	-	-	-	3540
5	0	0	160	60	-	-	-	-	-	-	-	-	-	-	0	40	20	0	280
6	80	220	260	320	-	-	-	-	-	-	-	-	-	-	180	240	140	0	1440
7	100	120	480	500	-	-	-	-	-	-	-	-	-	-	160	100	240	0	1700
8	40	80	200	120	-	-	-	-	-	-	-	-	-	-	0	60	40	0	540
9	40	20	360	440	-	-	-	-	-	-	-	-	-	-	40	0	60	0	960
10	180	160	640	860	-	-	-	-	-	-	-	-	-	-	120	360	280	0	2600
11	40	20	160	180	-	-	-	-	-	-	-	-	-	-	60	160	180	0	800
12	80	300	620	1020	-	-	-	-	-	-	-	-	-	-	280	520	440	0	3260
13	60	120	260	260	-	-	-	-	-	-	-	-	-	-	40	40	160	0	940
14	40	20	100	160	-	-	-	-	-	-	-	-	-	-	40	100	40	0	500
15	-	-	-	-	0	100	120	120	80	220	80	520	40	60	-	-	-	-	1340
16	-	-	-	-	0	160	160	80	80	460	220	620	80	80	-	-	-	-	1940
17	-	-	-	-	20	180	160	140	80	240	140	640	60	100	-	-	-	-	1760
18	-	-	-	-	0	0	0	0	0	20	20	0	20	0	-	-	-	-	60
Total	660	1060	3240	3920	200	1180	1560	740	1040	2840	980	4520	700	640	920	1620	1600	0	27420

NOTE: All trips recorded with an origin and destination on the same side of Rogers Creek have been eliminated in this table.

TABLE 3-1

24-HOUR ORIGIN/DESTINATION CREEK CROSSING TRIP TABLE 1980

TABLE 3-2

NUMBER OF VEHICLES CROSSING ROGERS CREEK

SUMMARY OF 1980 COUNT PROGRAM

Crossing	Direction	Lanes	A.M. Peak Hr.	P.M. Peak Hr.	24-Hour
Victoria Quay	Northbound	1	98	316	1,653
	Southbound	1	557	387	4,424
	Combined		655	703	6,077
Gertrude St.	Northbound	2	527	1,441	11,203
	Southbound	2	644	791	8,977
	Combined		1,171	2,232	20,180
Maebelle	Northbound	1	60	120	886
	Southbound	1	60	103	830
	Combined		120	223	1,716
Total	Northbound		685	1,877	13,742
	Southbound		1,261	1,281	14,231
	Combined		1,946	3,158	27,973

COMPARISON OF 1970 AND 1980 P.M. PEAK HOUR COUNTS

Crossing	Direction	1970	1980	Annual Increase
Gertrude	Northbound	1,120	1,441	2.6%
	Southbound	585	791	3.1%
	Combined	1,705	2,232	2.7%
Gertrude & Victoria	Northbound	1,405	1,757	2.3%
	Southbound	885	1,178	2.9%
	Combined	2,290	2,935	2.5%

TABLE 3-3

ZONE TO ZONE TRAVEL TIMES

Zone	Travel Time in Seconds to Gertrude Crossing	to 10th Avenue Crossing	to 21st Avenue Crossing
1	218	249	351
2	160	192	295
3	94	75	167
4	168	57	101
5	76	48	147
6	68	184	279
7	104	114	216
8	126	118	106
9	240	195	163
10	179	172	236
11	212	300	354
12	249	314	374
13	305	298	350
14	368	365	413

TABLE 3-4

POPULATION AND EMPLOYMENT BY POPULATION ZONE

Zone	Population			Employment		
	1980	1991	2001	1980	1991	2001
1	800	1,292	1,740	50	74	99
2	991	1,290	1,640	58	74	99
3	1,623	1,695	1,780	536	710	932
4	1,847	1,875	1,900	495	652	858
5	398	400	450	66	74	82
6	4	0	0	1,856	1,856	1,856
7	1,868	1,900	2,200	940	1,072	1,229
8	418	1,134	1,370	132	165	198
9	2,572	2,924	3,030	247	330	437
10	2,018	2,100	2,200	330	429	569
11	0	0	0	1,526	1,526	1,526
12	1,970	3,190	3,650	3,036	3,696	4,521
13	2,432	2,918	3,430	99	124	148
14	1,619	1,752	1,845	1,254	1,254	1,254
15	1,717	1,800	1,900	825	825	825
16	3,725	4,445	5,120	165	198	231
17	3,206	3,679	4,136	165	198	231
18	63	60	60	16	33	50
Totals	27,271	32,454	36,451	11,796	13,290	15,145

3.5 Future Traffic Crossing Rogers Creek

The background to the land use data base used for traffic forecasting is outlined in Chapter 6 of this report. Population and employment projections for both 1991 and 2001 were prepared on a traffic zone basis for use in developing origin-destination tables of creek crossings in these two horizon years and a summary is presented in Table 3-4.

The methodology used to determine future year vehicular movements across Rogers Creek is based upon an expansion of existing traffic flows. It assumes that the existing trips between two zones will increase in proportion to the total trip generating activity in the two end zones, this trip generating activity being defined as the sum of population and employment. While this may be an oversimplification of the real world situation, it is an attempt to weight the differences between trip generation rates of residential and employment land uses between different categories of employment, and is felt to be at least a hypothesis that will give consistent and non-arbitrary results.

The following model represents the methodology adopted:

$$t_{ij}^{91} = t_{ij}^{80} \times \frac{(P_i^{91} + E_i^{91} + P_j^{91} + E_j^{91})}{(P_i^{80} + E_i^{80} + P_j^{80} + E_j^{80})}$$

where:

t_{ij}^{91} - number of trips between zones i and j forcasted for the year 1991

t_{ij}^{80} = number of trips between zones i and j in 1980 based upon the O/D survey

P_i^{91}, P_j^{91} = population of zones i and j respectively projected for 1991

E_i^{91}, E_j^{91} = employment in zones i and j respectively projected for 1991

P_i^{80}, P_j^{80} = estimated population of zones i and j in 1980

E_i^{80}, E_j^{80} = estimated employment of zones i and j in 1980

The result of this procedure produced increases in the total number of creek crossings of only one percent per annum and, although this is a direct reflection of the projected growth in the relevant population and employment, it is considered to be low when viewed in the light of past traffic growth. Therefore, the total creek crossings were increased by a further five percent overall for each eleven or ten-year interval in order to consider a "worst case situation."

The forecasted origin-destination tables of creek crossings for 1991 and 2001 are shown in Tables 3-5 and 3-6 respectively. The distribution of trip origins and destinations for vehicles crossing the creek in 1991 is shown diagrammatically in Figure 3-3. Note that desire lines simply join up the centroid or centre of an origin zone to the centre of a destination zone, and therefore a considerable amount of dispersion around this desire line must be assumed. Note also that the width of the desire line (or in other words, the number of trips between the two end zones) is also a function of the size of zones themselves, this "size" being itself a function of population density, area covered by the zone and employment type and intensity.

The total number of trips crossing Rogers Creek are therefore anticipated to increase as follows:

	24 Hours (All Crossings)	Northbound P.M. Peak Hour (Gertrude and Victoria)	Growth Factor
1980	27,973	1,757	1.00
1991	32,403	2,041	1.16
2001	37,782	2,373	1.35

3.6 Evaluation of Traffic Impact of Alternative Schemes

In order to assess the impact of the alternative bridge crossing sites on traffic, an analysis of the changes in total travel time was carried out using the major zonal interchanges of base data trips:

(a) Within the City of Port Alberni only (i.e. zones 1 to 14). (This was because trips involving an external zone have much longer travel times and it was felt that if these were included their magnitude would overshadow any differences in local trip lengths.)

(b) For all trips.

The three alternatives considered in this analysis were as follows:

I: No new bridge.

II: New bridge at 10th Avenue.

III: New bridge at 21st Avenue.

The method used here was as follows: firstly, typical travel speeds on each link of all major roads in the City were determined, based upon the results of travel time and delay surveys carried out as part of this study; secondly, the minimum path between the centroids of the two zones of each zonal pair was selected and the travel time between these two centroids calculated using the selected speed and length of each link making up the path - this was done for each of the three crossing sites; thirdly, the number of trips in each zonal pair was then multiplied by the average travel time and all totals aggregated - once again for each scheme. Where travel times using alternative crossings were less than 30 percent different, the trips were distributed to both crossings, the amount of this distribution being dependent upon the difference in travel times. Note that any likely capacity restrictions on the bridges themselves were ignored.

The impact of each bridge crossing on traffic is summarized in Table 3-7.

TABLE 3-5

24-HOUR TRIP TABLE 1991

Origin Zone	Destination Zone 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
1	-	-	-	-	56	72	72	152	252	263	95	216	0	44	-	-	-	-	1222
2	-	-	-	-	24	198	264	128	72	219	88	418	24	44	-	-	-	-	1479
3	-	-	-	-	66	219	483	168	330	791	241	1275	239	154	-	-	-	-	3966
4	-	-	-	-	66	330	418	155	330	836	154	1121	308	197	-	-	-	-	3915
5	0	0	176	66	-	-	-	-	-	-	-	-	-	-	0	48	21	0	311
6	96	241	286	352	-	-	-	-	-	-	-	-	-	-	197	264	154	0	1590
7	120	132	528	550	-	-	-	-	-	-	-	-	-	-	176	110	263	0	1879
8	76	135	280	156	-	-	-	-	-	-	-	-	-	-	0	78	53	0	778
9	48	24	396	484	-	-	-	-	-	-	-	-	-	-	44	0	66	0	1062
10	216	176	704	946	-	-	-	-	-	-	-	-	-	-	132	396	307	0	2877
11	48	21	176	197	-	-	-	-	-	-	-	-	-	-	66	176	197	0	881
12	96	360	681	1121	-	-	-	-	-	-	-	-	-	-	308	624	48	0	3238
13	78	144	312	286	-	-	-	-	-	-	-	-	-	-	44	48	192	0	1104
14	48	21	109	176	-	-	-	-	-	-	-	-	-	-	44	109	44	0	551
15	-	-	-	-	0	109	132	156	88	241	88	572	44	66	-	-	-	-	1496
16	-	-	-	-	0	176	176	104	96	505	241	743	96	88	-	-	-	-	2225
17	-	-	-	-	21	197	176	182	96	263	154	768	72	110	-	-	-	-	2039
18	-	-	-	-	0	0	0	0	0	21	21	0	24	0	-	-	-	-	66
Total	826	1254	3648	4334	233	1301	1721	1045	1264	3139	1082	5113	807	703	1011	1853	1345	0	30679

TABLE 3-5

24-HOUR ORIGIN/DESTINATION CREEK CROSSING TRIP TABLE 1991

TABLE 3-6

24-HOUR ORIGIN/DESTINATION TRIP TABLE 2001

Origin Zone	Destination 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
1	-	-	-	-	72	84	84	193	196	308	112	270	0	50	-	-	-	-	1369
2	-	-	-	-	30	216	336	168	78	260	104	532	30	48	-	-	-	-	1802
3	-	-	-	-	78	240	572	192	390	864	264	1624	280	268	-	-	-	-	4672
4	-	-	-	-	78	330	456	180	360	912	154	1326	364	198	-	-	-	-	4358
5	0	0	208	78	-	-	-	-	-	-	-	-	-	-	0	56	26	0	368
6	112	286	312	352	-	-	-	-	-	-	-	-	-	-	198	312	168	0	1740
7	140	168	624	650	-	-	-	-	-	-	-	-	-	-	192	130	312	0	2166
8	92	160	320	180	-	-	-	-	-	-	-	-	-	-	0	96	64	0	912
9	56	28	468	528	-	-	-	-	-	-	-	-	-	-	52	0	78	0	1210
10	252	208	768	1032	-	-	-	-	-	-	-	-	-	-	144	468	364	0	3236
11	56	26	192	198	-	-	-	-	-	-	-	-	-	-	78	208	216	0	974
12	120	420	868	1326	-	-	-	-	-	-	-	-	-	-	364	728	616	0	4442
13	90	180	364	338	-	-	-	-	-	-	-	-	-	-	52	56	224	0	1304
14	56	26	130	192	-	-	-	-	-	-	-	-	-	-	52	130	52	0	638
15	-	-	-	-	0	130	144	168	104	264	104	676	52	78	-	-	-	-	1720
16	-	-	-	-	0	208	208	128	112	598	286	868	112	104	-	-	-	-	2624
17	-	-	-	-	26	216	208	216	112	312	168	896	84	130	-	-	-	-	2368
18	-	-	-	-	0	0	0	0	0	26	26	0	28	0	-	-	-	-	80
Total	974	1502	4254	4824	284	1424	2008	1245	1352	3544	1218	6192	950	776	1132	2184	2120	0	35983

TABLE 3-6

24-HOUR ORIGIN/DESTINATION CREEK CROSSING TRIP TABLE 2001

TABLE 3-7

1991 VEHICLE MOVEMENTS VIA ALTERNATIVE BRIDGE LOCATIONS

Scheme	Scheme I	Scheme II			Scheme III		
Location of bridges	Gertrude	Gertrude	10th Avenue	Combined	Gertrude	21st Avenue	Combined
(a) Trips within City only. Percentage of vehicles using each crossing.	100%	40%	60%	100%	77%	23%	100%
Average journey time/ vehicle (seconds) for trips within City only.	332	332	259	288	311	376	326
(b) All trips. Percentage of vehicles using each crossing.	100%	47%	53%	100%	78%	22%	100%

It is very apparent from Table 3-7 that constructing a new bridge at 10th Avenue produces the most favourable result in terms of both improving travel times and load distribution between bridges. If a new bridge is located at 21st Avenue, there is only a minimal improvement in overall average travel times (based upon cross-creek intra-city trips only) from 332 seconds (Scheme I) to 326 seconds (Scheme II), and in addition, only 22 percent of the total vehicles crossing the creek would be diverted to this bridge. On the other hand, a new bridge at 10th Avenue reduces the average travel time from 332 seconds to 290 seconds/trip and could divert 53 percent of the traffic on to it if there was the capacity to handle the volume.

3.7 Bridge Lane Requirements

At present, there are six lanes of traffic across Rogers Creek to carry 28,000 ADT or 1,757 v.p.h. one-way northbound in the afternoon rush hour. This volume is forecast to increase to 2,370 v.p.h. in 20 years (2001).

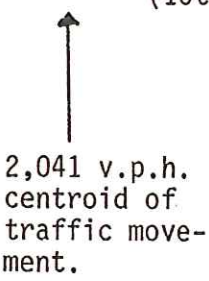
As a rule of thumb, a lane of traffic can easily carry 1,200 v.p.h. per lane, however this capacity is reduced by the traffic signal "green time" allocated to the street. Thus a street with 50 percent green time would carry $\frac{50}{100}$ x 1,200 = 600 v.p.h. per lane.

The present Gertrude and Victoria Quay bridges are both restricted in their capacities not by the bridges but by the signalized intersections on each side of the bridges (at Johnston and at Rogers). The Roger/ Gertrude intersection is particularly close to the Gertrude Street bridge and limits the increase in capacity that might be obtained through intersection improvements.

While some improvement in traffic flow could undoubtedly by obtained by traffic improvements to the intersections, there will always be some traffic congestion due to the volume of traffic to or from the eastern zones turning at these intersections.

A new crossing (or crossings) has thus been considered across Rogers Creek.

A schematic diagram of the three alternative bridge locations is shown below. This indicates the 1991 traffic volume (one-way afternoon rush hour northbound) and the number of traffic lanes required (one-way) to handle this volume at an intersection.



	Location A (Gertrude)	Location B (10th Ave.)	Location C (21st Ave.)
Scheme A (no new crossing)	2,041 v.p.h. 4 lanes	-	-

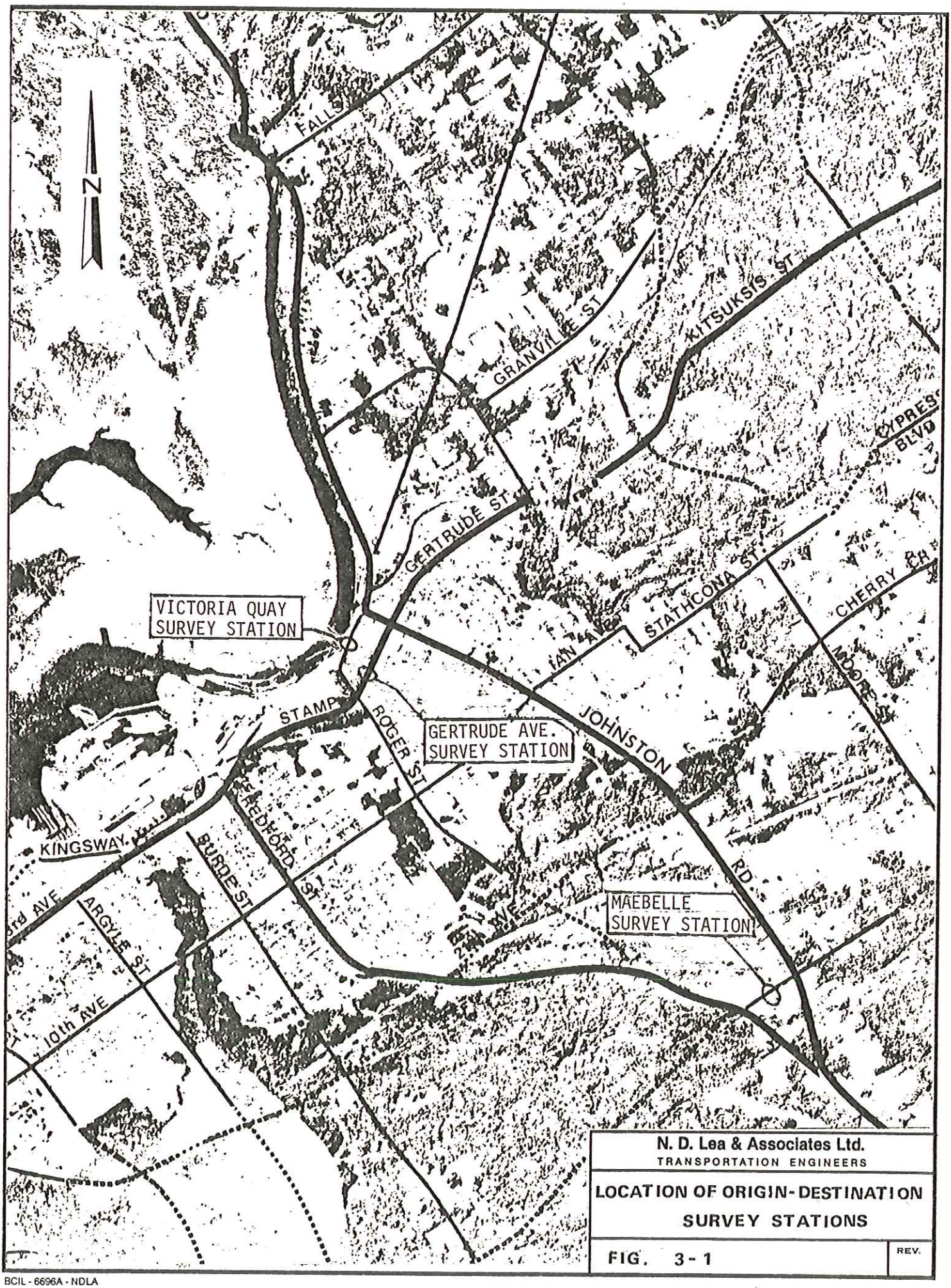
	Location A (Gertrude)	Location B (10th Ave.)	Location C (21st Ave.)
Scheme B (10th Ave. crossing)	981 v.p.h. 2 lanes	1,060 v.p.h. 2 lanes	-
Scheme C (21st Ave. crossing)	1,600 v.p.h. 3 lanes	-	441 v.p.h. 1 lane

The best traffic distribution is achieved by Scheme B (10th Avenue), although Scheme C achieves a better utilization of the existing bridges (3 lanes) with the construction of a single two-lane bridge.

Examination of the crossing at 10th Avenue (Location B) indicates that a two-lane bridge with widening of the north end span for northbound traffic at the Johnston intersection would in fact be sufficient.

3.8 Timing of Future Bridge Crossings

Based on the forecast traffic growth, it is felt that the first improvements to the crossing of Rogers Creek should be carried out fairly soon, say by 1985. If this resulted in the addition of two more lanes of traffic across the creek, then this represents a 33 percent increase, which would suffice until around 2001.



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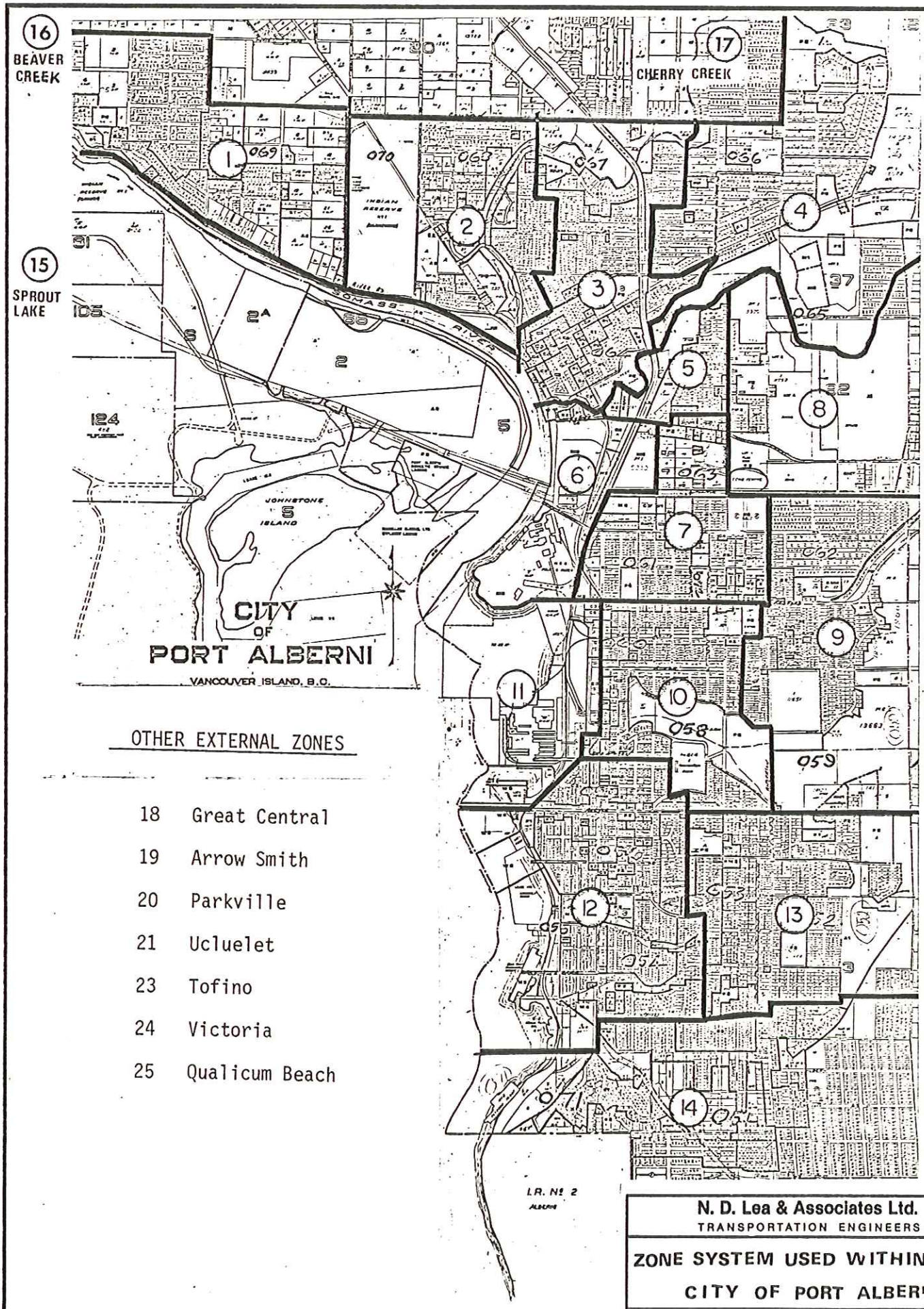
LOCATION OF ORIGIN-DESTINATION SURVEY STATIONS

FIG. 3-1 | REV.

BCIL - 6696A - NDLA



OTHER EXTERNAL ZONES

18	Great Central
19	Arrow Smith
20	Parkville
21	Ucluelet
23	Tofino
24	Victoria
25	Qualicum Beach

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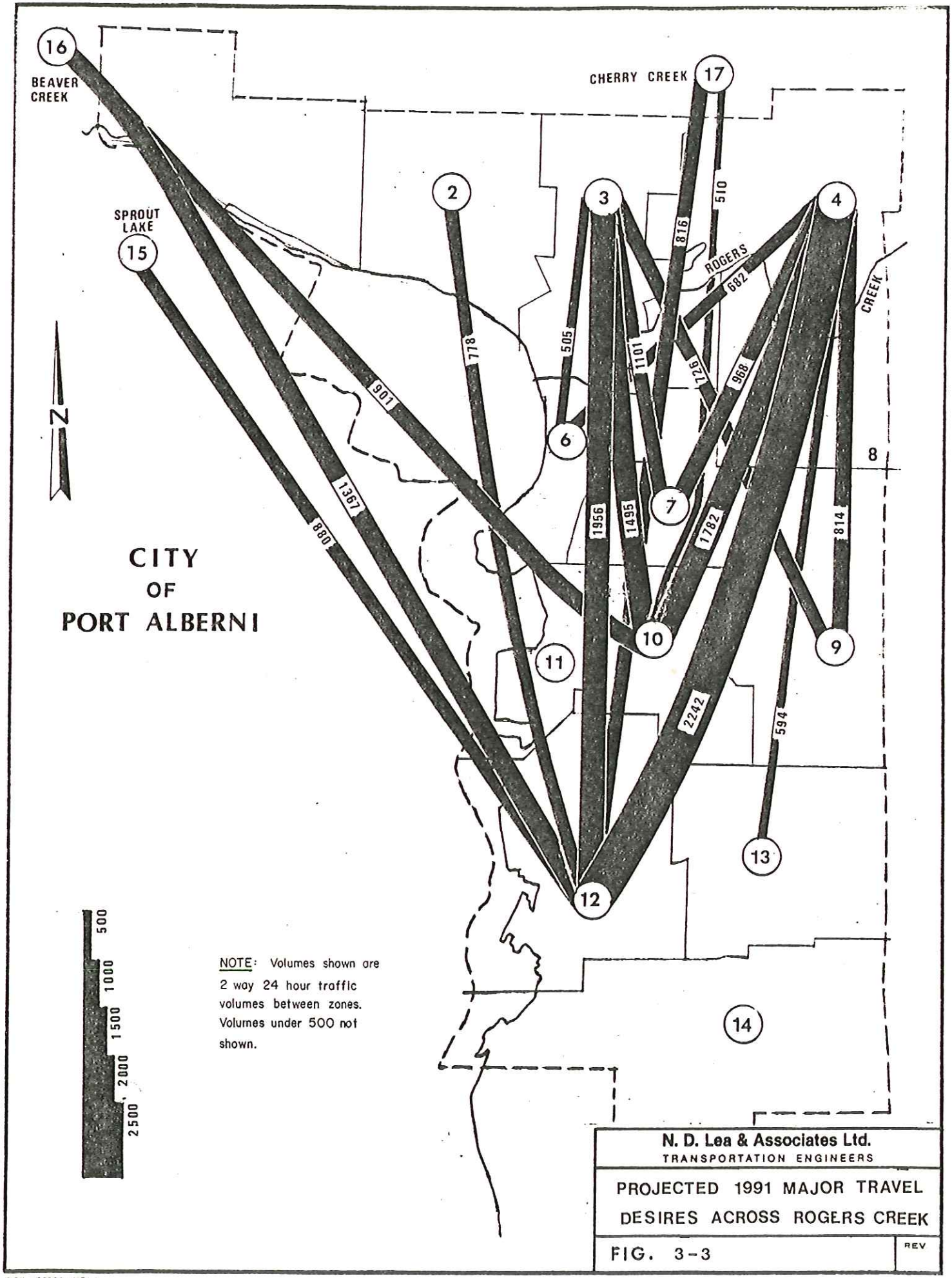
ZONE SYSTEM USED WITHIN THE CITY OF PORT ALBERNI

FIG. 3-2 | REV.

BCIL - 6696A - NDLA



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PROJECTED 1991 MAJOR TRAVEL DESIRES ACROSS ROGERS CREEK

FIG. 3-3 REV

BCIL - 6696A - NDLA

Chapter 4

SOILS AND GEOLOGY

4.1 General

Rogers Creek drains an area on the east side of the Alberni Valley and has cut a deep canyon-like channel from the point where it crosses Highway 4A to its junction with the Somass River. This portion of the channel appears to have been eroded since the end of the last glaciation, and throughout most of the channel bedrock is exposed intermittently on the lower slopes.

The bedrock consists of shale and fine-grained sandstone of the Nanaimo series of Cretaceous age and the beds are generally flat lying or gently dipping. Where the bedrock is exposed, it forms very steep slopes which tend to ravel down in small pieces. No deep-seated slumps in bedrock were observed.

Overburden materials consist of glacial till, glaciomarine silts and sands and alluvial sands and gravel. The glacial materials rest directly on bedrock and are mantled in places by thin deposits of stream-laid gravels formed as Rogers Creek cut down to its present level.

The overburden materials are exposed near the top of the banks and appear to vary from about 10 to as much as 40 feet thick. They have weathered to moderately steep slopes and, where the creek has cut down through the deeper deposits, appear to have slumped. No areas of active landsliding were noted.

In flood stage, Rogers Creek appears to occupy the whole of the channel between the steep banks. At normal and low water stages, there are narrow floodplains along the creek. Frequently the main channel is flowing right against the base of the steep slope exposing shale bedrock.

4.2 10th Avenue Extension Alignment

Figure 4-1 (Drawing No. 17-604-5-1) shows the profile across Rogers Creek on the 10th Avenue extension alignment. The locations of borings done by Ripley Klohn Leonoff in 1965, which are only slightly off this alignment, have been scaled from their Drawing No. D-838-1.

Test hole 2002 encountered 40 feet of sand and fairly soft silt or silty clay on the south bank and test hole 2006 on the north bank encountered about 30 feet of similar material. This probably represents the depth of glacial material over shale bedrock.

Test holes 2003, 2004 and 2005 met refusal, possibly on shale within a few feet of the surface.

On the south bank between the top of the slope at 12+00 and 13+30 and on the north bank between about 15+60 and the top of the bank near 17+25, the topography is somewhat hummocky. This may be an expression of ancient slumping of the overburden materials as the creek was cutting down.

On the south bank, shale is exposed between 13+30 and the toe of the steep slope at about 13+80. On the north bank, the steep slope between 15+30 and 15+70 is probably underlain by shale bedrock at shallow depth, although no outcrops were noted.

No bedrock was observed in the channel between the steep slopes, but the floodplain deposits probably are no more than 10 feet deep and rest directly on shale bedrock.

4.2.1 Proposed Structure at 10th Avenue Crossing

Figures 7-8 and 7-9 show the structure for this crossing.

The south abutment will be founded on end-bearing piles driven through sands and silts to refusal on shale bedrock or dense glacial till. The length of the piles will be about 40 feet.

At the location of the main piers in the valley bottom, shale bedrock will be encountered at depths of less than 20 feet and therefore spread footings will be preferred over piles. If uplift resistance is required, anchors in the bedrock can be designed.

On the north bank the abutment will be located on an approach fill up to 40 feet deep. The abutment will be founded on piles driven through the fill to refusal on shale bedrock at about el. 90.0.

The overburden material on the north bank appears to have been disturbed by slumping when Rogers Creek cut down to its present level. There is no evidence of active sliding at present and no sign of seepage zones. Therefore, it appears practical to build the approach fill on a 2:1 slope as shown. However, a detailed subsurface investigation of the slope is required and the design of the fill may involve stripping soft material, special subsurface drains, use of good quality fill material, extra careful construction procedures and compaction control and attention to surface drainage. All of these measures will add to the cost of this approach fill.

At both the north and south approaches to the bridge, special attention should be paid to the collection and control of surface runoff.

If design and construction proceeds for this structure, test pits or borings should be put down at each pier and abutment location to confirm subsurface conditions as well as the subsurface investigation required for the design of the approach fill on the north bank.

4.3 21st Avenue Alignment 6

Figure 4-1 shows the soils profile across Rogers Creek on this alignment.

The main channel of the creek is against the steep north bank and shale bedrock is exposed on the lower slope of this bank.

The floodplain on the south side of the channel appears to have been flooded during spring runoff. The auger hole on the floodplain passed through silty sand with organic material and met refusal on cobbles (probably close to shale bedrock at less than five feet).

The slope on the south bank does not show any exposures of bedrock, but abundant fragments of shale in the soil mantle indicate that shale bedrock is close to the surface. The test hole at the top of the bank encountered coarse cobbles and boulders, probably alluvial deposits laid down by Rogers Creek before it began to cut down to its present channel.

Rogers Creek crosses the alignment at approximately right angles and then makes a 90-degree turn to the left so that the alignment south of the south abutment runs along the top of the bank approximately parallel to Rogers Creek. Between Sta. 6+00 and 6+50, hummocky ground is suggestive of an old landslide which moved diagonally across the alignment toward the steep bank. This feature could be avoided by a relatively minor change in alignment.

On the north bank above the shale outcrops, the bank is somewhat flatter and abundant shale fragments in the soil suggest that shale bedrock is close to the surface.

About 100 feet east of alignment 6, a continuous exposure in a cut made for the storm sewer shows stiff silty clay and bouldery glacial till 15 to 20 feet deep overlying shale bedrock. Similar silty clay and bouldery material was encountered in test holes 80-5 and 80-6. No evidence of seepage was noted.

4.3.1 Proposed Structure at Alignment 6

N. D. Lea Figures 7-11 and 7-12 show the structure at alignment 6.

The approach to the north abutment is through a cut about 15 feet deep and will encounter silty clay and bouldery glacial till similar to that exposed in the cut a few hundred feet to the east. The cut may reach shale bedrock.

The north abutment will be on or very close to shale bedrock, and spread footings rather than piles will be the foundation type.

At the site of the main pier on the floodplain, shale bedrock will be encountered at shallow depth (less than 20 feet and possibly less than 10 feet). Spread footings rather than piles will be the preferred foundation type. If uplift resistance is required, anchors drilled into the bedrock can be designed to meet this need.

On the south bank, granular alluvial materials are exposed near the top of the bank and were encountered in the auger hole 50-10. The south abutment can be founded on these granular materials, on dense glacial till or shale bedrock, at depths of less than 20 feet. Spread footings rather than piles will be the preferred foundation type.

If this alignment is chosen for design and construction, a back-hoe test pit should be dug at the selected location of each abutment and the main pier to confirm the exact depth to firm bearing material.

4.4 21st Avenue Alignment 4

Figure 4-1 shows the soils profile across Rogers Creek along Alignment 4. This alignment crosses the generally flat upland area south of Rogers Creek and meets the steep valley wall at about right angles. On the north side of the valley, the alignment follows a narrow ridge which is bounded on the west by a gully partially filled with garbage and on the east by a near vertical cliff of shale which has been undercut by Rogers Creek. The narrow ridge severely restricts the alignment and from a long term point of view, would cause some concern regarding maintenance and stability.

Shale is exposed on the steep slopes on both sides of the valley at this alignment. Auger holes 80-3 and 80-8 were put down at the top of the bank and test holes encountered silty clayey material similar to that exposed in the gully to the west. Both were stopped at three to four feet by cobbles and roots.

Based on the topography and exposures in the nearby gully, it appears that up to 25 feet of glacial till and stiff silty clay overlies shallow bedrock at the top of the bank.

Material on the floodplain is silty sand and fine gravel with a mixture of organic material, probably 5 to 10 feet deep over bedrock.

4.4.1 Proposed Structure at Alignment 4

N. D. Lea Figure 7-10 shows the structure at alignment 4.

Exposures on both sides of the ridge on the north approach to the bridge together with the results from auger holes indicates that silty brown clay and glacial till with boulders overlies shale bedrock. At the north abutment, shale bedrock will be encountered within 20 feet or less and spread footings will be a preferred foundation.

At the main piers on the floodplain, shale bedrock will be encountered within 20 feet and probably at 10 feet or less. The piers can be founded on spread footings and if uplift resistance is required, anchors drilled into bedrock can be designed.

At the south abutment, stiff brown clay and glacial till overlies shale bedrock. Firm bearing on bedrock or dense glacial till will be encountered at less than 20 feet and spread footings will be the preferred foundation.

The ridge which forms the north approach to the bridge is undercut by Rogers Creek on the east side and a shallow slide has developed in glacial material on the west side. The approach will be in a shallow cut which will increase the width of the top of the ridge. Nevertheless the ridge severely constrains the alignment and the cliff on one side and slide area on the other will cause concern and may require expensive maintenance in the future. For this reason, alignment 4 is not recommended unless there are very large advantages compared to the alternatives. If this alignment is chosen for construction, a backhoe test pit should be put down at each abutment and pier location to confirm depth to firm bearing.

4.5 Culvert Alternatives

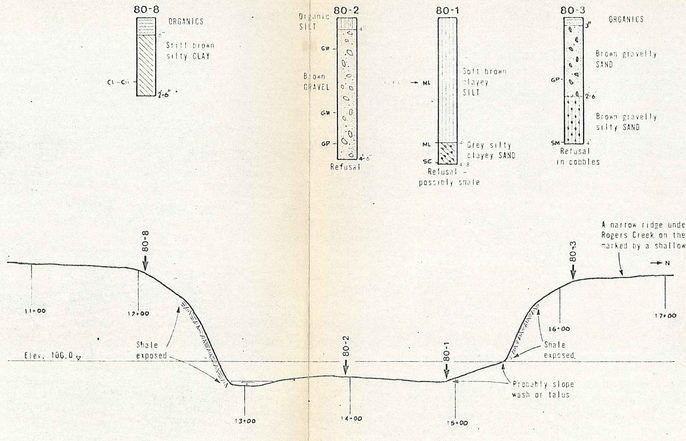
A 16-foot diameter multiplate culvert or a 16-foot concrete arch with a 28-foot base to pass the flow of Rogers Creek through a major fill has been suggested as an alternative to the bridge structures at all three alignments.

With proper preparation of the bed for the culvert and foundations for the arch, there are no geotechnical constraints on this proposal. The shale foundation will not settle significantly under the load imposed by the fill.

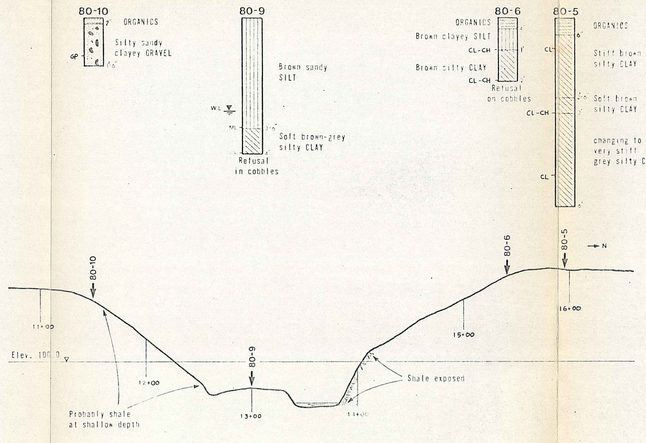
The fill material would have to be selected and placed using carefully controlled construction procedures and sequence.

Access for haul roads to construct the fill in the narrow canyon would be difficult.

Environmental and aesthetic considerations would have to be accounted for in any evaluation of this proposal.

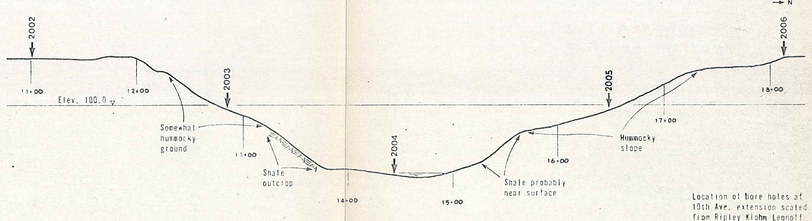


TWENTY FIRST AVE. - ALIGNMENT 4



TWENTY FIRST AVE. - ALIGNMENT 6

For summary of Test Hole Data see Ripley, Klohn & Leonoff Ltd. Dwg. D - 838-1 in Appendix F.



10th AVE EXTENSION

Location of bore holes at 10th Ave. extension scaled from Ripley Klohn Leonoff drawing D-838-1.

FIG. 4-1

N. D. Lea & Associates		H.W.N.
SOILS & GEOLOGY		D.W.S.
		May 20, 1980
Rogers Creek Crossings		1" = 60'
THURBER CONSULTANTS LTD., Geotechnical Engineers		17-604-5-1

Chapter 5

ENVIRONMENTAL IMPACT

5.1 Fisheries

Rogers Creek supports sea-going (anadromous) and resident fish up to the waterfall below Stoakes Creek. The type of fish using the creek and their spawning-rearing periods are shown in the following table:

Fish Type	Approximate No. of Adults	Sensitive Spawning-Rearing Period
Coho and Chum Salmon	500	Oct. 15 - May 1
Steelhead	100	Dec. 1 - July 1
Cutthroat Trout	2 - 3,000	Feb. 1 - July 1
Dolly Varden	few	Oct. 15 - May 1

On this basis, floodplain construction work, e.g. pier construction, should be restricted to the period from July 1 to October 15. Spawning and rearing habitat for these species are the gravel bars and shallow pools that exist throughout most of the streambed (see photos). Angling is restricted to persons under 16 or over 64 and there is a closure on Cutthroat trout December 1 to March 31.

Some photographs of the area showing suitable spawning areas are given in Appendix A (photos 20, 21 and 22)

The following guidelines are provided to protect fish habitat:

- Restrict floodplain construction activity to the period July 1 to October 15.
- Keep construction equipment out of streambed unless absolutely necessary.
- Avoid soil erosion and stream sedimentation, particularly in winter months.

- Do not allow structures on the floodplain to initiate bed or bank erosion (consider bank protection if required).
- Maintain streambank vegetation intact to the greatest degree possible and keep all clearing debris out of stream.

5.2 Recreation

There is only a small amount of recreational use of the ravine near or between the 10th and 21st Avenue crossing sites. Although there is long-term potential for use of the ravine as a linear park, there are no plans at present to develop road or improved trail access into the ravine in this area. Present use of the ravine is generally below 10th (Southgate Loop Trail and at Rogers Creek Park) or well above 21st (Rogers Creek Trail to the falls). Figure 5.1 shows the location of main hiking or walking trails, views and stream bank access points.

The Glenwood Sports and Recreation Area will continue to attract recreationists to the south side of Rogers Creek in District Lot 92. An unofficial bike and jogging trail follows the top of the ravine in this area. Future recreational use of the ravine may develop from this direction.

Minimum disturbance of natural vegetation and reclamation of construction access and work areas will maintain the recreational potential of the ravine. A minimum separation of the proposed extension to Roger Street of about 400' (stream to road centre lines in plan view) appears advisable to separate future subdivision and traffic from park use and natural areas.

5.3 Vegetation

Forest vegetation near the crossing sites consists of second growth cedar, hemlock, fir, maple and alder (see photos). Due to the steepness of the banks and narrow floodplain, forest vegetation extends to the edge of the creek. Erosion and wind damage contribute a small amount of debris to the creek each year.

There would be a minor amount (less than 1 ha) of clearing required on approaches to the 10th Avenue crossing. At 21st Avenue, however, there would be considerable clearing (3.5 ha) required for the south side approaches and road connections. A bridge would be above most vegetation in the ravine at either location.

Grubbing of stumps should be restricted to actual construction sites where footings or fill would be placed. All construction areas would need to be revegetated with suitable plant materials. Attractive roadside landscaping can be used to blend the roadway with the surrounding vegetation.

5.4 Erosion and Sedimentation

Field observations of bank stability and erosion potential are reported in Chapter 4. Any long-term erosion problems caused by cuts, fills or stream bank undercutting should be avoided to prevent sedimentation of the creek. Direct drainage from roadside ditches into the creek should also be avoided.

As wide a strip of uncleared land as possible should be left between construction sites and the stream. Hand clearing and the use of rubber-tired equipment would minimize soil disturbance in the ravine. Hydroseeding of a grass cover on steep slopes will also reduce surface erosion. More detailed sediment and erosion control requirements should be developed at the design stage.

5.5 Culvert Design Option

Fish passage and habitat problems associated with culvert installations have been dealt with in some detail in two publications by B. G. Dane*.

* B. G. Dane 1978. A review & Resolution of Fish Passage Problems at Culvert Sites in British Columbia. Fisheries and Marine Service Technical Report No. 810, Fisheries and Environment Canada, B.G.

* Dane 1978. Culvert Guidelines: Recommendations for the Design & Installation of Culverts in British Columbia to Avoid Conflict with Anadromous Fish. Fisheries and Marine Service Technical Report No. 811, Fisheries and Environment Canada.

The passage of fish through a culvert depends upon the swimming ability of the fish and the hydraulic conditions at the site. A delay of as little as one day is thought to have serious consequences for spawning salmon and steelhead trout. Following are guidelines that would have to be considered if a culvert was used for the Rogers Creek Crossing:

- The average water velocity should not exceed 0.9 m/s throughout the migration period.
- The depth of water should not be less than .23 m in the culvert during the migration period;
- Any drop in water surface profile should not exceed 0.31 m.
- The maximum period during which the above conditions are not met should not exceed 3 consecutive days.

For Rogers Creek it would be difficult to determine in advance whether or not these guidelines could be successfully met unless the culvert was significantly oversized and preferably of an arch span (bottomless) type.

Other disadvantages of the culvert option would be the need to place a large amount of fill in the ravine, thereby increasing the amount of clearing and potential for stream sedimentation and detracting from the natural aesthetic values. From an environmental viewpoint, the culvert option should only be given serious consideration if there would be a significant (e.g. 20 percent) cost saving as compared to a bridge design.

5.6 Alignment Options

The three alignment options reviewed are shown on Figure 5-1. Alignment 1 is at 10th Avenue and alignments 4 and 6 are at 21st Avenue.

Alignment 1 is generally preferred in that it would intrude the least into potential park land, require the least clearing of natural vegetation and would only subject the lower part of the stream to any sediment that might enter at the crossing. The connection of 10th Avenue to Ian

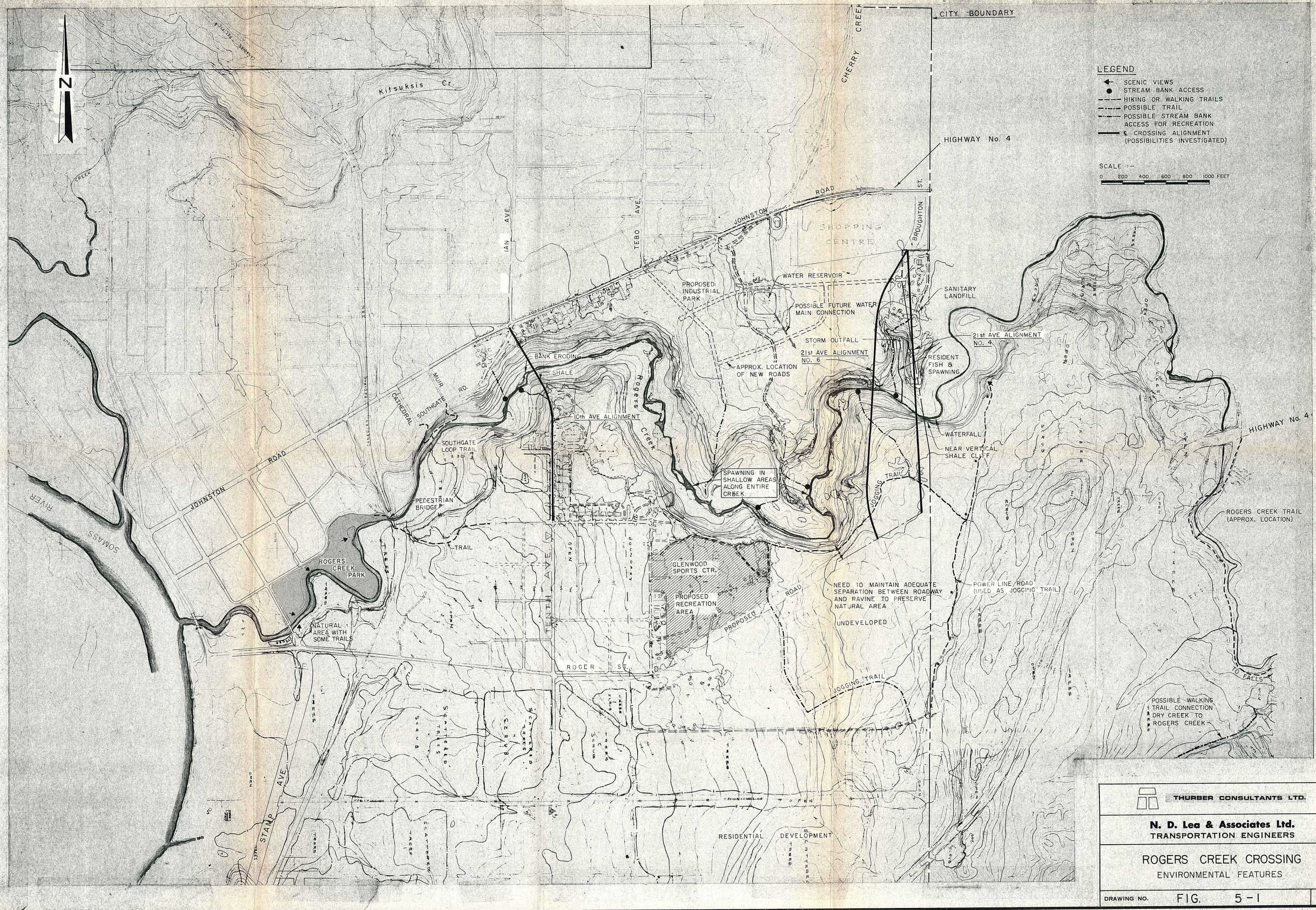
Avenue by a bridge would have only a minor environmental impact restricted primarily to the construction period. The structure may be visible from the Southgate Loop Trail and traffic noise would detract somewhat from the natural setting in this vicinity.

The south side of Rogers Creek at 21st Avenue is undeveloped, but has a potential for park use. Although there are no plans at present to promote recreational use of the ravine in this vicinity, it is an important natural feature in the community and would be an amenity to future residential developments in District Lot 92. Although the impact of a road would be restricted primarily to the right-of-way, a crossing at 21st would represent a much greater intrusion into potential park land than would occur at 10th Avenue. One possible advantage of a crossing at 21st Avenue is that it could be used for a future water main connecting to the reservoir near Johnston Road, thereby reducing the need for a separate right-of-way across the ravine. However, a separate water main right-of-way could serve as a riding or walking trail and blend in with other recreational uses.

Of the two alignments at 21st, No. 4 is preferred somewhat over No. 6 in that it would have less restriction on future ravine use. However, more detailed field work would be required before a definitive analysis could be made between alignments 4 and 6.

5.7 Bridge Design Options

Several options exist for the location and number of footing structures at either crossing site. Generally speaking, the fewer the number of footings that are constructed in the ravine, the lower the environmental impact. Also, footings below the high water mark should not cause significant channel constriction or erosion by deflecting the flow. However, geotechnical and structural requirements are generally more demanding than are environmental in determining the number and location of piers. Any architectural features that can be incorporated into the bridge design to enhance its attractiveness would be desirable considering the park setting in which it would be located.



THURBER CONSULTANTS LTD.

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TRANSPORTATION ENGINEERS

ROGERS CREEK CROSSING
ENVIRONMENTAL FEATURES

DRAWING NO. FIG. 5-1 REV.

Chapter 6

PLANNING AND SOCIO-ECONOMIC

6.1 Background

6.1.1 Introduction to Port Alberni and Environs

Port Alberni is situated within the Alberni-Clayoquot Regional District, at the head of Alberni Inlet in south-central Vancouver Island. The economy is almost wholly dependent upon the forest industry and, more particularly, upon MacMillan Bloedel Ltd., which operates a pulp mill, a plywood plant and two sawmills within the city and extensive logging operations in the forest beyond. The area has been the scene of continuous forestry operations since 1864, but received its major growth impetus and achieved its status as one of British Columbia's principal forestry centres with the opening of the pulp mill in 1948.

Port Alberni has developed on the west-facing slopes of the east shore of Alberni Inlet and the Somass River. The four MacMillan Bloedel mills, along with related port installations, occupy almost 2½ miles of the shoreline, with the community itself lying inland of and parallel to these industrial installations. Accordingly, the form of the community has evolved into an elongated north-south configuration, being approximately 3½ miles long in the north-south direction and averaging slightly less than one mile in width in the east-west direction.

In addition to the City of Port Alberni itself, residential development includes the rural and suburban settlements of Sproat Lake, Beaver Creek and Cherry Creek, which have become established in the Alberni Valley to the north-west of the City, and on the shores of Sproat Lake some three miles west of town.

6.1.2 Existing Physical Conditions

The City's hillside site is bisected by two major east-west ravines; known as Owatchet (or Dry) Creek and Rogers Creek, which effectively divide the community into three distinct areas. The northernmost of these areas is further subdivided by Kitsuksis Creek.

With a few minor exceptions, the basic street pattern is that of a rectangular grid composed of streets in the north-south and east-west directions. Because of the City's elongated configuration, the north-south streets have the more dominant role to play in linking together the various parts of the community. The north-south streets which cross the major ravines have developed into the principal arterials, these being the Third-Stamp-Gertrude Avenue alignment, which crosses both Dry and Rogers Creeks; and 10th Avenue, which crosses Dry Creek but terminates at Rogers Creek. The improvement of north-south movement through the location and subsequent construction of another Rogers Creek crossing is an underlying objective of the present study.

The residents of the area are served by a number of independent community water systems and by individual water systems. The community systems include the City of Port Alberni, the Beaver Creek Improvement District, the Cherry Creek Waterworks District and the Sahara Heights Water Users Community. Houses outside of these areas generally rely on wells, on intakes from streams or, in the case of many houses on Sproat Lake, upon intakes directly in to the lake.

The water system serving the City of Port Alberni consists of two systems that were constructed to serve the City of Alberni and the City of Port Alberni before their amalgamation in 1967. The source of water for the northern system is the Somass River, and for the southern system, China Creek and Bainbridge Lake. Although the City is proceeding to unify the two systems, they

still operate to some degree independently. Of particular relevance to this study is a plan to extend across Rogers Creek a water main from the China Creek System to provide gravity-fed service to the higher-elevation residential developments on the north side of the City.

All developed areas of the City are served by sanitary sewers. The overall system is comprised of five catchment areas, each consisting of a network of laterals and mains which flow by gravity to the base of the hill along the inlet. Here a network of force-mains and pump stations conveys the sewage under the Somass River to a treatment plant on the west side of the river. No need is foreseen for any future sewer lines to cross Rogers Creek above the Gertrude/Stamp alignment. There are no community sewers outside the City, although some preliminary planning is under way to consider extending the City system into adjacent areas of Cherry Creek in the north-east corner of the City, as part of a possible boundary extension.

6.2 Population and Land Use Forecasts

6.2.1 Introduction

For purposes of this study, the estimates of population growth for the City of Port Alberni and for the Alberni-Clayoquot Regional District have been derived from two sources:

(a) The recently completed economic study of the Alberni-Clayoquot Region prepared by AVG Management Science Ltd. of Vancouver on behalf of the Provincial Government and the Regional District Economic Development Commission.

(b) The publication "British Columbia Population Projections - 1979-2001," produced by B.C. Research in September 1979.

The B.C. Research forecasts alone were used for relevant areas outside the Alberni-Clayoquot Regional District.

6.2.2 Population and Employment Forecast

The detailed method of forecasting the population by community is given in Appendix B. The results are as follows for the Regional District.

Area	Year 1980	1991	2001
City of Port Alberni	19,562	22,449	25,235
Beaver Creek	3,725	4,274	4,805
Cherry Creek	2,721	3,122	3,509
Beaufort	485	557	627
Sproat Lake	1,717	1,970	2,214
Ucluelet-Tofino	2,979	3,419	3,844
Bamfield	842	966	1,086
Indian Reserves (Alberni Area)	356	409	460

The above figures assume that each community will continue to have the same percentage of overall Regional District population at each forecast period. Through discussions with City and Regional District officials, it is indicated this may not happen because of various constraints. Thus in the more detailed examination of traffic zones (see Section 6.3), adjustments have been made accordingly.

The proposed employment forecasts for the Regional District are as follows:

Employment Sector	Year 1980	1991	2001
Primary	2,850	3,150	3,150
Secondary	5,540	5,350	5,350
Tertiary	5,050	6,924	8,838
Total	13,440	15,424	17,338

6.2.3 Distribution of Future Population and Employment

The distribution of the future population has been undertaken by the traffic zones used in the traffic analysis (see Chapter 3) and the method is described in detail in Appendix B.

6.3 Planning Evaluation of Alternative Alignments

6.3.1 Impact Upon Community Plan

A fundamental concept of the Official Community Plan for Port Alberni is the acknowledgement and reinforcement of the natural division of the City by ravines into three "Districts". These three districts are referred to in the Plan as the "South", "Central" and "Oldtown" Districts. Each district is in turn made up of a number of "Neighbourhoods". The Plan defines a "Neighbourhood" as ..."an area relatively free of through traffic within which shall be located an elementary school adjoining, where possible, a neighbourhood playground and a park designed for the passive recreation of all residents of the neighbourhood. Ordinarily, the boundaries of neighbourhoods within a district will follow collector streets." The relationship between Neighbourhoods and Collector Streets is further defined by the statement ....."The collector street system within each district is designed to take neighbourhood traffic to and from community facilities (including the arterial highway system) while inducing as little traffic as possible onto streets within residential neighbourhoods."

With respect to the areas in the vicinity of the proposed Rogers Creek crossing alignments, the Community Plan proposes the development of a neighbourhood bounded by Roger Street, Rogers Creek, Glenwood Drive and the future parkland east of Anderson Street. This area conforms to the Plan's criteria of a neighbourhood, being

bounded by arterials, collectors and natural features and containing its own elementary school (Glenwood). It is understood that the School Board has considered the possibility of "mothballing" this school, but no decision has been made in this regard. If the 10th Avenue alignment were selected, it would create an arterial along 10th Avenue that would bisect this area, and would thus seriously jeopardize its potential to develop into a coherent neighbourhood as envisaged in the Community Plan.

The neighbourhood pattern proposed in the vicinity of the potential 21st Avenue crossing would be reinforced, rather than undermined, if the crossing were to go in this location. In this vicinity, a neighbourhood is defined by 10th, Redford, Roger and the proposed 21st Avenue Ring Road. Construction of the 21st Avenue crossing would result in the completion of the easterly and northeasterly extension of Roger, as well as providing a link in the eventual realization of the proposed east-side ring road. It would also provide the necessary road access and storm drainage required to open up for subdivision the municipally-owned land north of King Street.

A second basic concept of the Official Community Plan is the establishment of a heirarchy of streets comprising arterials, collectors and local streets. Arterials are intended to convey traffic between Port Alberni and other areas of the Island and to allow "easy passage through and around Port Alberni of traffic routing through the Alberni Valley"; collectors are intended to take neighbourhood traffic to and from community facilities, while local streets are intended to provide direct access to properties.

One of the key links in the arterial network for the City is the proposed Eastern Ring Road running northward from the south end of Anderson Avenue, along the eastern edge of the urban area, and crossing Rogers Creek along the 21st Avenue alignment. If the Rogers Creek Crossing is constructed at 10th instead of 21st,

then 10th Avenue would be required to carry the traffic otherwise intended to be accommodated on this proposed Eastern Ring Road, as well as its normal volume of internal City traffic. Major disadvantages of such a situation would include:

(a) Unsuitability of existing 10th Avenue right-of-way. 10th Avenue has only a 66-foot wide right-of-way, with innumerable driveway accesses throughout its length and with cross street intersections spaced only some 500 feet apart.

(b) Incompatibility of future traffic. Tenth Avenue presently serves as a major collector for city traffic, conveying it between various city-oriented origins and destinations, such as neighbourhood and local commercial establishments, recreational facilities, etc. If 10th became an arterial, then not only would there be an overall increase in traffic volume, but there would also be additional types of traffic, including through-movement of trucks, that would be in conflict with this existing "collector" traffic.

(c) Incompatibility with adjacent land-use. Throughout its length, 10th Avenue is fronted by a variety of land-uses, including single family dwellings, apartments, shops and stores, recreational buildings and schools. The amenity of these land-uses would be seriously diminished due to noise, traffic hazards and air pollution if additional volumes of arterial traffic were to be imposed upon 10th Avenue. Moreover, three elementary schools, Calgary, Eighth Avenue, and Hilton, have their catchment-areas traversed by 10th Avenue. Its elevation to the standard of an arterial would magnify the traffic hazard to school children required to cross 10th Avenue.

Accordingly, in terms of its impact upon the Community Plan, it is concluded that 21st Avenue is the preferred location for the crossing.

6.3.2 Impact Upon Regional Plan

In regional planning context, the proposed east side ring road, which would include a 21st Avenue crossing, has been perceived as an important element in a regional highway network since the 1971 Regional Plan was prepared. The ring road is intended to facilitate the movement of traffic between peripheral developments to the north and south of the City, without the need for this traffic to penetrate the more heavily urbanized areas of the City. Additionally, the ring road has the potential to link up with a possible future highway system heading southward toward Bamfield and Lake Cowichan. The construction of such a highway system would make Port Alberni a strategic crossroad of major north-south and east-west highways serving southern Vancouver Island and could greatly enhance its competitive position within the Island's economy.

If 10th Avenue were selected for the Rogers Creek Crossing, any extra-regional traffic using this north-south highway system would travel right through the centre of the city, instead of being able to bypass it; to the disadvantage of both the City and the highway user.

In terms of impact upon the Regional Plan, it is therefore concluded that 21st Avenue is the preferred location for the proposed crossing.

6.3.3 Impact Upon Community Cohesion

Although 10th Avenue functions as a collector street south of Roger, to the north of Roger it is virtually a dead-end street. The residential area in this location has evolved as a relatively quiet neighbourhood enjoying convenient access to commercial and community facilities, proximity to a wilderness area (Rogers Creek Ravine) and freedom from heavy traffic flows. Although it was beyond the scope of this study to conduct sociological studies into the values, attitudes and day-to-day living pattern of the

residents in this neighbourhood, a visual survey of the area indicates a fairly high degree of neighbourhood cohesiveness, as indicated by housing types and quality, etc. The only significant departure from the general pattern of single-family homes is a small enclave of commercial uses on 10th near Roger, which the Community Plan proposes to phase out through redevelopment to apartment uses.

If the 10th Avenue alignment were selected, pressure would develop not only to retain these existing commercial uses, but, in all likelihood, to expand them. With additional commercial development along 10th, together with greatly increased traffic volumes, the small remaining areas of housing to either side would become isolated pockets, too small to function on their own as a cohesive neighbourhood. Of particular concern would be the more westerly pocket, which would be squeezed between arterial and commercial disamenities along its eastern edge, and light-industry to the west.

To the north of Johnston Street, a 10th Avenue crossing would link up with Ian Street, transforming it from a local residential street into an arterial. Moreover, to enable this arterial to cross Kitsuksis Creek, a jog in the alignment would be required, resulting either in the removal of some existing housing or in an encroachment upon the park and school grounds at Mount Klitsa Junior Secondary School. This arterial route would prove extremely disruptive to the existing residential neighbourhood north of Johnston Street, and to the School/Park site itself.

With respect to the impact of a 21st Avenue crossing upon the community north of Johnston Street, much depends upon the eventual pattern of arterials being proposed in the long-range network plan, which is still in a state of flux. Current proposals would have the 21st Avenue crossing proceed northward across Johnston through vacant City-owned land to join the present alignment of Cherry Creek Road at approximately the northern boundary of the City. This route would bypass the houses on that part of Cherry Creek Road lying within the City,

but beyond the City would cut through the middle of the small community centred upon the intersection of Moore Street and Cherry Creek Road. The resulting eventual volumes of traffic would have a serious detrimental effect upon this community.

This condition could be relieved if an alternative route were selected to the east of Cherry Creek Road, but at the expense of pushing a new highway through Agricultural Reserve Land.

In summary, it is concluded that there will be problems and disadvantages in the area north of Johnston, regardless of whether the crossing is at 10th or 21st. However, the disadvantages associated with a 10th Avenue crossing appear greater than those associated with a 21st Avenue crossing, because the total length of arterial cutting through established built-up areas is substantially greater.

6.3.4 Impact on Community Facilities

The most important public facility in the vicinity of the 10th Avenue crossing alignment is the Echo Centre, a major community centre containing an indoor pool, meeting rooms, craft studios, library, banquet facilities, museum, saunas, whirlpool and exercise and fitness rooms. Areas to the south of Rogers Creek already enjoy good access to this centre, which would be unaffected by any new crossing. Areas to the north of the Creek would benefit from such a crossing, but those northern areas of the City lying west of the E. & N. Railroad, as well as the suburban communities of Beaver Creek and Sproat Lake, could be expected to find the existing Gertrude Avenue crossing would continue to be more convenient than either a 10th Avenue or 21st Avenue crossing. A 10th Avenue crossing would be of more convenience for persons living roughly between Leslie Avenue and Cherry Creek Road, while a 21st Avenue crossing would be approximately equal in convenience to a 10th Avenue crossing for people living east of Cherry Creek Road. In terms of access to the Echo

Centre from the more distant areas of the Region, the 10th Avenue alignment is preferred.

Of some concern, however, is the impact which increased traffic volumes on 10th Avenue would have upon pedestrian accessibility to Echo Centre from nearby areas. The City's largest senior citizen home lies directly across 10th Avenue from the Echo Centre and senior citizens comprise an important segment of the Centre's clientele.

A planned facility that would be affected by the choice of a crossing alignment is an industrial area proposed for City-owned land behind (south of) the Alberni Mall Shopping Centre. The Community Plan indicates an industrial designation contiguous to the south side of the 21st Avenue alignment, and a major road in this location could assist in the initial development of the proposed industrial area, as well as providing it with good accessibility to the southern areas of the City. A 10th Avenue alignment on the other hand would do little to assist or promote this industrial area.

The impact of each potential crossing-alignment upon firefighting accessibility was examined by the City's Planning Consultants, W. J. Blakely and Associates, in 1970. This examination, consisting of time-travel plotting, indicated that a 10th Avenue crossing was slightly better than a 21st Avenue crossing, in that a "relatively small area north of the (Rogers Creek) Ravine will be less well served by a 21st Avenue crossing than by a 10th Avenue crossing."*

The impact of each potential crossing-alignment upon the trade areas of the City's commercial centres has been examined as a part of this study (see Appendix B). This examination concluded that the principal effect of a Rogers Creek crossing would be the enhancement of the competitive strength of Alberni Mall at the expense of the Downtown and 10th-and-Redford centres. However,

the magnitude of the impact would be virtually the same regardless of whether the crossing was constructed at 10th Avenue or 21st Avenue.

The Mount Klitsa Junior Secondary School, in the northeast part of the City, currently derives a portion of its enrollment from the residential areas south of Rogers Creek. Because of the present access routes across Rogers Creek via Gertrude and Maebelle Avenues are so circuitous, these students must be bussed to school. A Rogers Creek crossing would alleviate this condition; and of the two alternative crossing locations, 10th Avenue is considered preferable by School Board officials.

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* Letter from W. J. Blakely to J. Sawyer, City Manager, dated October 20, 1970.

Chapter 7

ENGINEERING DETAILS AND COSTS - ROAD AND BRIDGE

7.1 Standards

For the purpose of this study, the proposed crossing of Rogers Creek is assumed to be an urban arterial undivided street, with a posted speed of 50 km/h (30 m.p.h.). However, 70 km/h (40 m.p.h.) design speed is recommended for safety. Therefore, the following standards have been adopted:

Design Speed: - 70 km/h (40 m.p.h.)

Grade: - 5% desirable, 8% maximum

Width: - Four-lane facility on the approach roads and two-lane initially on the bridge with provision for additional two-lane bridge in the future.
Curb to curb width: 14.6 m (48 feet) plus 3.05 m (10 feet) for utility strip, sidewalk and boulevard.

A detail of the cross-section is shown in Figure 7-1.

7.2 Alignment Details

Each alignment was studied firstly in the office using topographical mapping. As this topographic mapping is in imperial scale, this study has also been done in imperial measurements. The alignment was then cut and located in the field and existing ground elevations taken. These were then compared with the levels taken from the topo mapping and in general quite good correlation obtained. Each scheme is described in the following sections, with the bridge details described in 7.5.

7.2.1 10th Avenue Route

The alignment and profile of 10th Avenue crossing is shown on Figures 7-2 and 7-3 respectively.

The existing 10th Avenue route is the base centre line for the south side of the crossing, and similarly Ian Avenue is the base centre line on the north. The actual bridge crossing is essentially on a tangent at right angles to the creek and ravine topography. The profile is essentially level with sufficient grade to provide good drainage.

Figure 7-2 also shows the extent of fill in the ravine for a concrete arch culvert scheme.

7.2.2 21st Avenue Route Alignment 4

The alignment and profile of alignment 4, 21st Avenue route, are shown on Figures 7-4 and 7-5 respectively.

As can be seen from the contours, the north side of the crossing is located on the narrow spur of land extending south from the present SPCA compound.

The profile of route 4 is shown in cut on both sides of the crossing location. This is especially important on the north side to attain a satisfactory width on the narrow spur.

7.2.3 21st Avenue Route Alignment 6

Alignment 6 plan and profile is shown on Figures 7-6 and 7-7. The north side is located as an extension of the existing road on the east side of the shopping centre and skirts the ravine with the storm culvert therein. The south side is located on the top of the Rogers Creek bank as it bends to the south and gradually climbs up to the general plateau level. Inspection in the

field reveals this route to be quite feasible and the visual impact will not be severe if the design is carefully handled.

7.3 Hydraulics

The estimation of Rogers Creek runoff is really only critical in analyzing flow for consideration of a culvert design. This flow has been calculated for a 100-year rainfall intensity using the Rational Formula Q_2CIA, where:

Q = volume of flow (cubic feet per second)
C = runoff coefficient
I = rainfall intensity (inches per hour)
A = Catchment area of creek (acres)

The catchment area was obtained from topographic maps of the area. The rainfall intensity (inches per hour) is ordinarily obtained from rainfall intensity curves for the catchment area. In this instance, rainfall curves were only available up to the 10-year storm. However, the 50-year and 100-year curves were also to be derived mathematically from the 2, 5 and 10-year curves by assuming that the 2, 5 and 10-year curves were of the form $I = T^x t^y$, where:

I = intensity (inches per hour)
T = return period of storm (year)
t = duration of storm (minutes)

Based upon these assumptions, the 50-year and 100-year discharges were estimated at 2,250 cubic feet/second (cfs) and 2,850 cfs. A 200-year flood would be approximately 3,110 cfs.

7.4 Culverts

Two types of culvert for passing Rogers Creek under a highway fill alignment were considered. The first method considered would make use of a corrugated metal pipe (CMP) approximately 300 feet long covered

with a roadway embankment fill up to 80 feet high. The second method would employ the use of a 300-foot long concrete arch culvert under an 80-foot high fill. The CMP culvert was sized for the 50-year flood with no headwater ponding using inlet control for design. The 100-year flood would be passed with approximately three feet of water over the inlet. For these conditions, the size of CMP required was found to be 16 feet in diameter. A pipe of this size requires headwater for training the inlet flow and a concrete diffuser structure at the downstream end of the pipe to allow the creek to assume natural flow conditions and minimize creek bed and bank erosion. Both culvert types and embankment fill are for a four-lane roadway.

Inasmuch as Rogers Creek is a fish spawning stream, an installation of this type would involve very careful construction procedures. Construction operations in the creek bed may, in fact, be prohibited during certain parts of the year, i.e. October 15 through to the following July 1. The environmental impact of such a height of fill (up to 80 feet) would be detrimental to the creek valley, with as yet undetermined effects on the creek banks (due to stripping operations) and the creek bed (possible sedimentation problems). A fill of this height would require additional compaction of the embankment fill in order to utilize the thickest gage of the 16-foot diameter CMP. Debris control (see Photo 19) is also a major problem. Each alignment was considered and sufficient engineering design carried out to provide a cost estimate. The estimated costs for the culvert including embankment, protective works, etc., for the three alignments under consideration are shown in Table 7-1. It is not felt, however, that this type of culvert is environmentally acceptable.

The concrete arch culvert, approximately 300 feet long, was sized with sufficient waterway opening to pass the estimated 100-year flood of 2,850 cfs with no ponding. headwalls and training works would be required for this installation, but to a lesser extent than the more flexible CMP installation. A minor advantage to this type of installation is that the arch foundations may be constructed out of the creek bed proper, but sufficient scaffolding to prop up the green concrete during construction would be required to be placed in the creek bed.

Fill operations would then not be instigated until the concrete was properly cured (at least 28 days). With construction operations suspended during the spawning season (October 15 to July 1), it is conceivable that such a crossing may take at least two seasons to construct. The environmental impact would be somewhat less detrimental than that of a CMP installation. Cost estimates for each study alignment are shown in Table 7-2.

A steel arch culvert was briefly considered, but was discarded because limited fill height (up to about 40 feet) was not sufficient for the design height of the fill.

7.5 Bridges

Bridges are considered the best means of traversing Rogers Creek. Examination of existing ground profiles along the study alignments showed relatively steep creek banks with some rock outcroppings. Bridge pier construction in such locations is difficult and therefore costly in terms of dollars. It was decided, therefore, to consider long-span continuous or cantilever types of structures to eliminate as far as possible pier construction on the steep creek banks.

Although structural depth is not a consideration here (the design profile provides for more than adequate clearance above high water), certain economies can be achieved by the use of continuous or cantilever-type structures. Preliminary geotechnical reports indicate that most piers and abutments can be founded upon bedrock, which would mean negligible settlements. For foundations not founded on bedrock, piles driven to refusal in the ground would be used to avoid settlements.

Continuous structures are more easily designed and fabricated in structural steel; hence structural steel was considered as one alternative. In order to achieve long spans using concrete, a cast-in-situ post-tensioned box girder or a cantilever box girder supporting simply supported spans is worthy of consideration. The latter was chosen as being more economical; the former alternative is economical for spans

well over 200 feet. To utilize the 200-foot plus span length would require piers on the steep creek banks, a proposition which is more expensive.

In placing the piers, an attempt has been made to keep them out of, or at the edges of, the creek's flood plain. The spans are such that probably only a single pier would be within the limits of the flood plain. For the location studies, the single pier within the flood plain would not be considered a significant obstruction. Any pier within the flood plain would be designed to minimize downstream erosion, depending on bridge location. Some form of bank and/or channel protection (i.e. rip rap) may be necessary to prevent erosion or scouring.

Two bridge designs, one continuous structural steel and one concrete cantilever style were considered for each location. Sufficient engineering was done to estimate the cost of each structure. Unit prices were obtained from recently tendered structures of similar configuration and design and represent 1980 prices. As may be seen from Table 7-1, the concrete cantilever structure is the more economical of the two bridge types considered. Layouts of this type of bridge structure are shown on Figure 7-8 for alignment No. 4 and Figure 7-9 for alignment No. 6. Figure 7-10 shows a steel alternative for alignment No. 6. Because it is anticipated that the piers are to be founded upon the shale bedrock, twinning of the structure may be carried out (at some future date) as close as construction limitations would permit.

7.6 Staging of Structures

Traffic considerations have indicated that a two-lane bridge is sufficient for the immediate future (see Section 3.7). Therefore all bridges have been costed for a two-lane structure with the possibility of adding a parallel two-lane structure when required, as shown on the drawings. Note however the northern end span of 10th Avenue crossing has been widened to allow for an extra lane at the Johnston intersection northbound.

For record purposes, the cost difference in building a four-lane bridge versus a two-lane bridge is about 1.6.

The substructure cost of a bridge is about 30 - 35 percent of the total bridge cost. To build a four-lane substructure now would add about 30 percent to the substructure cost, while to build a four-lane superstructure would add about 70 percent to the superstructure cost, the overall increase being about 60 percent. To build footings only for four lanes now would add about 5 percent to the total cost.

To design a high-level bridge for future widening is difficult. If the substructure (i.e. footings and piers), which cost comparatively little extra for a four-lane bridge, are built initially, then these look out of proportion to the two-lane superstructure.

Due to the uncertainty of timing for four lanes, we feel it best to stay with an initial two-lane structure.

7.7 Bridge Versus Culvert

A choice may need to be made between a bridge or culvert. (A metal pipe culvert is rejected in favour of the arch culvert as it is felt it is not environmentally acceptable.) The relative costs are as follows:

2-lane bridge	$2.6 million
2-lane culvert	$2.65 million
4-lane bridge	$3.6 million
4-lane culvert	$2.9 million

The culvert would only be a consideration for the four-lane facility and, it is felt, should only be considered if it was 20 percent or more less expensive. As it is in fact just 20 percent less, then it should be considered further if a four-lane facility is required.

7.8 Roadwork Costs

Roadwork costs have been estimated for two sections:

(a) The north-south connection of Roger Street to Johnston Street.

(b) Roger Street extension (from 10th Avenue north to junction with 21st Avenue).

Table 7-2 shows comparative costs.

Note, however, for the 10th Avenue route there is no cost included for Roger Street extension and the construction of 10th Avenue is only included from Johnston Street to Alderwood Drive.

Costs have been based on current 1980 costs and include allowances for utility relocation, street lighting, landscaping and a four-lane road with curbs and sidewalks as shown on Figure 7-2.

Roadwork costs do not include embankment fill for culverts or for the bridges which are included in the estimates for same.

Costs for right-of-way are assumed to be nil as land is owned by the City, except that on 10th Avenue alignment an allowance has been made for the one property and house to be acquired.

7.9 Continuing Street North of Johnston

The two alternatives, 10th Avenue and 21st Avenue routes, are to be extended to a future bypass route according to the proposed major street network plan. These two routes have been inspected and photographs are included (see photo 17 for Ian Avenue - Strathcona route and photo 19 for Cherry Creek route).

The Ian Avenue - Strathcona route is presently paved up to Moore Street and from there to the bypass is a distance of 3,000 metres and includes necessary reconstruction of the bridge over Kitsuksis Creek. The bridge

cost including raising of approach fill to improve the grade is estimated at $500,000 plus roadworks for a two-lane rural road of $750,000 for a total of $1,250,000.

The Cherry Creek route is mostly paved to an acceptable standard at present. Also the existing bridge is considered adequate for the immediate future. The section north of Johnston Road is to be realigned to meet the 21st Avenue route so that the total length of new construction is 1,500 metres at an estimated cost of $700,000.

Right-of-way costs are not included in the above estimates.

TABLE 7-1

ROGERS CREEK CROSSING STRUCTURAL COSTS

ESTIMATED COSTS ($ 1980)

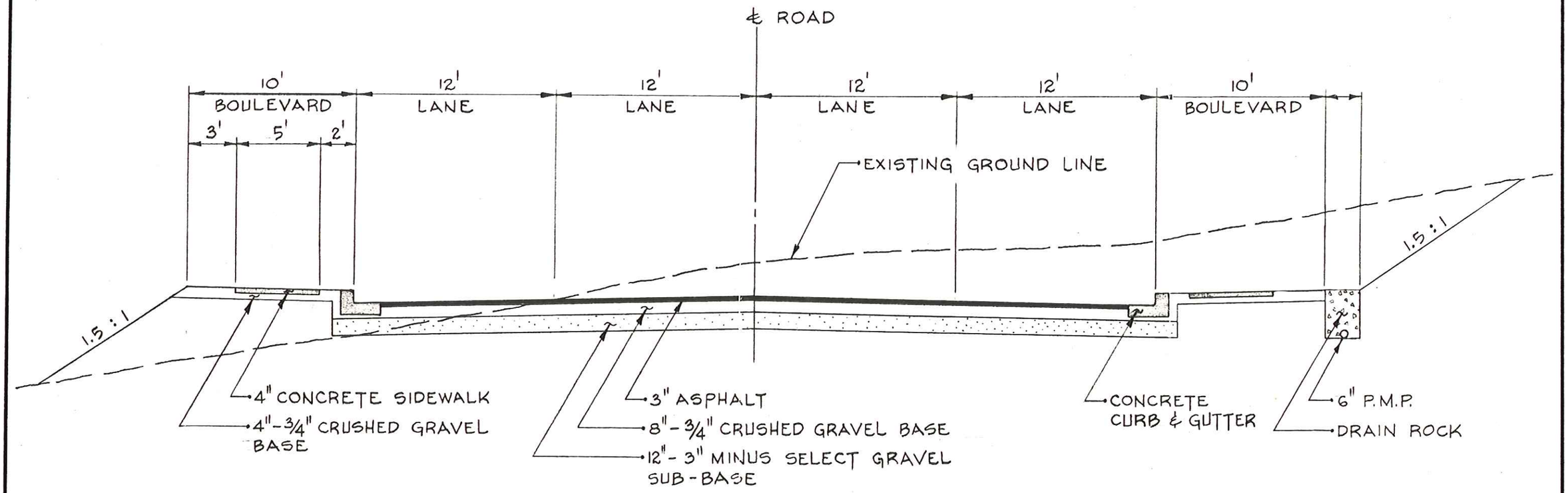
		Alignment No. 1 (10th Ave.)	Alignment No. 4 (21st Ave. ext.)	Alignment No. 6 (21st Ave. ext.)
2-Lane Continuous Structural Steel Bridge	Construction	$2,280,000	$1,607,000	$1,458,000
	Contingencies	456,000	321,000	292,000
	Engineering	228,000	161,000	146,000
	Total	$2,964,000	$2,089,000	$1,896,000
2-Lane Cantilever Concrete Bridge	Construction	$1,797,000	$1,287,000	$1,043,000
	Contingencies	359,000	257,000	209,000
	Engineering	180,000	129,000	104,000
	Total	$2,336,000	$1,673,000	$1,356,000
4-Lane 16' Ø Multiplate Culvert and Fill	Construction	$1,761,000	$1,293,000	$ 995,000
	Contingencies	352,000	259,000	199,000
	Engineering	176,000	129,000	100,000
	Total	$2,289,000	$1,681,000	$1,294,000
4-Lane Concrete Arch Culvert and Fill	Construction	$1,858,000	$1,584,000	$1,287,000
	Contingencies	372,000	317,000	257,000
	Engineering	186,000	158,000	129,000
	Total	$2,416,000	$2,059,000	$1,673,000
4-Lane Cantilever Concrete Bridge	Construction	$2,754,000	$2,059,000	$1,669,000
	Contingencies	551,000	412,000	334,000
	Engineering	275,000	206,000	167,000
	Total	$3,580,000	$2,677,000	$2,170,000

		TENTH AVE			21 ST AVE. ALIGNMENT #4			21 ST AVE. ALIGNMENT #6		
STRUCTURES	TYPE OF STRUCTURE	BRIDGE	MULTI-PLATE CULVERT	CONC. ARCH CULVERT	BRIDGE	MULTI-PLATE CULVERT	CONC. ARCH CULVERT	BRIDGE	MULTI-PLATE CULVERT	CONC. ARCH CULVERT
	SUB-TOTAL	$1,797,000	1,761,000	1,858,000	1,287,000	1,293,000	1,584,000	1,043,000	995,000	1,287,000
ROADWORKS ROGERS CREEK CROSSING	ROAD WORKS	194,000	286,000	286,000	673,000	743,000	743,000	559,000	622,000	622,000
	R/W AQUISITION	100,000	100,000	100,000	—	—	—	—	—	—
	SUB-TOTAL	$294,000	386,000	386,000	673,000	743,000	743,000	559,000	622,000	622,000
ROADWORKS ROGERS ST. EXTENSION	ROAD WORKS	—	—	—	787,000	787,000	787,000	707,000	707,000	707,000
	R/W AQUISITION	—	—	—	—	—	—	—	—	—
	SUB-TOTAL	—	—	—	787,000	787,000	787,000	707,000	707,000	707,000
TOTAL	CONSTRUCTION	$2,091,000	2,147,000	2,244,000	2,747,000	2,823,000	3,114,000	2,309,000	2,324,000	2,616,000
	CONTINGENCY 20%	418,000	429,000	449,000	549,000	565,000	623,000	462,000	465,000	523,000
	ENGINEERING 10%	209,000	215,000	224,000	275,000	282,000	311,000	231,000	232,000	262,000
	GRAND TOTAL	$2,718,000	2,791,000	2,917,000	3,571,000	3,670,000	4,048,000	3,002,000	3,021,000	3,401,000

N. D. Lea & Associates Ltd.
TRANSPORTATION ENGINEERS

ROGERS CREEK CROSSING
COST ESTIMATES

TABLE 7-2 | REV



N. D. Lea & Associates Ltd.
TRANSPORTATION ENGINEERS

ROGERS CREEK CROSSING
TYPICAL SECTION

DRAWING NO. FIG. 7-1

REV.

CONCRETE ARCH CULVERT

IAN AVENUE

TENTH AVENUE

0+00

5+00

10+00

15+00

R = 560

P.I. 11+22.5

ALDERWOOD DR

STREET

HOLLYWOOD

JOHNSTON ROAD

ROGERS CREEK

SKEET CLUB

125

100

75

50

SCALE 0 100 200 300 400 FT.

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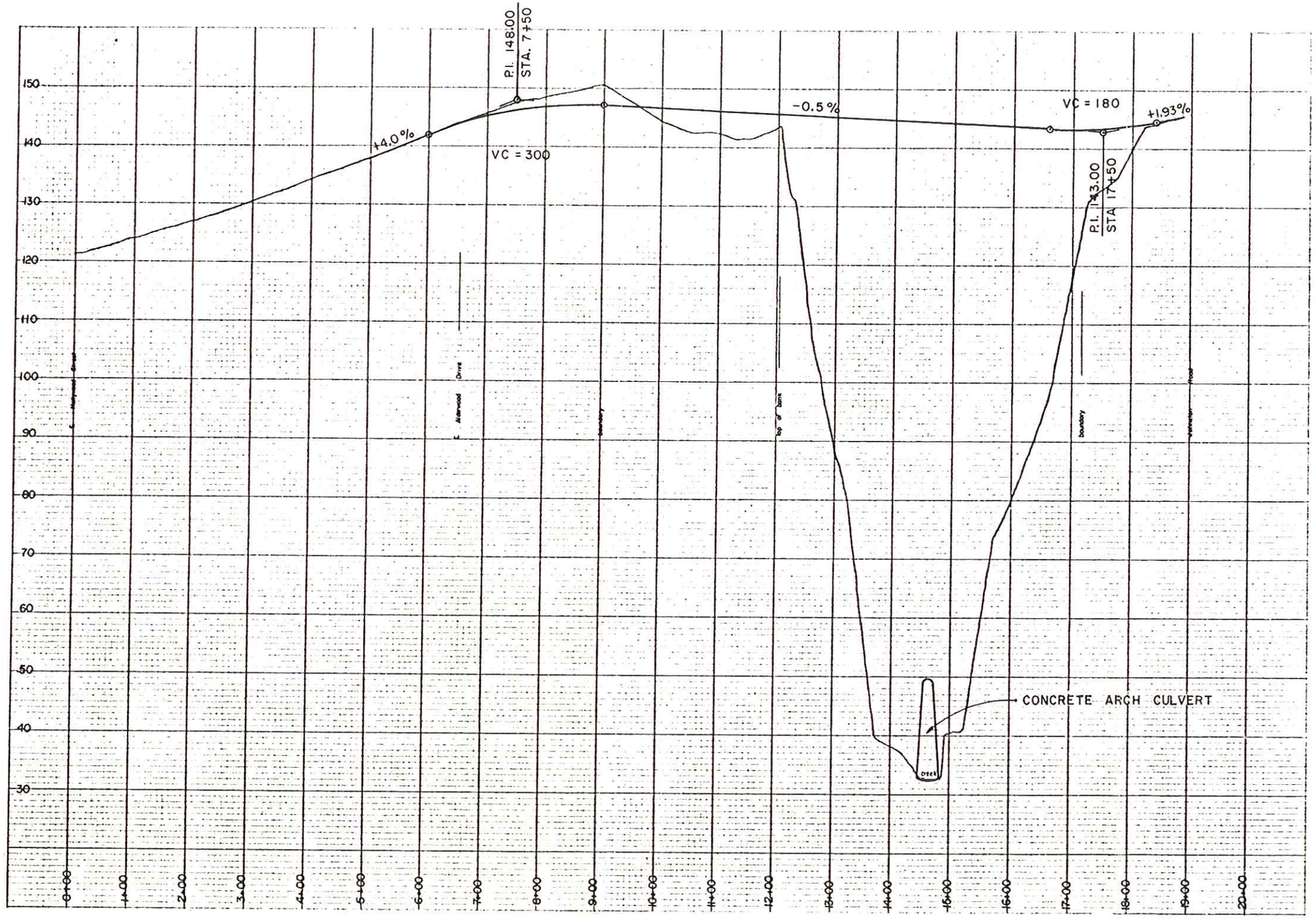
ROGER CREEK CROSSING
10 TH AVENUE ALIGNMENT
PLAN

DRAWING NO. FIG. 7-2

REV.

TRANSTEX 29 500-6-75



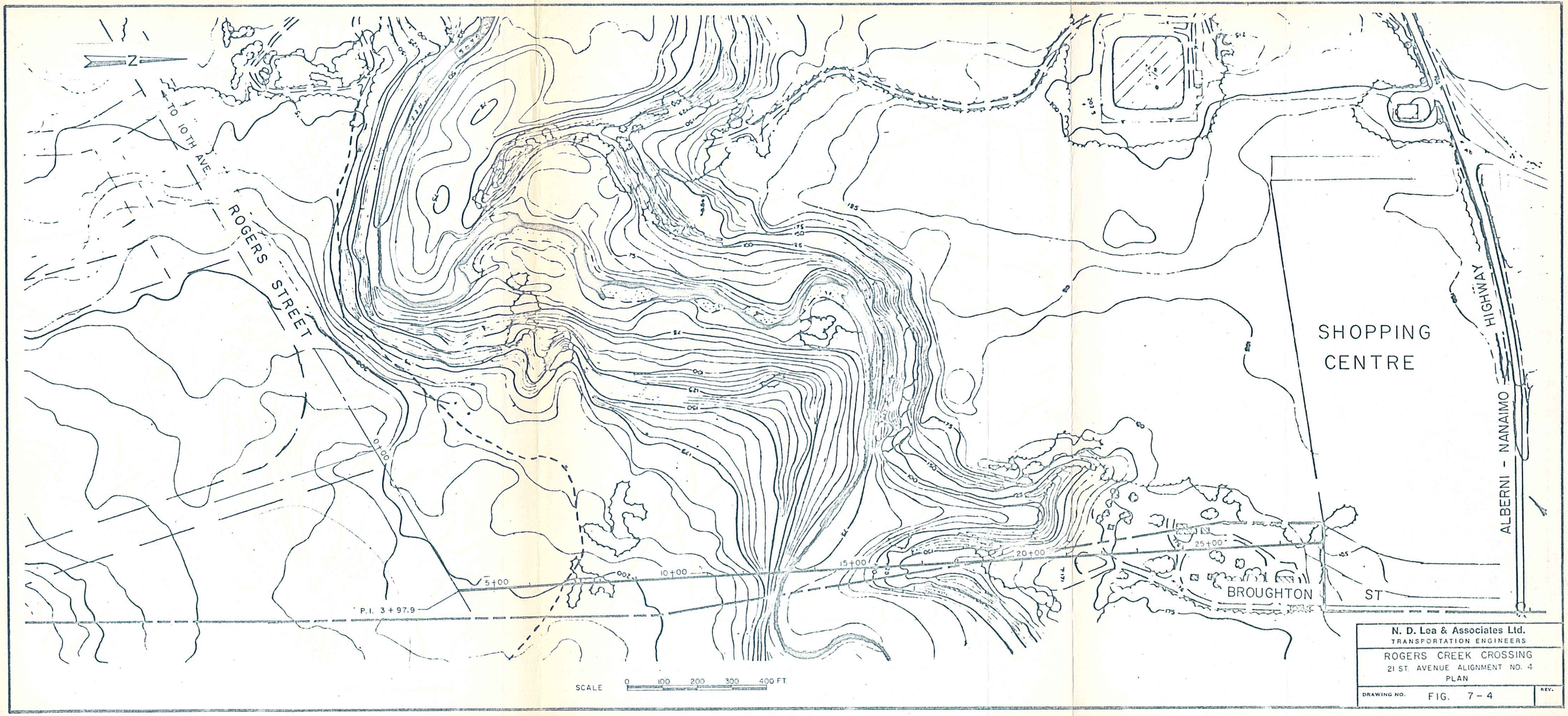
HORIZONTAL SCALE 0 100 200 300 400 FT.

VERTICAL SCALE 0 10 20 30 40 FT.

N. D. Lea & Associates Ltd.
TRANSPORTATION ENGINEERS

ROGERS CREEK CROSSING
10 TH AVENUE ALIGNMENT
PROFILE

DRAWING NO. FIG. 7 - 3 REV.

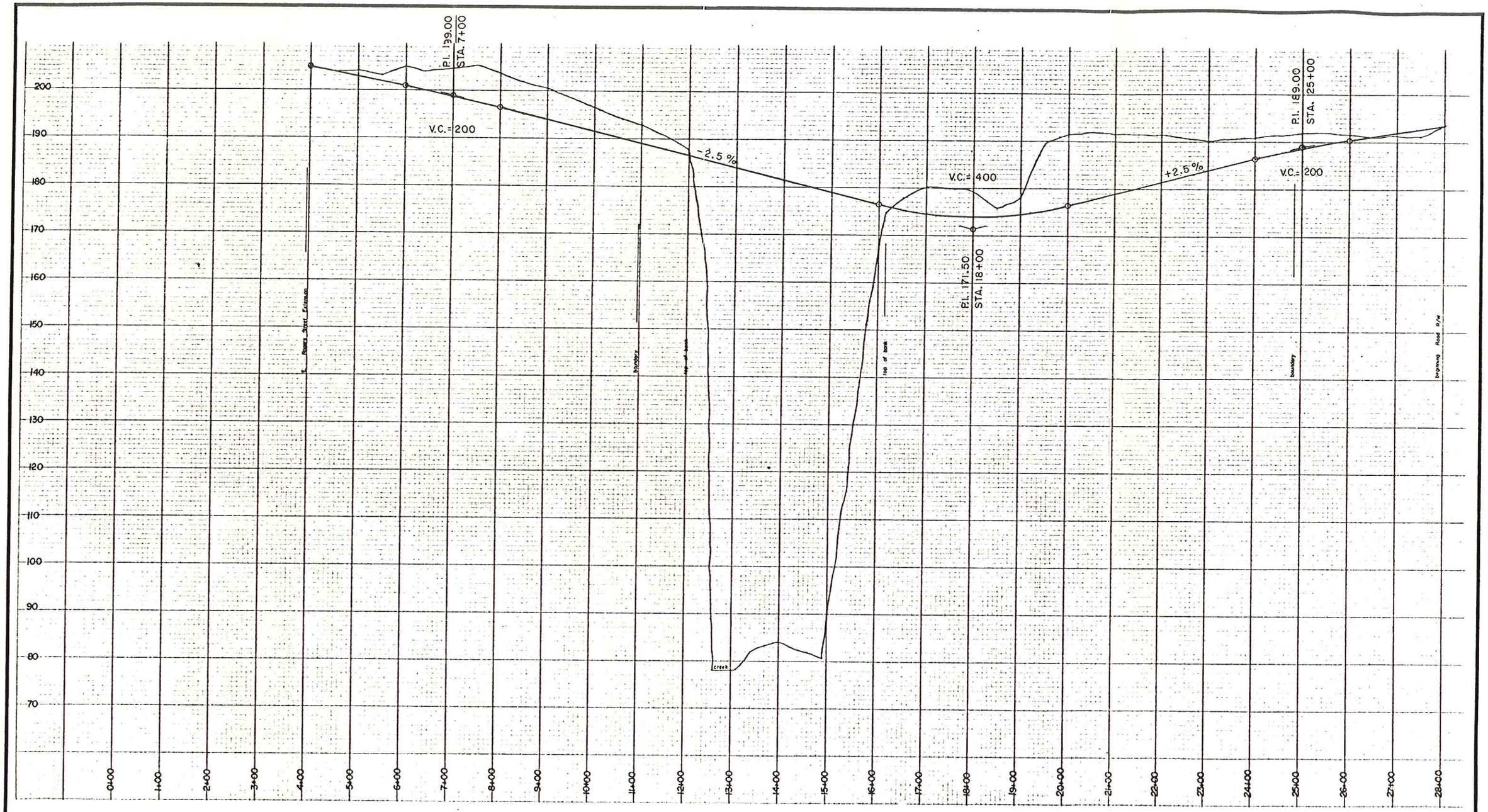


N. D. Lea & Associates Ltd.
TRANSPORTATION ENGINEERS

ROGERS CREEK CROSSING
21 ST. AVENUE ALIGNMENT NO. 4
PLAN

DRAWING NO. FIG. 7-4

REV.



HORIZONTAL SCALE 0 100 200 300 400 FT.

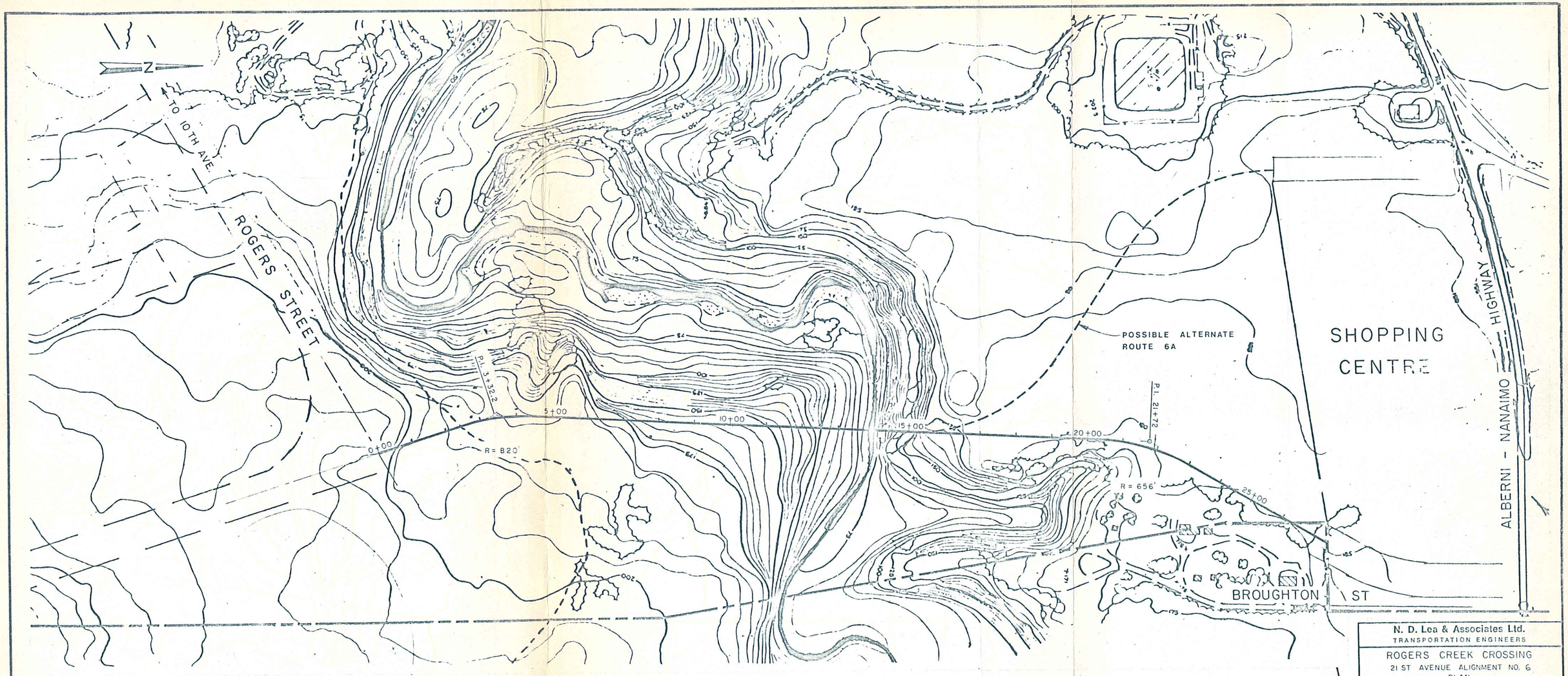
VERTICAL SCALE 0 10 20 30 40 FT.

N. D. Lea & Associates Ltd.
TRANSPORTATION ENGINEERS

ROGERS CREEK CROSSING
21 ST AVENUE ALIGNMENT NO. 4
PROFILE

DRAWING NO. FIG. 7-5

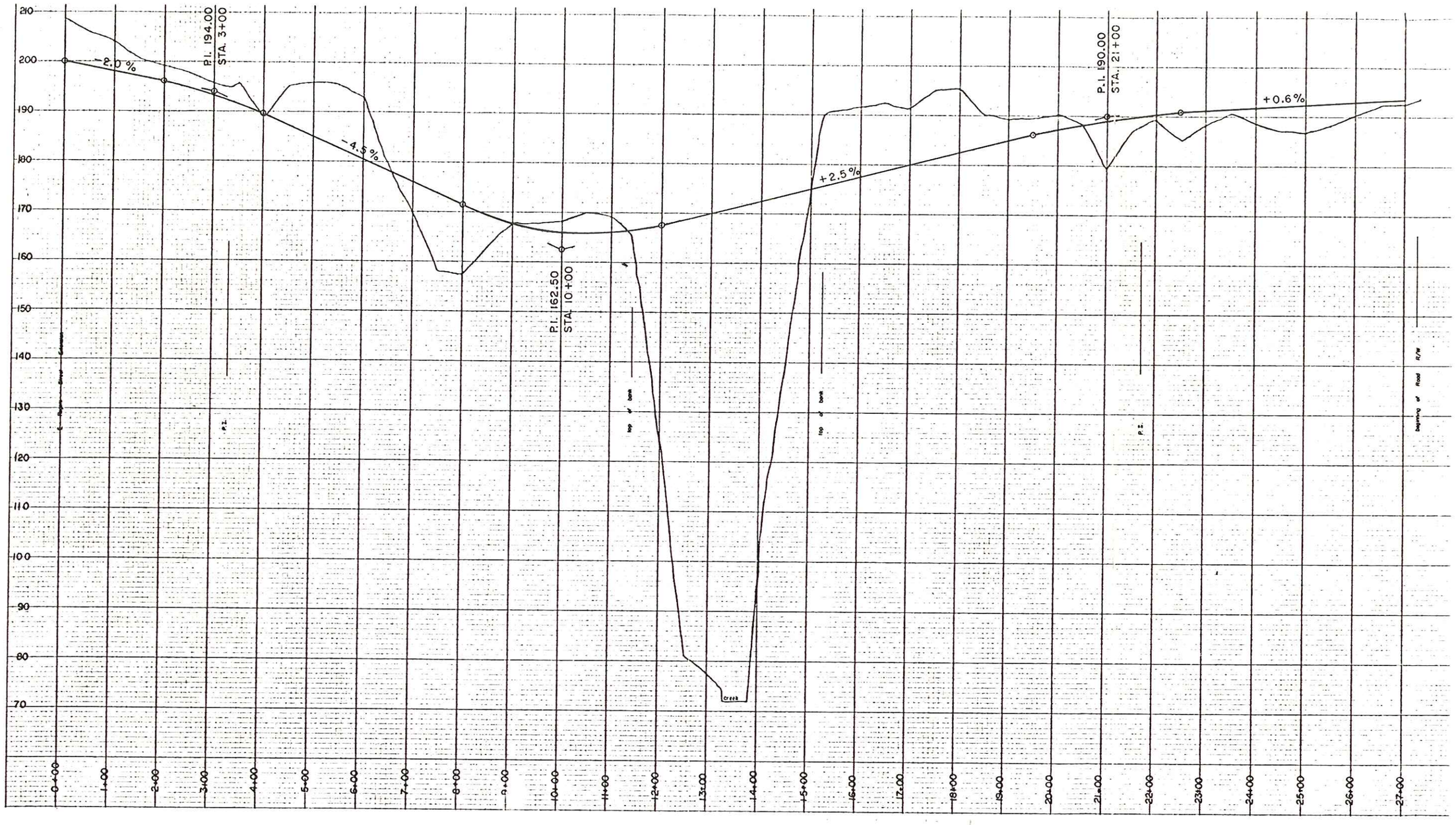
REV.



N. D. Lea & Associates Ltd.
TRANSPORTATION ENGINEERS

ROGERS CREEK CROSSING
21 ST AVENUE ALIGNMENT NO. 6
PLAN

DRAWING NO. FIG. 7-6 REV.



HORIZONTAL SCALE 0 100 200 300 400 FT.

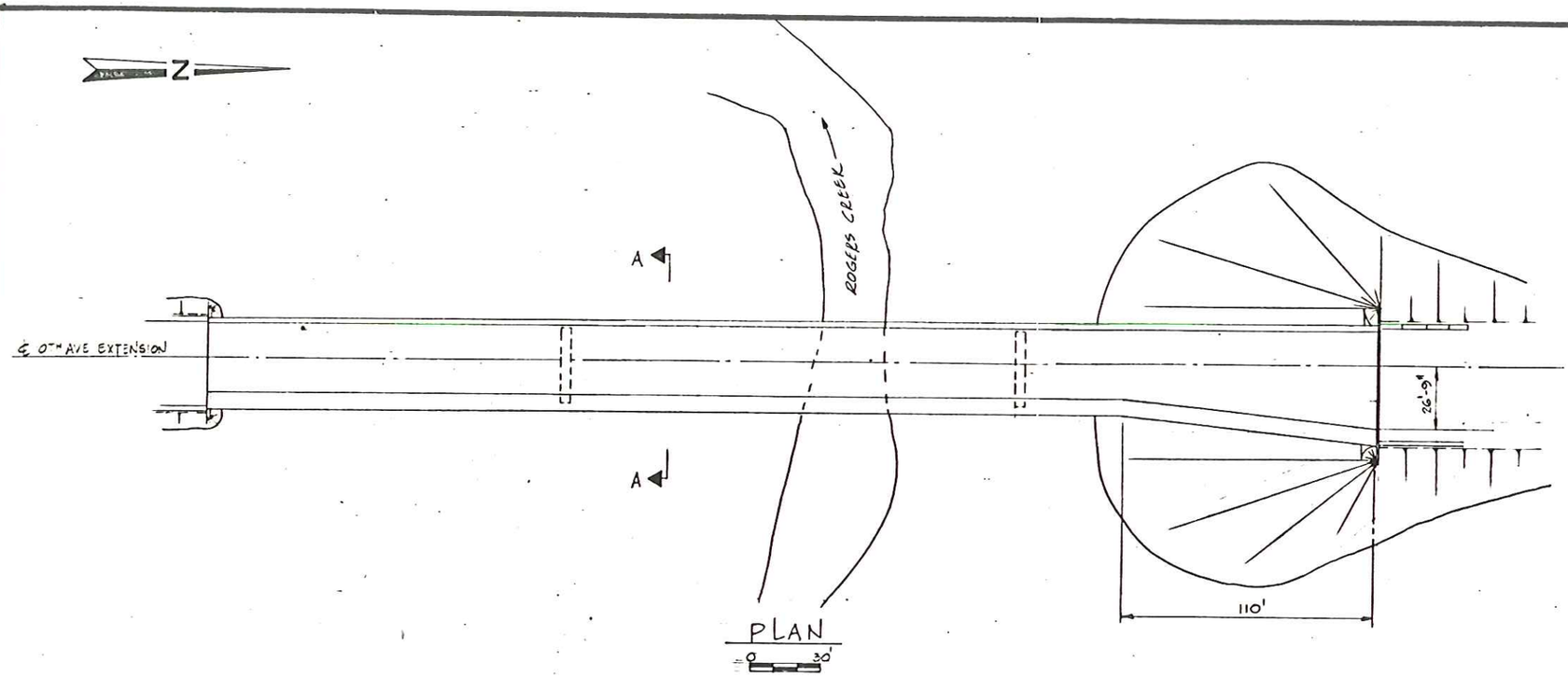
VERTICAL SCALE 0 10 20 30 40 FT.

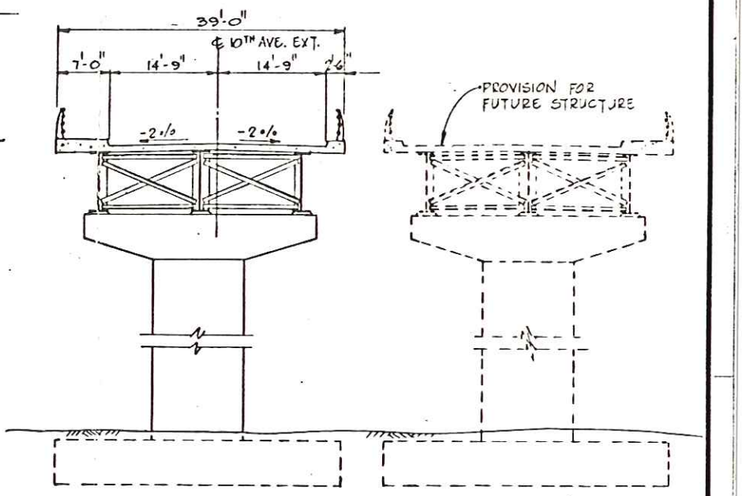
N. D. Lea & Associates Ltd.
TRANSPORTATION ENGINEERS

ROGERS CREEK CROSSING
21ST AVENUE ALIGNMENT NO. 6
PROFILE

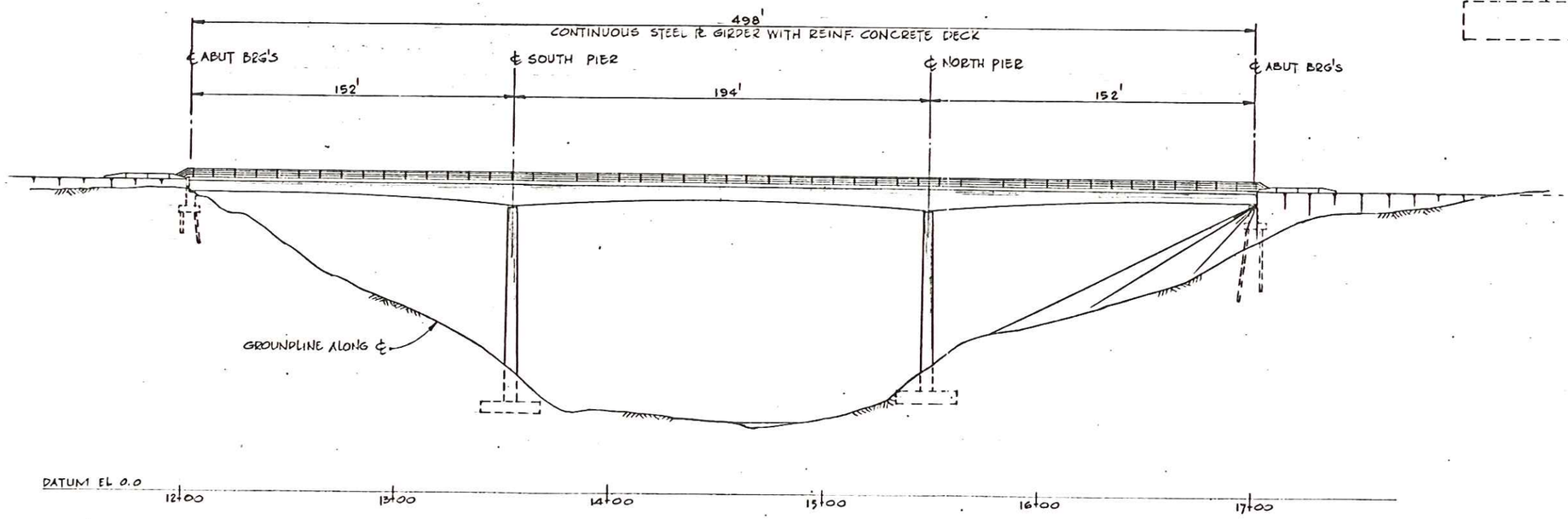
DRAWING NO. FIG 7-7

REV.





SECTION A-A
0 10'



ELEVATION
0 30'

NOTES

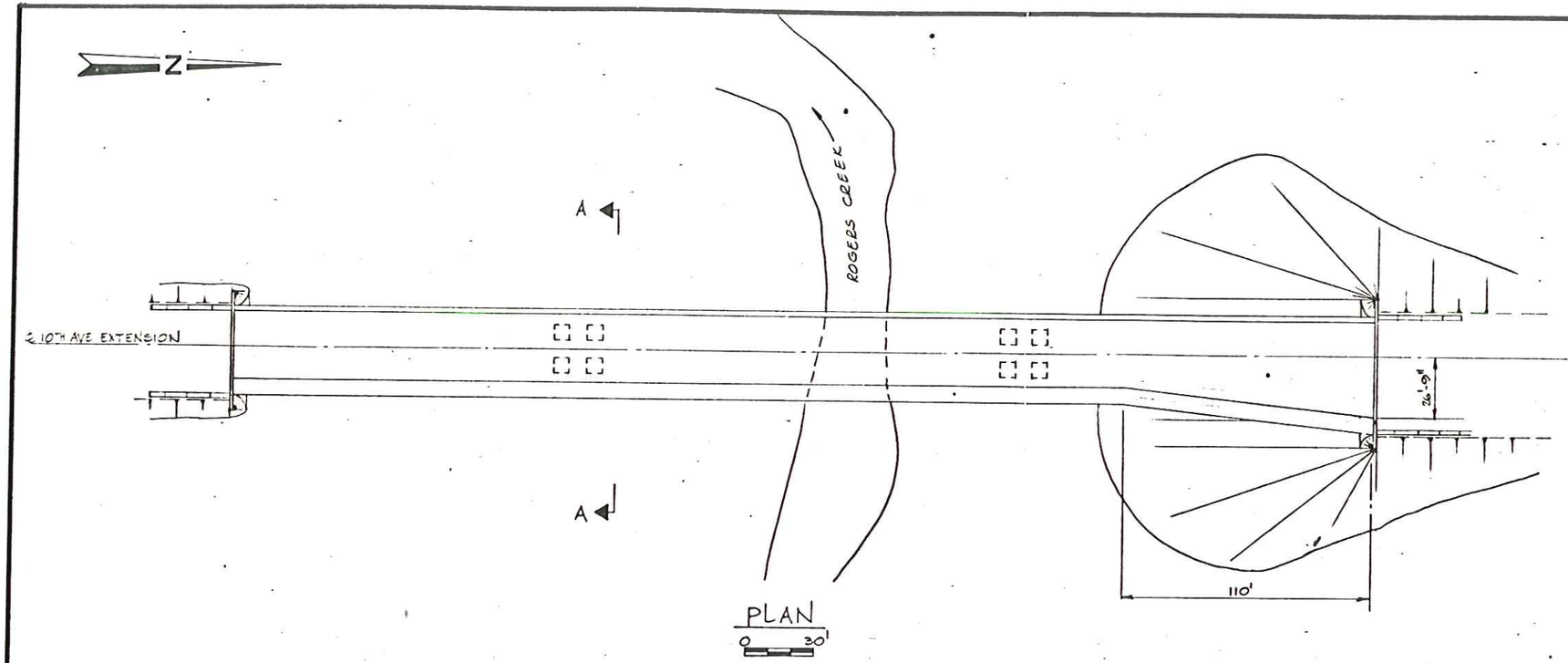
1. DESIGN SPECIFICATIONS: CAN 3-S6-M78
2. DESIGN LIVE LOAD MS 250

DATE: 1980-04-09
BY: R.R.

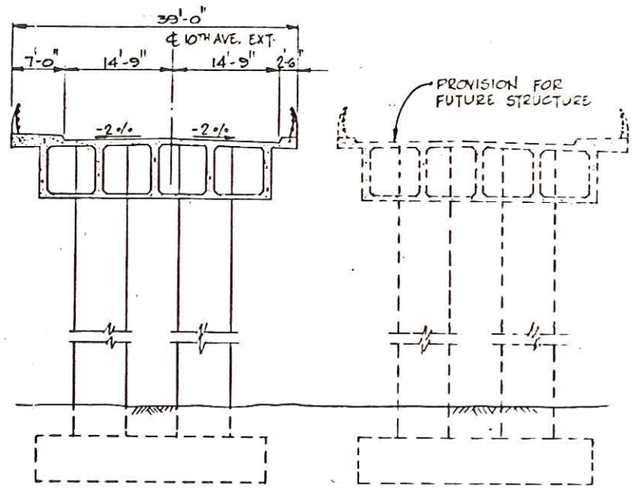
N. D. Lea & Associates Ltd.
TRANSPORTATION ENGINEERS

ROGERS CREEK CROSSING
10th AVE ALIGNMENT-STEEL ALTERNATIVE
GENERAL ARRANGEMENT

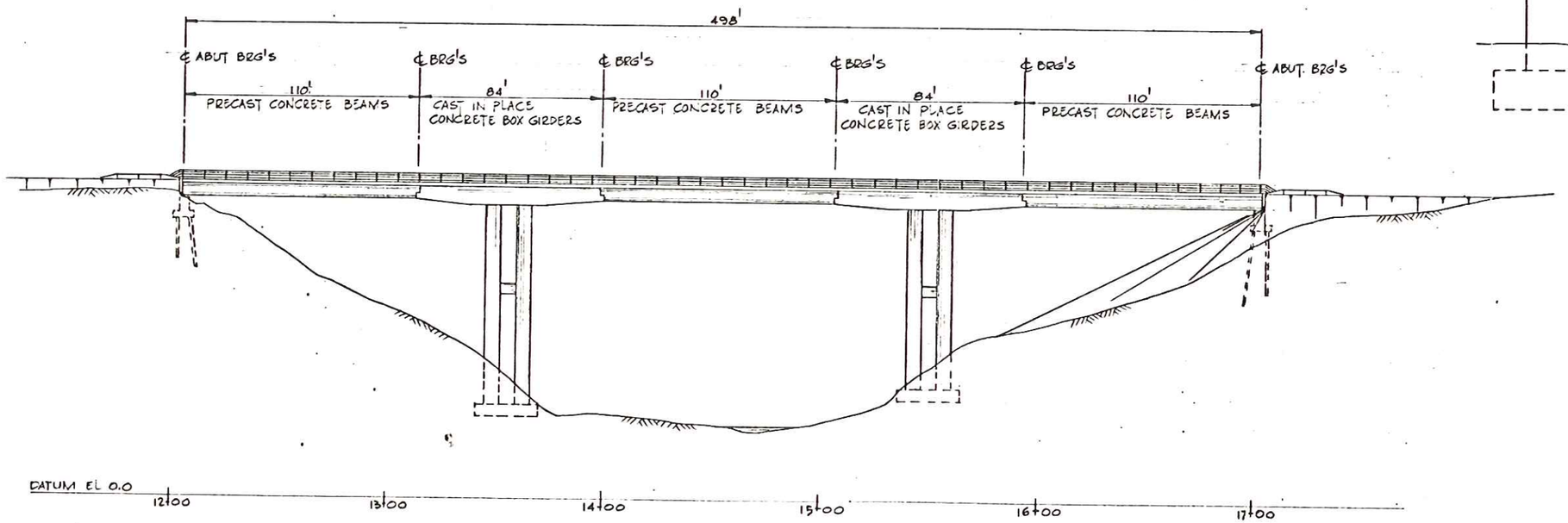
DRAWING NO. FIG. 7-8 REV.



PLAN
0 30'



SECTION A-A
0 10'



ELEVATION
0 30'

NOTES

1. DESIGN SPECIFICATIONS: CAN3-S6-M78
2. DESIGN LIVE LOAD MS 250

N. D. Lea & Associates Ltd.
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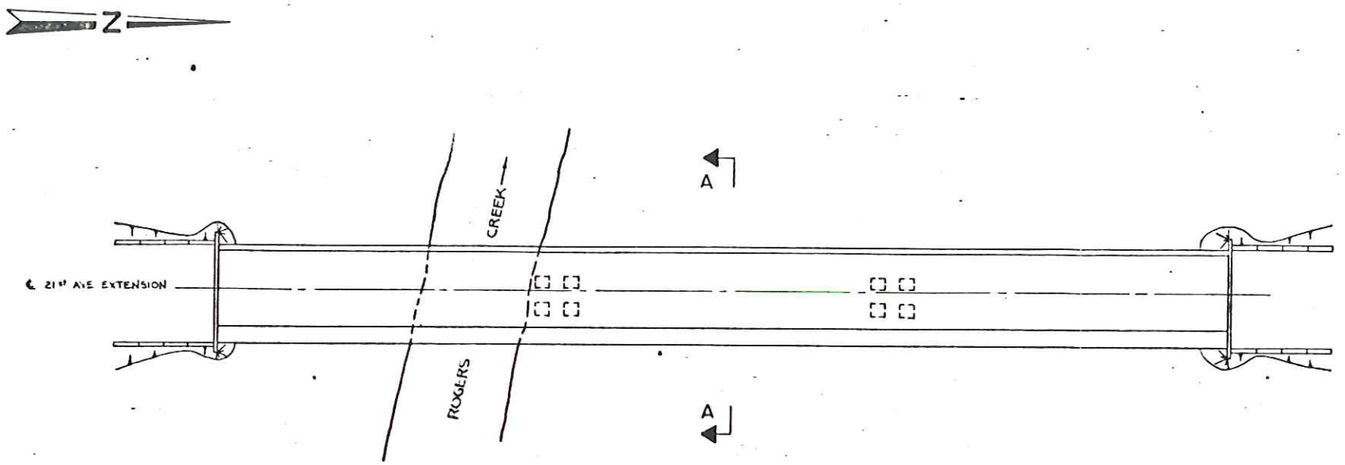
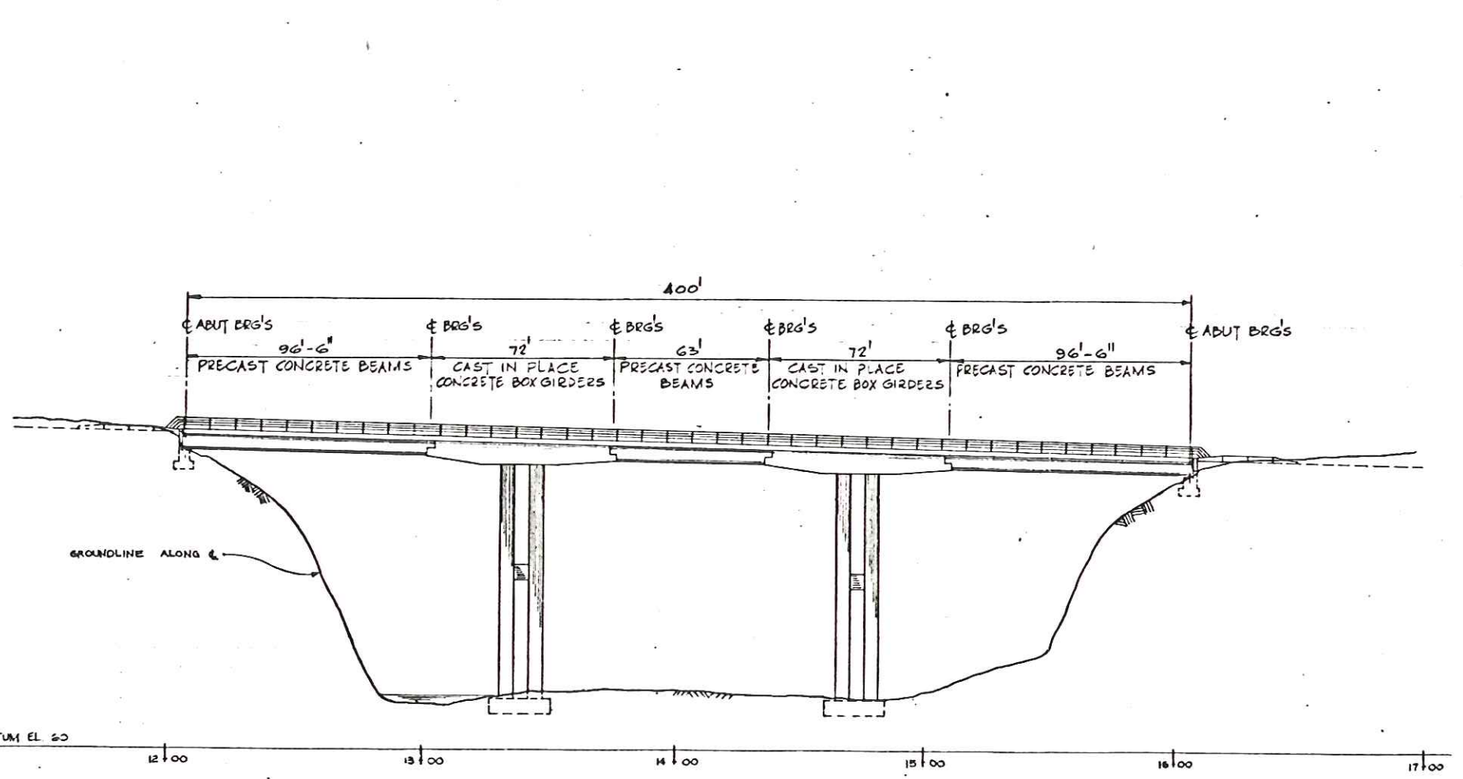
ROGERS CREEK CROSSING
10th AVE ALIGNMENT - CONCRETE ALTERNATIVE
GENERAL ARRANGEMENT

DRAWING NO. FIG. 7-9 REV.

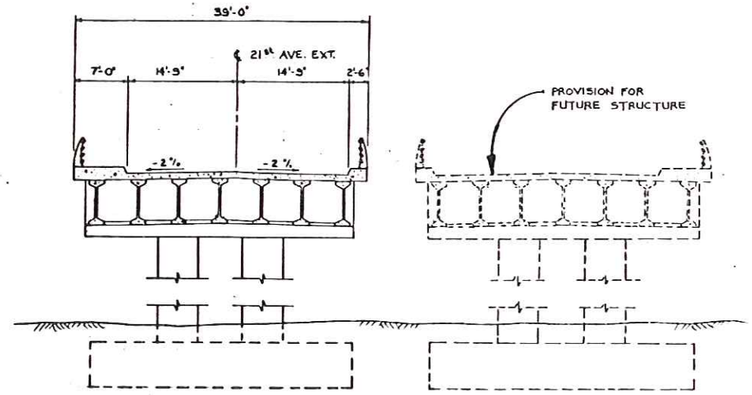
JOB: 1350-04-09
DWG: R.R.
CHD:



PLAN
0 30'



ELEVATION
0 50'



SECTION A-A
0 10'

NOTES

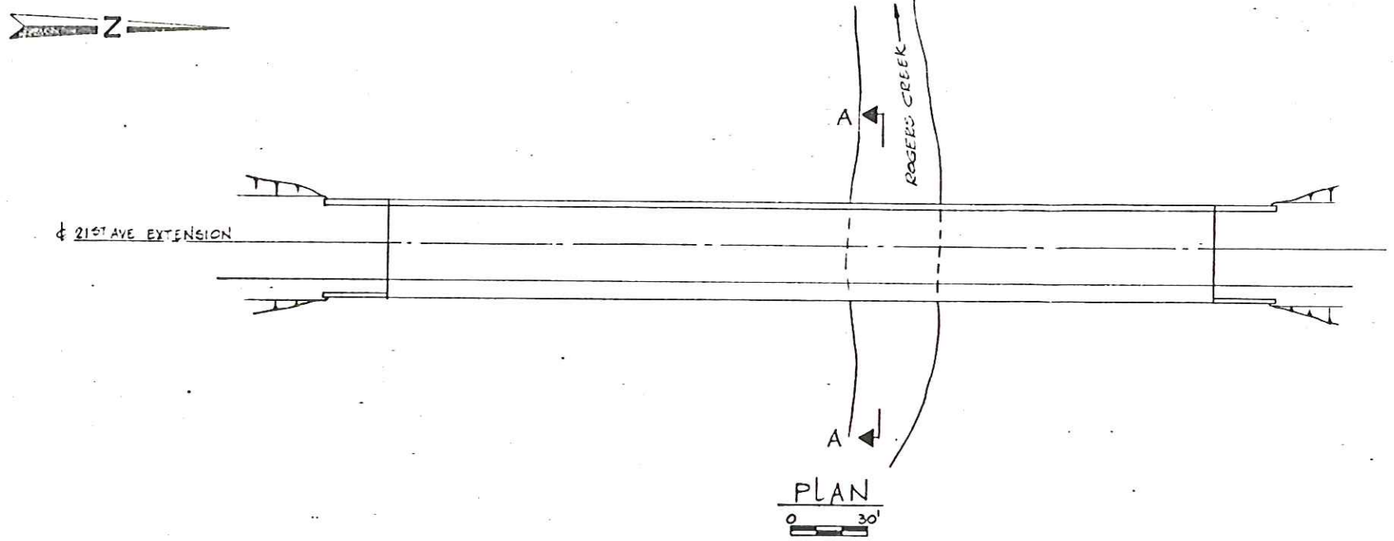
1. DESIGN SPECIFICATIONS : CAN S - S6 - M78
2. DESIGN LIVE LOAD MS 250

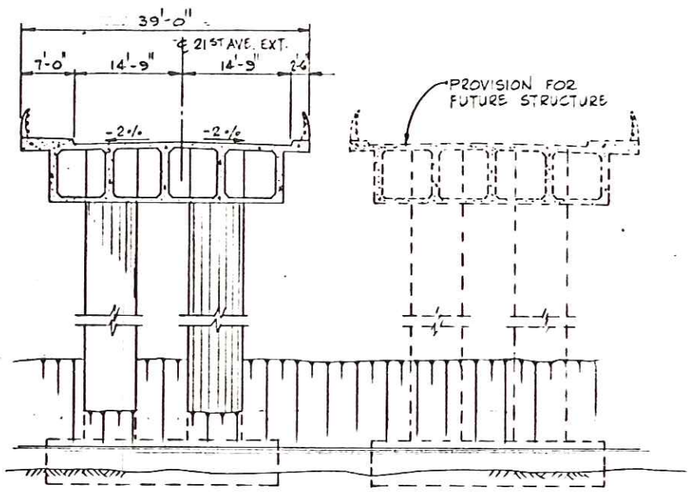
N. D. Lea & Associates Ltd.
TRANSPORTATION ENGINEERS

ROGERS CREEK CROSSING
21st AVE. ALIGNMENT No. 4 CONCRETE ALTERNATIVE
GENERAL ARRANGEMENT

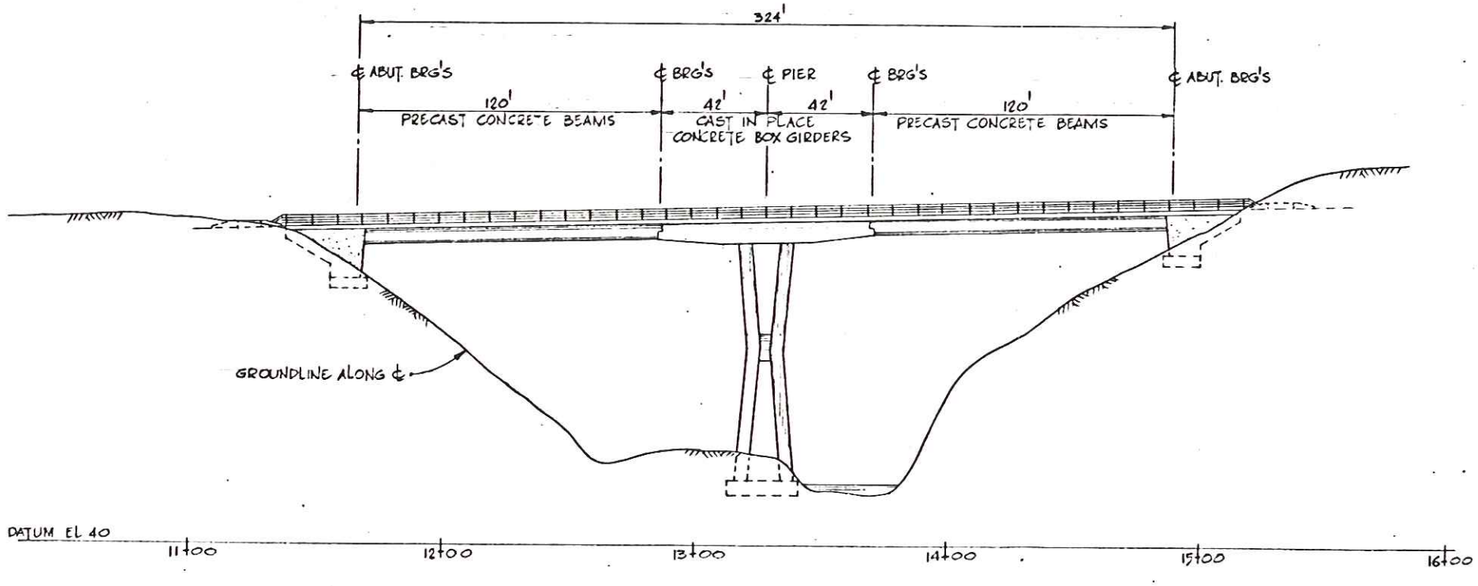
DRAWING NO. FIG. 7-10 REV

DATE: 1980-04-09
DWG:





SECTION A-A
0 10'



ELEVATION
0 30'

NOTES

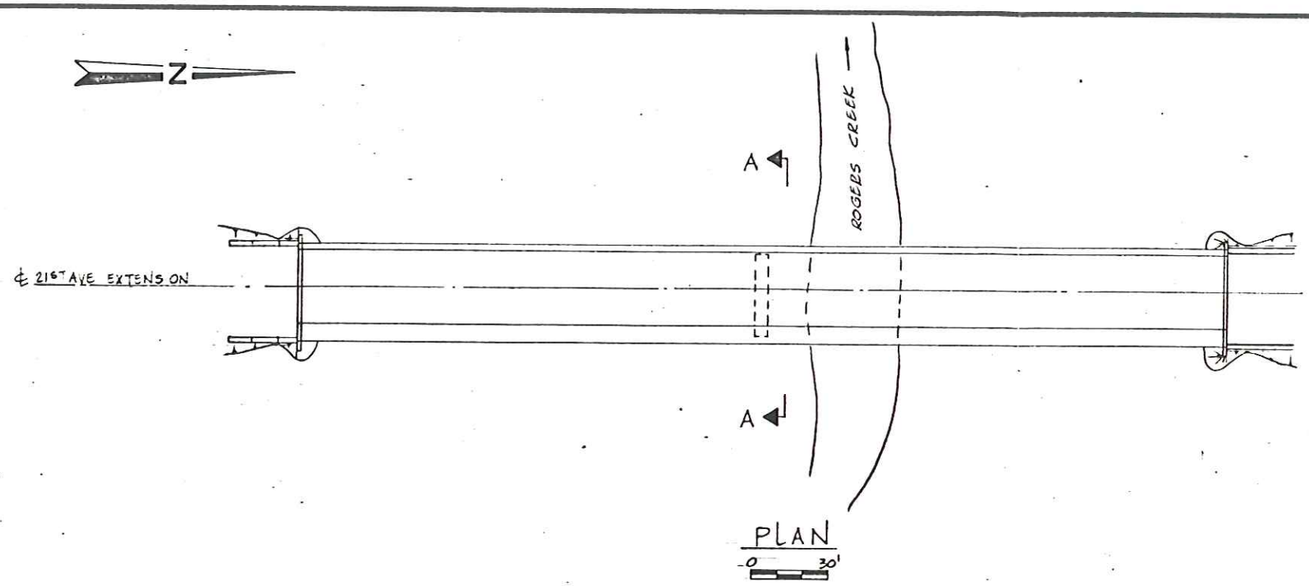
1 DESIGN SPECIFICATIONS : CAN 3-S6-M78
2 DESIGN LIVE LOAD MS 250

N. D. Lea & Associates Ltd.
TRANSPORTATION ENGINEERS

ROGERS CREEK CROSSING
21 st AVE. ALIGNMENT No 6 - CONCRETE ALTERNATIVE
GENERAL ARRANGEMENT

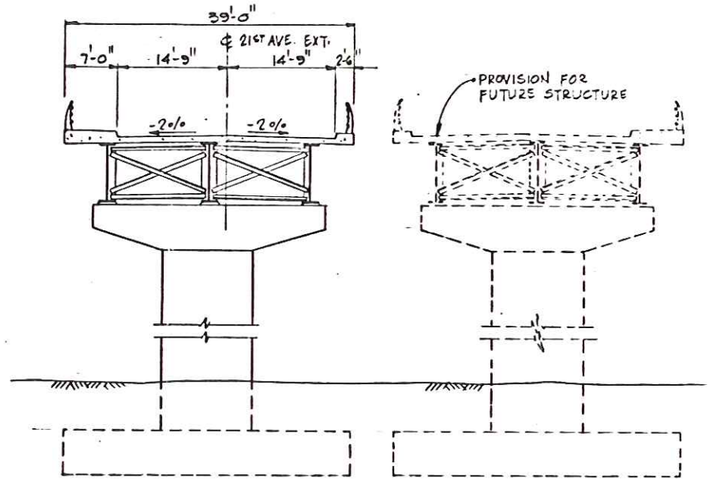
DRAWING NO. FIG. 7-11

DATE: 1980-05-16
BY: R.R.



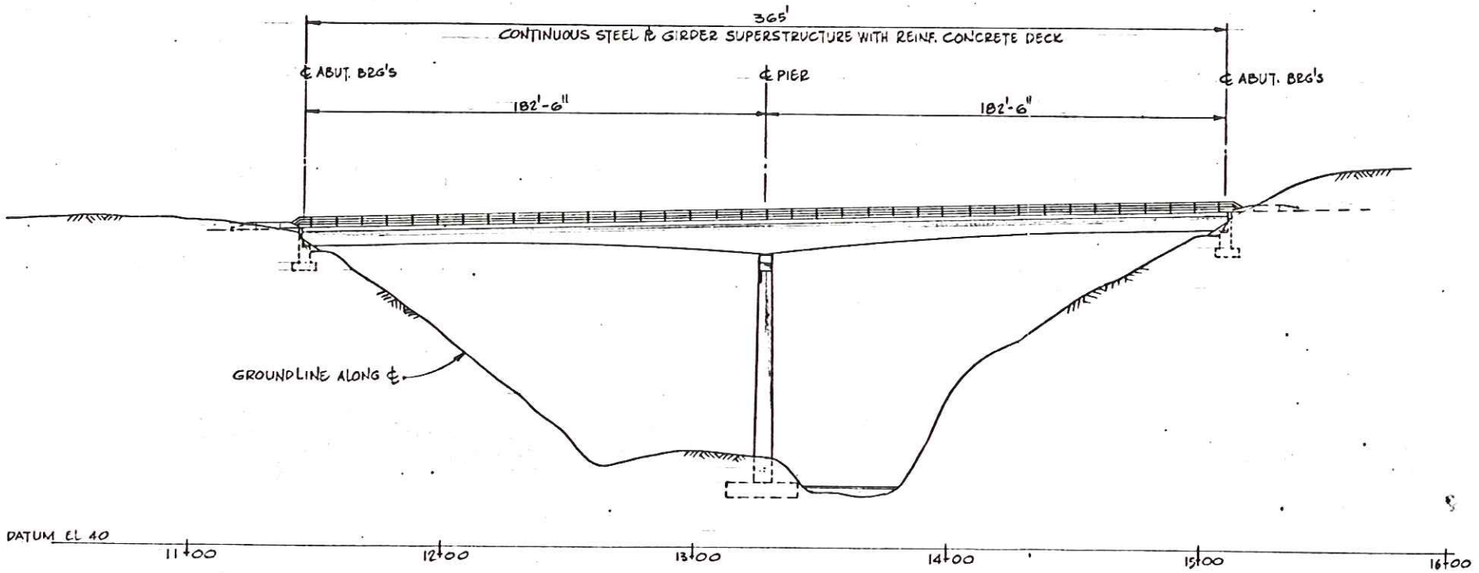
PLAN

0 30'



SECTION A-A

0 10'



ELEVATION

0 30'

NOTES

1 DESIGN SPECIFICATIONS: CAN3-S6-M78

2 DESIGN LIVE LOAD MS 250

IS: 1980-04-09
NO.: R.R.

N. D. Lea & Associates Ltd.
TRANSPORTATION ENGINEERS

ROGERS CREEK CROSSING
21st AVE. ALIGNMENT No 6 - STEEL ALTERNATIVE
GENERAL ARRANGEMENT

DRAWING NO. FIG. 7-12

Chapter 8

EVALUATION

8.1 General

There is no universally recognized means of evaluating projects that takes into consideration all evaluation items to be considered. In the 1960's a straight economic evaluation using cost/benefit ratios or rate of return was the general criteria. However, in the 1970's other considerations such as environment, socio-economic, planning, etc. gained importance, sometimes to the exclusion of economic evaluation. Current procedures tend to examine all aspects in considerable detail, but there is still no definite agreement as to how to evaluate comparatively the different aspects.

One of the most detailed and descriptive manuals on the subject is the U.S. Department of Transportation's "Identification of Transportation Alternatives", published in 1975, a book four inches thick printed on two sides. It covers six notebooks, namely:

1. Identification of Alternatives
2. Social Impacts
3. Economic Impacts
4. Physical Impacts
5. Environmental Assessment
6. References

It does not, nowever, indicate how to assess the relative importance of different impacts. This perhaps is significant in that in the final decision it is up to the decision-maker to weigh the importance of different aspects. The task therefore is to give as much background data as possible to the decision-maker. This is what is attempted herein and, although our evaluation and recommendation is given, it is recognized that the final decision-makers may weigh relative aspects differently.

8.2 Items of Consideration

The type of items that will be considered within this study for the different routes are as follows:

Social Impact:
- Community cohesion
- Accessibility
- Displacement of people
- Effect on residential activity
- Effect on regional and community plans and growth

Economic Impact:
- Effect on business activity
- Effect on property taxes and land values
- Effect on vehicle operation
- Effect on transit

Environmental Impact:
- Visual impact
- Biotic impact
- Recreational impact

Engineering Impact:
- Geotechnical
- Cost of construction
- Safety consideration
- Noise consideration

Traffic Impact:
- Congestion - short term
- Congestion - long term
- Network system
- Travel choice

8.3 Initial Comparative Evaluation

One way to do a comparative evaluation is to give different value to the importance of each item. Thus if we are comparing say five different items, then if we rate the total out of 100 percent, we can give different weights to each, e.g.:

Social impact	A%
Economic impact	B%
Environmental impact	C%
Engineering impact	D%
Traffic impact	E%
Total	100%

Then each alternative solution can be compared as to its effect on each item.

The procedure followed in this study was to have five members of the team each give their weighting to the relative importance of each impact and an average taken of the five inputs. Results are:

Social impact	22%
Economic impact	13%
Environmental impact	16%
Engineering impact	21%
Traffic impact	28%
Total	100%

It is worth noting that the percentage points assigned by various members did not vary by more than 5 percent from the average and, further, that the member responsible for a particular impact generally weighted his specialty lower than the remaining members.

The next step was for the team member responsible for each area of expertise to value the schemes. The schemes considered were:

- Existing route
- 10th Avenue route
- 21st Avenue route

The existing route (i.e. Gertrude and Victoria Quay) was included for comparative purposes.

It was felt better to choose between these three routes and then, depending on results, further evaluate choices, e.g. between route 4 or route 6 for 21st Avenue, between bridge or culvert and between 2 and 4-lane bridge.

Table 8-1 was used for this purpose and a blank table is included so the reader can do his own evaluation. The results of the team's evaluation is given in Table 8-1A.

While each assignment of points is obviously arbitrary, the following are some of the considerations and comments under each heading:

Social Impact: This evaluates the broad social/planning effects of each route on the community.

- Community cohesion ties the community on both sides of the creek together.
- Accessibility is a measure of ease of access to individual residential/business areas from other parts of the city.
- Displacement of people is a measure of the number of residences acquired or affected by the route.
- Residential effect is the effect, beneficial or adverse, that the route has on the residential neighbourhoods it traverses.
- Regional effect is a measure of how a route promotes regional goals.

The 21st Avenue route rated high on social consideration as it was good for nearly all aspects. It dropped a point on accessibility and another point on community cohesion. Both these points might be negated if the 21st Avenue route continued south rather than just tie into 10th Avenue at Roger.

The existing route gained nothing on accessibility, community cohesion or regional effect and received its points from displacement of people (none) and residential effect (no change).

The 10th Avenue route received its points from accessibility, regional effect and community cohesion, but lost points on displacement of people and residential effect.

Economic Impact: This evaluates the broad economic effect of a route on area business and residents' activity.

- Business activity is a measure of how a route promotes area business and commercial centres.
- Taxes is a measure of how a route might improve the tax base (by promoting development) or negatively by increasing taxes to pay for the construction.
- Vehicular operation is a measure of the costs of vehicle operation by the different routes and is related to vehicle rules of travel.
- Transit is a measure of how a route promotes the use of transit by allowing better transit routes and lower operating costs.

Environmental Impact: This evaluates the direct and indirect environmental effects of each route on the Rogers Creek area.

- Visual is a measure of the visual attractiveness of each crossing; amount of clearing required, etc.
- Biotic is a measure of the effect of each crossing on the stream habitat.
- Recreational is a measure of the effect of each route on the present and future outdoor recreational use of the Rogers Creek area.

In general, the existing route has no environmental impact on the creek area and, therefore, rates high, while the 21st Avenue route has the greatest effect and rates lowest.

Engineering Impact: This evaluates the engineering feasibility of each route.

- Geotechnical looks at the suitability of each route for construction and for future maintenance problems.
- Cost considers the capital cost of each route.
- Safety considers the operational safety of vehicles using the facility or how the route promotes safety.
- Noise is directly related to anticipated traffic volume, which is primarily heavy commercial vehicles on grades or stopped at intersections.

Traffic Impact: This evaluates the overall traffic utility of each route to cross-creek traffic.

- Congestion short term is a measure of how a route helps improve the level of service in the short term (0 - 5 years).
- Congestion long term is similar, but allows for growth of traffic in the period 5 - 20 years.
- Network system measures the extent to which each crossing serves and implements the general network layout.
- Travel choice is a measure of how each crossing allows flexibility in travel pattern.

It will be obvious that a fair amount of personal judgement is involved in these considerations and that some aspects are included under more than one heading. Nevertheless, it is felt that it does provide a means of comparing non-quantifiable and dissimilar considerations.

The results of this initial comparative evaluation were fairly clearcut in preferring the 10th Avenue route. However, it was recognized that team members could have an unrecognized bias, so a sensitivity evaluation was carried out by doubling the weighting of impact consideration. The results were as follows:

Doubling social impact consideration	Selects 21st Avenue route
Doubling economic impact consideration	Selects 10th Avenue route
Doubling environmental impact consideration	Selects 10th Avenue route
Doubling engineering impact consideration	Selects 10th Avenue route
Doubling traffic impact consideration	Selects 10th Avenue route

8.4 Pros and Cons of 10th Avenue Versus 21st Avenue Routes

A further review was carried out after discussions with the City Planning consultant on the merits of each route.

Some of the points made were as follows:

10th Avenue Route:

- Tends to put a much heavier traffic load on 10th Avenue south of Rogers Creek which, while it serves the travel desire of motorists, imposes a much higher usage of 10th Avenue to the detriment of residents along this route.
- Because of the higher desire to use 10th Avenue, the result is that a four-lane crossing would be required on this location sooner than on 21st Avenue and further that the existing bridges would be underused.

21st Avenue Route:

- The cost of the 21st Avenue route includes development of a greater part of the street network system, including the Rogers Street extension, which forms part of a future city subdivision. If the latter cost of $707,000 is not considered, then the 21st Avenue route is less expensive.
- An alternative (or additional) connection of the 21st Avenue route to the existing Cherry Creek Road intersection with Johnston Street west of the shopping centre would be attractive by reducing travel time slightly to area zone 4.

The point to note is that perhaps the initial comparison of the 10th Avenue route and the 21st Avenue route is bound to favour 10th Avenue in that both routes end at the same point (Roger and 10th Avenue), but the 21st Avenue route is both longer and (if Roger Street extension is considered) more expensive.

However, in the long range with 21st Avenue continued southwards along the eastern edge of the city development, the comparison could well be different. The street network would then have an outer edge eastern arterial (21st Avenue) complementing the western edge arterial (Gertrude-Stamp), and 10th Avenue, the central route, would serve local trips, but because it did not cross Rogers Creek, it would not become the main central arterial route.

8.5 Conclusion

In the short run, the 10th Avenue route serves the travel desires of the community best and at lowest cost. It does, however, impose more traffic on 10th Avenue, which will eventually be to the detriment of the street. The 21st Avenue route initially, by also connecting to 10th Avenue, does not make any difference, although by being a longer route it attracts less traffic onto 10th Avenue, and although costing more it does help develop the Roger Street extension. In the long run, however, with 21st Avenue extended north along the east edge of the City, then it could well be an equal route for traffic and better from a social planning viewpoint. The choice therefore must rest with the importance attached to short or long term goals.

The point must also be borne in mind that in transportation municipal decision making, most weight is generally given to the effect on residential areas traversed by a route. Thus the 10th Avenue route, while it could serve the whole area residents, could well be objected to by local residents along its route.

The possibility of needing both a 10th Avenue and a 21st Avenue route seems too far in the future to provide both facilities, so a choice must therefore be made for one. Present needs are best met by a 10th Avenue route, but long term needs are perhaps better served by a 21st Avenue route provided the route is extended southwards as planned. This then is our conclusion and thus a decision would rest with the commitment to be made by the municipality to the extension of the network in the future.

TABLE 8-1

EVALUATION OF SCHEMES

	Weighted Points	Existing Route	Pts.	10th Ave.	Pts.	21st Ave.	Pts.
Social Impact							
Community Cohesion							
Accessibility							
Displacement People							
Residential Effect							
Regional Effect							
Economic Impact							
Business Activity							
Taxes							
Vehicle Operation							
Transit							
Environmental Impact							
Visual							
Biotic							
Recreational							
Engineering Impact							
Geotechnical							
Cost							
Safety							
Noise							
Traffic Impact							
Congestion: Short Term							
Congestion: Long Term							
Network System							
Travel Choice							
Totals							

TABLE 8-1A

EVALUATION OF SCHEMES

	Weighted Points	Existing Route Pts.	10th Ave. Pts.	21st Ave. Pts.
Social Impact				
Community Cohesion	5			
Accessibility	5			
Displacement People	4	8	12	20
Residential Effect	4			
Regional Effect	4			
	22			
Economic Impact				
Business Activity	5			
Taxes	2	2	11	7
Vehicle Operation	3			
Transit	3			
	13			
Environmental Impact				
Visual	3			
Biotic	5	16	9	4
Recreational	8			
	16			
Engineering Impact				
Geotechnical	5			
Cost	12			
Safety	1	21	18	14
Noise	3			
	21			
Traffic Impact				
Congestion: Short Term	8			
Congestion: Long Term	6	13	26	17
Network System	7			
Travel Choice	7			
	28			
Totals		60	76	62

Chapter 9

CONCLUSION

1. The results of the study indicate that there is no technical difficulty in providing a new crossing of Rogers Creek at either 10th Avenue or 21st Avenue.

2. The evaluation process has preferred 10th Avenue in the short term and 21st Avenue in the longer term. The selection will therefore depend on whether or not the municipality is prepared to commit the extension of 21st Avenue to the south so as to complete the street network served by a crossing on this location.

3. A two-lane crossing is sufficient for the first 20 years of operation until 2001. At that time, consideration should be given to widening to four lanes or building another crossing at 21st Avenue.

4. A bridge is preferred to a concrete arch culvert.

5. The cost of a bridge at 10th Avenue and connecting street improvement in 1980 dollars is $2.72 million.

   The cost of a bridge at 21st Avenue and connecting streets is $3.57 million for alignment #4 and $3.0 million for alignment #6.

APPENDIX A

SITE PHOTOS

1. Intersection of Johnson and Ian Avenue showing house to be acquired.

2. Looking south on 10th Avenue alignment.

3. On 10th Avenue crossing.

4. Looking north on 10th Avenue alignment.

5. Looking north on 10th Avenue from top of south bank.

6. Crossing No. 4. 21st Avenue East looking downstream at bridge site.

7. Crossing No. 4 looking north from top of south bank.

8. Crossing No. 4 looking north at river crossing from top of south bank.

9. Crossing No. 6, 21st Avenue West looking upstream at bridge site.

10. Crossing No. 6 looking north at river crossing from top of south bank.

11. Crossing No. 6 looking north at north bank from top of south bank.

12. Crossing No. 6 looking south from river level at the south bank.

13. Gertrude Street Bridge over Rogers Creek. Looking south.

14. Victoria Quay Bridge over Rogers Creek. Looking north.

15. Ian Avenue north of Johnston Road.

16. Strathcona Street looking east.

17. Kitsuksis Creek north of Johnston Road. Another barrier to continuation of a through crossing route.

18. Cherry Creek Road Bridge.

19. Cherry Creek Road Bridge looking west.

20. Rogers Creek near Rogers Creek Park as an example of suitable fish spawning habitat.

21. Rogers Creek just downstream of proposed 10th Avenue fish spawning pools and gravel suitable for fish spawning and rearing.

22. Attractive waterfall just upstream of alignment 4 adds to recreational value of this area. Typical streambanks vegetation also apparent.

23. Conducting origin-destination survey on Victoria Quay looking north across the bridge.

24. Conducting survey at Gertrude looking south showing all four lanes of traffic being stopped.

APPENDIX B

PLANNING DATA

APPENDIX B

ROGERS CREEK CROSSING STUDY

B-1 POPULATION AND LAND-USE FORECASTS

General Discussion

The economic base of the Alberni-Clayoquot Regional District is heavily dependent upon the forest industry, under the operations of MacMillan Bloedel Ltd. The Economic Development Commission indicates that, in 1978, the total number of employed persons within the Regional District was 7,705; of whom 5,700 (or 74%) worked for MacMillan Bloedel.

Plan modernization by MacMillan Bloedel will result in the following estimated reductions in employment by the end of 1981:

Alberni Plywood Plant	162
Alberni Pacific Sawmill	50
Somass Sawmill	138
Total Reduction	350

This reduction represents approximately 6% of MacMillan Bloedel's labour force, or approximately 4½% of the total number of employed persons within the Alberni-Clayoquot Regional District.

The Company plans to achieve this reduction through attrition rather than layoffs, so many of the redundant jobs may be represented by workers who retire but who choose to continue to live in Alberni. Thus, the negative impact of this employment reduction may not be too serious.

It is hoped that other employment opportunities may develop in the near future. Possibilities include increased port activity, increased employment in the fishing and fish-packing industry and expanded tourism related to the Alberni Valley's location on the highway to the Pacific Rim National Park.

Thus, the Port Alberni region is expected to experience slower growth over the next twenty years than is the Province as a whole. For example, B.C. Research (BCR) forecasts a Provincial growth rate from 1976 to 2001 of 1.416% (compound) per annum, whereas its forecast rate for the Alberni-Clayoquot Regional District is only 0.729%.

The two sources of forecasts are not entirely compatible with one another. For example:

- AVG forecasts go only to 1991, whereas BCR forecasts extend to 2001.
- AVG forecasts provide a breakdown by communities and/or electoral areas, but BCR forecasts do not, being applicable only to the Regional District as a whole.
- AVG forecasts are higher than those of BCR for each forecast year, as indicated below:

Year	AVG	BCR
1976 (Census)	32,180	32,180
1980	33,634	31,140
1991	39,440	34,895
2001	N.A.	38,591

It is beyond the scope of this study to attempt an independent forecast, so it is proposed to regard the above two forecasts as representing a "high" and "low" range of forecasts. For purposes of this bridge location study, it is further proposed that an average of the two be taken. If the results of the traffic analysis indicate that the difference between the two forecasts is sufficient to affect the choice of location then it would be necessary to investigate and evaluate the methodology of the two forecasts to determine which one is likely to be the more reliable.

Methodology

To extend the AVG forecast to the year 2001, the annual growth rate for the period 1981 - 1991, (1,329) was assumed to continue to apply during the period 1991 to 2001. This yields a forecast population of 44,966 for the year 2001.

The proposed "average" population forecast for the Alberni-Clayoquot Regional District, derived from the AVG and BCR forecasts, is as follows:

1980 - 32,387
1991 - 37,168
2001 - 41, 779

The allocation of population by community, provided in the AVG Study, as as follows:

City of Port Alberni	60.4%
Beaver Creek	11.5%
Cherry Creek	8.4%
Beaufort	1.5%
Sproat Lake	5.3%
Ucluelet-Tofino	9.2%
Bamfield	2.6%
Indian Reserves in the Alberni area	1.1%
	100.0%

Applying these percentage allocations to the previously derived Regional District population forecasts results in the following population distribution by community:

Area	Year 1980	1991	2001
City of Port Alberni	19,562	22,449	25,235
Beaver Creek	3,725	4,274	4,805
Cherry Creek	2,721	3,122	3,509
Beaufort	485	557	627
Sproat Lake	1,717	1,970	2,214
Ucluelet-Tofino	2,979	3,419	3,844
Bamfield	842	966	1,086
Indian Reserves (Alberni Area)	356	409	460

The above figures assume that each community will continue to have the same percentage of overall Regional District population at each forecast period. Through discussions with City and Regional District Officials, it is indicated that, because of growth constraints in some areas (such as the Agricultural Land Reserves and septic tank limitations), not all communities are going to share equally in future growth. In the more detailed examination of traffic zones which follows, these constraints have been taken into account and adjustments have been made accordingly in population forecasts.

Employment

The AVG study provides statistics and projection for existing and future employment as follows:

EMPLOYMENT BY INDUSTRY AND AREA

Standard Industry Category	Total 1971	Estimated 1978 by Location: Port Alb.	Uclue-let	Tofino	Other	Total 1978	Forecast: Total 1981	Total 1991
Agriculture	150	100				100	100	100
Fishing, etc.	465	250	150	100	300	800	800	800
Forestry	1,800	1,000	150	100	550	1,900	1,900	1,900
Mining	100	10	10	10	20	50	50	350
Sub-Total Primary Ind.	2,515	1,360	310	210	870	2,850	2,850	3,150
Construction	200	460	20	30	-	510	340	250
Manufacturing	4,345	4,670	340	270	20	5,300	5,200	5,100
Sub-Total Secondary Ind.	4,545	5,130	360	300	20	5,810	5,540	5,350
Utilities, Trade, Comm.	370	340	20	40	30	430	460	550
Wholesale Trade	100	190	20	10	-	220	240	300
Retail Trade	1,330	1,340	110	40	60	1,550	1,700	2,200
Finance, Insur., Real Est.	140	300	20	10	-	330	370	400
Services	1,375	1,960	120	170	30	2,280	2,390	3,500
Public Admin. & Defence	470	600	100	30	20	750	800	930
Sub-Total Tertiary Ind.	3,785	4,730	390	300	140	5,540	5,960	7,880
TOTAL ALL INDUSTRY	10,845	11,220	1,060	810	1,030	14,200	14,350	16,380
1976 Estimate		10,284	966	759	966	12,975		

Basically the AVG report foresees most primary employment classifications remaining constant (i.e., Forestry, Fishing and Agriculture). "Secondary" classifications are foreseen as declining slightly (i.e., Construction and Manufacturing). Since 90% of all existing manufacturing employment is directly involved with forest products, this decline can be largely attributed to the proposed modernization of MacMillan Bloedel operations. Most employment growth is predicted for the "Tertiary" sector, with increases in trade and service jobs being related to overall community growth and to the tourist industry. Also, some 300 new jobs are forecast in the mining industry.

In reviewing the AVG employment forecasts, it is suggested that the 300 job increase in mining and the 1,500 job increase in tourism, predicted by 1991, may be somewhat optimistic. If these jobs do not materialize, then the AVG population forecasts would have to be adjusted downward.

Because the population forecasts proposed for use in this bridge location study are lower than the AVG forecasts (due to their having been "averaged" with the B.C. Research forecasts), such an adjustment has, to some extent, already been made.

The AVG forecasts for 1991 employment represent a participation rate of 41.5%, with an unemployment rate of 6%. Accepting these rates and applying them to the proposed population forecasts yield the following results:

Year	Employment
1980	13,440
1991	15,424
2001	17,338

The assumptions in the AVG report regarding stability and/or slight decline in primary and secondary employment appear valid and so it is proposed to accept the figures provided by AVG for these sectors. The reduction in employment which the above figures represent in comparison with AVG figures is accordingly applied to the tertiary sector, with most of the reduction assigned to tourist-related employment.

Using the above methodology, the proposed employment forecasts for the Regional District are as follows:

	Year		
Employment Sector	1980	1991	2001
Primary	2,850	3,150	3,150
Secondary	5,540	5,350	5,350
Tertiary	5,050	6,924	8,838
Total	13,440	15,424	17,338

When estimating employment in specific traffic zones for purposes of traffic analysis, the above figures can be used only as a guide, for they are only of limited value in establishing the actual location and amount of employment. For example, many of the jobs in fishing and forestry will represent Alberni residents who work on fish boats or in logging camps well outside the Region and who do not contribute to commuter journey volumes.

Therefore, in estimating the amount of employment in specific zones, reliance has been placed primarily on ratios relating employment to floor space or site area. The ratios used in this report were derived from analysis done by the Greater Vancouver Regional District Planning Department in suburban municipalities within Greater Vancouver. Ratios used are as follows:

Areas of small industrial establishments in older central areas of city	25 employees per acre
Modern planned industrial estates	8 to 10 employees per acre
Low density space - extensive industrial areas	4 to 5 employees per acre
Retail areas	400 sq. ft. per employee
Office areas	150 sq. ft. per employee
Auto oriented and service commercial	4 to 5 employees per acre

For major centres of employment, such as the various MacMillan Bloedel operations and the West Coast General Hospital, exact employment figures were obtained from the employer rather than relying on ratios.

B-2 GEOGRAPHIC DISTRIBUTION OF FUTURE POPULATION GROWTH

Methodology

An essential step in forecasting future traffic patterns is to determine the distribution and location of population at the time the origin-destination survey was taken, and to estimate what that distribution and location is expected to be in the selected forecast years. This distribution must be expressed in terms of the traffic zones defined in the origin-destination study.

Census-enumeration areas provide the best basis for determining population and distribution. However, as the enumeration areas in Port Alberni and its suburbs are not precisely co-terminous with the defined traffic zones, it was necessary to use windshield surveys and air-photo interpretation to translate existing enumeration to translate existing enumeration area data into traffic zone data and arrive at existing population distribution by traffic zone.

With the completion of this step, growth trends, land capability and community plans for the City and Regional District were analyzed to facilitate the estimation of future population distribution.

The development of the City and of the surrounding areas of the Regional District reflects two different sets of lifestyle preferences. Development within the City is essentially urban in character, with residential areas consisting primarily of single family dwellings at an average density of four to five units per acre, supplemented by townhouses and apartments in selected locations. Development beyond the City limits is suburban and rural in character consisting primarily of small farms and acreage lots, although there are a few subdivisions and lakeshore developments that are more nearly urban in terms of density.

An Official Community Plan, augmented by zoning and subdivision controls is in place to guide the growth of the City and Settlement Plans are in the process of being adopted for the Sproat Lake, Cherry Creek, Beaver Creek and Beaufort areas of the Regional District to "flesh-out" the 1971 Regional Plan.

In addition to these basic control mechanisms, there are a number of site specific development constraints and advantages that provide a further indication as to where future growth may be expected to occur.

City of Port Alberni Distribution

Urban development within the City requires full services including water, sewers and storm drainage. Hence, the availability of services or the possibility of installing them at an economic cost - a major locational determinant of future growth. Moreover, the City itself owns much of the remaining undeveloped land and is thus in a strong position to influence the direction of future growth. Low-lying areas near the mouth of the Somass River are considered vulnerable to Tsunami damage, and zoning controls endeavour to discourage urban development in these locations.

From discussion with the City Planning Consultant, the most probable areas to experience future growth, and their capacities, have been identified as follows:

Area 1: South end of City, bounded by Scott, Anderson, Ravenhill and Ship Creek Road. Approximate capacity - 75 single family dwellings.

Area 2: East edge of City, easterly extension of Montrose, Melrose, Bruce and Neil Streets. Approximate capacity - 110 single family dwellings and 70 townhouses.

Area 3: East edge of City, between Burde Street and Highway 4A. Approximate capacity - 130 single family dwellings.

Area 4: East edge of City south of Rogers Creek. Capacity - 175 single family dwellings.

Area 5: Extreme northwest corner of City. Capacity - 260 single family dwellings.

From an analysis of 1976 census data it is noted that the average household size for newer single family dwellings and townhouses in Port Alberni is approximately 3.6 persons per dwelling unit. On this basis the combined capacity of the above-noted growth areas is sufficient to accommodate all of the City's population growth which has been forecast for the period 1980 to 1991. (Capacity - 2,952, forecast growth - 2,887). However, as there still remain some smaller pockets of undeveloped land and scattered vacant lots, and as some future growth can be expected to be accommodated in new apartment construction in central parts of the city, it would be unrealistic to expect the identified growth areas to capture 100% of all growth during the next decade.

In recognition of this fact, assumptions must be made as to the probable rates of development within each growth area. Areas 2, 3 and 4 are considered the most "constraint-free", being entirely City-owned and reasonably accessible to services. Area 1 is under several private ownerships and Area 5 is in mostly public ownership but with private ownership around the periphery. Hence, these latter two areas may experience a more sporadic process of development. Accordingly, it has been assumed that Areas 2, 3 and 4 will become 75% developed over the next ten years, with the final 25% being developed in the decade after next. Areas 1 and 5 have been assumed to become 50% developed over the next ten years, with the final 50% being developed in the decade after next.

These assumed development rates have the effect of assigning 2/3 of all new residential growth to the above-defined growth areas during the 1980-1991 period with the remaining 1/3 to be accommodated in infill housing and apartments in established areas of the city. Assuming that apartment construction will remain at its present reather slow pace over the next ten years (approximately 30 units per year) and assuming an average apartment occupancy of 1.5 persons, then the estimated distribution of new population growth during 1980-1991 becomes:

New Growth Areas	1,903 persons
Infill Housing	534 persons
New Apartments	450 persons
Total	2,887 persons

The infill and apartment growth was distributed among the various traffic zones in proportion to the amount of suitably-zoned vacant land available within each traffic zone.

For the decade 1991 to 2001, new City growth was presumed to consist of:

(a) The completion of development within the new-growth areas discussed above.

(b) Extension of single family development into the remaining suitable undeveloped lands, including:

- the lands above the proposed future ring-road in the southeast corner of the City
- the Crown lands in the extreme south of the City
- infilling in the vicinity of Kitsuksis Creek.

(c) Redevelopment of central areas of the City of higher density forms of apartments in locations designated in the Official Community Plan.

With the filling up of the City, more emphasis on apartments was assumed in this decade, with the estimated distribution being 1,550 in apartments, 1,220 in the previously-identified growth areas and 200 in the presently-rural areas of the City.

Regional District Distribution

Traffic zones beyond the city limits are much larger than those within the City and each one encompasses several enumeration areas as indicated below.

Traffic Zone	Enumeration Areas
# 15 "Sproat Lake"	008,009,026, southerly portion 011
# 16 "Beaver Creek"	104,105,106,107,108,109,010
# 17 "Cherry Creek"	101,102,103,110 and 115
# 18 "Great Central"	northerly portion 011

Traffic zones numbered 19 and higher are not contiguous to the study area itself, and they interact with the study area only via the main highways leading to the Alberni Valley. This interaction will be unaffected by the geographic distribution of population within these remote traffic zones and hence, for purposes of this report, it is sufficient to provide an overall population forecast for each of these traffic zones without the need for a detailed locational breakdown. The forecasts prepared by B.C. Research were relied upon for this purpose.

Traffic Zone 15, "Sproat Lake", in recent years has been one of the fastest-growing areas in the Alberni Valley, primarily due to the attractiveness of the lakeshore and the relative freedom from air pollution from the pulp mill. However, the draft Settlement Plan recommends a strongly conservationist approach to future residential growth in recognition that further development would pose serious environmental hazards to the lake. Specific recommendations include a substantially increased minimum lot size (from 18,000 square feet to 26,000 square feet) and the rejection of a community water system until present sewage disposal problems are solved. The draft also notes that ". . .the current supply of lots is sufficient for the next three to five years. Once the vacant lots are built on, the future supply will be restricted to new lots over five acres in size and splitting lots that can pass the soil percolation test for septic fields. Until some type of community waste water system is installed development around Sproat Lake will be limited." For these reasons the growth forecasts for Sproat Lake, presented earlier in this report, have been adjusted downward substantially for use in estimating future traffic patterns.

Traffic Zone 16 was given the name "Beaver Creek" in the origin-destination study. However, the zone actually encompasses the two areas known locally as "Beaver Creek" and "Beaufort", both of which are accessed to Port Alberni via Beaver Creek Road. Beaver Creek is considered in the Regional Plan as one of the primary growth areas in the Alberni Valley. It is presently a mixture of producing farms, hobby garms, large-lot residential developments and mobile home parks strung out along the spine of Beaver Creek Road. The area is provided with water service by the Beaver Creek Improvement District, but sewage disposal is by means of individual septic tanks. The draft Settlement Plan for Beaver Creek foresees continued strong growth, but constraints imposed by the Agricultural Land Reserve and by Provincial septic tank regulations are expected to concentrate development into smaller lots in the vicinity of the City, which may ultimately be absorbed into the City through northerly extensions of the municipal sewer sytem. Beaufort, on the other hand, is primarily an agricultural area, with very few lots being less than five acres, and most being 20 acres or more in size. No community water service is available and none is planned. Future growth is expected to be quite gradual due to the Agricultural Land Reserve and to remoteness from the City. The growth forecasts for the combined Beaver Creek/Beaufort traffic zone, presented earlier in this report, have been adjusted slightly upward for traffic forecasting purposes in recognition of the growth potential of Beaver Creek.

Traffic Zone 17, "Cherry Creek" lies to the north and east of the City. Historically, most of the settlement in this area has developed along Cherry Creek Road, which leads northward from the northeast corner of the City and along secondary streets which have developed as tributaries to Cherry Creek Road. Additional smaller pockets of development have occurred along both the old and new alignments Highway 4 leading eastward from the northeast part of the City, including a small service-industrial area on the old highway and a motor lodge and several automobile-oriented commercial developments on the new highway. With the establishment of the A.L.R., the historical progression of development northward along Cherry Creek Road has beek curtailed, and most future residential development is expected to be directed to the non-A.L.R. lands along the eastern boundary of the City. The more northerly areas in this vicinity can be provided with water service from the Cherry Creek Waterworks District, but the areas south of Highway 4A would be efficiently serviced through easterly extensions of the City's street, water and sewer systems.

In view of the Cherry Creek area's proximity to the City, its supply of potentially developable land and the availability of services, the growth forecasts for this area, presented earlier in this report have been adjusted upward.

Traffic Zone 18, "Great Central" is a largely uninhabited area of Tree Farm and Crown Land whose dominant feature is Great Central Lake. Because of the basic incompatibility between residential development and commercial forestry, as well as a desire to protect the environment of Great Central Lake, no future growth is forecast for this area.

Summary

The application of the above-described methodology to the traffic zones defined in the origin-destination study yields the following tabular summary of population forecast by traffic zone.

Traffic Zone	Population 1980	1991	2001
1	804	1,292	1,740
2	991	1,290	1,640
3	1,623	1,695	1,780
4	1,847	1,875	1,900
5	398	400	450
6	4	0	0
7	1,868	1,900	2,200
8	418	1,134	1,370
9	2,572	2,924	3,030
10	2,018	2,100	2,200
11	0	0	0
12	2,970	3,190	3,650
13	2,432	2,918	3,430
14	1,619	1,752	1,845
City Total	19,563	22,450	25,235
15	1,717	1,800	1,900
16	3,725	4,445	5,120
17	3,206	3,679	4,136
18	63	60	60
Suburban Total	8,711	9,984	11,216
City and Suburban Totals	28,274	32,434	36,451

B-3 GEOGRAPHIC DISTRIBUTION OF FUTURE EMPLOYMENT

As with residential population, determining the distribution and location of employment at each forecast stage is an essential step in the process of predicting future traffic patterns. For this purpose, major centres of employment within the Alberni Valley were identified. It should be noted that the total employment within these centres will not equal the total employment of the community, as many people work in locations scattered throughout the area (e.g., corner stores, schools, suburban gas stations), many have jobs that do not have a fixed location (e.g., construction workers) and still others work outside the community altogether (e.g., loggers, fishermen).

These major centres of employment are as follows (see Figure for location).

1. Marshalling Yard - Sproat Lake Logging Division of MacMillan Bloedel/
2. Alberni Mall Shopping Centre and Industrial Park.
3. Gertrude/Johnston business district.
4. Office and Service Commercial Area on 6th Avenue from Maitland to Roger (including School Board Office, B.C. Telephone Office, M.B. Computer Centre, Dental Clinic and Municipal Works Yard).
5. MacMillan Bloedel Pulp Mill.
6. MacMillan Bloedel Somass Division Sawmill.
7. MacMillan Bloedel Alberni Pacific Sawmill.
8. MacMillan Bloedel Alberni Plywood Plant.
9. Downtown Core.
10. West Coast General Hospital.
11. 10th Avenue at Redford Community Centre.
12. Highway Commercial and Hotel concentration along Redford.
13. Marshalling Yard, Cameron Logging Division of MacMillan Bloedel.
14. Service Commercial area along Third Avenue.
15. Waterfront Industrial Area.

In order to apply the "employment ratios" discussed earlier, data was obtained from the City of Port Alberni and the Regional District Economic Development Commission regarding commercial floor areas; air photos augmented by windshield surveys were used to determine site areas of space-extensive industrial and service-commercial areas; and actual employment figures were obtained from major employers such as MacMillan Bloedel and West Coast General Hospital.

To estimate future levels of employment, reliance was placed on the employment forecasts prepared by AVG Management Science Ltd. As noted earlier, the AVG study forecasts little or no change in primary and secondary employment and, accordingly, the number of jobs in the employment centres containing these types of jobs were held constant throughout the forecast period (or, in the case of MacMillan Bloedel operations undergoing modernization, were reduced). Employment centres of tertiary employment were factored upward by the percentage increase estimated for this sector in the AVG study (2.83% per annum).

The results of this process were as follows:

Employment Centre	Employment Forecast		
	1980	1991	2001
1	500	500	500
2	300	395	520
3	325	430	565
4	225	260	300
5	670*	670*	670*
6	550*	505*	505*
7	220*	205*	205*
8	230*	230*	230*
9	1,200	1,600	2,100
10	150*	195*	250*
11	130	170	225
12	150	200	265
13	320	320	320
14	140	185	245
15	250	250	250
	5,360	6,115	7,150

* Indicates maximum per single shift (day shift).

Note: Employment centres is not same number as zone number.

B-4 IMPACT OF ROGERS CREEK CROSSING UPON COMMERCIAL TRADE AREAS

The retail and business facilities within an urban area generally tend to sort themselves out into a hierarchy of centres as follows:

1. The local store or corner store which offers a limited range of regularly consumed items (bread, milk, cigarettes, etc.) to a small local market area, usually located within walking distance of the customers it serves.

2. The nieghbourhood centre, which provides for the sale of convenience goods (foods, drugs and sundries) and personal services (dry cleaning, barbering, etc.) for the day-to-day living needs of a minimum trading area of around 5,000 to 7,500 persons. Such a centre will usually have a minimum floor area of around 30,000 square feet, with its principal store being a supermarket.

3. The community centre, which offers a wider range of goods than the neighbourhood centre, including wearing apparel, hardware and appliances and which usually serves a trade area of around 30,000 to 40,000 persons. Such a centre will usually have a variety store or a junior department store as its principal store, with a total floor area of from 100,000 to 200,000 square feet of retail space.

4. The regional centre, which serves a wide trade area of around 100,000 people or more and offers a full range of consumer goods and services in depth and variety. Such centres have a minimum of around 300,000 square feet of retail space and contain at least one full-line department store.

5. The central business district, which, in addition to containing the greatest retail and service concentration within the urban area, is the principal locale of other establishments such as business and public administrative offices, hotels, theatres and other entertainment facilities.

Leaving aside the category of "corner store", there are, within Port Alberni, four recognizable commercial centres that can be classified in accordance with the foregoing hierarchy of centres. These are:

1. The downtown area centred at Third Avenue and Argyle Street. Containing the area's principal concentration of offices, as well as City Hall, various senior government offices and hotel, restaurant and entertainment facilities, this is clearly the Central Business District for the City and Region. With close to 300,000 square feet of commercial space including one full-line department store, it functions at the level of a "Regional Centre". Although the population of Port Alberni and environs (approximately 32,000) is theoretically not large enough to sustain a retail centre at the regional level, the existing downtown area is able to function at this level because of:

   a) additional trade derived from beyond the valley
   b) the area's above-average per capita income
   c) the area's remoteness from larger competing centres.

2. The Alberni Mall, on the south side of the 3500 block Johnston Street. With 150,000 square feet of floor space including a junior department store, this centre functions at the level of a "Community Centre". Since a community centre requires a minimum trade area of around 30,000 persons, this centre must draw its market support from throughout the entire urban area, thus placing it in direct competition with the downtown centre.

3. The area centred on the Gertrude/Johnston intersection. Usually referred to as "Northport", this centre was the downtown core of the former City of Alberni prior to its amalgamation with Port Alberni. With some 65,000 square feet of retail space, including a supermarket, the retail component of Northport functions at the level of a "neighbourhood centre". However, the area also contains service, commercial, office and hotel facilities in addition to its retail content reflecting its former role as a central business district.

4. The area centred on the Tenth Avenue/Redford intersection. With 51,000 square feet of retail space including a supermarket, this centre is functioning at the level of a "Neighbourhood Centre".

The automobile is the dominant mode of access to all levels of commercial centres with the possible exception of the corner store. Consequently, any significant alteration to the street and road network can seriously shift the trade areas of individual centres.

To estimate the impact of a Rogers Creek crossing at Tenth Avenue and Twnety-First Avenue upon the trade areas of the four centres in Port Alberni, maps were prepared depicting isograms for five-minute driving times from the two neighbourhood centres, and five- and ten-minute driving times from the two larger centres. These driving times were based on an assumed average speed of 20 miles per hour, and made no allowance for any other future changes in the road network over and above the Rogers Creek crossing.

At prevailing densities of four units per acre in the built-up urban area, such a five-minute driving time will encompass approximately 3,600 households. As a general rule of thumb, one household is considered to support approximately 25 square feet of commercial floor space. Accordingly, for the two neighbourhood centres, the five-minute isogram would define a market area capable of supporting roughly 22,000 square feet of floor space, while for the two larger centres, the ten-minute isogram wouldddefine a market area sufficient to support roughly 90,000 square feet.

Since each centre is larger than these floor areas determined above, each is obviously deriving a substantial measure of market support from beyond the areas illustrated by the five- and ten-minute isograms.

The Northport Neighbourhood centre is strategically located to dominate the neighbourhood level of shopping trade from the extreme northwest corner of the City, and from the Sproat Lake and Beaver Creek areas, beyond the five-minute isogram. These areas represent some 1,550 households at the present time; sufficient to provide support for approximately 40,000 square feet of neighbourhood floor space. Together with the 22,000 square feet that can be supported by the market area inside the five-minute isogram, this total "supportable" floor space roughly equals the actual floor space of 65,000 square feet within this centre at the present time.

A review of the effect which the alternative Rogers Creek Crossing would have upon the market area of Northport indicates that both crossings have an approximately equal positive effect in that they extend the five minute isogram into the currently vacant municipal land at the easterly extension of Roger Street. However, as this area is closer to both Alberni Mall and Tenth and Redford, it is doubtful if Northport could expect to derive much additional trade as a result.

The Twenty-First Avenue alignment of a future Rogers Creek Crossing would have little negative impact upon Northport, in the sense of allowing its primary market area to be significantly penetrated by a competing centre. However, the Tenth Avenue alignment would have the effect of extending the "five Minute" market area of the Tenth and Redford Centre into a portion of the Northport five minute zone. The area affected is bounded roughly by Johnston, the railroad, the northern city limits and Bishop Avenue. This area contains approximately 220 households, equivalent to roughly 9 percent of the total required market support for the Northport Centre. By way of contrast, the northwest market area, over which Northport has primary dominance (and which it will continue to dominate regardless of whether or not a Rogers Creek Crossing is constructed) is forecast to expand by some 500 households during the time frame of this study. So even if Northport were to lose some trade to Tenth and Redford as a result of a new Rogers Creek Crossing, it should be able to continue to flourish at its present size due to increased trade from other areas.

It should also be noted that the area predicted to fall within range of Tenth and Redford is an area that Northport must already share with Alberni Mall. The principel "magnet" at the neighbourhood shopping level is the supermarket and both Alberni Mall and Tenth and Redford has as their supermarket a Safeway Store. Thus Northport is not likely to lose much additional trade to the Tenth and Redford Safeway, when the people within the newly penetrated segment of its market area already enjoy equally easy access to the Safeway at Alberni Mall.

With respect to the Tenth and Redford Centre, the principle potential benefit, as discussed above, is the opportunity to penetrate northward into the area north of Rogers Creek. However, as this is an area already served by similar but closer facilities in Northport and Alberni Mall, this benefit will be of almost negligible value.

In a negative sense, the Tenth and Redford Centre will experience stiffer competition from Alberni Mall with the construction of a Rogers Creek Crossing. In fact almost one-third of its "five minute" market area will also lie within five minutes of Alberni Mall, but because of the pattern of arterial and collector roads on both sides of Rogers Creek, the extent of this market penetration is unaffected by the relative locations of either a Tenth Avenue or a Twenty-first Avenue alignment.

The Alberni Mall Centre will have its competitive strength enhanced by the construction of a Rogers Creek Crossing, because those portions of the urban area lying south of Rogers Creek will be brought into much closer driving range as a result. However, as noted earlier, the associated pattern of collectors and arterials werving the Rogers Creek Crossing is such that the size and location of this expanded market area is not noticeably affected by choice of a Tenth Avenue versus a Twenty-First Avenue location for the crossing.

Of the four existing commercial centres, Downtown is the one which has its market area expanded the least by the construction of a Rogers Creek Crossing. Only a few small areas in the northeast of the urban area are added to the ten minute zone, and as these are virtually on the doorstep of Alberni Mall (with which Downtown is in direct competition), it is doubtful if this would be of any benefit.

In summary, it is concluded that the principal effect which a Rogers Creek Crossing will have upon retail market areas is the enhancement of Alberni Mall at the expense of Downtown and Tenth and Redford. Moreover, this effect will be of almost equal magnitude regardless of whether the crossing is constructed at Tenth Avenue or Twenty-First Avenue. Therefore, impact upon commercial trade areas does not emerge as a significant factor to be taken into account in choosing between Tenth and Twenty-First Avenues for the crossing location.

APPENDIX C

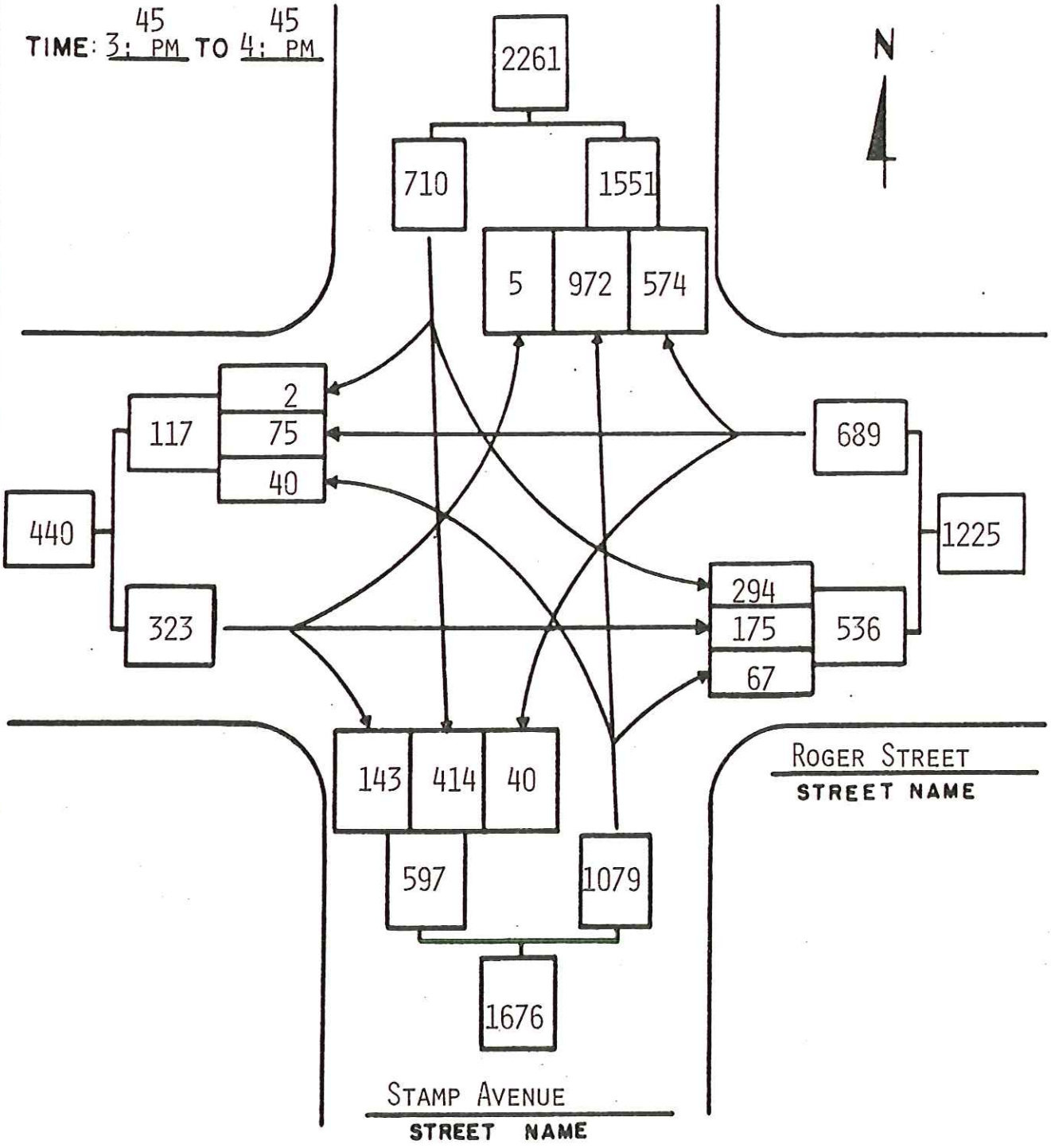
TRAFFIC RECORDS

TRAFFIC VOLUME SUMMARY

CITY Port Alberni DATE Feb. 20/80 DAY Wednesday

INTERSECTION OF Gertrude St. AND Roger St.

TIME: 3: 45 PM TO 4: 45 PM

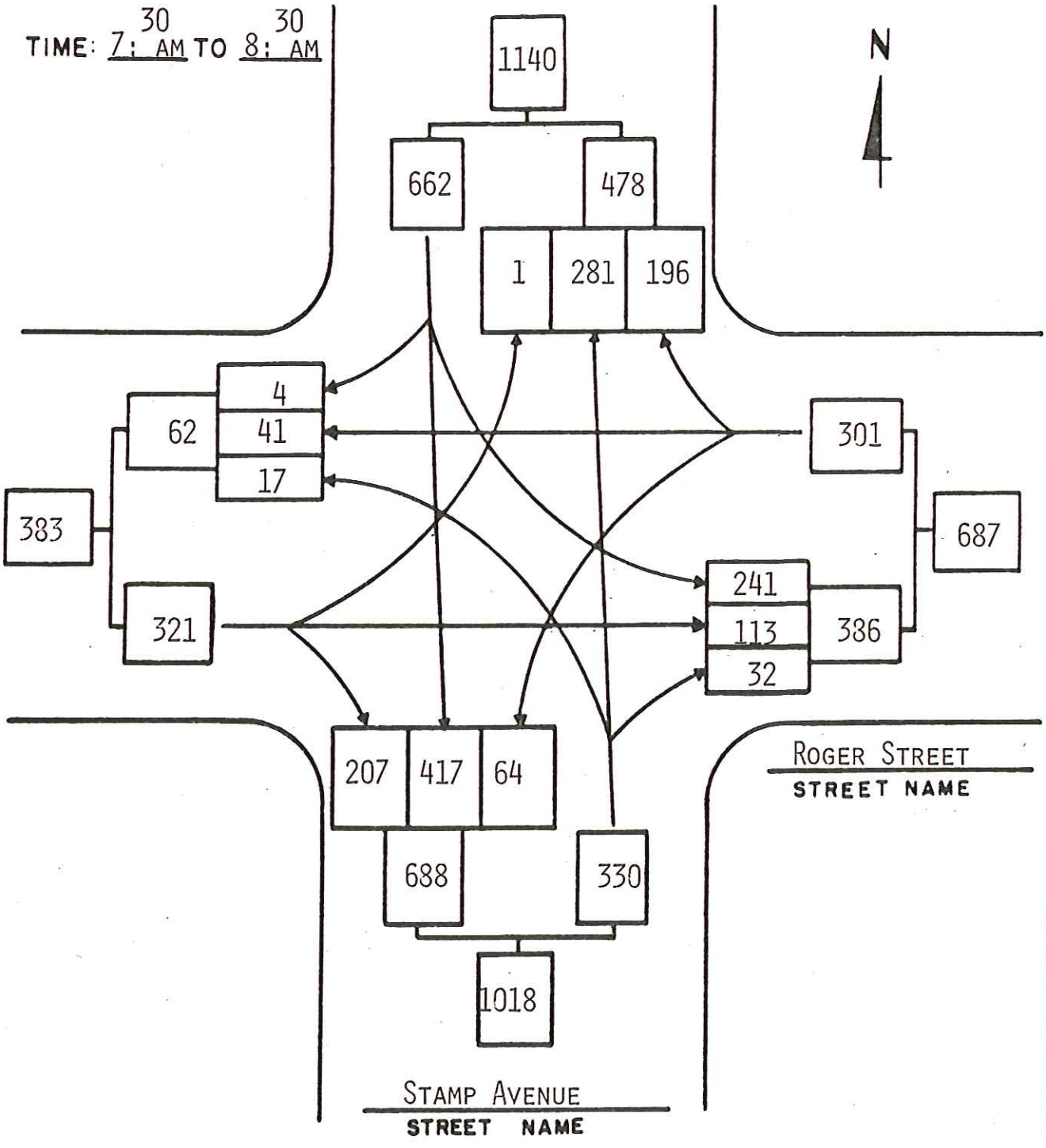


TRAFFIC VOLUME SUMMARY

CITY Port Alberni DATE Feb. 20/80 DAY Wednesday

INTERSECTION OF Gertrude St. AND Roger St.

TIME: 7:30 AM TO 8:30 AM

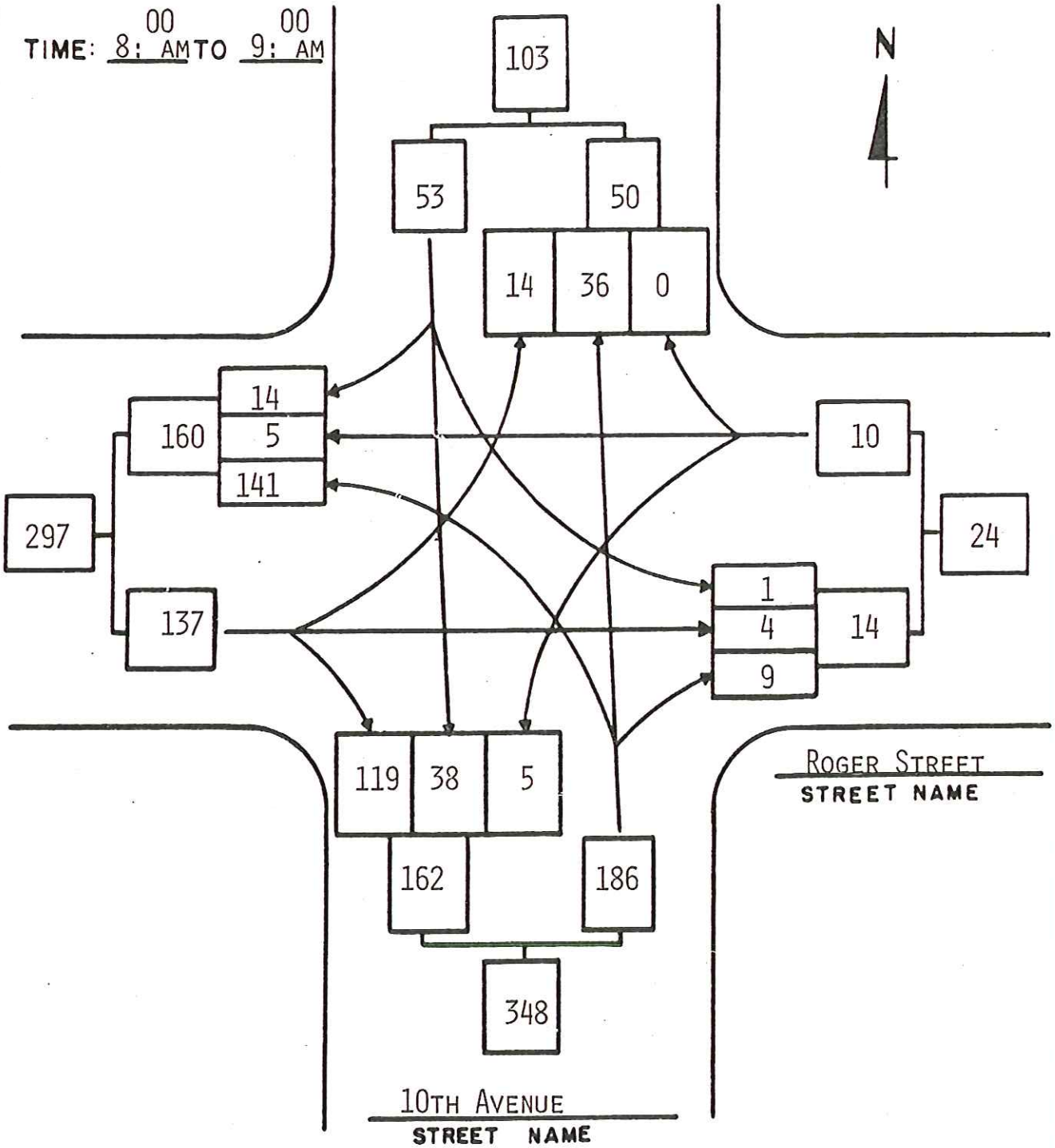


TRAFFIC VOLUME SUMMARY

CITY Port Alberni DATE July 9/80 DAY Wednesday

INTERSECTION OF Roger Street AND 10th Avenue

TIME: 8:00 AM TO 9:00 AM

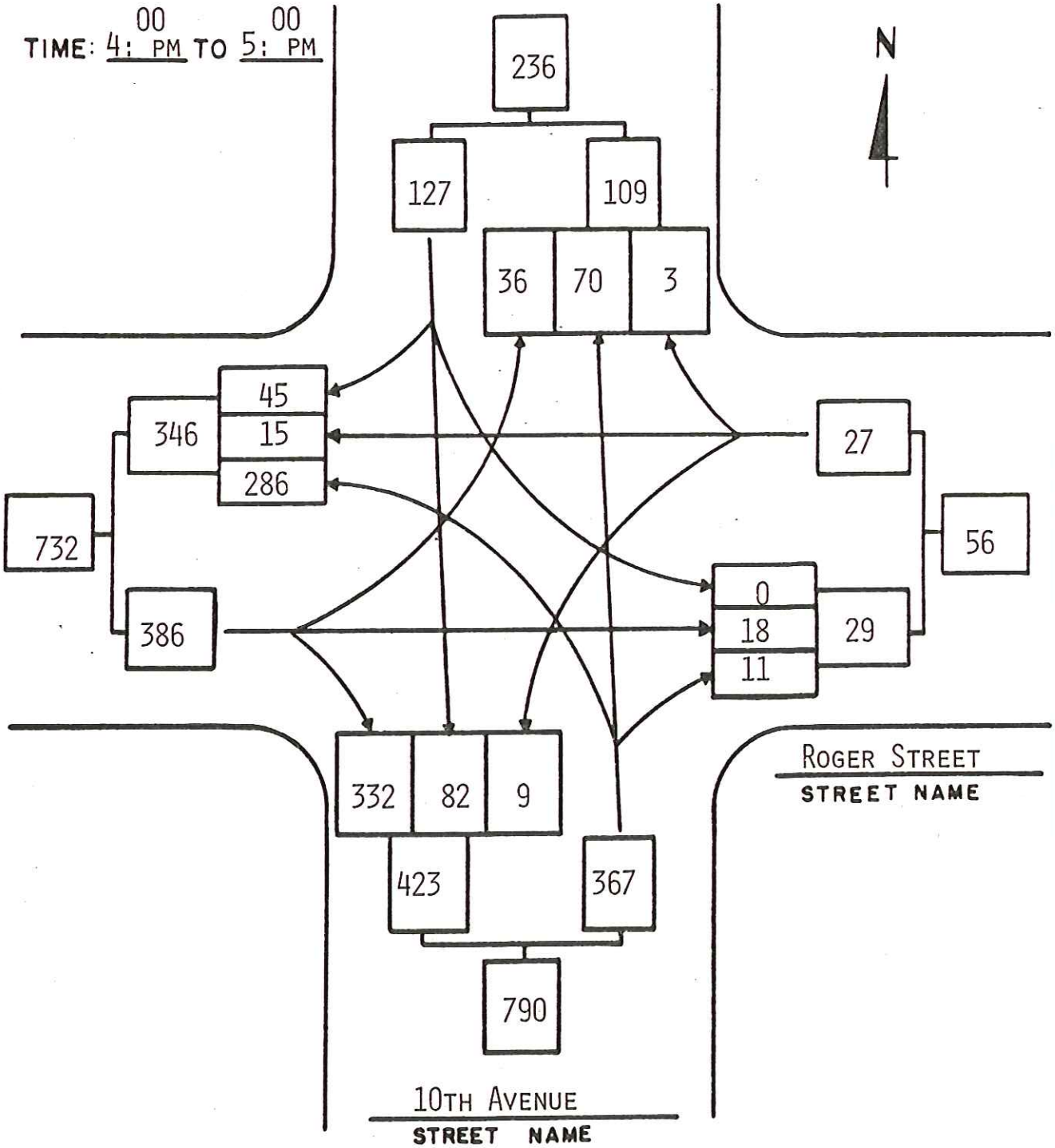


TRAFFIC VOLUME SUMMARY

CITY Port Alberni DATE July 15/80 DAY Tuesday

INTERSECTION OF Roger Street AND 10th Avenue

TIME: 4:00 PM TO 5:00 PM



FILE NDLEA (CREATION DATE = 03/18/80)

Q4 NUMBER OF PERSONS IN VEHICLE

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
1 PERSON	1.	952	64.8	64.8	64.8
2 PERSONS	2.	352	23.9	24.0	88.8
3 PERSONS	3.	101	6.9	6.9	95.6
4 PERSONS	4.	39	2.7	2.7	98.3
5 PERSONS	5.	15	1.0	1.0	99.3
6 PERSONS	6.	5	0.3	0.3	99.7
7 PERSONS	7.	3	0.2	0.2	99.9
9+ PERSONS	9.	2	0.1	0.1	100.0
NO RESP	0.	1	0.1	MISSING	100.0
	TOTAL	1470	100.0	100.0	

VALID CASES 1469 MISSING CASES 1

FILE NDLEA (CREATION DATE = 03/18/80)

05 TYPE OF VEHICLE

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
CAR	1.	947	64.4	64.4	64.4
LIGHT TRUCK-VAN	3.	446	30.3	30.3	94.8
MEDIUM TRUCK-COMM	4.	39	2.7	2.7	97.4
HEAVY TRUCK	5.	8	0.5	0.5	98.0
OTHER	6.	30	2.0	2.0	100.0
	TOTAL	1470	100.0	100.0	

VALID CASES 1470 MISSING CASES 0

FILE NOLEA (CREATION DATE = 03/18/80)

Q3 PRIMARY PURPOSE OF TRIP

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
GOING TO WORK	1.	223	15.2	15.2	15.2
WORK RELATED	2.	193	13.1	13.1	28.3
SCHOOL OR COLL.	3.	62	4.2	4.2	32.5
PERSONAL BUSINESS	4.	196	13.3	13.3	45.9
GOING HOME	5.	244	16.6	16.6	62.4
RECREATN-SOCIAL	6.	153	10.4	10.4	72.9
SHOPPING	7.	237	16.1	16.1	89.0
DRIVING PASSENGR	8.	43	2.9	2.9	91.9
OTHER	9.	119	8.1	8.1	100.0
	TOTAL	1470	100.0	100.0	

VALID CASES 1470 MISSING CASES 0

Business
Reply Mail
No Postage Stamp
Necessary if Mailed
in Canada

Postage will be paid by

ROGERS CREEK CROSSING STUDY
PORT ALBERNI CITY HALL,
4850 ARGYLE ST.,
PORT ALBERNI, B.C.
V9Y 9Z9

ROGERS CREEK CROSSING SURVEY

The City of Port Alberni has commissioned this survey as part of an evaluation of possible new crossings of Rogers Creek. The purpose of this survey is to obtain information regarding your travel patterns and why you were making the particular trip during which you were given this form.

Your assistance by completing and returning this form in the attached envelope as soon as possible will be appreciated. NO SIGNATURE OR POSTAGE IS REQUIRED.

1. When you recieved this form, where had you just come from? (start of this one trip - exclude any short intermediate stops for gas etc...)

_____, _____ ☐☐☐☐

ORIGIN ADDRESS OR NEAREST INTERSECTION — CITY (eg. Port Alberni) OR DISTRICT (eg. Sproat Lake)

2. Where were you going to? (once again exclude any short intermediate stops for gas etc...)

_____, _____ ☐☐☐☐

DESTINATION ADDRESS OR NEAREST INTERSECTION — CITY OR DISTRICT

3. What was the primary purpose of the trip?

1. Going to work
2. Work related business
3. To or from School or College
4. To or from personal business
5. Going home from work
6. To or from recreational/social
7. To or from shopping
8. Driving passenger
9. Other _____ (please specify)

please write number in box → ☐

4. How many persons (including driver) were in your vehicle?

please write number in box → ☐

5. What type of vehicle were you driving?

1. Car
2. Motorcycle
3. Light truck or van
4. Medium truck (commercial)
5. Heavy truck (3 axles or more)
6. Other _____ (please specify)

please write in box → ☐

P.T.O.

6. Have you ever made this trip between origin (question 1) and destination (question 2) by bus?

1. No
2. Yes

please write number in box → ☐

7. The following space is provided for any comments you may wish to make concerning transportation matters:

Tear Off Here

Fold Over Stick Down

INSTRUCTIONS TO DRIVERS:

Please give the details of the trip you were making when you were given this questionnaire by printing your answers and numbers in the spaces provided (the shaded boxes are for office use only).

Then detach the completed questionnaire from the prepaid envelope provided, fold it and mail in the prepaid envelope as soon as possible (NO POSTAGE OR SIGNATURE REQUIRED)

The information you provide will be of vital importance in assisting our consultants, N.D. Lea & Associates Ltd., in this study and your co-operation is greatly appreciated by members of the City Council.

Thank you.

J.A. Robertson
Mayor

APPENDIX D

ACKNOWLEDGMENTS

The following contacts were made and gratefully acknowledged:

Personal interviews by H. M. Etter or J. Vickerson

1.	Larry Beres	- Parks and Recreation Commission
2.	Rick Olson	- Community Program Leader
3.	Ron Doetzel	- Program Leader Gyro Sports Centre
4.	Doug Brimacombe	- Parks Superintendent
5.	Zoltan Szy	- Park Recreation Foreman
6.	Craig Flemming	- City Engineer
7.	Bob Cerenzia	- B.C. Fish & Wildlife Branch
8.	Gary Horncastle	- B.C. Fish & Wildlife Branch
9.	Bruce McDonald	- Fisheries and Oceans Canada
10.	Ed Lockbaum	- Fisheries and Oceans Canada

Telephone interviews by J. Vickerson:

11.	Brian Roan	- Alberni Valley Outdoor Club
12.	Billy Sadish	- Tuesday Walkers
13.	Bertha Smith	- Girl Guide Group

Additional relevant information was obtained from the following sources:

Mr. Bill Brown	- Planner, Alberni-Clayoquot Regional District
Mr. William Blakely	- Planning Consultant, City of Port Alberni
Mr. Bill Bjornson	- Planning Technician, City of Port Alberni
Mrs. Susan McFarlane	- Alberni-Clayoquot Economic Development Commission
Mr. Bernard Kimble	- Public Relations Officer, MacMillan Bloedel

Port Alberni Parks & Recreation Commission

School Board (School District #70, Alberni)

APPENDIX E

TERMS OF REFERENCE

CITY OF PORT ALBERNI
CITY HALL • 4850 ARGYLE ST. • PORT ALBERNI, B.C. V9Y 1V8
PHONE 723-2146 *In replying please refer to file number* _____

October 15th, 1979

N.D. Lea & Associates Ltd.,
1455 West Georgia Street,
Vancouver, B.C.
V6G 2T6

We enclose a copy of the proposed Terms of Reference for a study of a Major Road Crossing of Rogers Creek within this City. This study is being commissioned jointly by the City and the Provincial Government.
Your firm is invited to submit a proposal by November 16th, 1979, regarding this study.

Yours very truly,
CITY OF PORT ALBERNI

J. Sawyer,
City Manager

JS/ja
Encl.

October, 1979

CITY OF PORT ALBERNI

INVITATION FOR PROPOSALS

FOR

STUDY OF MAJOR ROAD CROSSING OF ROGERS CREEK

1. Introduction

The City of Port Alberni and the Province of British Columbia are jointly funding an assessment of a proposed major road crossing of Rogers Creek. Two opportunities for such a crossing, via 10th Avenue and via 21st Avenue, have been identified by the Alberni Valley Major Street Network Plan Study recently conducted by the City, the Regional District, and the Ministry of Transportation, Communications and Highways. They have been the subjects of earlier preliminary engineering assessment by Associated Engineering Services Ltd., and copies of those reports are included in the accompanying information package. The prime objectives of this assignment are to determine which of these opportunities should be utilized at this time for the development of a crossing and at what time in the future a further crossing may be required.

Accordingly, proposals are now requested for consulting services to conduct a functional planning study of the two route alignments and to recommend the preferred routing for the next crossing based on an assessment of social and environmental implications and the cost effectiveness of each route. It should be noted that while this assignment does not require facility design, it does require supplementing and up-grading of available topographic and geotechnical data to the extent that an unreserved recommendation can be made as to location and facility type. Cost estimates and particulars of the options, sufficient for referendum and funding purposes, shall be included.

2. Terms of Reference

The study is to include, but not be limited to, the following considerations and requirements:

i. Consultant shall meet with the study Steering Committee to review background and recommendations of the Alberni Valley Major Road Network Study, and at appropriate stages in the advancement of the assignment.

ii. Consultant shall assemble and interpret pertinent plans and statistics identifying urban growth trends and characteristics as they may relate to selection of the location and type of crossing.

iii. Consultant shall undertake sufficient ground survey work to supplement and verify available topographic mapping as he deems appropriate and necessary for the purposes of this study.

iv. Consultant shall analyse and evaluate the soil analysis forming part of the Associated Engineering Services Ltd. "Preliminary Report of Roger Creek Crossing" (at 10th Avenue) dated November, 1966 and shall undertake field work for geotechnical surveys, including any sub-surface exploration, that may be appropriate at the 21st Avenue site, sufficient to enable a comparative evaluation of both sites and to enable derivation of substructure and earth work costs.

v. Consultant shall identify, collect and analyse all traffic and land use data he deems necessary for the prime purposes

of this study and as a basis for the preliminary design of approach roads. Projections of this data will be made to indicate the stage of population increase and land development at which a subsequent crossing would also be warranted.

vi. Consultant shall be responsible for the indentification, collection, and analysis of all information he deems necessary to assess the environmental implications of both Rogers Creek crossings and connecting routes, taking into account the prospect of other crossings for water and gas mains.

vii. Consultant shall identify and assess the social consequences and implications of both Rogers Creek crossings and connecting routes.

viii. All work and cost estimates are to be based on the ultimate design of a four lane bridge across Rogers Creek with geometrics to the City of Port Alberni standards. However, the feasibility of staging by the construction of a 2 lane bridge with capability for expansion to 4 lanes should be examined.

ix. Consultant shall conduct sufficient functional planning design work for each route option to produce documentation to include:

- road plan and profile drawings, including approach roads
- illustrative cross sections
- quantities estimates
- rights-of-way requirements
- identify type of Rogers Creek structure and retaining walls requirements
- other guidance he deems appropriate

x. Consultant shall provide preliminary right-of-way and construction cost estimates for each routing option; cost estimates for the structures should be stated separately from approach road requirements.

xi. Consultant shall summarize the social and environmental implications of each routing option and comment on the utility provided by each routing when considered in conjunction with the Alberni Valley Major Road Network. On this assessment, and the cost effectiveness of each routing, the Consultant will recommend the preferred routing.

xii. Consultant shall provide the City with Twenty (20) copies of the study report.

3. Steering Committee

A Steering Committee of technical representatives of the City, Regional District, Ministry of Transportation, Communications and Highways will be formed to oversee progress on the study. Proposals will indicate at which stages in the advancement of the work the Consultant will liaise with the Committee.

4. Proposals

i. The Consultant shall state the basis for his remuneration together with an estimate of the total cost of carrying out this study.

ii. The proposal shall outline methodology, schedule of field work and report preparation, anticipated time and expenditure on major study elements.

iii. Identification of key study personnel and that of any sub-consultants must be included.

iv. Summary of Company experience related to this assignment is also to be included.

v. The Consultant shall give adequate evidence that he has the expertise and capability, if requested, of following up this study with the design of the structure and approach roads, the preparation of detailed drawings and specifications, the calling of tenders and the contract award, and the supervision of construction-all as required for the completion of the structure and appurtenances as recommended in his proposal.

vi. 8 copies of the Consultant's proposal embodying the above study content will be received by the City Manager up to 5:00 p.m., November 16th, 1979. Proposals may outline any further content felt appropriate to the study purposes.

5. Acceptance

It is anticipated that the Consultant will be appointed by December 31st,. 1979.

6. Reference Material

Enclosed:-

- Copy of Associated Engineering Services Ltd. Report "Preliminary Report on Roger Creek Road Crossing" dated November, 1966.
- Copy of Associated Engineering Services Ltd. Report "Roger Creek Crossing Study - 21st Avenue Site", dated November, 1970.

Available for perusal at City Hall:-

- Aerial Topographic Mapping of locale-1" to 400', 5' Contour intervals.

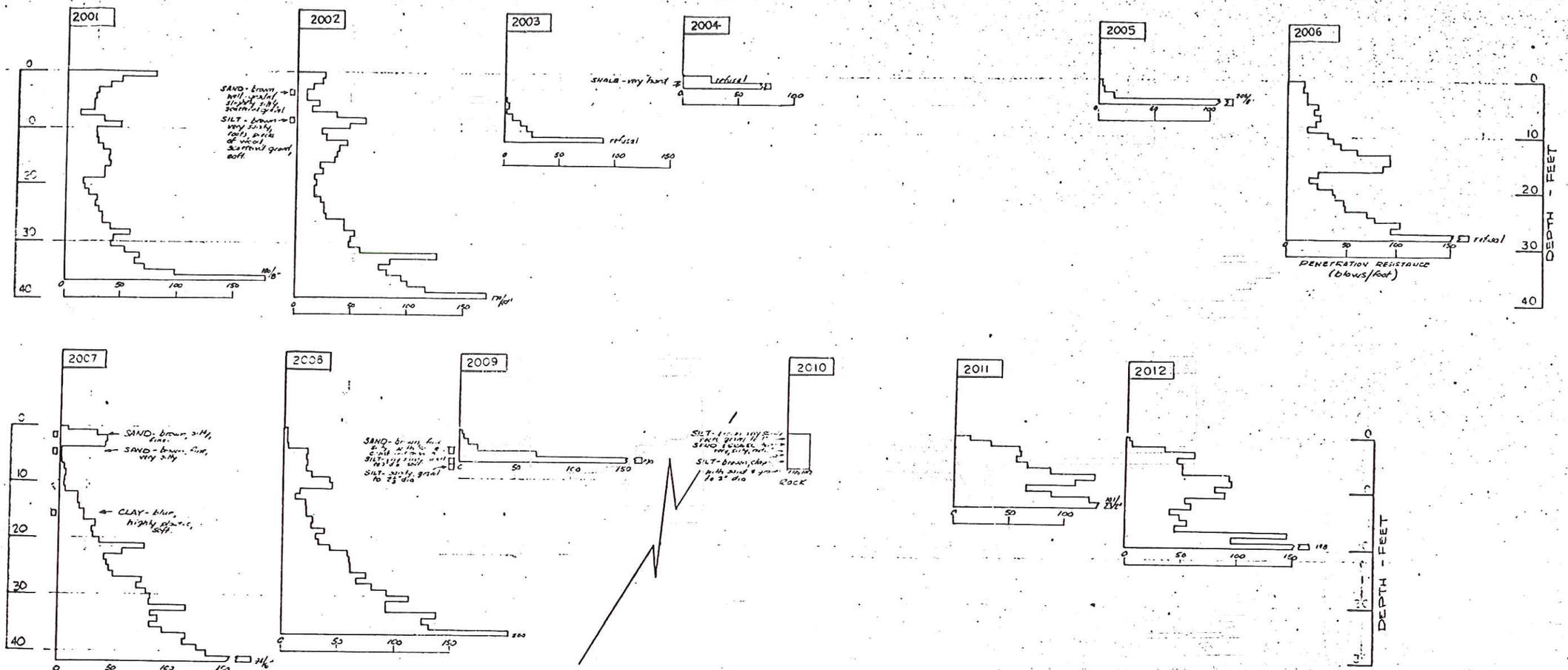
- Aerial Photo Mosaic, 1976 - 1:5000 (approximately 1" to 400')
- Aerial Photographs of locale - 1976 - 1:10000
- Legal Map showing Major Land Holdings - 1" to 400'.
- Ministry of Highways Surveys:
  - Licence Plate Survey - 1976.
  - Summer Short Count Program - June 1979.
  - Intersection Counts and Truck Classification Count - June 4th & 5th, 1979 and August 13th & 14th, 1979.

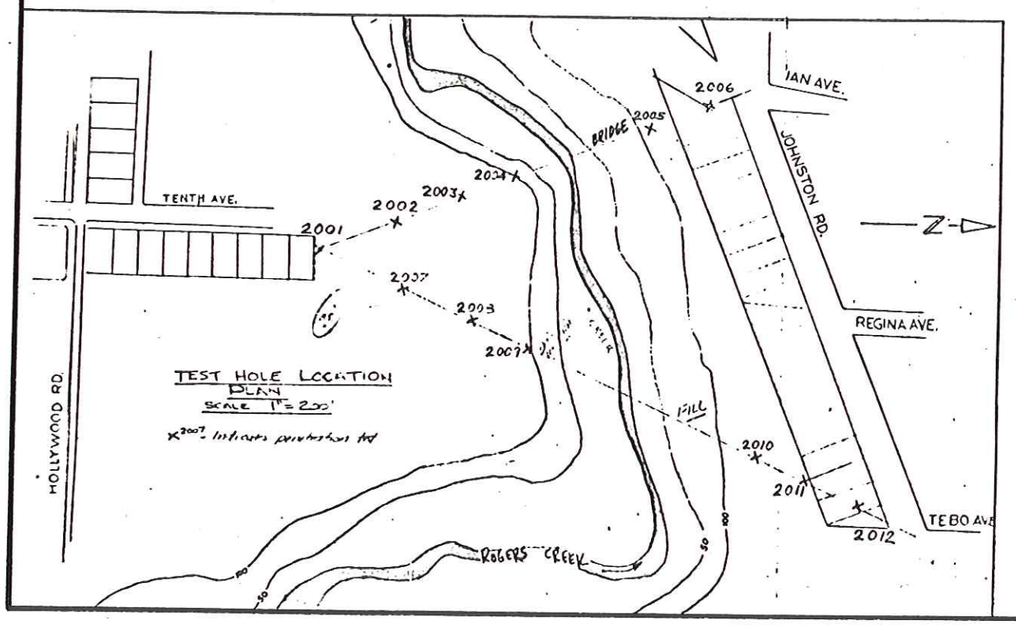
List of consulting firms from whom submissions have been requested:

1. Associated Engineering Services Ltd.
2. C.B.A. Engineering Ltd.
3. De Leuw Cather Canada Ltd.
4. Ker Priestman & Associates Ltd.
5. N.D. Lea & Associates Ltd.
6. Zoltan J.K. Kuun Associates
7. Stanley Associates Engineering Co. Ltd.
8. Reid Crowther & Partners Ltd.
9. Underwood McLellan (1977) Ltd.
10. Aplin & Martin Engineering Ltd.

APPENDIX F

SOILS DRAWING - 10TH AVENUE SITE





PENETRATION DATA
WEIGHT OF HAMMER = 50 lb.
HEIGHT OF DROP = 30 in.
DIAMETER OF DRIVE ROD = 1 in.
DIAMETER OF DRIVE SHOE = 1¾ in.

REV.	DATE	DETAILS OF CHANGE
		REVISIONS

Ripley, Klohn & Leonoff Ltd.
CONSULTING ENGINEERS
VANCOUVER & WINNIPEG, CANADA

CLIENT: ASSOCIATED ENGINEERING SERVICES LTD

PROJECT: PROPOSED ROGER CREEK ROAD CROSSINGS — ALBERNI, B.C.

TITLE: SUMMARY OF TEST HOLE DATA

DRAWN BY V.K. / CHK'D BY J.R. / APPROVED

SCALES 1" = 10' VERT. / 1" = 50' HORIZ.

DATE MAY 27, 1965

DWG. NO. D-838-1

REV.