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ROGER CREEK CROSSING STUDY
21ST AVENUE SITE

Prepared for
City of Port Alberni, British Columbia

By
Associated Engineering Services Ltd.
1661 West 8th Avenue
Vancouver 9, B. C.

November 1970

November 30, 1970

File: 4037-29280

Mayor and Members of Council,
City of Port Alberni,
400 Argyle Street,
PORT ALBERNI, British Columbia.

Gentlemen:

We are pleased to present herewith our report entitled "Roger Creek Crossing Study, 21st Avenue Site".

It is hoped that this report will serve as a useful guide towards the future implementation of a crossing over the Roger Creek ravine.

Yours truly,



J. R. O'Brien, P.Eng.,
Manager, B. C. Division



K. E. Fenton, P.Eng., AMITE,
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JRO'B:KEF:km

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INTRODUCTION

A long-range community plan has recently been received by the City of Port Alberni. This plan envisages a new arterial crossing of the Roger Creek ravine in the vicinity of 21st Avenue. Since construction of such a crossing will require large capital expenditures as well as property acquisition, the City commissioned Associated Engineering Services Ltd. to study alternative methods of crossing the ravine at this location, and to update a previous study for a crossing at 10th Avenue.

The study also includes projections of future traffic for the various alternatives in order that lane requirements together with economic considerations can be determined. The findings of this study are outlined in the following paragraphs.

EXISTING TRAFFIC CONDITIONS

Traffic Counts

Traffic counts were taken on each of the existing bridges across Roger Creek. These counts were taken during the period 7:00 to 9:00 am and 4:00 to 6:00 pm on November 13, 17, and 18. The following is a summary of the peak hourly volumes during both the morning and evening peak periods:

Table 1. Existing Bridge Traffic

Crossing	Lanes	am Peak		pm Peak	
		N/B	S/B	N/B	S/B
Victoria Quay Bridge	2	133	450	285	300
Gertrude Bridge	4	470	500	1120	585

Level of Service

As can be seen in Table 1, the highest peak hourly volume is represented by the northbound traffic on the Gertrude Bridge, which was recorded to be 1120 vehicles per hour during the period 4:15 to 5:15 pm. Southbound traffic during this same period on the bridge was recorded as 585 vehicles per hour. Although no detailed volume-capacity relationships were determined at any of the adjacent intersections, it is estimated that this bridge is operating at approximately 70% capacity during the peak period. This is based on the assumption that the capacity of the bridge is controlled by the existing street system.

The highest peak hourly volume on the two-lane Victoria Quay bridge was recorded as 450 vehicles per hour southbound during the period 7:30 to 8:30 am. The highest volume during the evening peak period was recorded as 300 vehicles per hour, also southbound, during the period 4:15 to 5:15 pm. This bridge is estimated to be operating at 55% capacity during the morning peak period and 37% during the evening peak.

Traffic counts recorded by the Provincial Department of Highways indicate that increases of between 19% and 40% have been recorded at various locations in the Port Alberni area since 1966. Using this information as a guide in conjunction with the projected population growth, it is estimated that the Gertrude Bridge will reach capacity by 1976. Since the Victoria Quay Bridge is expected to have excess capacity during the same year, diversion of traffic from the Gertrude Bridge to the Victoria Quay Bridge could extend the date of capacity for the combined bridges to 1980.

PROJECTED TRAFFIC CONDITIONS

Data Base

The data base for this report has been developed in collaboration with the City of Port Alberni, Town Planning Consultant, W. J. Blakely & Associates. This data basically includes the following elements:

1. Design population 63,000
2. Future land use plan
3. Existing and projected population distribution
4. Existing and projected employment distribution

It should be noted that the projected population of 63,000 includes 43,000 within the existing limits of the City of Port Alberni, and 20,000 outside.

General Comments

In the future it is estimated that the City of Port Alberni and its immediate surrounding area will generate 157,000 vehicle trips per day. Since this particular study is primarily concerned with north-south travel movements across the Roger Creek ravine, analysis of the data has been made accordingly.

Figure 1 illustrates that the largest daily vehicle movements across Roger Creek are expected to be oriented in a northwest-southeast direction and in the vicinity of the existing bridges. The Figure also shows that the demand across the ravine in the vicinity of the proposed 10th Avenue or 21st Avenue crossings will be approximately the same.

It should be noted, however, that the desire lines show travel demands between centroids of land use areas, and they therefore represent the most direct travel desires irrespective of route. The total estimated future one-way northbound vehicle movements across the Roger Creek ravine are expected to be 4500 vehicles per hour during the evening peak period.

Future Volumes

If no new bridges were to be constructed the existing bridges are expected to have traffic volumes in the order of 85% above capacity at an acceptable level of service. Theoretically, all of the projected traffic

could be accommodated by the existing bridges. Extreme congestion and intolerable delays would, however, be experienced by the motorists. These conditions make it obvious that a new crossing of the Roger Creek ravine will be necessary in the future. Table 2 summarizes the projected traffic volumes which can be expected at the existing bridges and the 10th Avenue and 21st Avenue sites.

Table 2
Projected Peak Hour Volumes

Alternatives	VPH	% Capacity
Condition 1 - No new crossings Existing bridges	4500	185%
Condition 2 - 10th Ave. Crossing Existing Bridges	2260	95%
10th Ave. Crossing (4 lane)	2280	142%
Condition 3 - 21st Ave. Crossing Existing bridges	3000	125%
21st Ave. Crossing (2 lane)	1540	128%
21st Ave. Crossing (4 lane)	1540	64%
Condition 4 - 10th Ave. & 21st Ave. Crossings Existing bridges	2260	95%
10th Ave. (2 lane)	970	121%
21st Ave. (2 lane)	1310	109%
Assumptions:		
Capacity existing bridges = 800 vph/lane		
Capacity 10th Ave. crossing = 800 vph/lane		
Capacity 21st Ave. crossing = 1200 vph/lane		
Capacity of bridges will be controlled by the connecting street system.		

POSSIBLE ALIGNMENTS FOR 21ST AVENUE CROSSING

Preliminary Alignments

Since the projected traffic volumes indicate that considerable merit exists for the construction of a crossing in the vicinity of 21st Avenue, analysis of potential crossing sites at this location were investigated. Initially seven alignments were investigated. However, it was obvious that only four of these required detailed study: one alignment utilizing fill and culvert, and three utilizing a structure.

Crossing Standards

It has been assumed that the geometric design standards for a crossing will conform to the Canadian Good Roads Association (CGRA)

designation RAU-50. Such a standard is based upon a 50 mph design speed and a maximum grade of 6%.

Fill and Culvert Alignment FC-1

Only one general location for a fill and culvert crossing of Roger Creek in the vicinity of 21st Avenue appears economically practical. As shown, this alignment is similar to that proposed by the Town Planning Consultant. Since the fill and culvert method requires the excavation of large volumes of material, the sidehill site as shown is advantageous in that materials excavation can be kept to a minimum. Due to cuts and fills at the approaches, it will be necessary to construct a section of roadway approximately 2100 feet in length. This would be sufficient to connect the 180-foot contours on either side of the ravine. It is estimated that a two-lane crossing at this location will cost \$575,000, and a four-lane crossing \$675,000. These costs do not include provisions for either a culvert or diversion of the existing creek that enters the Roger Creek ravine immediately west of the existing garbage disposal area. The costs do, however, include an allowance for a pedestrian tunnel through the embankment which, in turn, could act as an overflow in the event of an extreme flood.

Structural Alignment S-1

The alignment for this alternative is the same as for Alternative FC-1, the only exception being that a structure would be constructed across the steepest portion of the ravine rather than an embankment. It is estimated that a structure approximately 260 feet in length would be required. The cost of a four-lane structure only is estimated at \$700,000, and a two-lane structure \$400,000. Since Alternative FC-1 above is based on a roadway approximately 2100 feet in length, 1840 feet of roadway approaches have been added to this cost in order that equitable comparisons can be made. For the four-lane alternative, the approaches are estimated to cost \$525,000, or a total of \$1,255,000. Similarly, for the two-lane roadway the cost of approaches is estimated at \$390,000, or a total of \$790,000.

Structural Alignment S-2

This alternative is located in the same general area as the previous alternatives. However, volumes of cut and fill have been reduced by maintaining a higher roadway elevation. A crossing at this location with a structure appears to have four distinct advantages over Alternative S-1. These are:

1. The overall cost is less for both a four-lane and two-lane crossing. A four-lane crossing is estimated to cost \$1,000,000 including \$700,000 for the structure and \$300,000 for the approaches. A two-lane crossing is expected to cost \$600,000 including \$400,000 for the structure and \$200,000 for the approaches.

2. A virtually straight alignment appears possible and therefore could be considered superior from a safety aspect.
3. Approach elevations would be nearer to the existing ground line and therefore access to adjacent land would be easier.
4. Roadway geometrics would be superior since a 4% grade is possible for the north approach.

Structural Alignment S-3

This crossing of Roger Creek could make use of the existing finger of land located immediately east of the garbage disposal area. The alignment illustrated appears to be the most favourable orientation for a crossing at this location. One problem of constructing a crossing at this site would be the removal of the overburden to a depth of 10 to 15 feet to create a sufficiently wide surface for construction of the approaches to the crossing. Although visual inspection of the site indicates that the side slopes of the finger are relatively stable, extensive soils testing would have to be carried out to substantiate the feasibility of a crossing at this location.

The cost of a four-lane crossing is estimated at \$1,180,000, including \$930,000 for a structure and \$250,000 for the approaches. A two-lane structure is estimated to cost \$730,000, including \$530,000 for the structure and \$200,000 for the approaches. It should also be noted that the north abutment and approach would be located outside of the existing boundaries of the City of Port Alberni and therefore may be more favourable for cost sharing with the provincial government.

Assumptions Relating to Structures

1. Road approaches to the structure will be complete at the time of erection of the superstructure.
2. Access to the structure will be available from both ends for movement of heavy equipment.
3. Piers and abutments will be constructed under optimum conditions.
4. Soil conditions will be such that foundations for abutments and piers will be sound, and overburden will not exceed five feet.
5. Bridge superstructures will be designed for alternative materials (concrete versus steel) and as arch or slant leg structures.

Structures vs Fill and Culvert

An obvious advantage of the fill and culvert alternative is the lower cost. However, with the increasing emphasis upon preservation of the environment, a crossing of the ravine using a structure should not be overlooked. Some advantages of a structure are as follows:

1. Less clearing would be necessary, and therefore the aesthetic qualities of the ravine would not be disrupted to as great a degree.
2. Since Roger Creek is a salmon spawning channel, a structure would not interfere with this natural phenomenon. It could be argued that a constriction already exists at the present highway crossing, and therefore a fill and culvert would be acceptable. It is not inconceivable, however, that the existing crossing will one day be replaced with a structure, in particular since it is understood that extremely high floods have exceeded the capacity of the culvert.
3. Scenic trails in the ravine would not be affected by a structure to any major degree.
4. A structure can be staged. That is, a two-lane bridge could be constructed initially, followed by a twin span later, whereas, with the fill and culvert method, four lanes should be created initially. Staging of construction has three distinct advantages.
 - (a) The initial cost of a structure is less than the cost of a four-lane fill and culvert crossing.
 - (b) The crossing will not be oversized during the early years of growth.
 - (c) The second stage can be added when needed and, therefore, will be financed by the users.

Soil Conditions

A visual inspection only of soil conditions at the 21st Avenue site was made. It is apparent from outcroppings in the area that shale is prevalent and therefore construction of footings should present no serious problem. This shale material, which will require blasting, can also be used as fill material in the construction of embankments. Before any firm decision regarding any alignment and method of crossing is made, comprehensive soils tests must be undertaken.

COST ESTIMATES

Update 10th Avenue Crossing

A preliminary report for a crossing of Roger Creek in the vicinity of 10th Avenue was prepared by Associated Engineering Services Ltd. in 1966. The following table summarizes the costs for both a two-lane and four-lane crossing as determined in that report. The table also includes updated costs in order that a comparison between a 10th Avenue crossing and a 21st Avenue crossing can be made. The costs were updated by applying an inflation factor as well as increasing the allowance for engineering and contingencies from 15% to 25%.

Table 3

Estimates of Costs - 10th Avenue Site

Type of Crossing	1966 Cost		1970 Cost	
	2 lanes	4 lanes	2 lanes	4 lanes
A. Fill & Culvert	\$ 557,000	627,000	720,000	815,000
B. Bridge:				
1. Bridge only	\$ 514,000	876,000	670,000	1,140,000
2. Bridge & underpass	\$ 450,000	702,000	590,000	910,000
C. Earth Dam	\$1,129,000	1,296,000	1,470,000	1,690,000

21st Avenue Crossing

The following table summarizes the cost estimates for the various alternatives for a crossing at 21st Avenue. It should be noted that all of the estimates are based on a section of roadway 2100 feet in length.

Table 4

Summary of Costs - 21st Avenue Site

Alternative	Lanes	Cost		Total
		Structure	Approaches	
Alignment FC-1	2	-	-	575,000
	4	-	-	675,000
Alignment S-1	2	400,000	390,000	790,000
	4	700,000	525,000	1,225,000
Alignment S-2	2	400,000	200,000	600,000
	4	700,000	300,000	1,000,000
Alignment S-3	2	530,000	200,000	730,000
	4	930,000	250,000	1,180,000

CONCLUSIONS

Implications of a 10th Avenue Crossing

1. A four-lane crossing would ultimately be necessary.
2. On a short-term basis, that is to say, less than about ten years, a new crossing at 10th Avenue would probably generate more usage than one at 21st Avenue. However, beyond this period, a 21st Avenue crossing would increase in importance.
3. It is estimated that future traffic volumes across Roger Creek at this location will be approximately equal to future volumes at the existing bridges. If this is the case, the existing bridges should have sufficient capacity.
4. It is probable that 10th Avenue itself would have to be widened to six lanes to have sufficient capacity to accommodate the projected volumes if a four-lane crossing were constructed. It is, however, a certainty that congestion would increase, and travel times on 10th Avenue would deteriorate with increased population growth.
5. In view of the recent planning studies completed by the Town Planning Consultant and the projected traffic conditions indicated by this report, it is apparent that a crossing at 10th Avenue would not only be inconsistent with land use, but also would not fit into an overall transportation plan.

Implications of a 21st Avenue Crossing

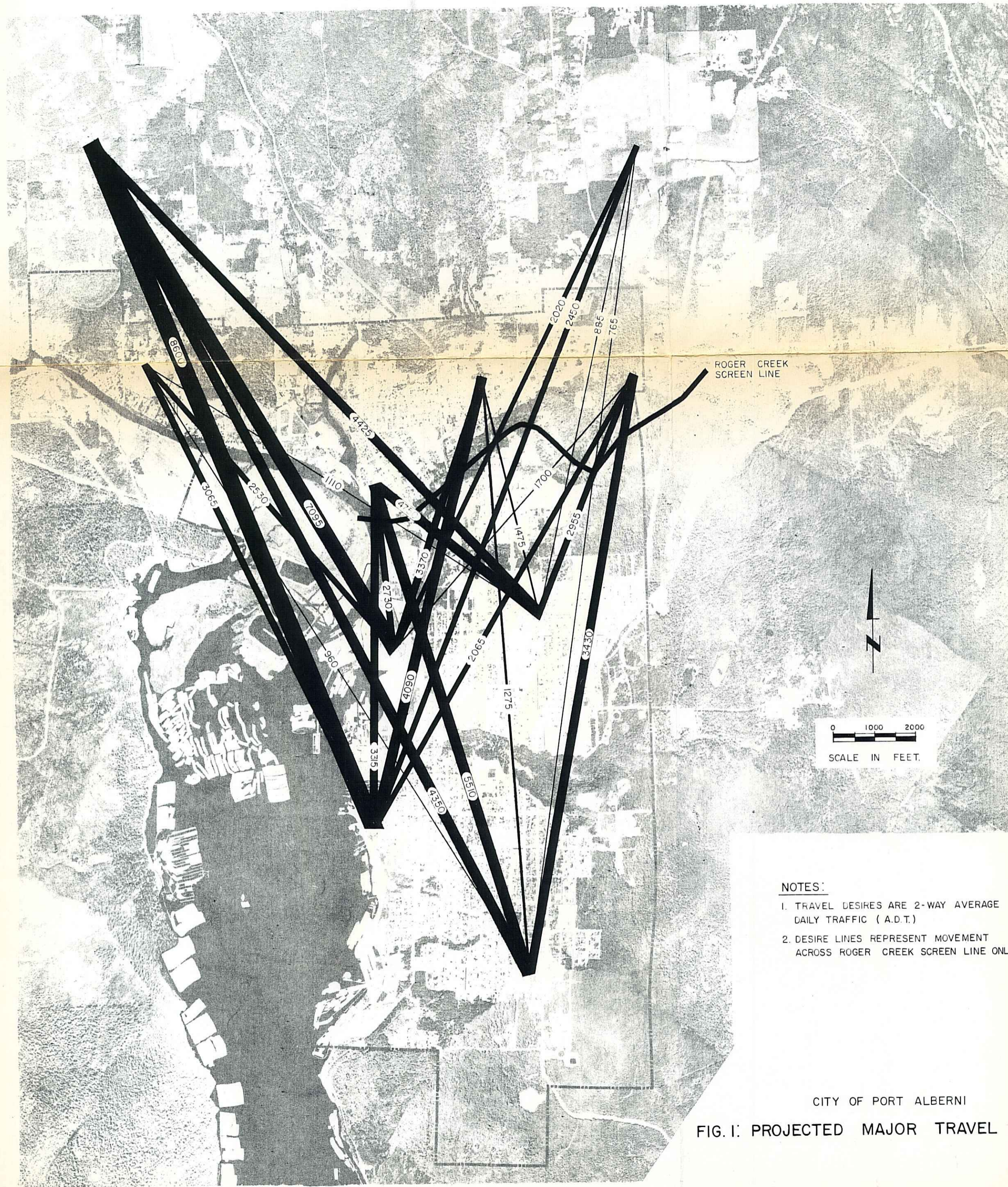
1. A four-lane crossing would ultimately be necessary.
2. A four-lane crossing would only be operating at 64% capacity and could, therefore, accommodate additional unforeseen growth.
3. Congestion on downtown streets, in particular 10th Avenue, would be kept to a minimum.
4. The existing bridges will probably have volumes exceeding capacity by about 25%, and therefore greater delays can be expected at these bridges than if a crossing were constructed at 10th Avenue.
5. A crossing at 21st Avenue would be consistent with proposed overall land use and transportation plans. These plans also include a crossing of Dry Creek in the vicinity of the old abandoned railway crossing. The length of a crossing at this location is estimated to be approximately 225 feet. Due to the depth of the ravine at this location, which is about 100 feet, a fill and culvert crossing is not considered feasible. Accordingly, cost estimates to span the ravine with a structure were made. A four-lane structure is estimated to cost \$650,000, and a two-lane structure \$360,000. Although estimates of future traffic volumes across Dry Creek were not made, a two-lane structure would probably be adequate.
6. The connecting roadway to a crossing at 21st Avenue could be designed to higher standards and would therefore be more attractive.
7. A crossing at 21st Avenue may be more eligible for provincial government assistance than a crossing at 10th Avenue due to the arterial nature of the roadway and also because it is located partially outside of the City of Port Alberni.
8. Construction of a future water main can be tied in with a crossing at this location.

Recommendations

1. Based on the findings of this report it is recommended that preference be given to a crossing of Roger Creek at the 21st Avenue site as opposed to the 10th Avenue site.
2. A cost comparison of alternatives clearly indicates that for an equivalent crossing the fill and culvert method will be more economical than a structure. A two-lane structure, on the other hand, has a lower initial cost than a four-lane fill and culvert crossing. Accordingly, it will be necessary

for the City to establish a policy regarding the type of crossing.

3. If a policy is established to construct a fill and culvert crossing, the most practical general alignment is FC-1. Since there is very little difference in cost between a two-lane and a four-lane crossing it is recommended that a four-lane crossing be constructed initially. In addition, widening of a two-lane embankment to four lanes could present construction problems and may, therefore, be extremely costly. Stream studies should be carried out to ensure that a culvert can be designed which will permit safe passage of salmon to spawning grounds.
4. If a policy is established to cross the ravine with a structure, Alignment S-2 appears to be the most economical. An advantage of this alignment over S-3 is that the approaches to the crossing on both sides of the ravine can be designed to approximately coincide with the fill and cut alignment, and therefore a single approach right-of-way could be used for either alternative. Therefore it is recommended that Alignment S-2 be given priority over Alignment S-3.
5. Alignment S-3 should not, however, be entirely rejected as the cost of a crossing at this location is estimated to be only 10% greater than S-2. Detailed studies prior to actual construction could improve the attractiveness of the S-3 alternative. It is therefore recommended that the S-3 alignment also be retained as a possible crossing site as long as practical.
6. Based on the overall advantages afforded by a structure together with its staging characteristics, it is recommended that serious consideration be given to initially constructing a two-lane bridge with provisions for future widening to four lanes.
7. It is important to recognize that no firm decision regarding a crossing can be made until detailed soils surveys are carried out. It is therefore recommended that such surveys be conducted as soon as possible in order that a firm alignment and method of crossing can be established.

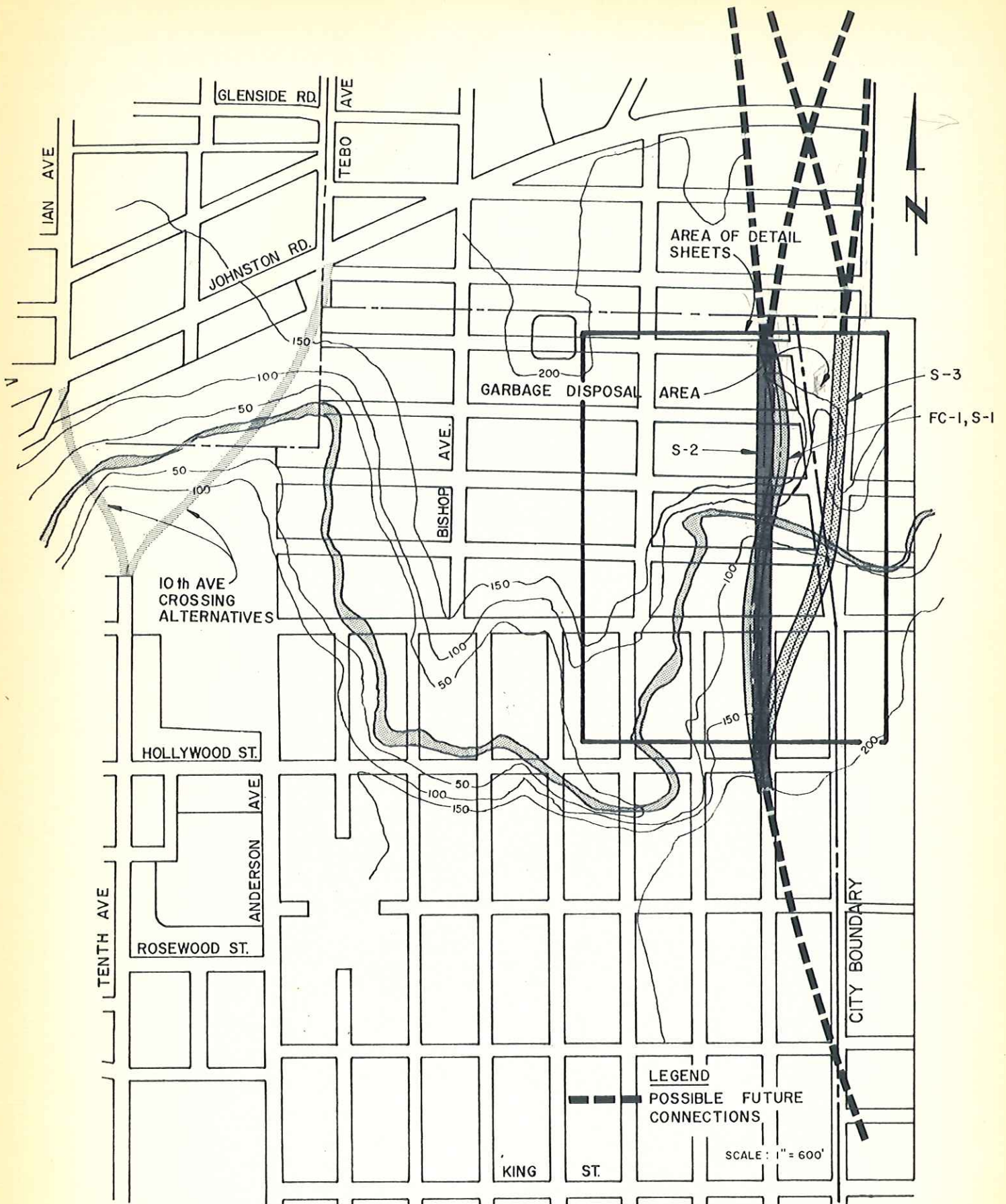


NOTES:

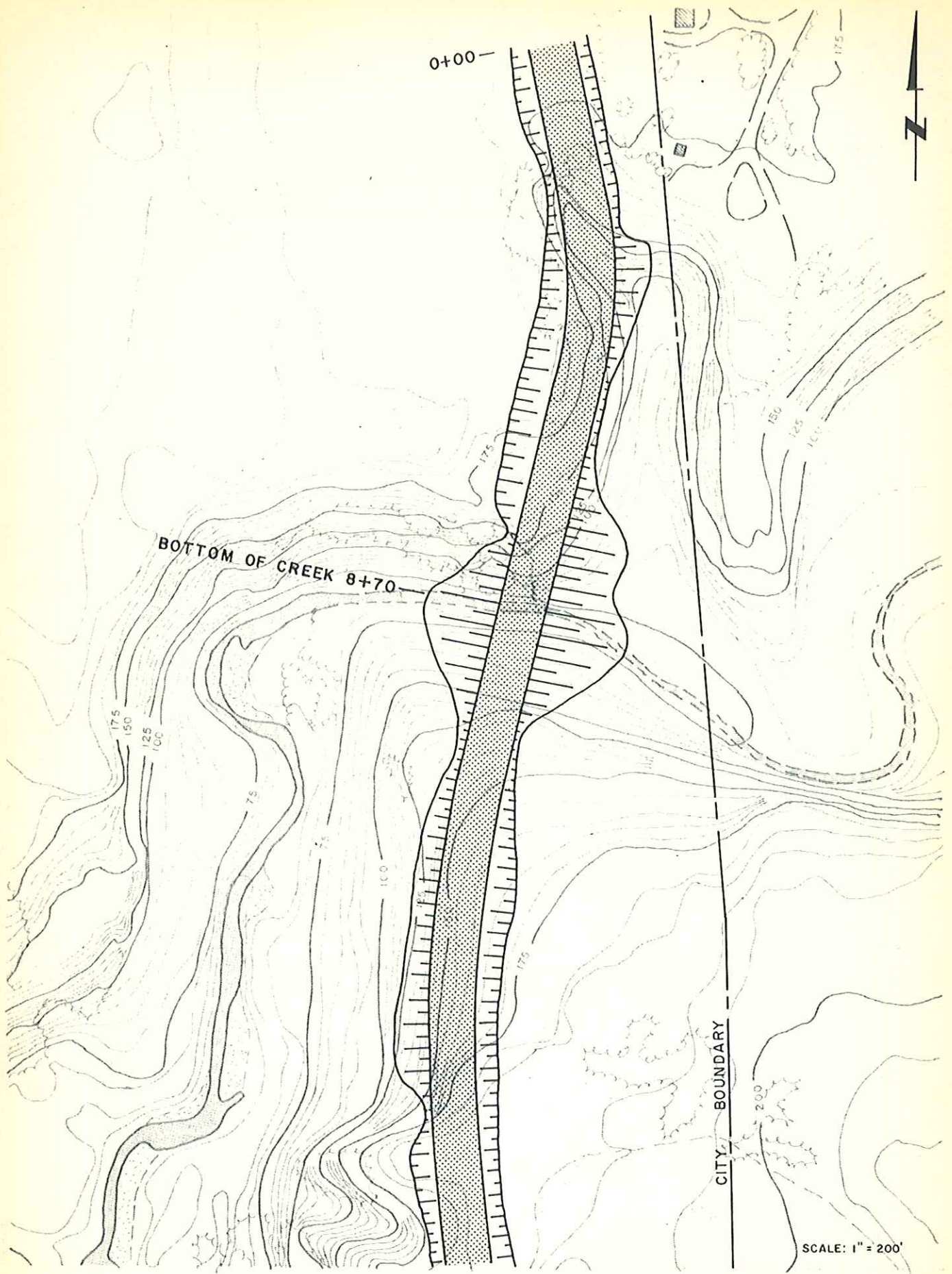
1. TRAVEL DESIRES ARE 2-WAY AVERAGE DAILY TRAFFIC (A.D.T.)
2. DESIRE LINES REPRESENT MOVEMENT ACROSS ROGER CREEK SCREEN LINE ONLY.

CITY OF PORT ALBERNI

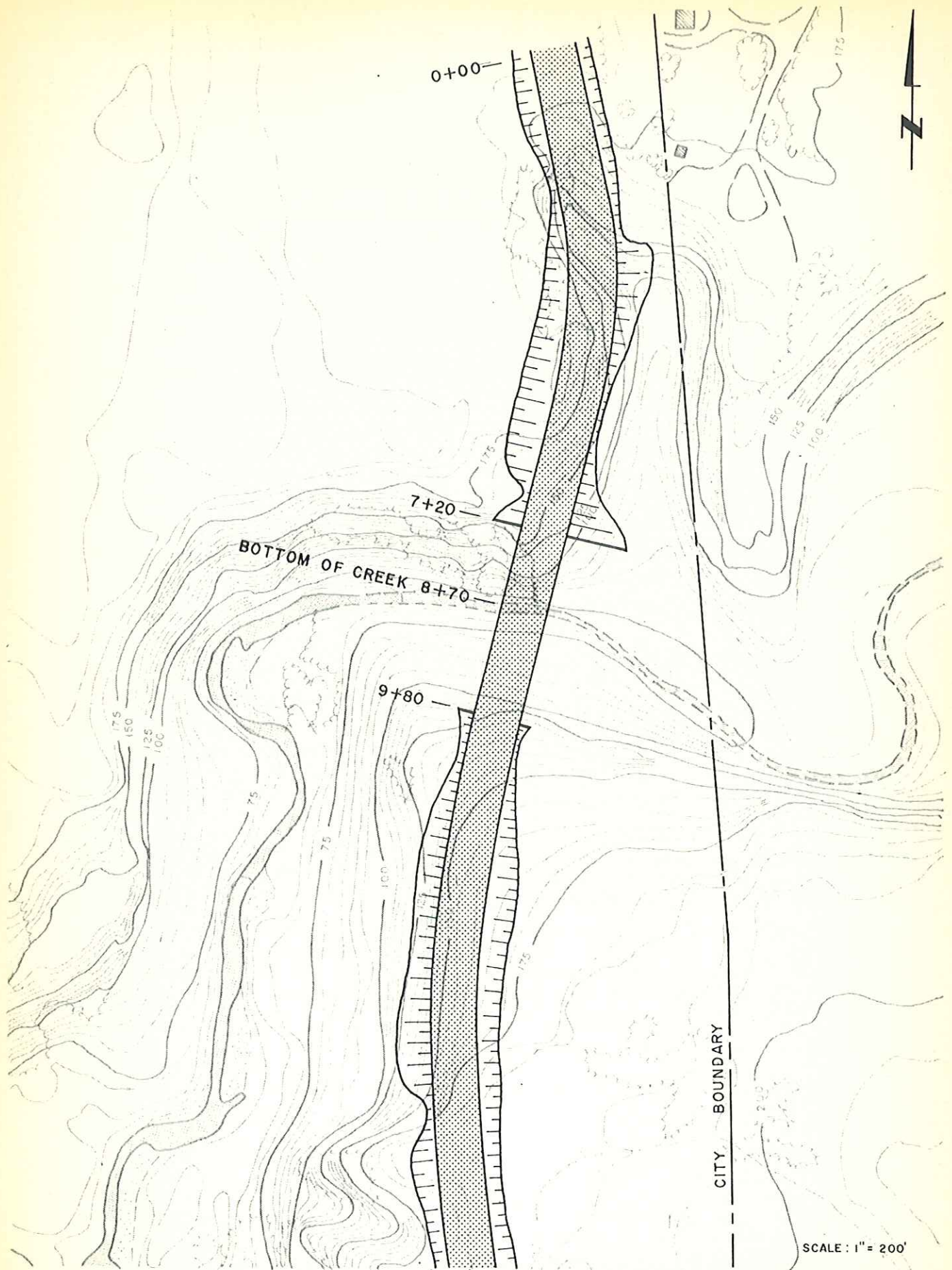
FIG. I: PROJECTED MAJOR TRAVEL DESIRES



PROPOSED ROGER CREEK CROSSING—SITE LOCATION PLAN

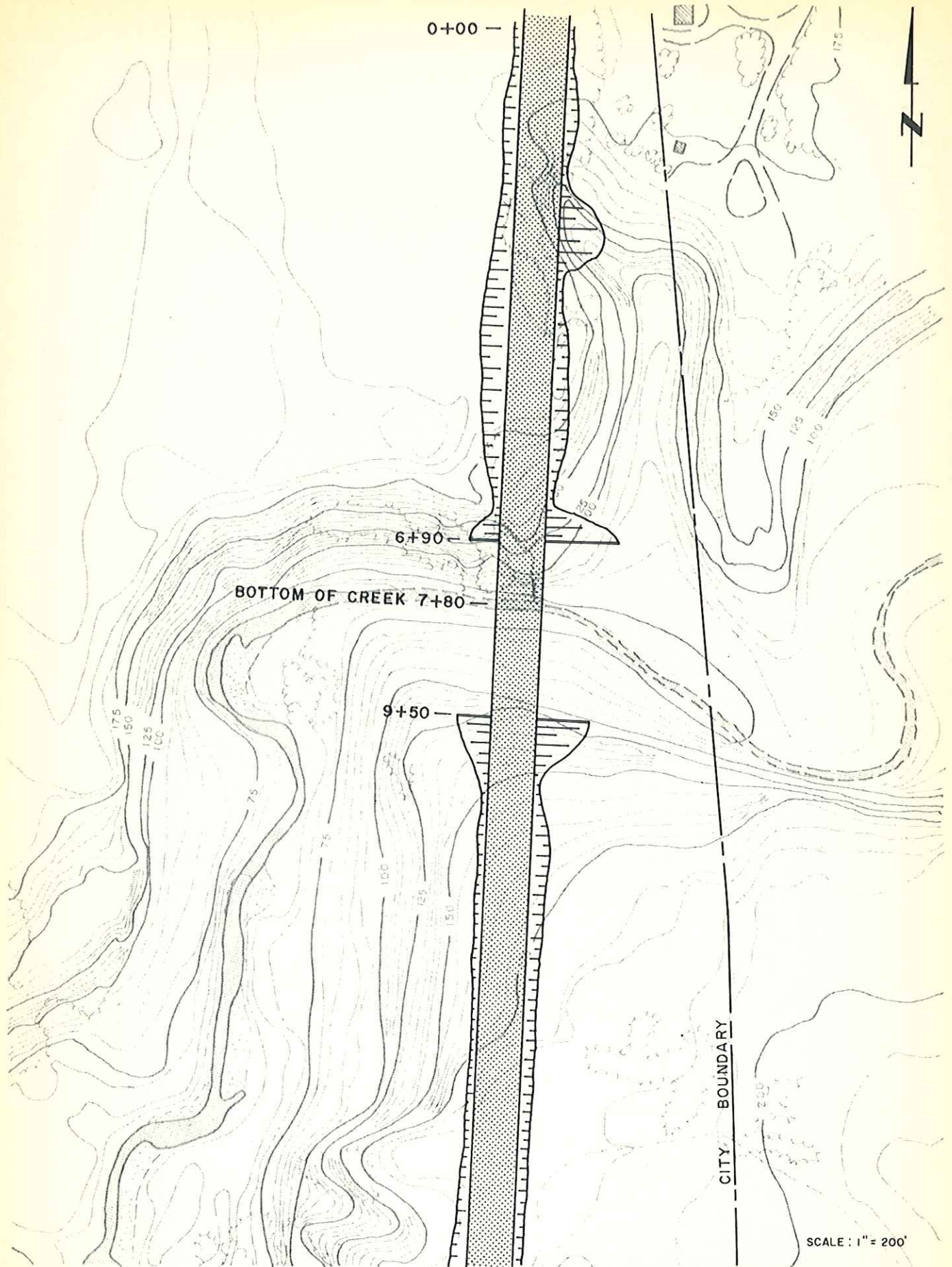


PROPOSED ROGER CREEK CROSSING AT 21 AVE. SITE - ALIGNMENT FC-1



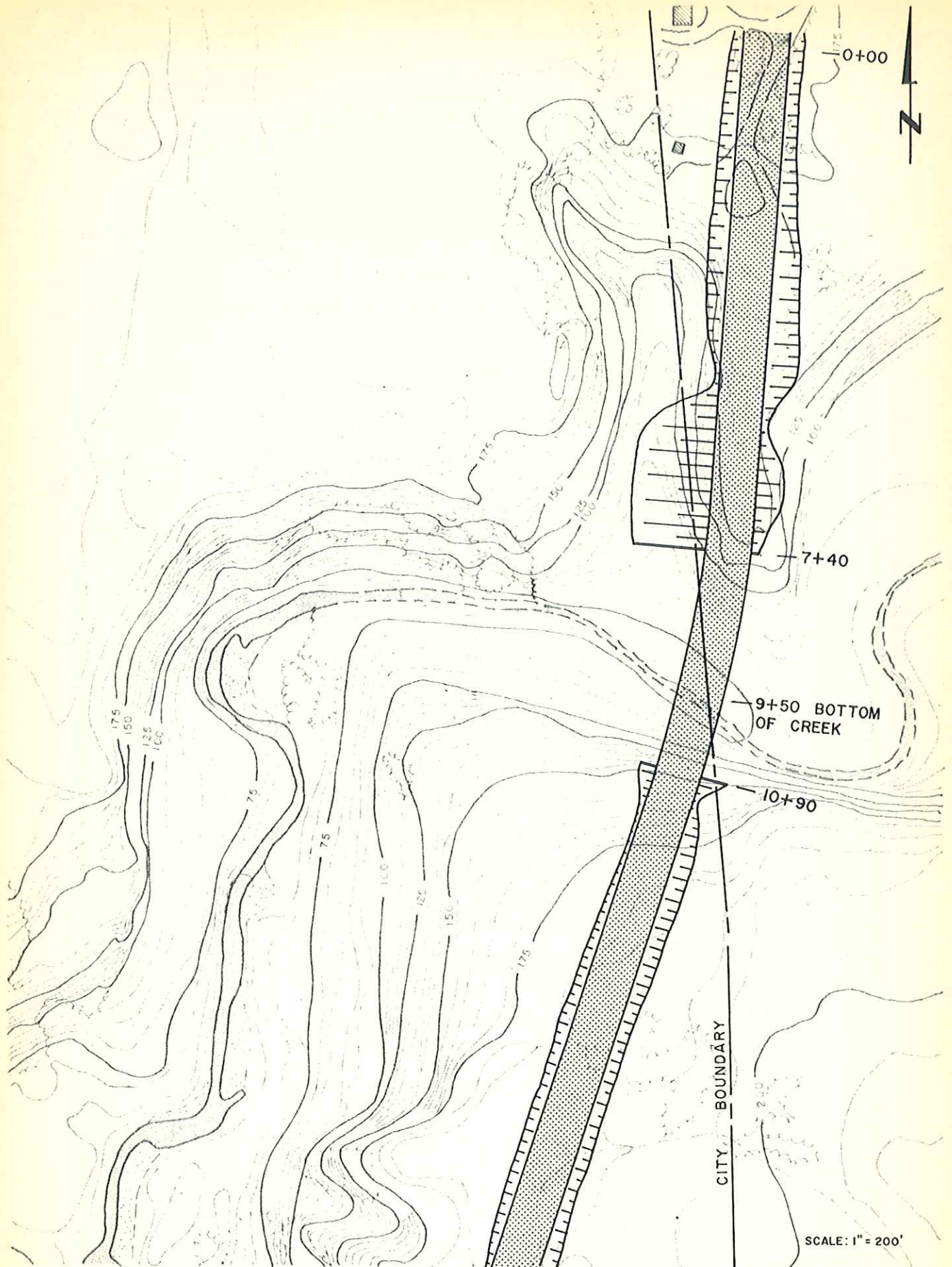
PROPOSED ROGER CREEK CROSSING AT 21 AVE. SITE - ALIGNMENT S-1

SCALE: 1" = 200'

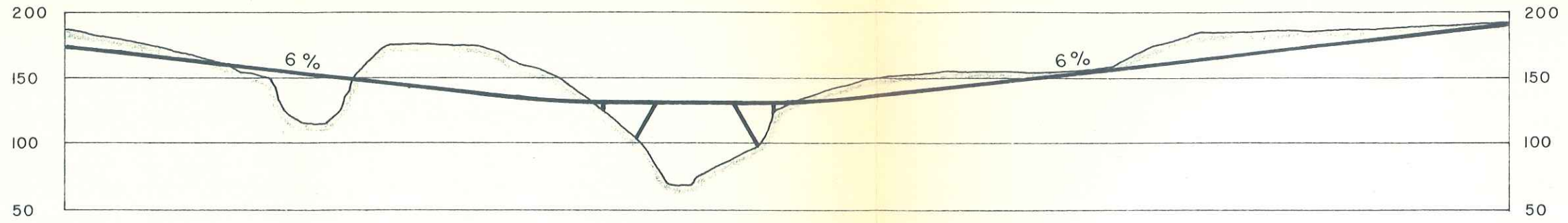


PROPOSED ROGER CREEK CROSSING AT 21 AVE. SITE - ALIGNMENT S-2

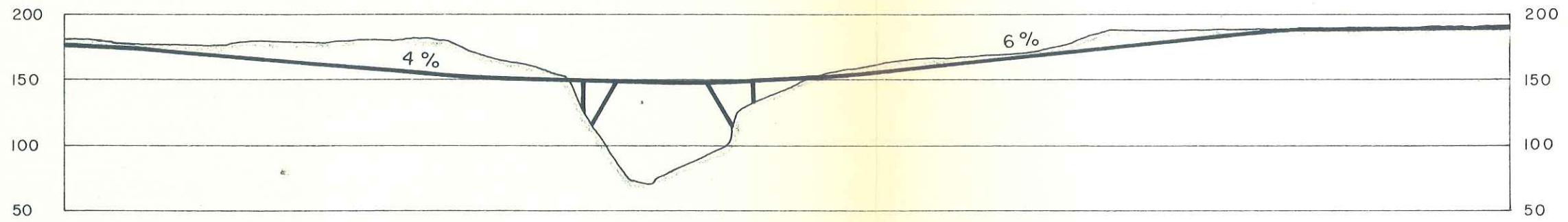
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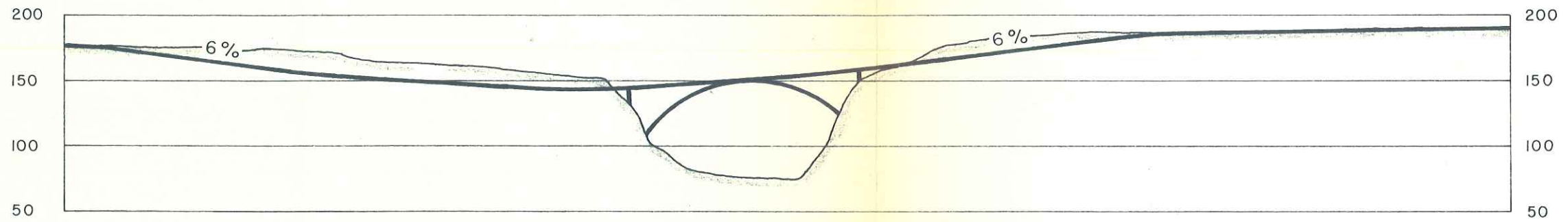
PROPOSED ROGER CREEK CROSSING AT 21 AVE. SITE - ALIGNMENT S-3



ALIGNMENT S-1 & FC-1



ALIGNMENT S-2



ALIGNMENT S-3

0+00 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00 9+00 10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00 19+00 20+00 21+00