PROJECT NO. C-3736

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS

COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR

COUSINS ROAD TO GORMAN'S MILL

(3.48 km)

(L-1100) STA. 1169+72.677 TO 1197+67.933
INCLUDING
HIGHWAY NO. 97 LANDMARK INVENTORY SEGMENT 1115
km 58.84 TO km 61.25 (LENGTH 2.41 km)

DRAWING INDEX

AC-C3736-02 TO 08	PLANS
AC-C3736-09 TO 15	PROFILES
AC-C3736-16	TYPICAL SECTIONS
AC-C3736-17	RETAINING WALL ELEVATIONS

LEGEND

CULVERT (NEW)	
CULVERT (EXIST.)	
U/G GAS	– G —— G –
U/G WATER	– W —— W –
U/G TELEPHONE	– T —— T –
CATCH BASIN (NEW)	
CATCH BASIN (EXIST.)	
MANHOLE (NEW)	
MANHOLE (EXIST.)	
FENCE	—x——x—
CONCRETE BARRIER	
RETAINING WALL	
TELEPHONE POLE	
HYDRO POLE	
COMB. POLE	
DRAINAGE DITCH	
JUNCTION BOX	
LUMINAIRE (W/J.B.)	
ELECTRICAL CONDUIT	

389267

Province of British Columbia
Ministry of Highways and Public Works

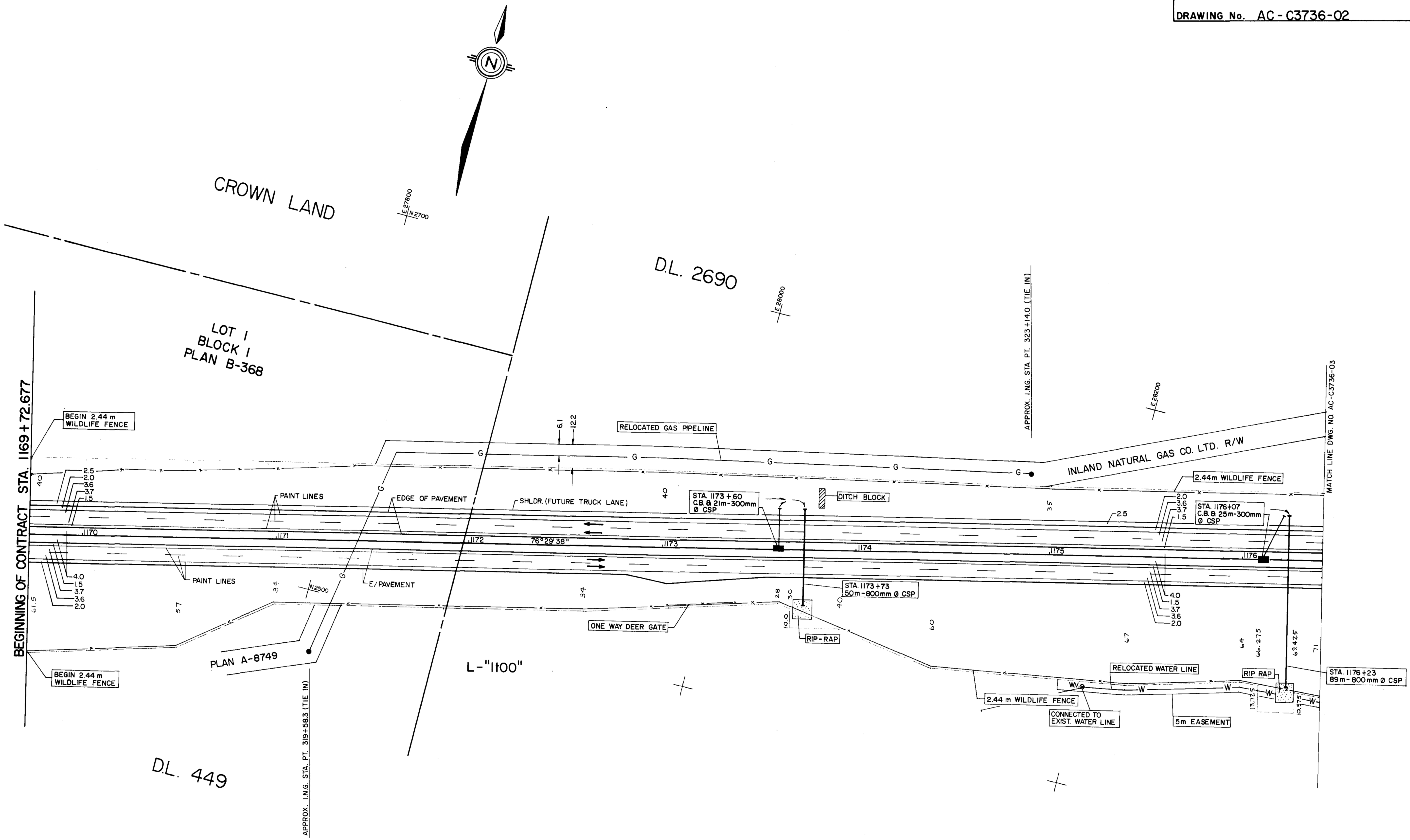
AS CONSTRUCTED PLAN and PROFILE

PROJECT No.
C-3736
Sheet 01 of 17

Scales Plan 1:1000 Traced by J. ROE
Profile 1:2000 (HOR.) Date MARCH 10, 1988
1:200 (VERT.)
Commenced 1986·06·18 Project Supervisor R.P. Zerr
Completed 1988·01·21
Contractor Edgeworth Construction Ltd.

H-191

PROJECT No. C-3736
DRAWING No. AC-C3736-02



C.B.	C.B.
STA. 1173+60	STA. 1176+07
GRATE 534.661	GRATE 523.067
21m-300mm Ø	25m-300mm Ø

389268

PROJECT No. C-3736
DRAWING No. AC-C3736-03

C.B.	C.B.
STA. 1178+60	STA. 1183+40
GRATE 512.95	GRATE 494.532
25m-300mm Ø	26m-300mm Ø

VANCAL - 7826

389269

72-1813-

H-191-A

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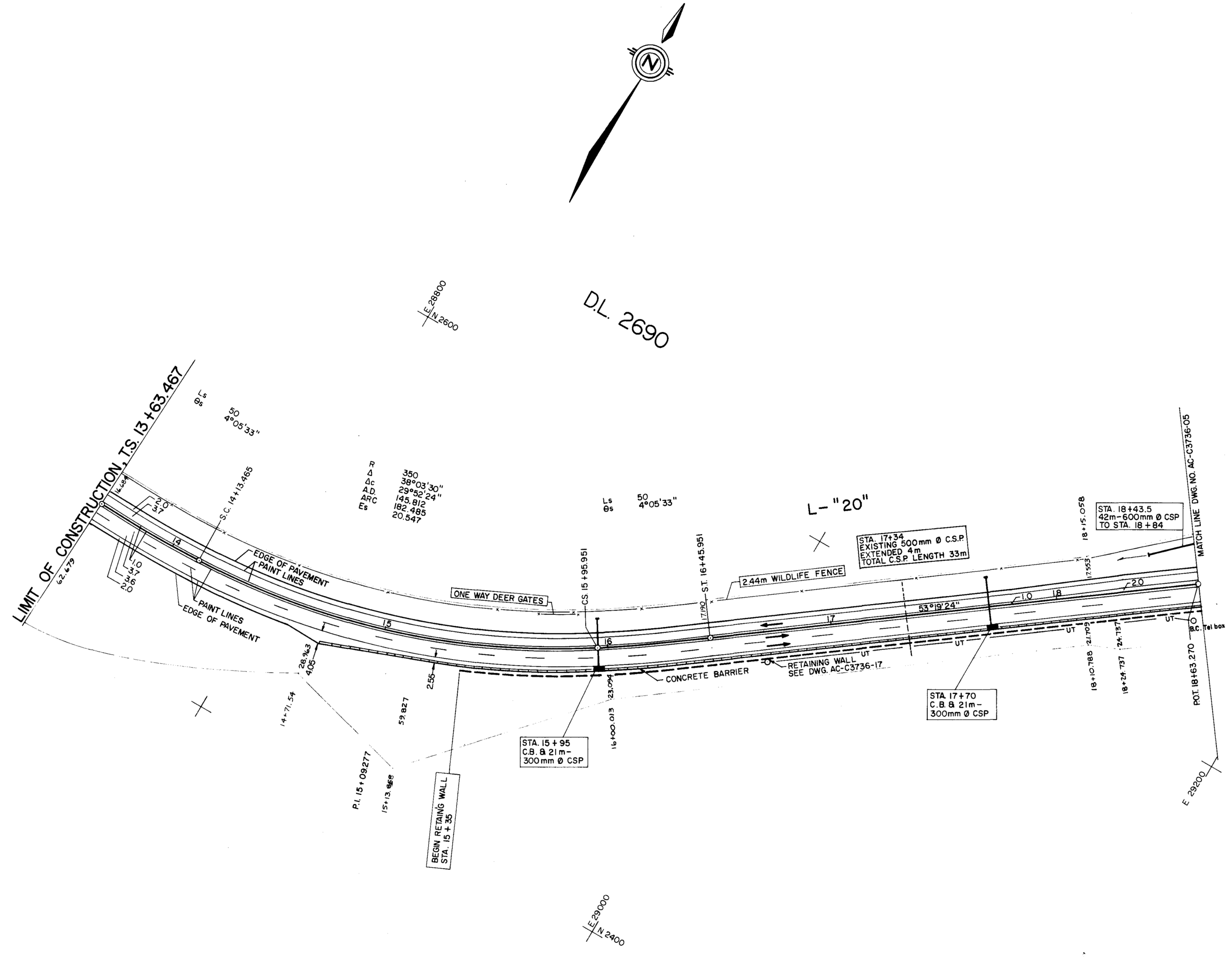
PROJECT No. C-3736
DRAWING No. AC-C3736-04



C.B.	C.B.
STA. 15+95	STA. 17+70
GRATE 455.707	GRATE 460.921
21m-300mm Ø	21m-300mm Ø

VANCAL - 7826

389270

PROJECT No. C-3736
DRAWING No. AC-C-3736-05

CURVES

(1)		L60
	R	250
	Δ	29°01'29"
	A.D.	64.712
	ARC	126.644
	E	8.240

(2)		L40
	R	400
	Δ	44°19'43"
	Δc	31°26'13"
	A.D.	208.271
	ARC	219.471
	Es	32.827
	Ls	90
	θs	6°26'45"

(3)		L30
	R	380
	Δ	22°48'42"
	Δc	9°14'30"
	A.D.	121.820
	ARC	61.293
	Es	8.561
	Ls	90
	θs	6°47'06"

(4)		L50
	R	560.437
	Δ	14°58'28"
	A.D.	73.656
	ARC	146.472
	E	4.819

(5)		L1100
	R	380
	Δ	22°48'42"
	Δc	9°14'30"
	A.D.	121.820
	ARC	61.293
	Es	8.561
	Ls	90
	θs	6°47'06"

(6)		L30
	R	70
	Δ	155°06'28"
	Δc	130°33'09"
	A.D.	351.567 BK.
		322.220 AH.
	ARC	159.500
	Ls	60 BK.
	θs	24°33'19"BK.

(7)		L50
	R	52.500
	Δ	107°45'00"
	A.D.	74.895
	ARC	68.731
	E	38.963
	Ls	60
	θs	32°44'26"

(8)		L50
	R	746.23
	Δ	5°20'16"
	A.D.	34.785
	Arc	69.519

(9)		L70
	R	50
	Δ	25°29'15"
	A.D.	11.308
	ARC	22.242
	E	1.263

(10)		L20
	R	300
	Δ	25°25'36"
	Δc	0°35'54"
	A.D.	133.108
	ARC	3.133
	Es	9.942
	Ls	130.000
	θs	12°24'51"

(11)		L30
	R1	230
	R2	270
	Ls	41.739
	θs	2°16'28"
	L.T.	24.8398
	S.T.	17.4031

(12)		L1100
	R	244.2
	Δ	102°30'17"
	Δc	83°27'00"
	A.D.	346.841 BK
		345.684 AH.
	ARC	355.671
	Ls	82.427 BK.
		80 AHD.
	θs	9°40'11" BK.
	θs	9°23'06"AH.

(13)		L80
	R	75
	Δ	37°41'04"
	A.D.	25.594
	ARC	49.329
	E	4.247

(14)		L70
	R	50
	Δ	49°23'16"
	A.D.	22.991
	ARC	43.099
	E	5.033

(15)		L70
	R	50.00
	Δ	11°42'11"
	A.D.	5.124
	ARC	10.213
	E	0.262

SCHEDULE OF CATCH BASINS & MANHOLES

C.B. 1 STA. 1185+65 GRATE 486.454 OUT 77m-450Ø	C.B. 2 STA. 1185+80 GRATE 487.308 OUT 3m-300Ø	C.B. 3 STA. 70+95 GRATE 476.800 OUT 13m-300Ø	C.B. 4 STA. 71+55 GRATE 471.836 OUT 2m-600Ø	C.B. 5 STA. 71+60 GRATE 471.820 OUT 6m-450Ø	C.B. 6 STA. 1189+40 GRATE 499.039 OUT 14m-300Ø	C.B. 7 STA. 1190+40 GRATE 502.387 OUT 14m-300Ø	C.B.M.H. 1 STA. 1186+40 GRATE 486.5C IN 18m-600Ø OUT 13m-600Ø	M.H. 1 STA. 1186+40 COVER 487.43 OUT 21m-600Ø	C.B.M.H. 2 STA. 1186+40 GRATE 481.73 OUT 24m-600Ø	C.B. 3A STA. 70+95 GRATE 474.217 OUT 3m-600Ø	M.H. 4 STA. 70+95 GRATE 471.90	C.B.M.H. 5 STA. 54+66 GRATE 475.38 IN 17m-600Ø OUT 78m-600Ø	M.H. 2 STA. 71+55 GRATE 471.855 OUT 33m-600Ø

VANCAL - 7826

389271

92-1813-5191-A

PROJECT No. C-3736
DRAWING No. AC-C3736-06

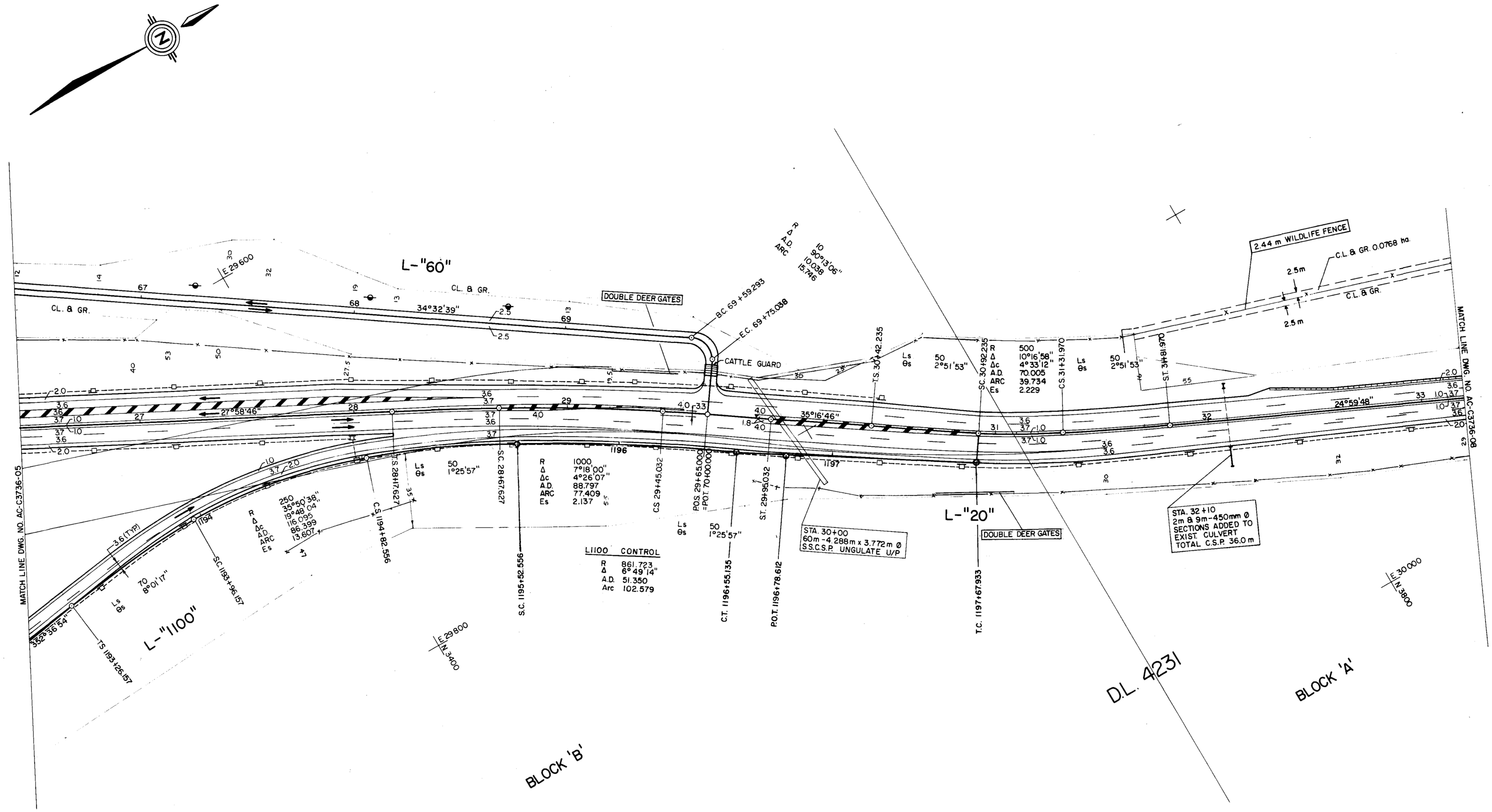
LANING & ELECTRICAL DETAIL

389272

VANCAL - 7826

92-1813 H-191-A

PROJECT No. C-3736
DRAWING No. AC-C3736-07

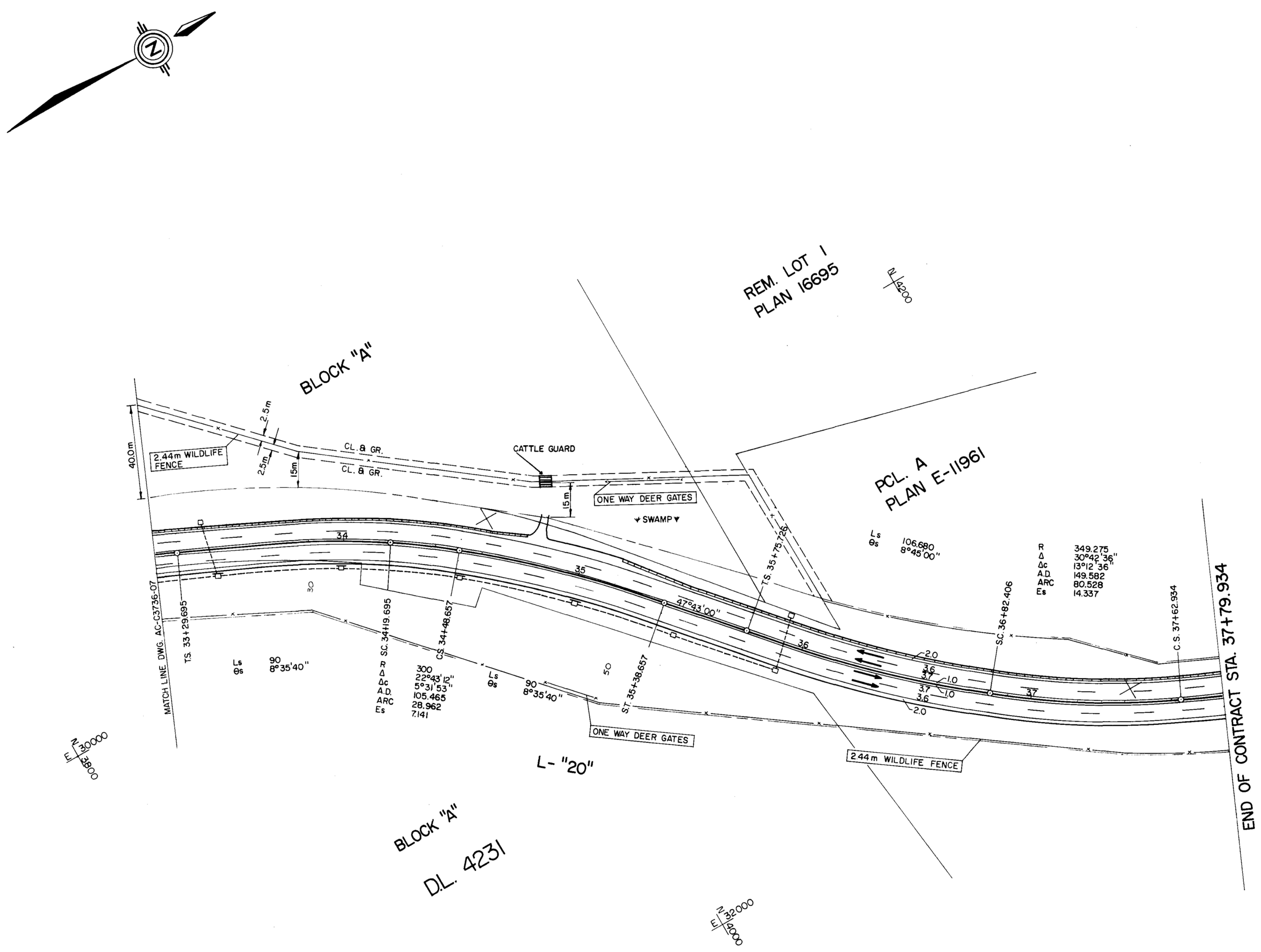


VANCAL - 7826

389273
92-1813-52 H-191-A

PROJECT No. C-3736

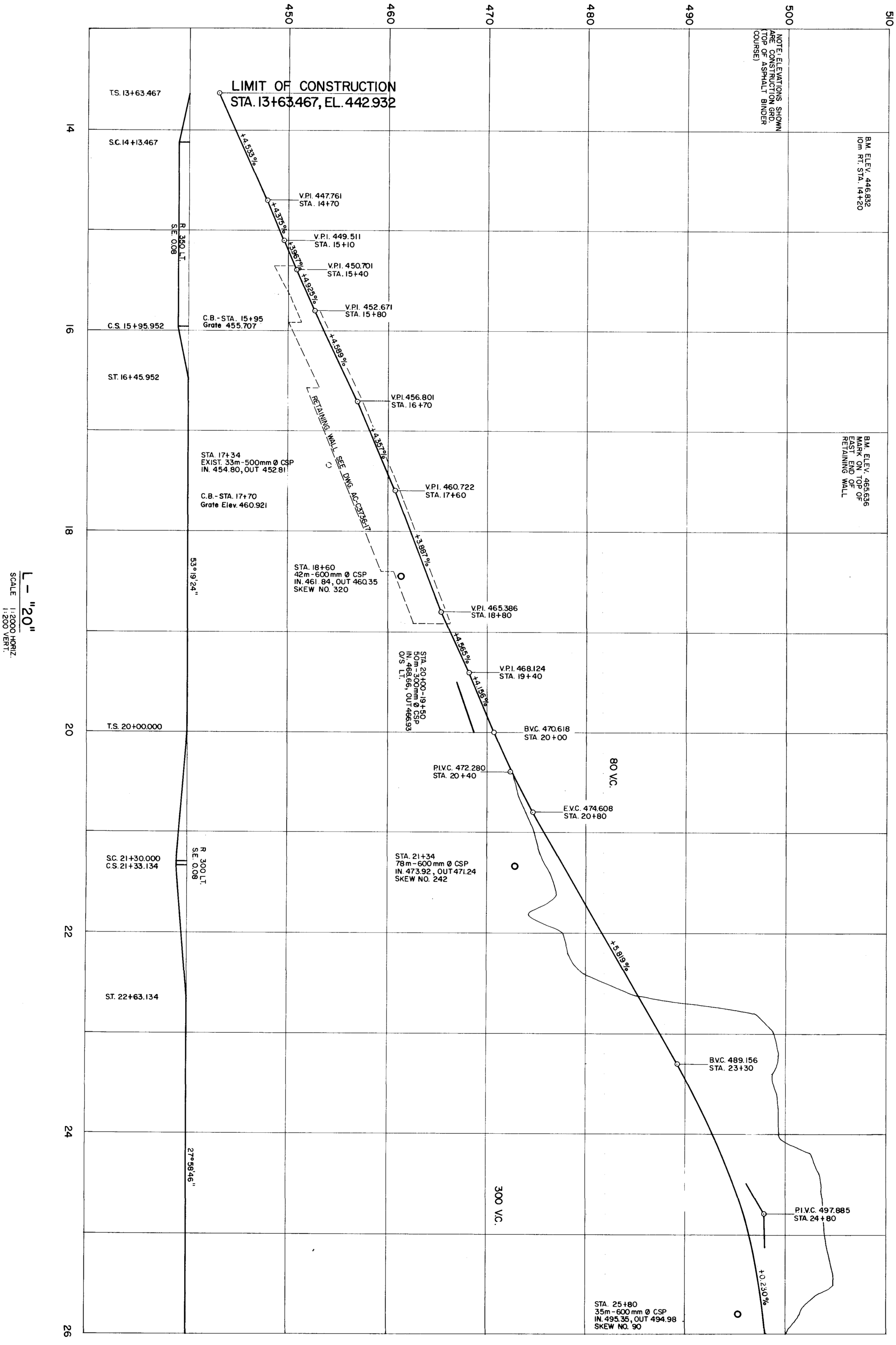
DRAWING No. AC-C3736-08



VANCAL - 7826

389274

92-1813-5 H-191-A

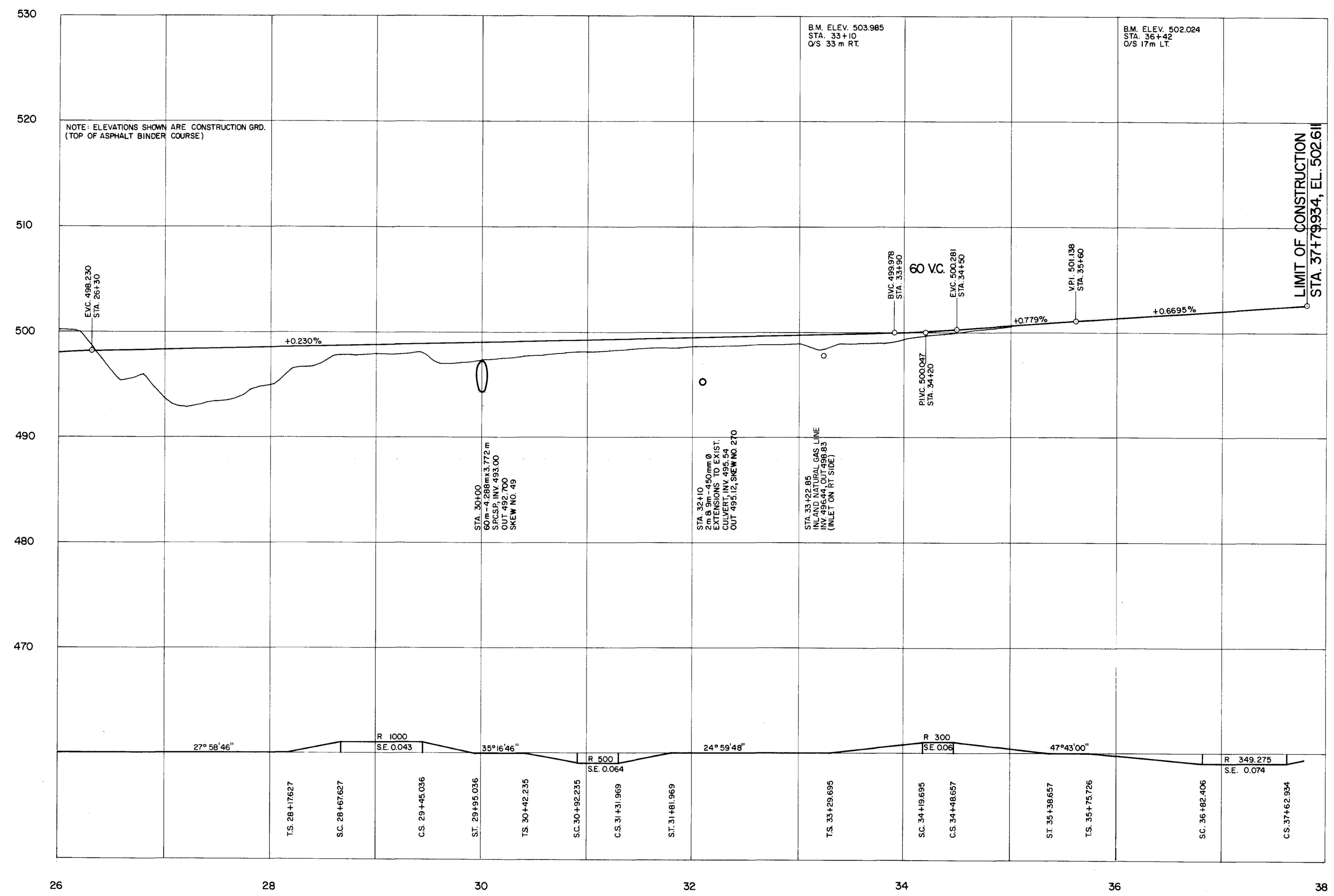


PROJECT No. C-3736
DRAWING No. AC-C3736-09

92-1813-52

H-191-A

PROJECT No. C-3736
DRAWING No. AC-C3736-10



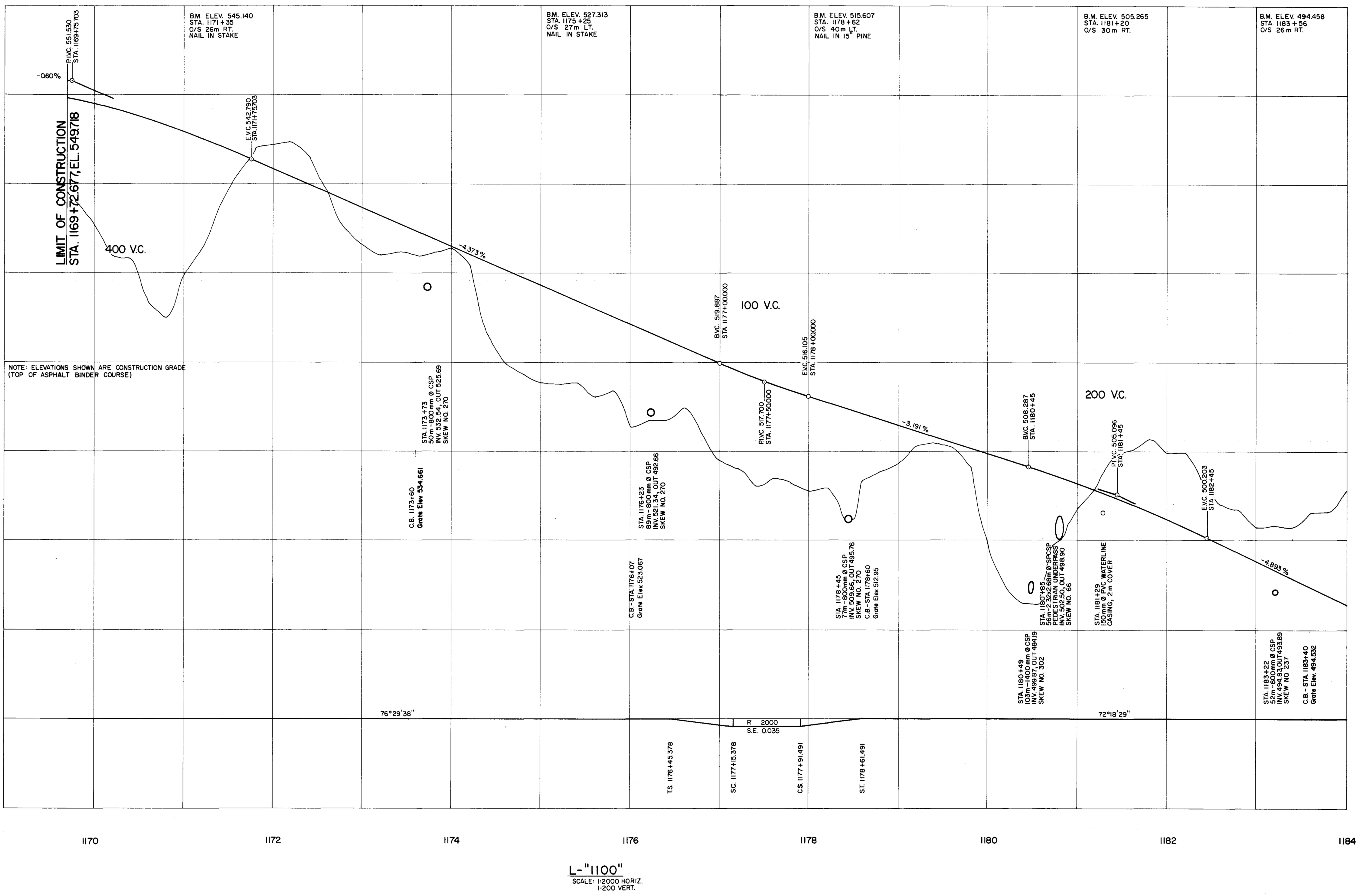
L-"20"

SCALE 1:2000 HORIZ.
1:200 VERT.

VANCAL - 7826

389276
92-18-5-5 H-191-A

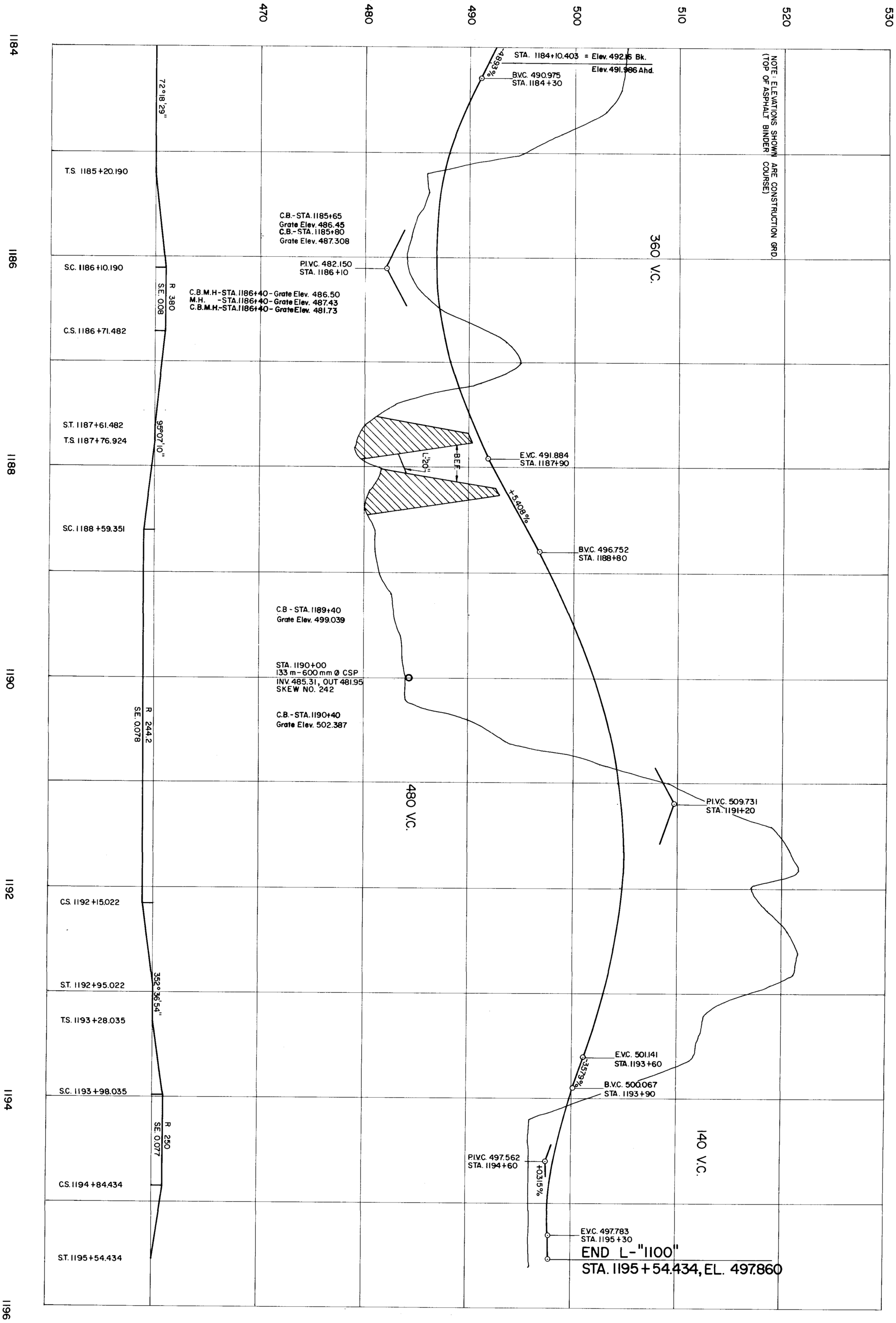
PROJECT No. C-3736
DRAWING No. AC-C3736-11



L-"1100"
SCALE: 1:2000 HORIZ.
1:200 VERT.

VANCAL-7825

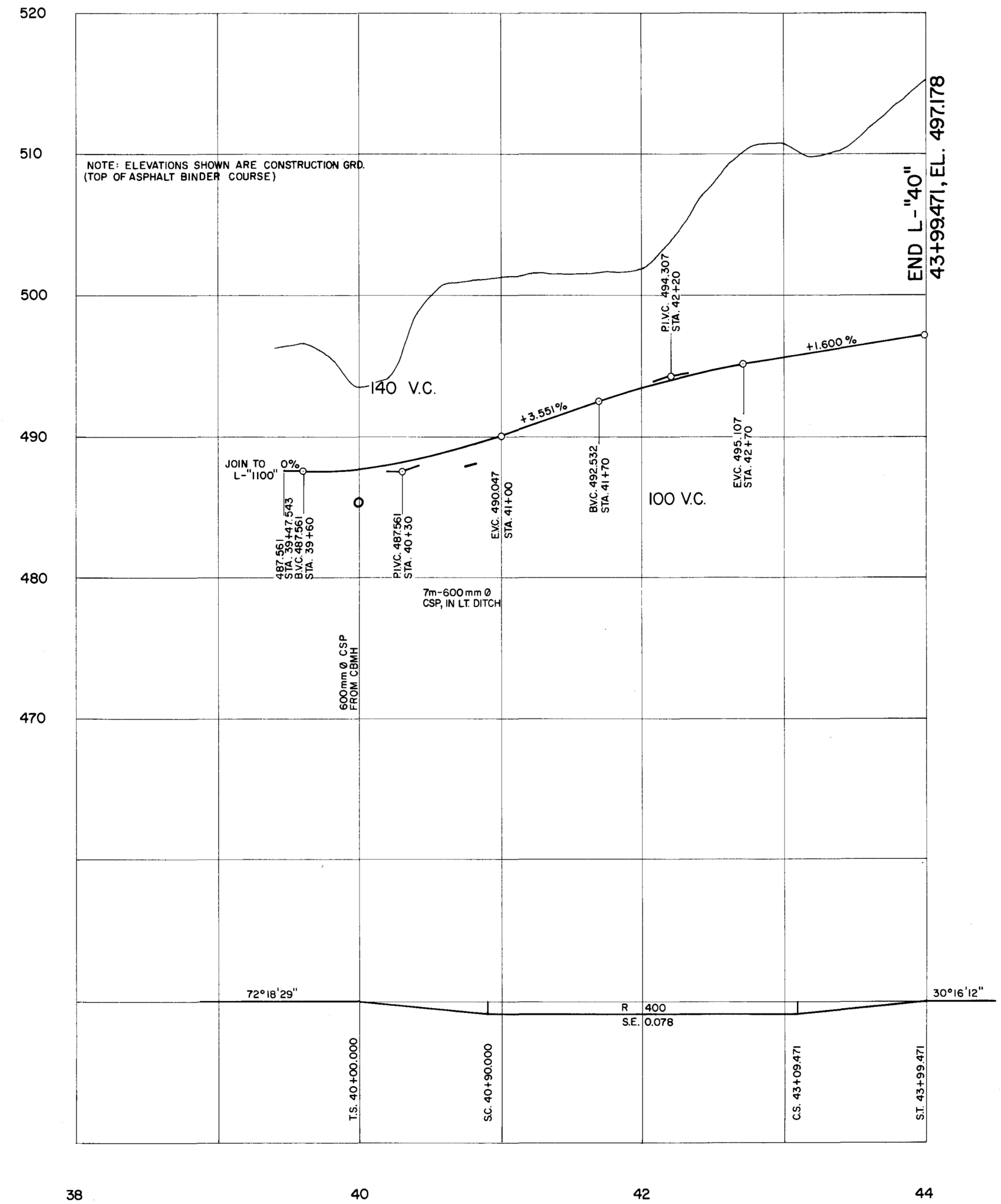
389277
92-1813-5a H-191-A



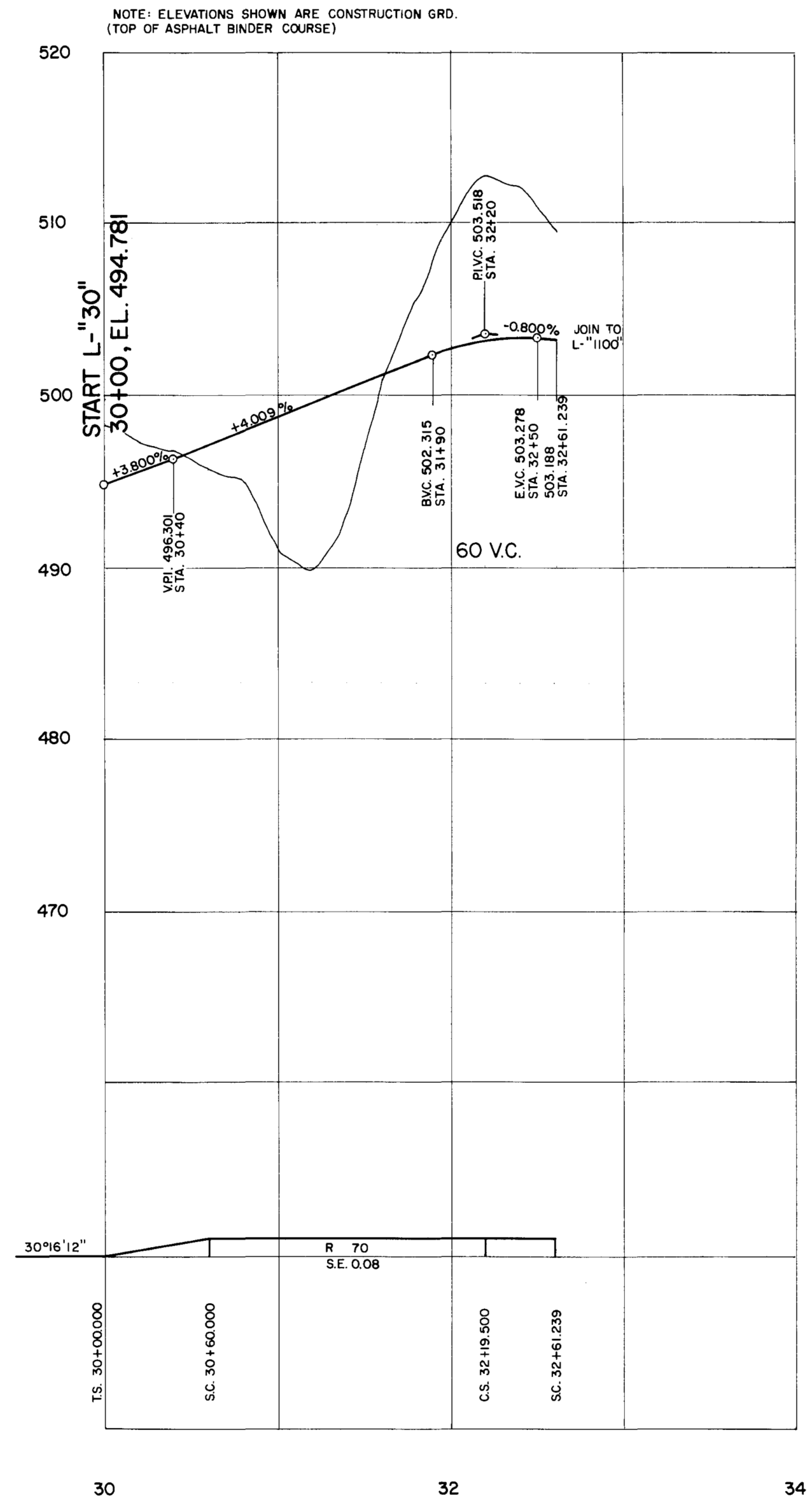
L-"1100"
SCALE 1:2000 HORIZ.
1:200 VERT.

PROJECT No. C-3736
DRAWING No. AC-C3736-12

PROJECT No. C-3736
DRAWING No. AC-C3736-13



L-"40"
SCALE: 1:2000 HORIZ.
1:200 VERT.

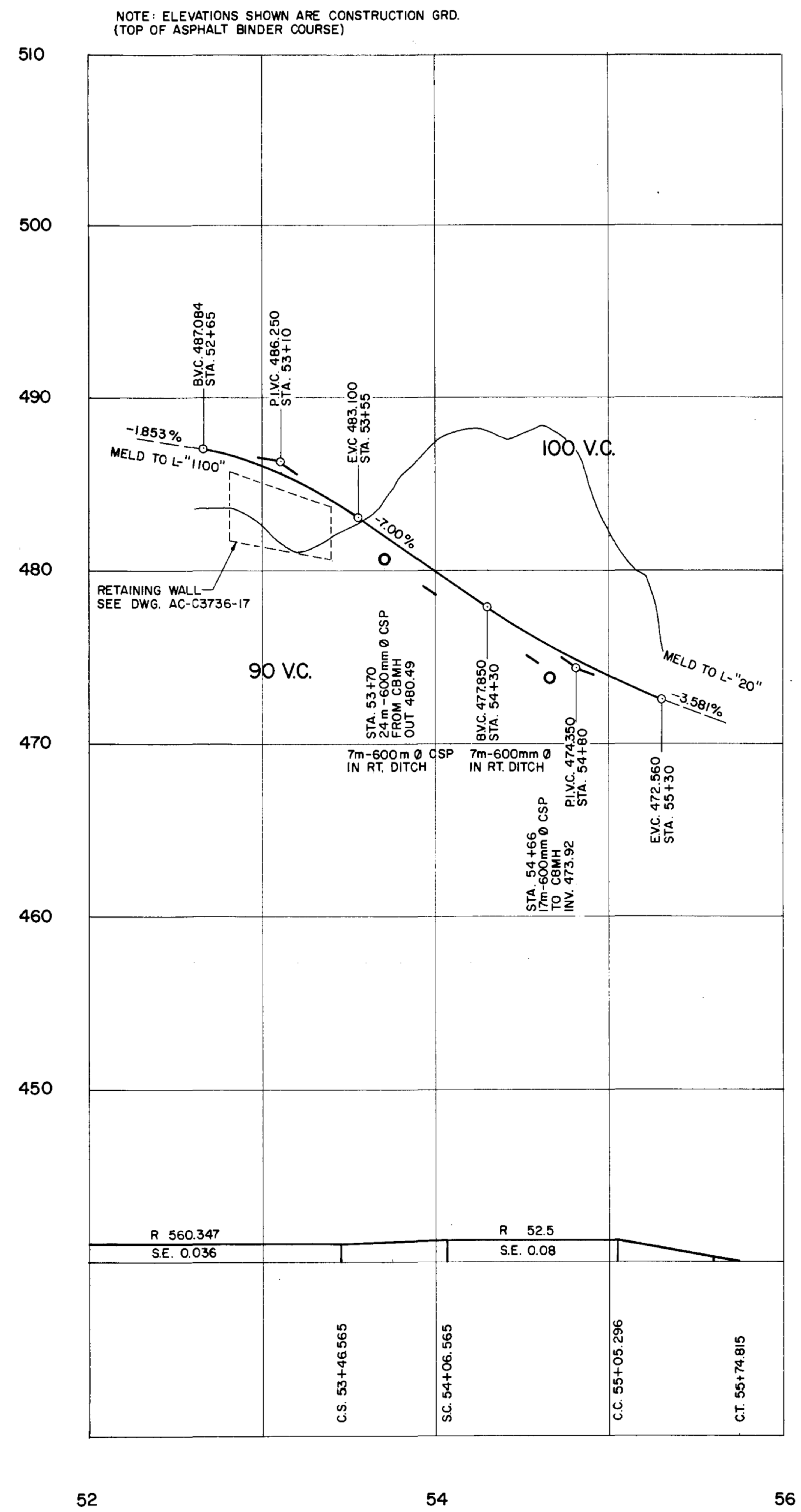


L-"30"
SCALE: 1:2000 HORIZ.
1:200 VERT.

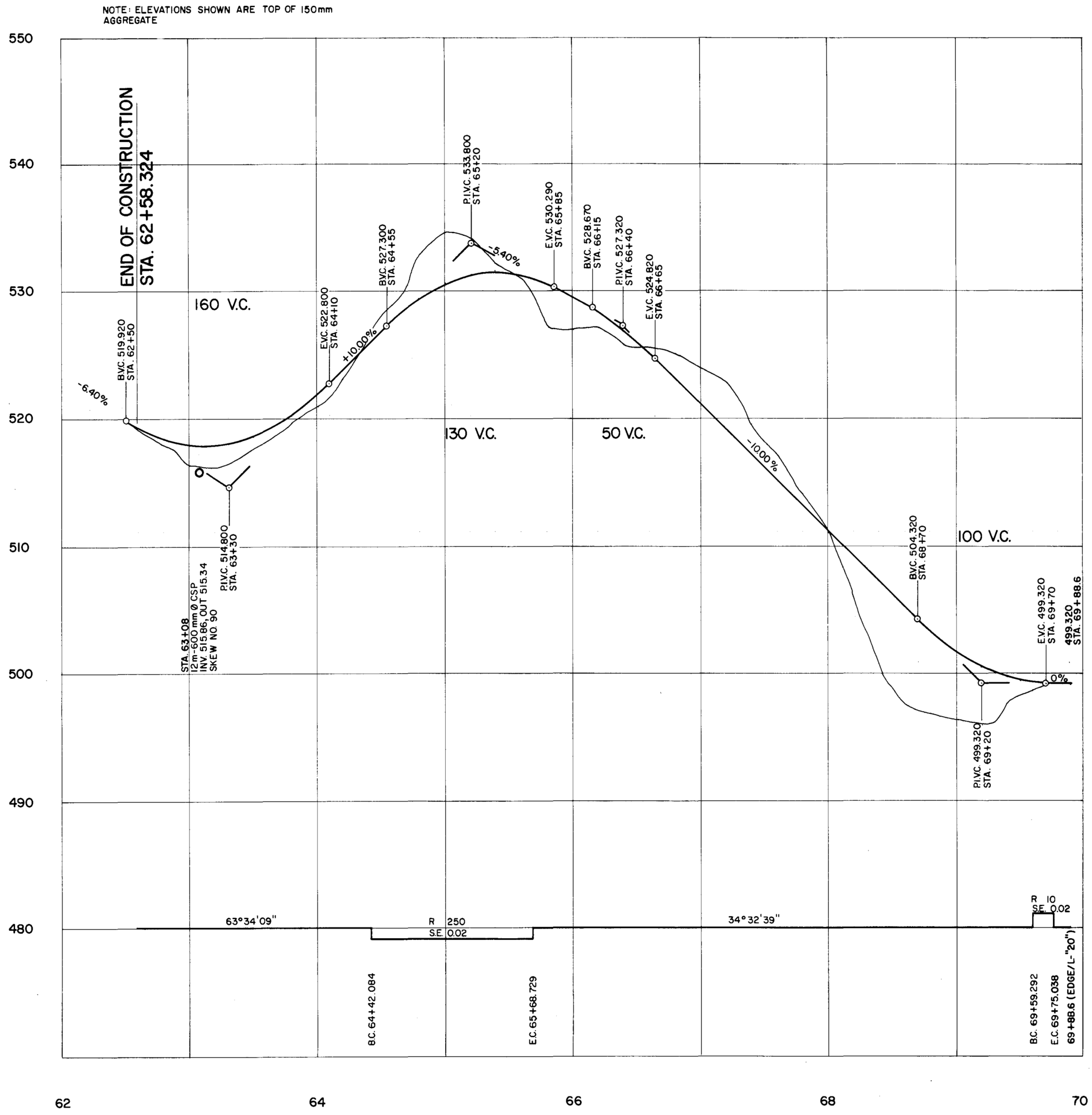
VANCAL - 7826

389279
92-1913-52 H-191-A

PROJECT No. C-3736
DRAWING No. AC-C3736-14



L-"50"
SCALE: 1:2000 HORIZ. 1:200 VERT.



L-"60"
SCALE: 1:2000 HORIZ. 1:200 VERT.

389280
92-1813-52 H-191-A
VANCAL 7826
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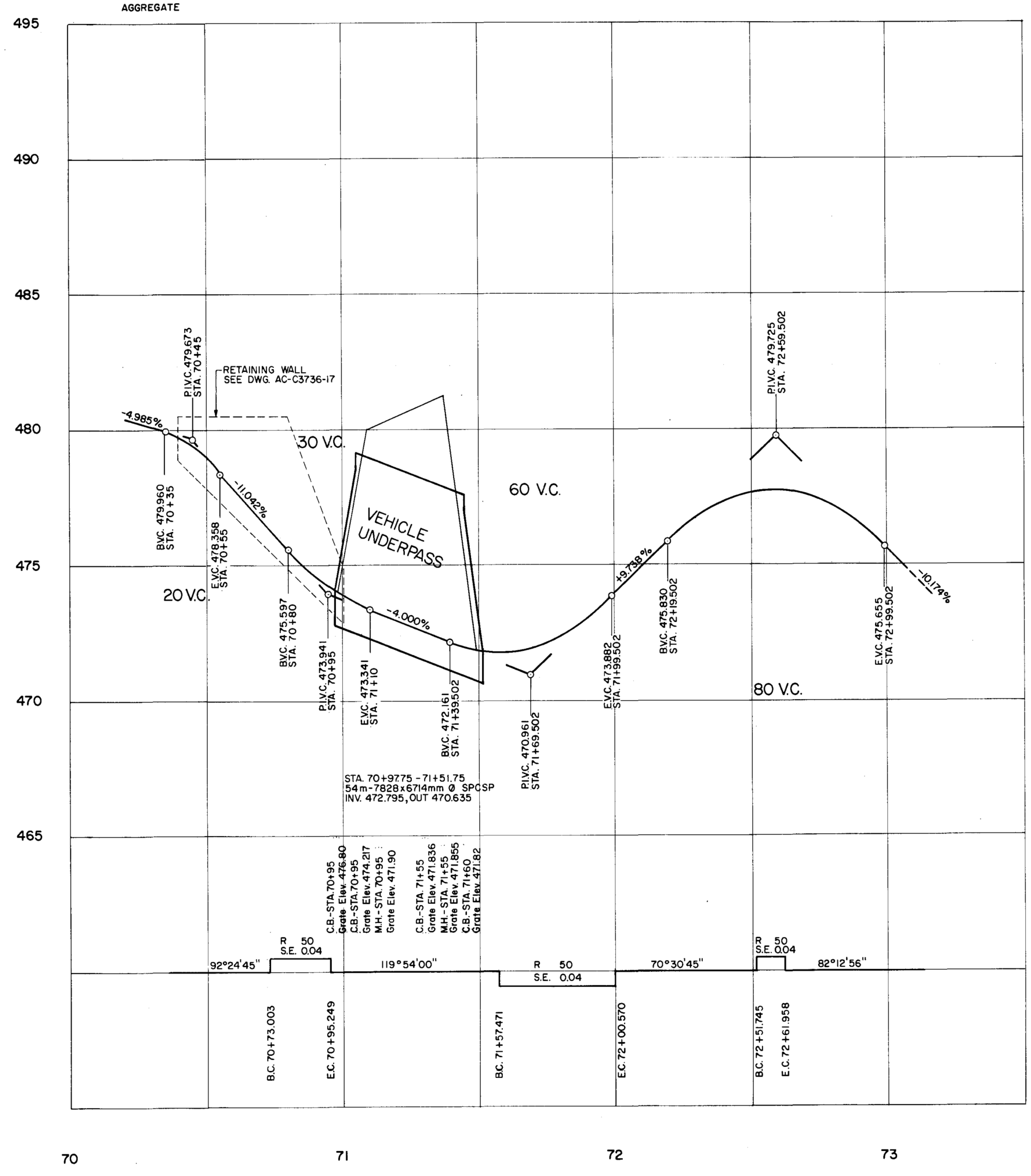
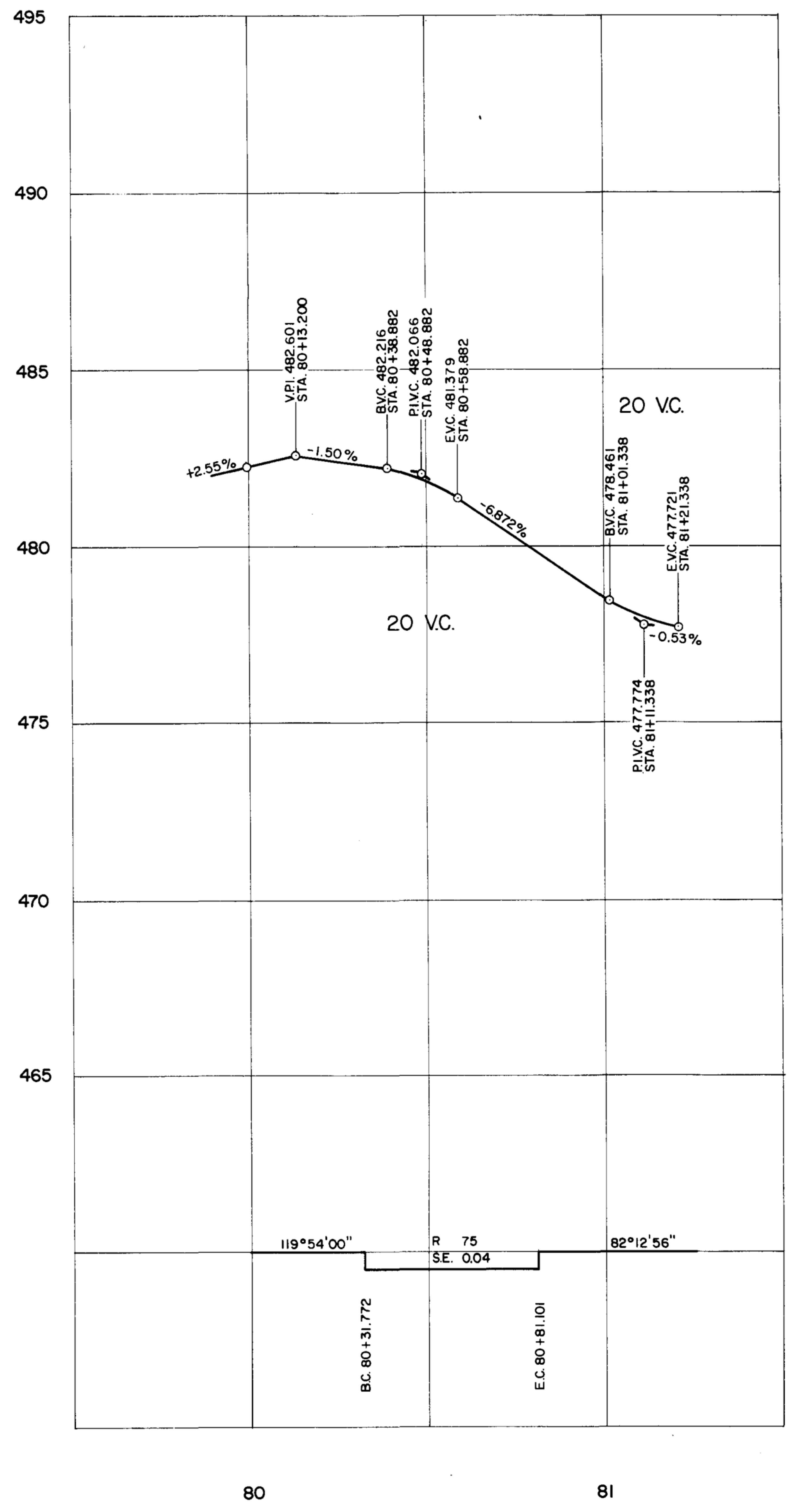
PROJECT No. C-3736
DRAWING No. AC-C3736-15

NOTE: ELEVATIONS SHOWN ARE TOP OF 25mm AGGREGATE



L-"70"
SCALE 1:1000 HORIZ.
1:100 VERT.

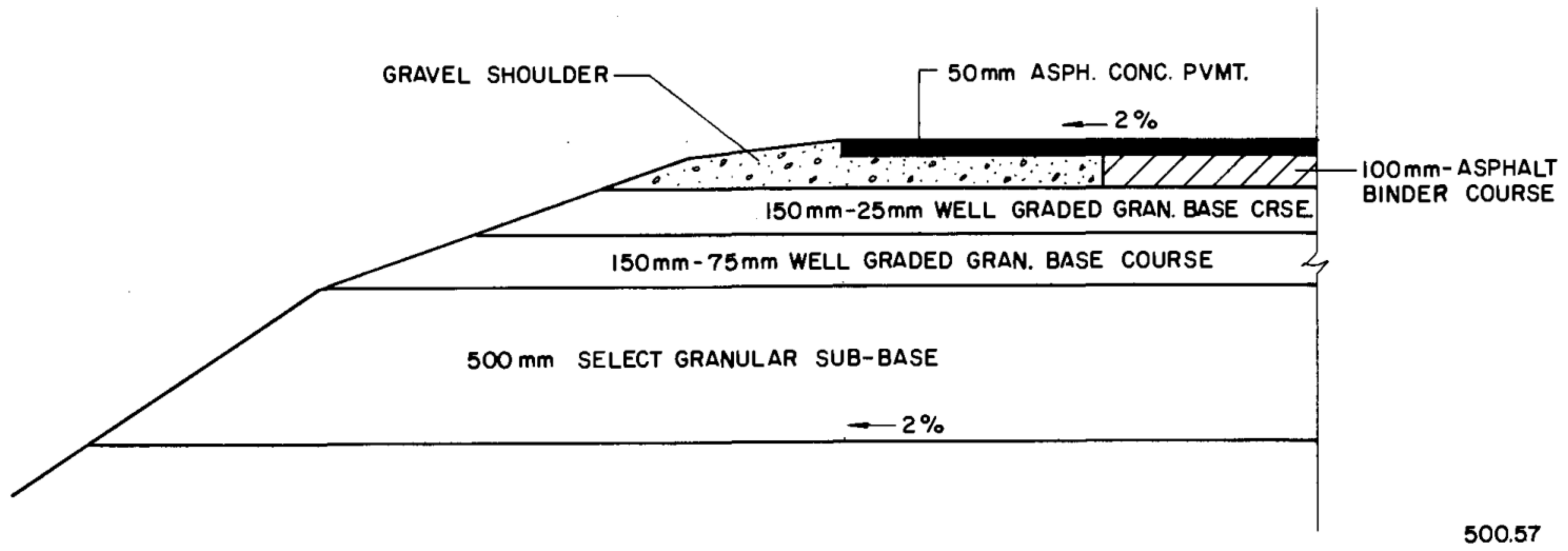


L-"80"
SCALE 1:1000 HORIZ.
1:100 VERT.

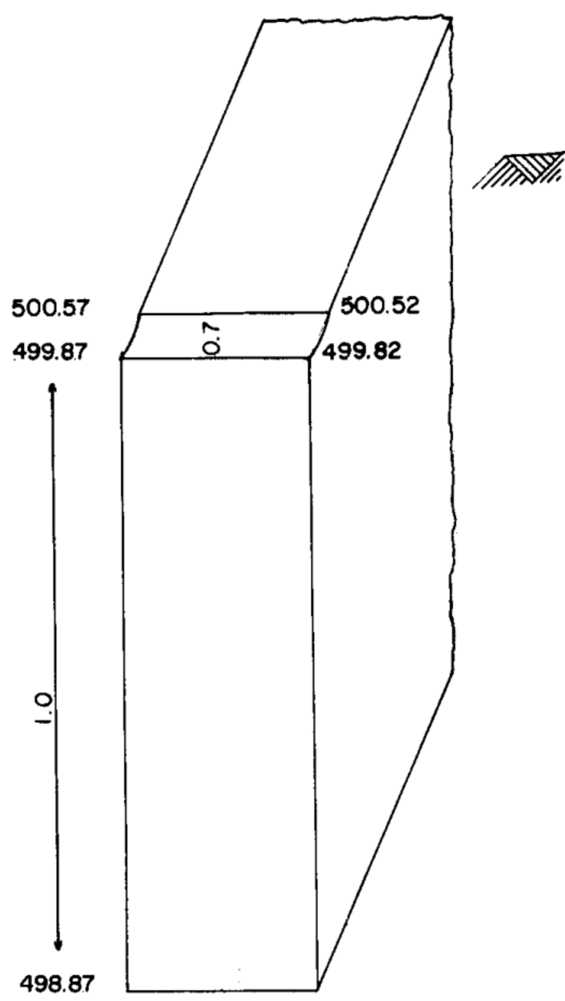
VANCAL - 7828

389281
92-1813-52 H-191-A

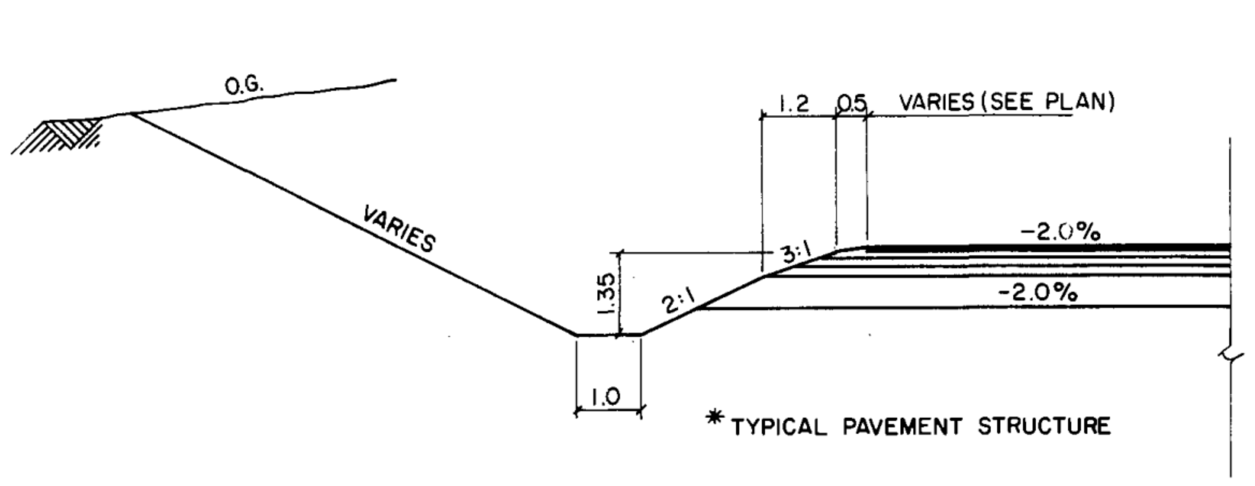
PROJECT No. C-3736
DRAWING No. AC-C3736-16



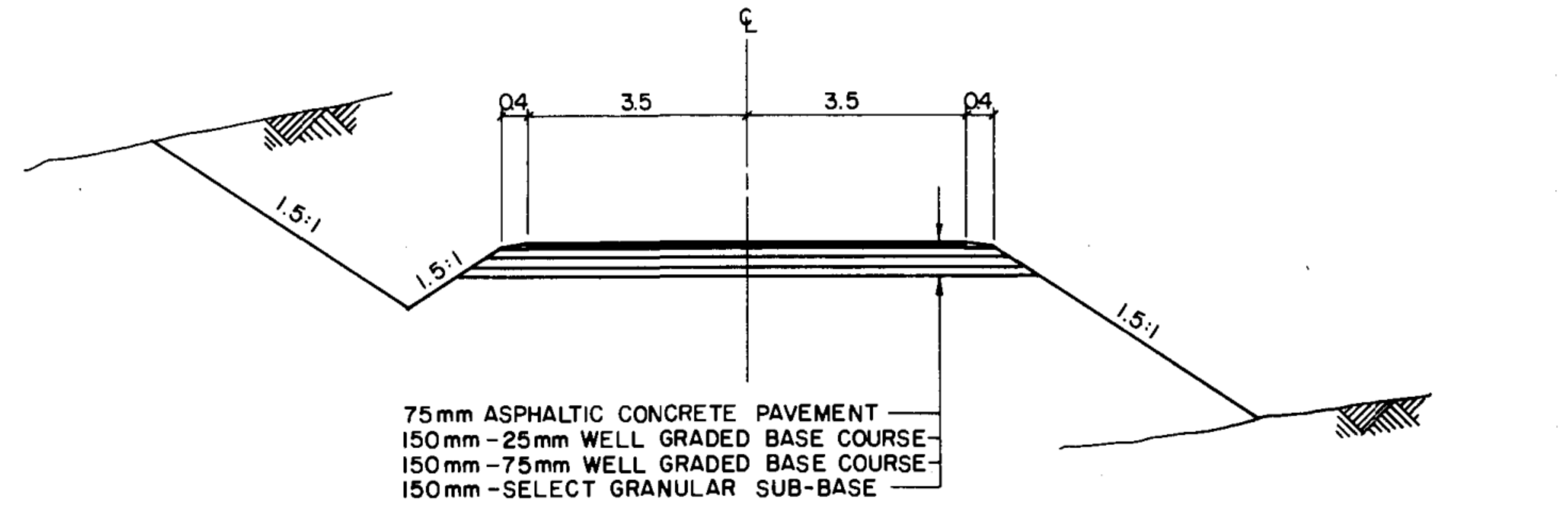
* TYPICAL PAVEMENT STRUCTURE
ALL ROADS EXCEPT L-"60", L-"70" & L-"80"
N.T.S.



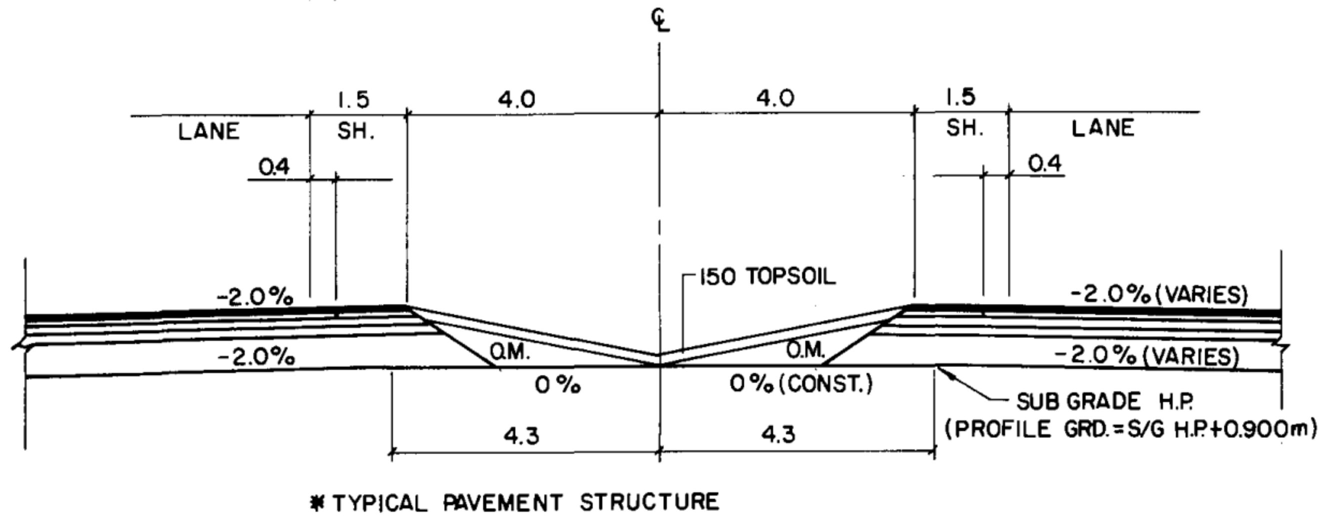
1400mm CONCRETE CUT-OFF WALL
STATION 1180+51
DROUGHT CREEK



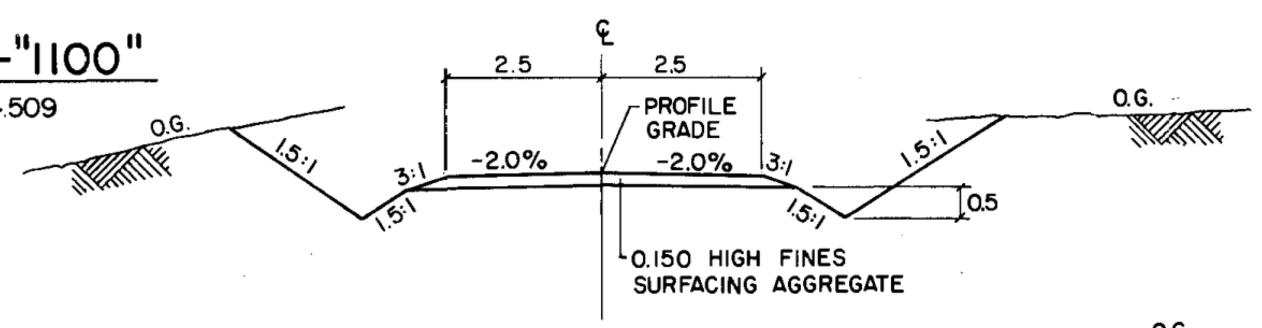
TYP. CUT SECTION
SCALE 1:100



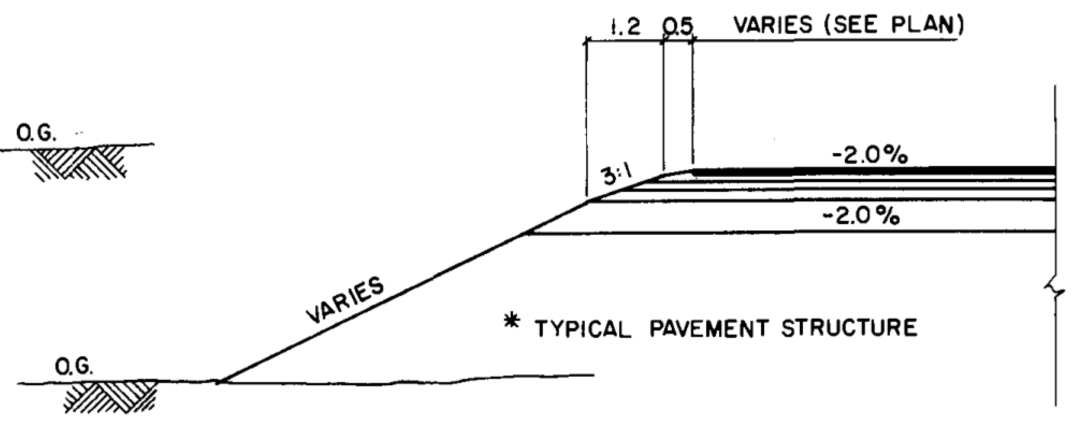
TYP. SECTION L-"80"
SCALE 1:100



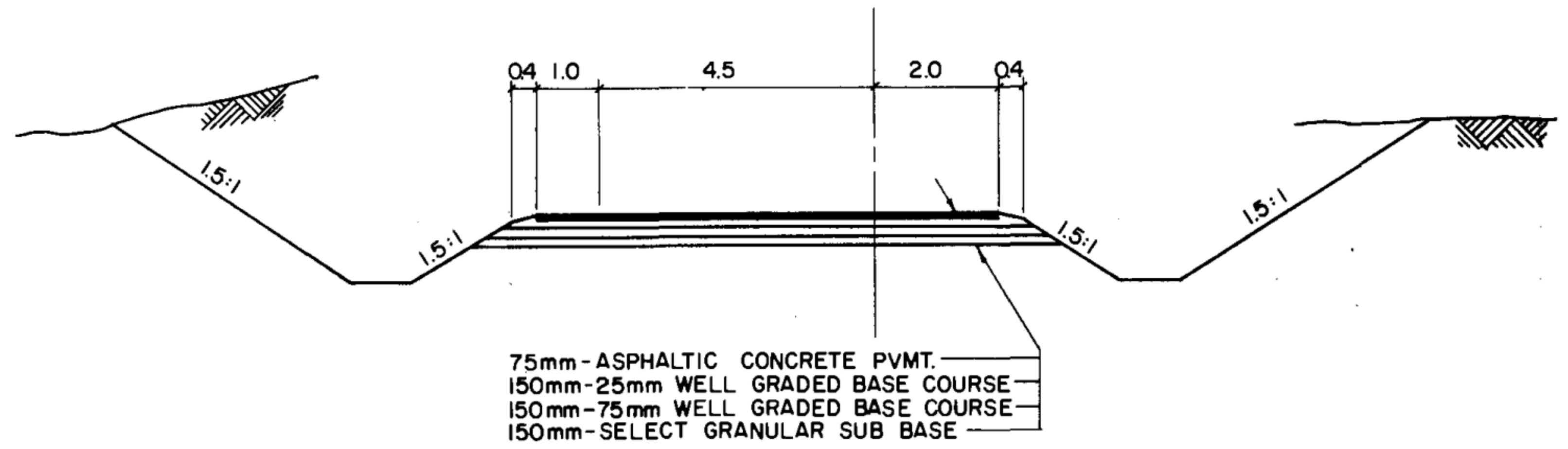
TYP. MEDIAN SECTION L-"1100"
STA 1169 +72.677 TO 1185 +04.509
SCALE 1:100



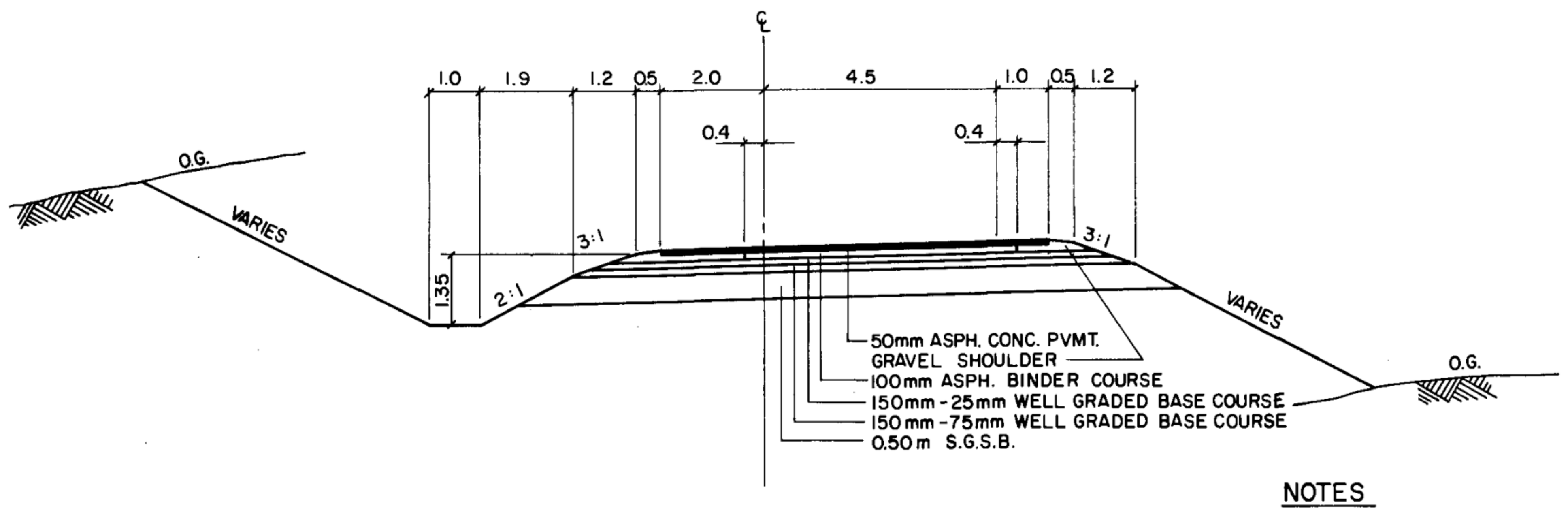
TYP. SECTION L-"60"
SCALE 1:100



TYP. FILL SECTION
SCALE 1:100

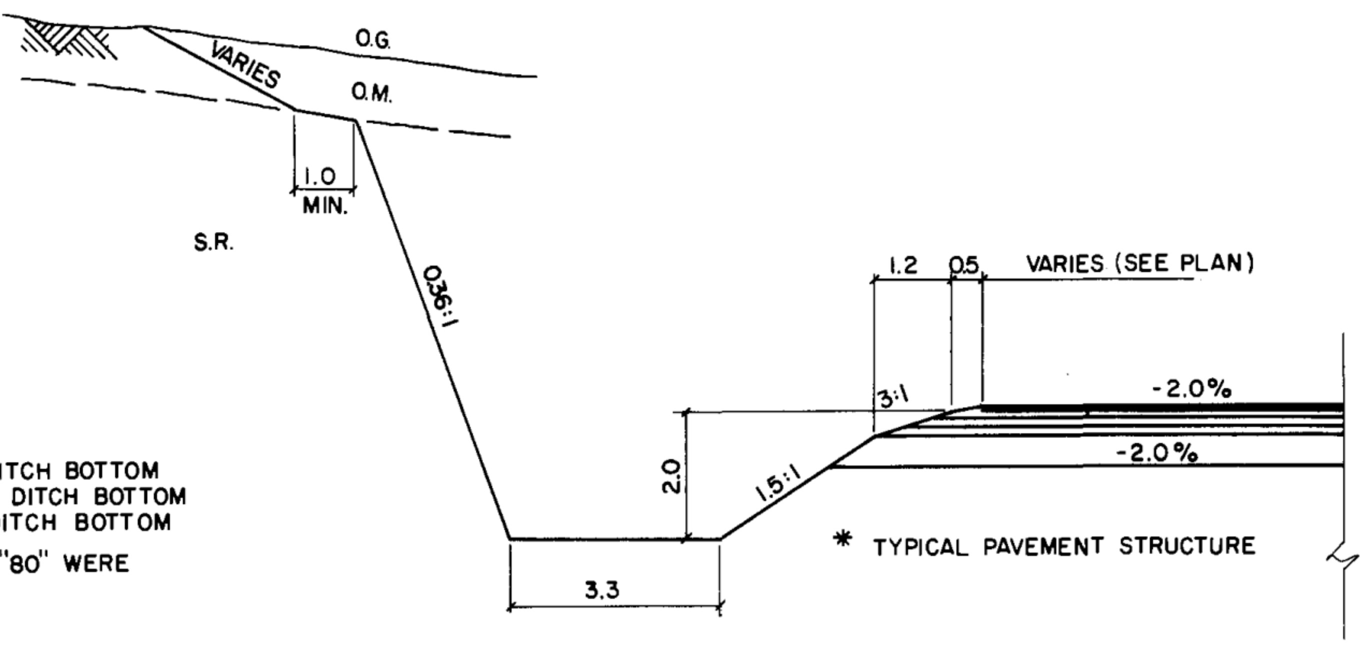


TYP. SECTION L-"70"
SCALE 1:100

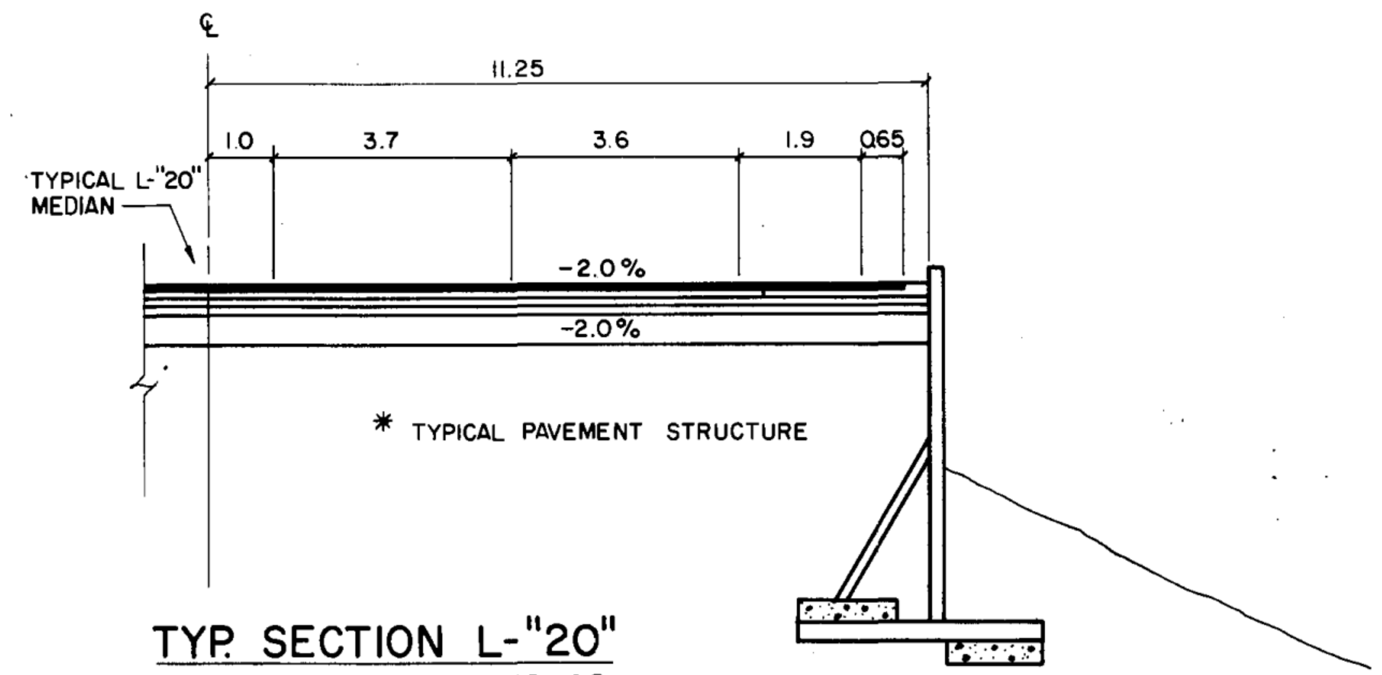


TYP. SECTION - L-40 RAMP
L-"30" & L-"50 RAMPS ARE
REVERSALS OF L-"40."
(STATIONS RUN OPPOSITE TO L-"40")
SCALE 1:100

NOTES
1 FILL SLOPES
- 3:1 UP TO 2.0m HIGH
- 2:1 2.0 TO 3.5m HIGH
- 1.5:1 OVER 3.5m HIGH
2 O.M. CUT SLOPES
- 3:1 UP TO 2.5m FROM DITCH BOTTOM
- 2:1 2.5m TO 4.0m FROM DITCH BOTTOM
- 1.5:1 OVER 4.0m FROM DITCH BOTTOM
3 ONLY L-"20", L-"70", & L-"80" WERE PAVED ON THIS PROJECT.



TYP. S.R. CUT SECTION
SCALE 1:100



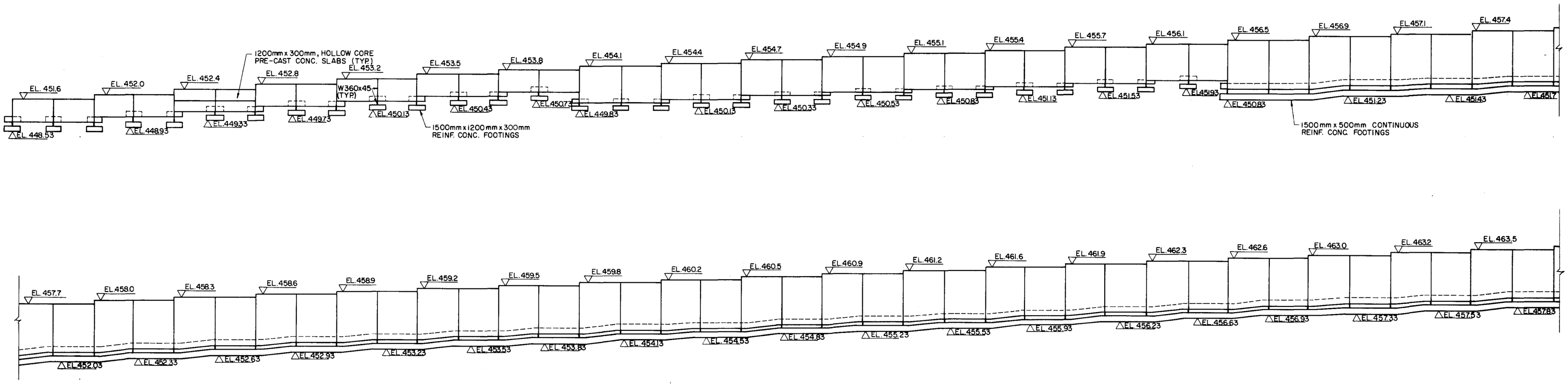
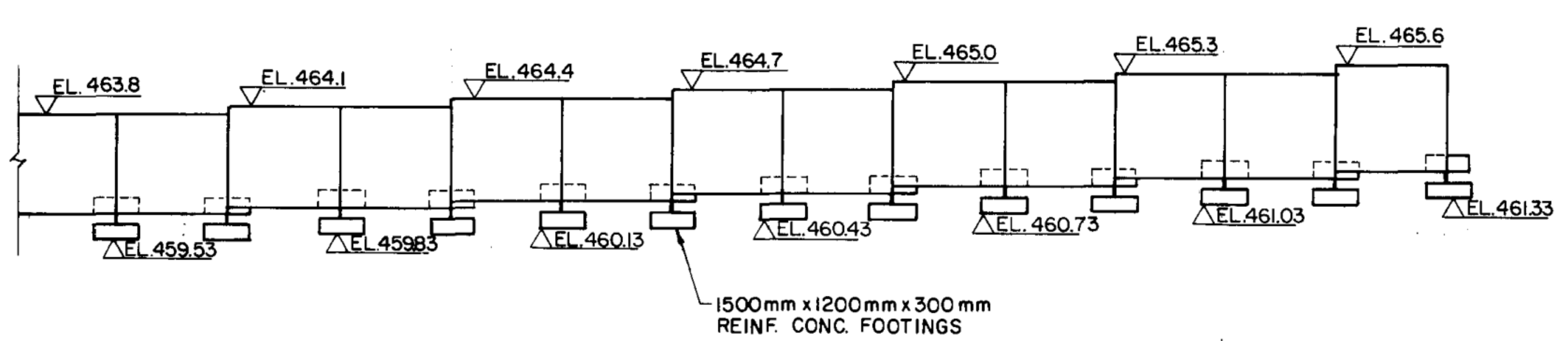
TYP. SECTION L-"20"
STA. 15+35 TO STA. 18+90
SCALE 1:100

PREFABRICATED RETAINING WALL, STA. 15+35 - 18+90 (N.T.S.)

VANCAL - 7826

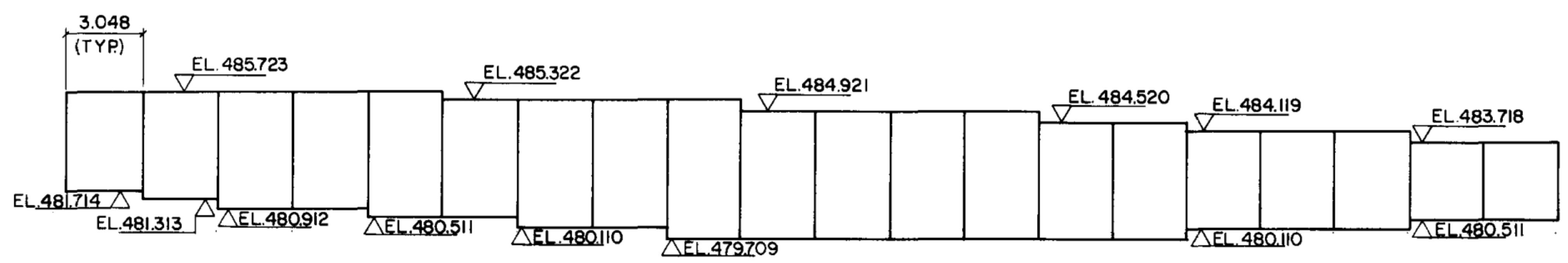
389282
92-1813-32 H-191-A

PROJECT No. C-3736
DRAWING No. AC-C3736-17

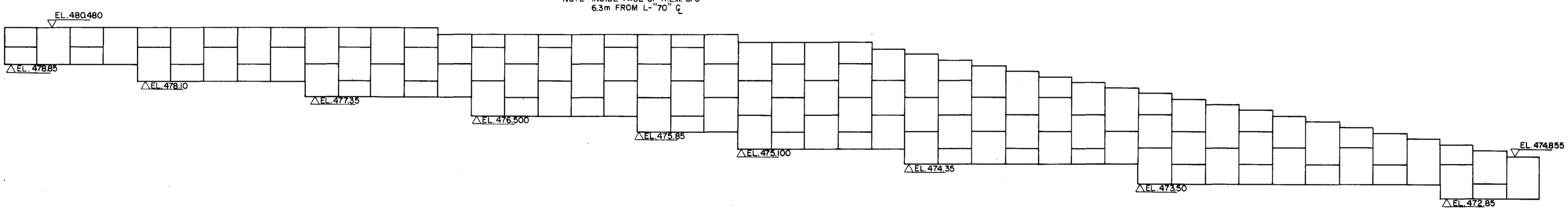
DROUGHT HILL RETAINING WALL
RT. SIDE STA. 15+35 TO STA. 18+91
SCALE 1:200

NOTE: TOP OUTSIDE FACE OF WALL O/S APPROX. 4.4 FROM L-"50" ℄



L-"50" METAL BIN WALL
RT. SIDE STA. 52+80 TO STA. 53+40.96
SCALE 1:200

NOTE: INSIDE FACE OF R.E.W. O/S 6.3m FROM L-"70" ℄



L-"70" REINFORCED EARTH WALL
LT. SIDE STA. 70+394 TO STA. 71+05.45
SCALE 1:100

VANCAL - 7826

389283
92-1813-5
H-191-A

PROJECT NO. C-3736

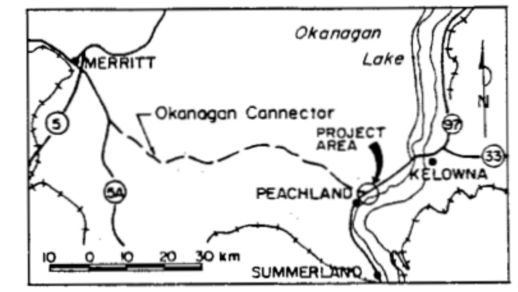
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS

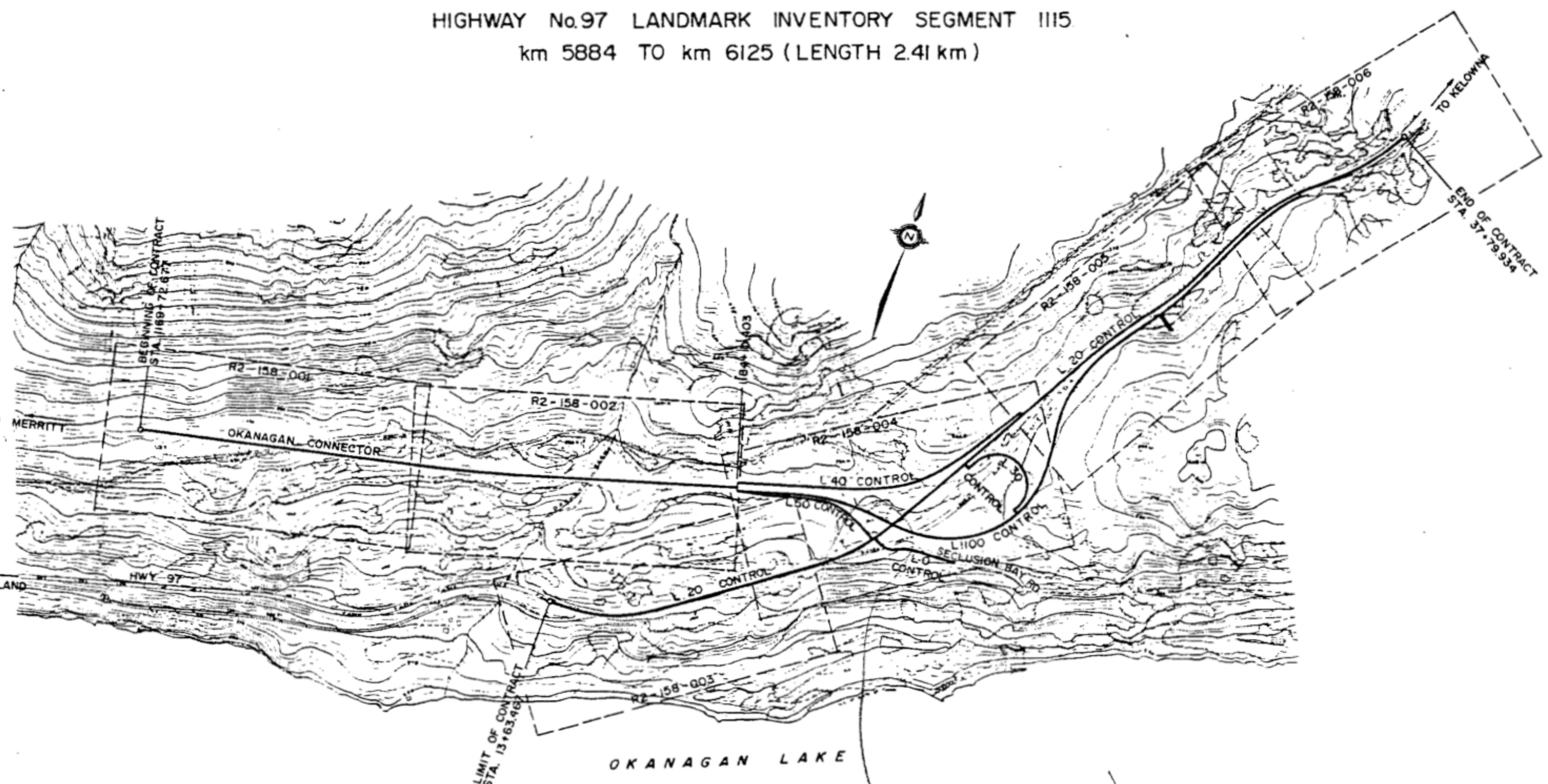
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR

COUSINS ROAD TO GORMAN'S MILL (3.48 km)

INCLUDING
HIGHWAY No. 97 LANDMARK INVENTORY SEGMENT 1115
km 5884 TO km 6125 (LENGTH 2.41 km)

REDUCED PLAN
APPROX. HALF SIZE





KEY. MAP
100m 0 300m
1:7500

Revision
For Seclusion Bay Road

DRAWING INDEX

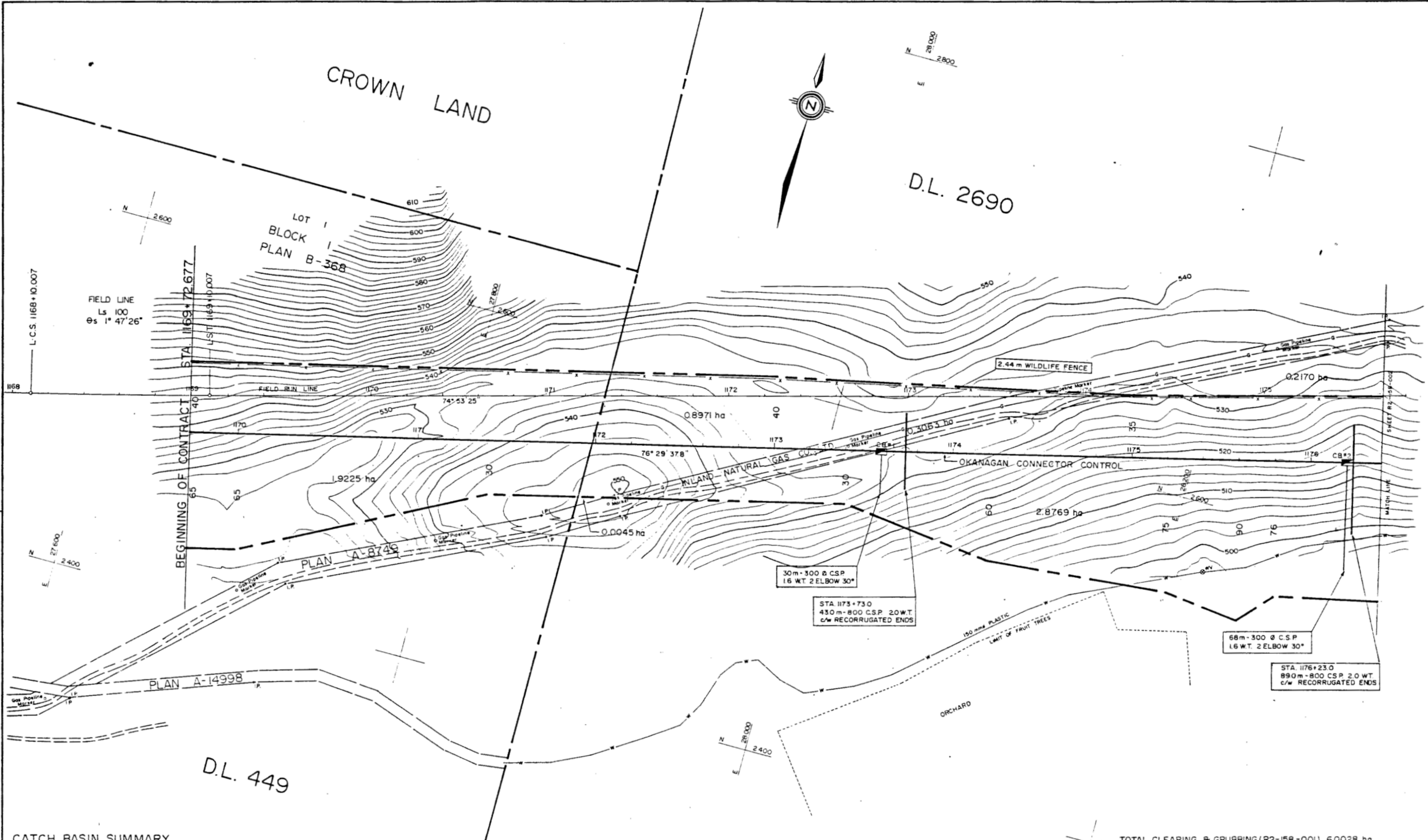
R2 - 158 - 000	KEY PLAN
R2 - 158 - 001 to 006	PLANS
R2 - 158 - 007 to 012	PROFILES
R2 - 158 - 013 to 014	TYPICAL SECTIONS
R2 - 158 - 015	VOLUME OVERHAUL DIAGRAM
R2 - 158 - 016	VOLUME OVERHAUL DIAGRAM
R2 - 158 - 017	GRAVEL QUANTITIES
R2 - 158 - 018 to 022	GEOMETRICS AND LANING
R2 - 158 - 023	UNGULATE CROSSING & PEDESTRIAN UNDERPASS - DETAILS
R2 - 158 - 024	FENCING AND DRAINAGE - DETAILS
R2 - 158 - 025	CATTLE GUARD - DETAILS
R2 - 158 - 026 to 029	RETAINING WALLS

LEGEND

SURVEY LINE	P - LINE
HIGHWAY No. 1 CENTRELINE	L - LINE
CUT AND FILL	TOP OF CUT (T.O.C.) BOTTOM OF FILL (B.O.F.)
LIMIT OF CLEARING & GRUBBING	CL. & GR.
STORM SEWER	CATCH BASIN MANHOLE S S
TEMPORARY PAVEMENT	
ASPHALT REMOVAL	
HIGHWAY R/W	
℄ CHAINAGE	300
PAVED ROAD	
GRAVEL ROAD	
PROPOSED DRAINAGE DITCH	
PROPOSED CULVERT	105m - 1200 mm ⌀ CSP
EXISTING CULVERT	
BORROW AREA BOUNDARY	
FENCE	
RAILWAY	
NO POST GUARD RAIL	
POWER TRANSMISSION LINE	
TELEPHONE POLES	EXISTING PROPOSED FOR REMOVAL
POWER POLES	EXISTING PROPOSED FOR REMOVAL
SHOULDER EDGE - S.E.	PAVEMENT EDGE - P.E. LANE EDGE - L.E.

UMA Engineering Ltd.

PROJECT No. C-3736	DWG. No. R2 - 158 - 000



CATCH BASIN SUMMARY

C.B. No.	TYPE	STATION	GRATE ELEV	300 mm Ø 1.6 W.T. C.S.P. PIPE LENGTH (m) 2	3	4	5	7	TOTAL	FITTINGS
1	7-SP 219	1173+60	534.30	1	1			3	30	2-30° ELBOWS
2	7-SP 219	1176+20	522.43	1	2			9	68	2-30° ELBOWS

CULVERT SUMMARY

STATION	DIAMETER	W.T.	3m	5m	6m	ANNULAR COUPLING	30° ELBOWS
1173+73.0	800	2.0	1		7	7	0
1176+23.0	800	2.0		1	14	14	2

UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories

0 50

TOTAL CLEARING & GRUBBING (R2-158-001) 6.0028 ha

SCALE	1:1000	DESIGNED H.B.	DATE 86-03-17	
		CHECKED W.A.P.	DATE 86-03-21	
F				
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REVISIONS				

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

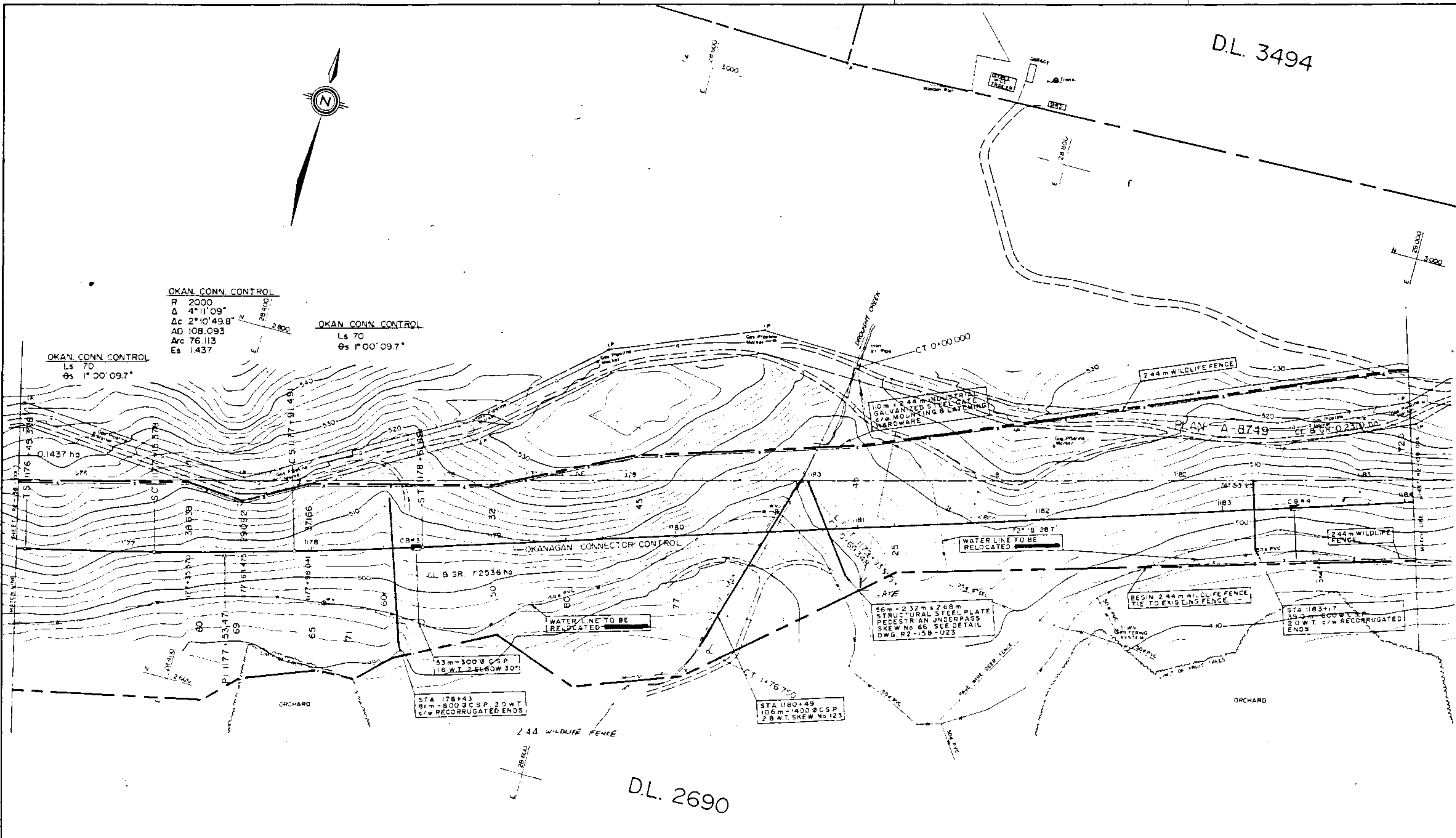
PLAN
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
STA. 1169+72.677 TO 1176+40 OKANAGAN CONNECTOR

PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE March 20, 1986	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	M G Elston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

INDEX	NEG No	FILE No.	PROJECT No	REGION	DRAWING No.
		L2-M221-698	C-3736	2	R2-158-001

FORM H 3081

CANCEL PRINTS BEARING EARLIER LETTER



CATCH BASIN SUMMARY

C B No	TYPE	STATION	GRATE ELEV	300mm Ø 1.6 W.T. C.S.P. PIPE LENGTH (m)						FITTINGS
				2	3	4	5	7	TOTAL	
3	7-SP219	1178+60	512.95		1	2		6	53	2-30° ELBOWS
4	7-SP219	1182+40	494.33							

CULVERT SUMMARY

STATION	DIAMETER	W.T.	6M	3M	ANNULAR COUPLING	30° ELBOWS
1178+43	800	2.0	13		13	2
1183+70	600	2.0	6	1	6	0

UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories

TOTAL CLEARING & GRUBBING (R2-158-002) 7.4846 ha

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

PLAN
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
STA. 1176+40 TO 1184+05 OKANAGAN CONNECTOR

SCALE 1:1000	DESIGNED H.B.	DATE 86.03.17	
	CHECKED W.A.P.	DATE 86.03.21	
F			
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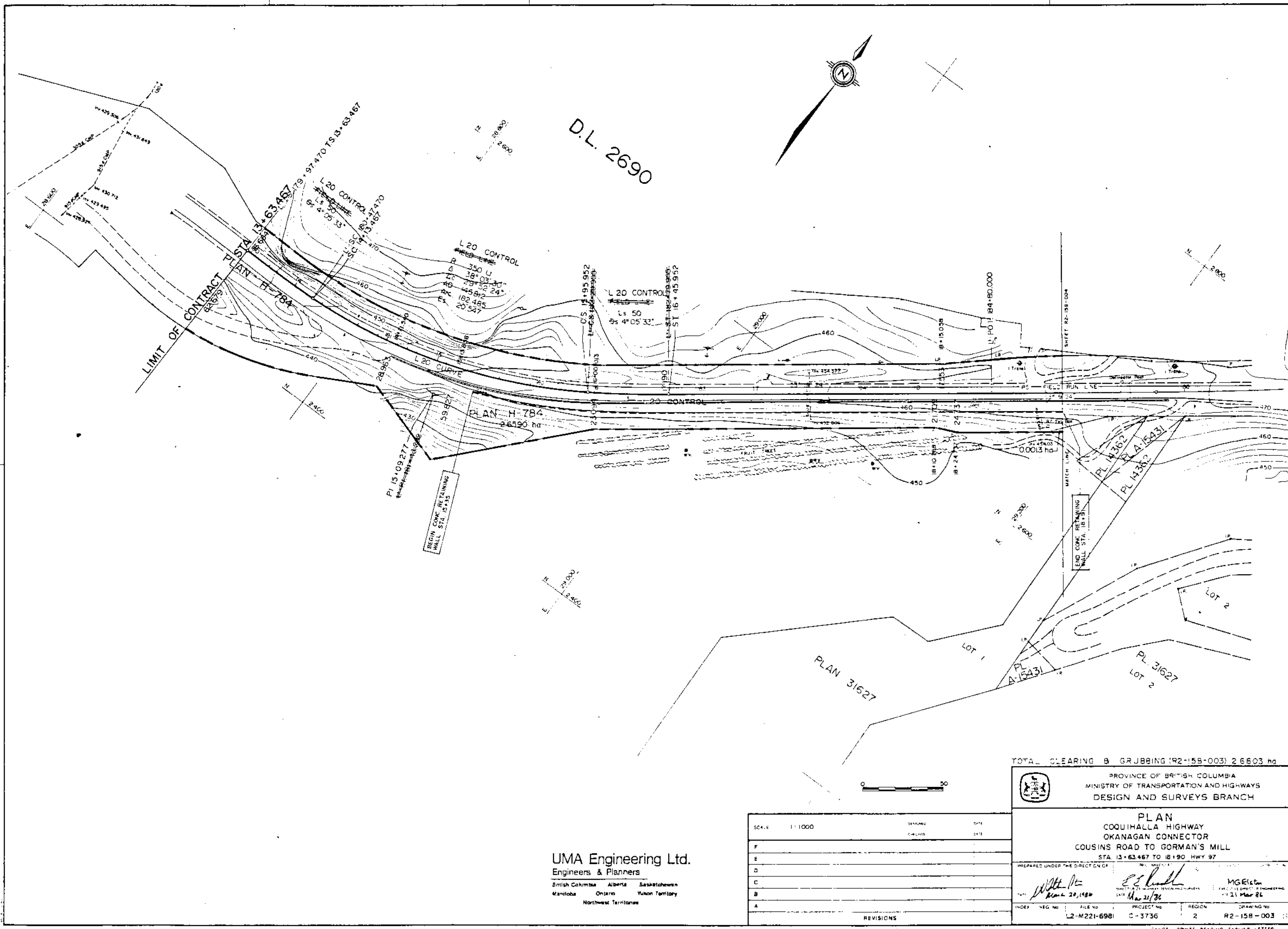
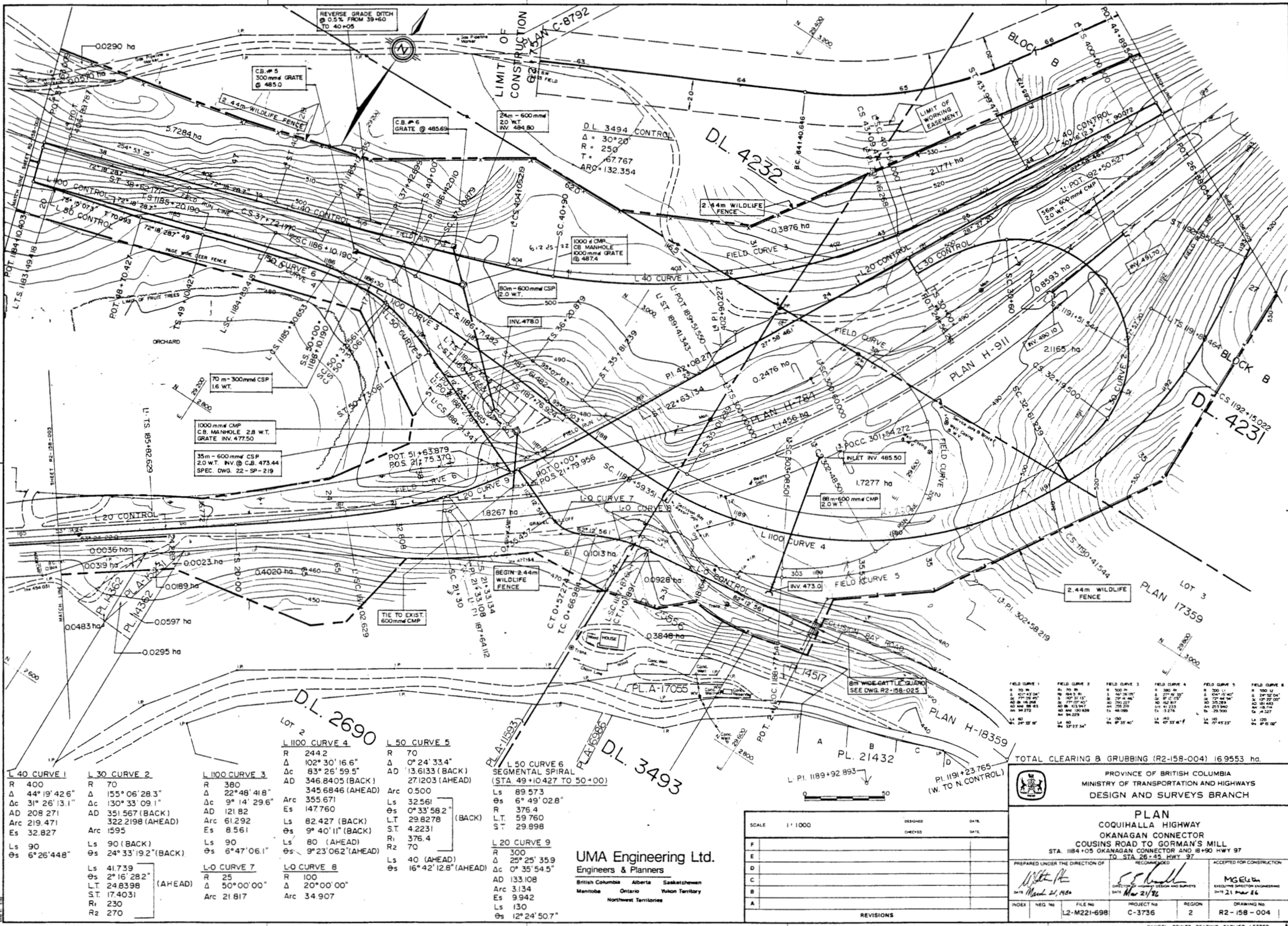
A			
REVISIONS			

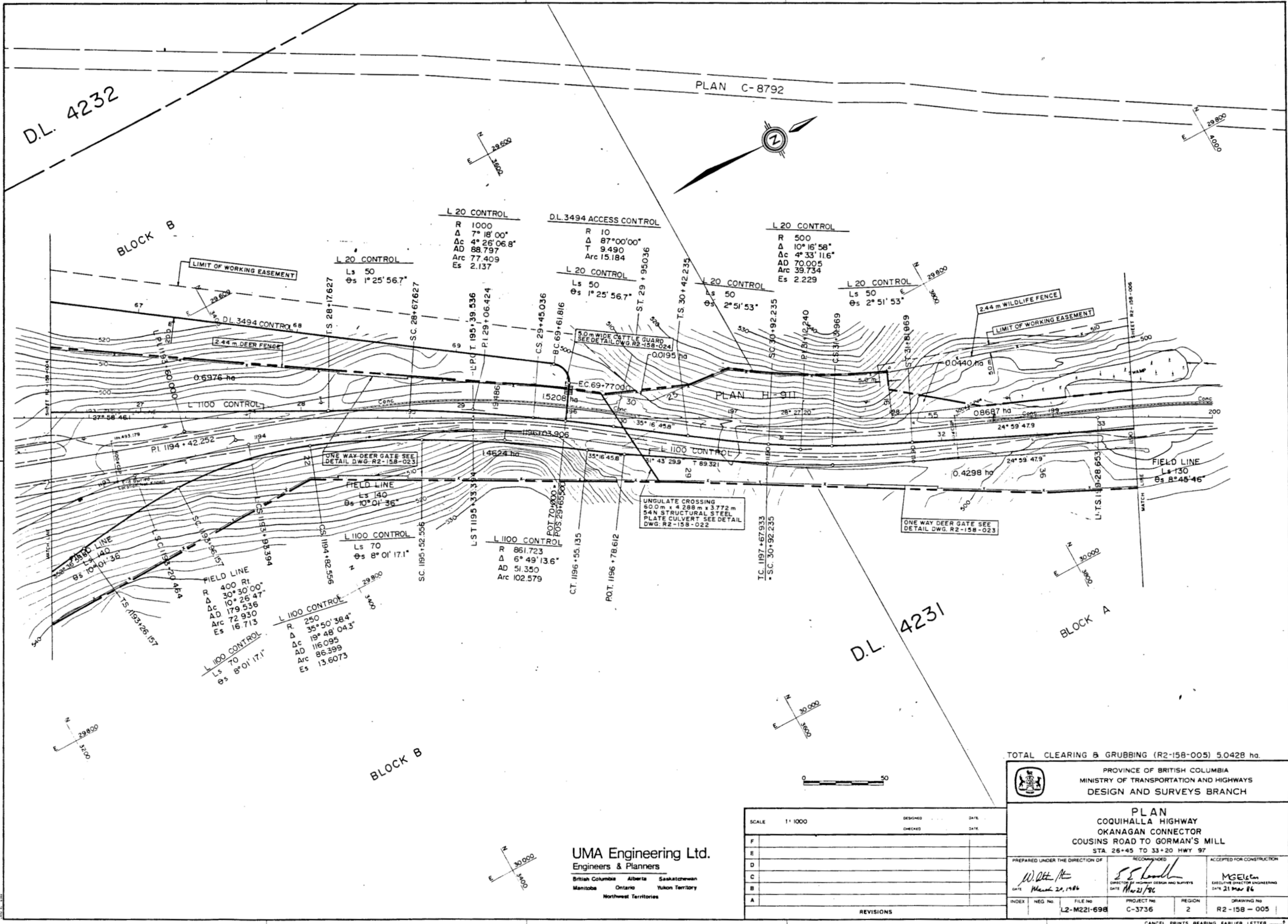
PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE March 20, 1986	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

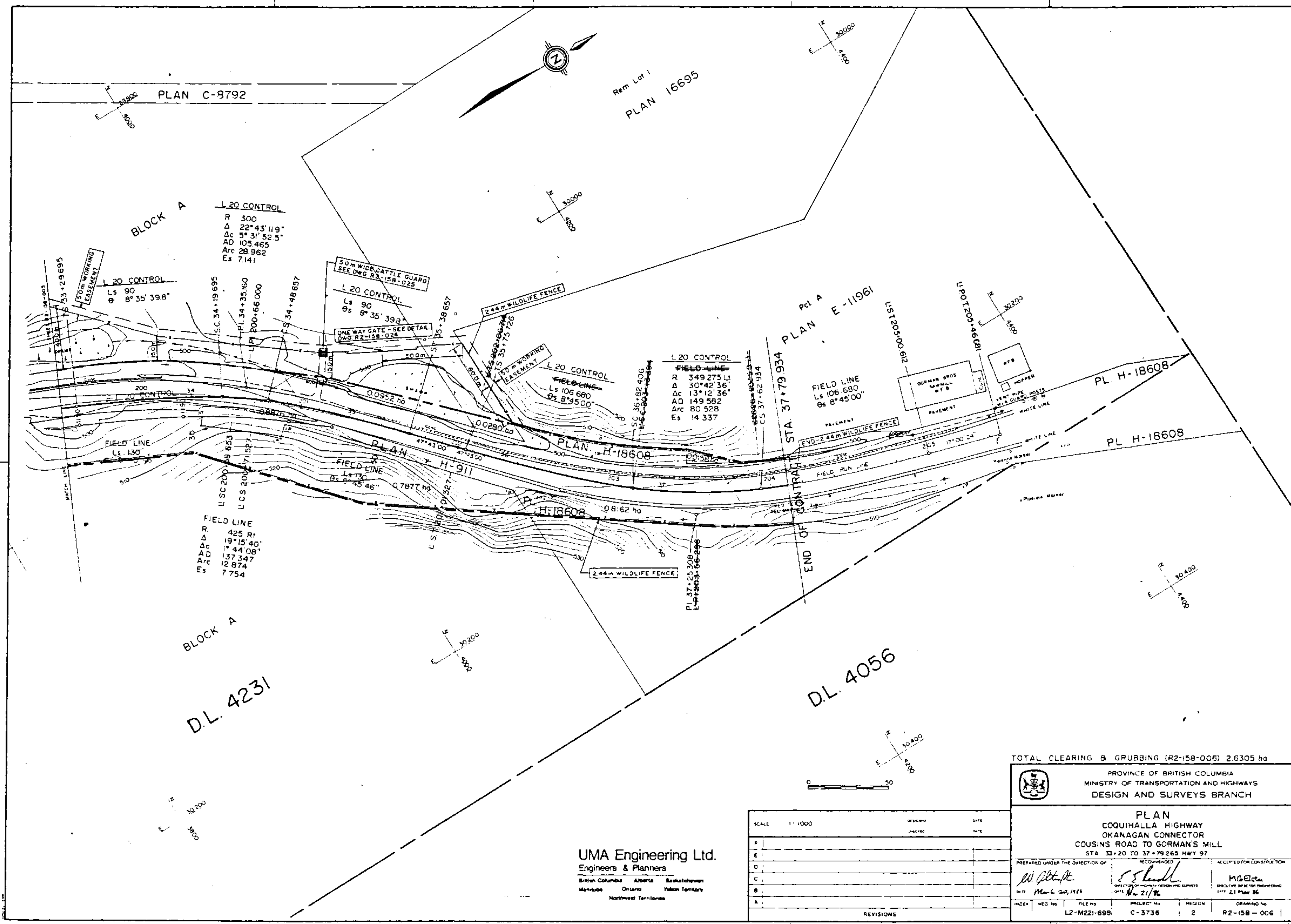
INDEX	NEG. No.	FILE No.	PROJECT No.	REGION	DRAWING No.
		L2-M221-698	C-3736	2	R2-158-002

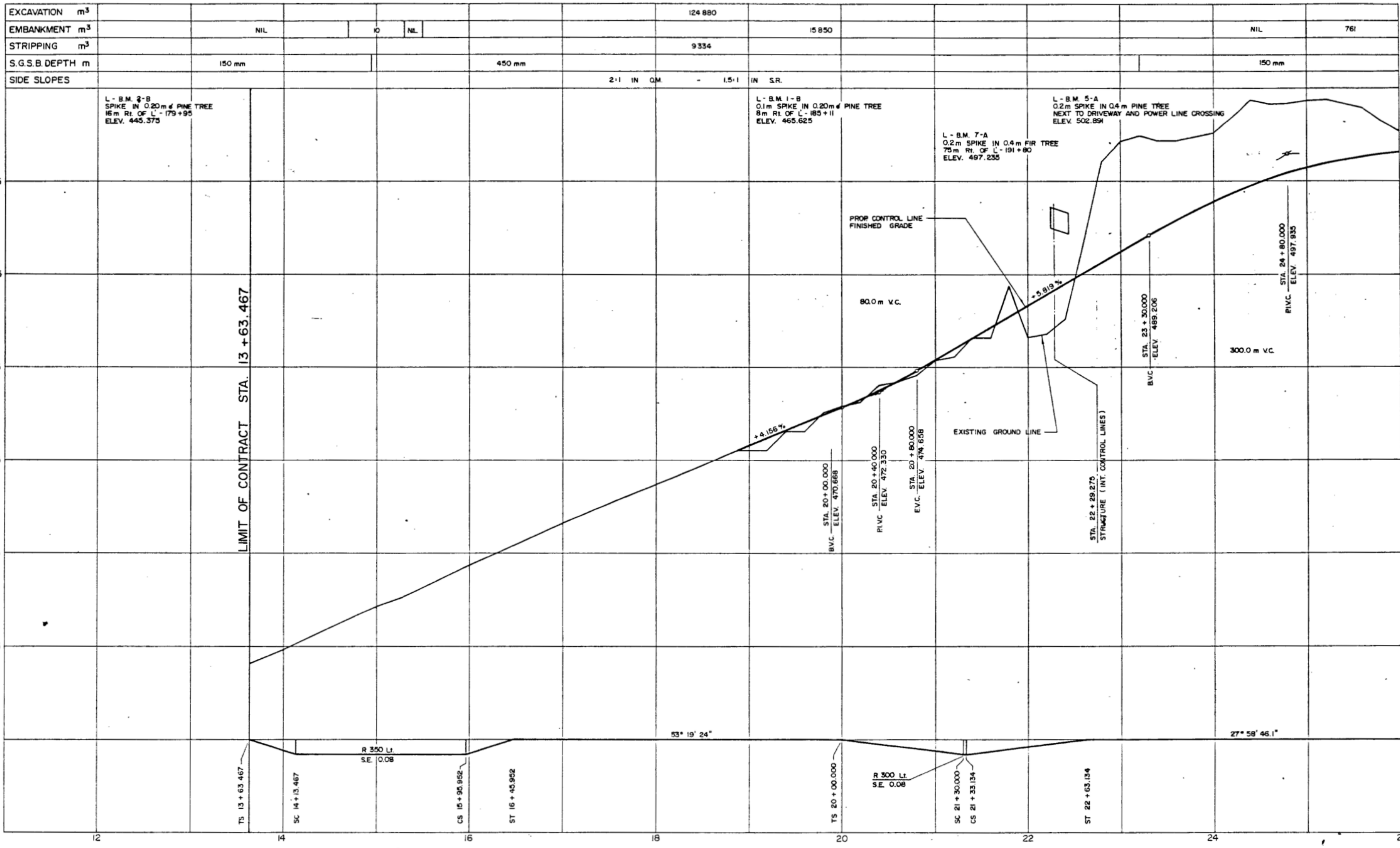
CANCEL PRINTS BEARING EARLIER LETTER


D.L. 2690
LIMIT OF CONTRACT STA. 13+63.467
PLAN H-784
L 20 CONTROL
R 350 Lt
Δ 38° 03' 30"
Ls 50
θs 4° 05' 33"
L 20 CURVE
PLAN H-784
2.6590 ha
BEGIN CONC. RETAINING WALL STA. 15+35
END CONC. RETAINING WALL STA. 18+91
0.0013 ha
FIELD RUN LINE
L 20 CONTROL
PL 14362
PL A-15431
PLAN 31627
LOT 1
LOT 2
PL 31627
TOTAL CLEARING & GRUBBING (R2-158-003) 2.6603 ha
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH
PLAN
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
STA. 13+63.467 TO 18+90 HWY 97
SCALE 1:1000
REVISIONS
L2-M221-6981
C-3736
2
R2-158-003
UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories
CANCEL PRINTS BEARING EARLIER LETTER


REVERSE GRADE DITCH @ 0.5% FROM 39+60 TO 40+05
LIMIT OF CONSTRUCTION
PLAN C-8792
BLOCK B
D.L. 4232
D.L. 3494 CONTROL
Δ = 30°20'
R = 250
T = 67.767
ARC = 132.354
C.B. # 5 300mmø GRATE @ 485.0
C.B. # 6 GRATE @ 485.69
24m - 600mmø 2.0 W.T. INV. 484.80
2.44m WILDLIFE FENCE
LIMIT OF WORKING EASEMENT
L 40 CONTROL
L 100 CONTROL
L 80 CONTROL
L 20 CONTROL
L 30 CONTROL
L 40 CURVE 1
FIELD CURVE 3
FIELD RUN LINE
PAGE WIRE DEER FENCE
ORCHARD
1000 ø CMP CB MANHOLE 1000mmø GRATE @ 487.4
80m - 600mmø CSP 2.0 W.T.
INV. 478.0
56m - 600mmø CMP 2.0 W.T.
INV. 491.70
INV. 490.10
70 m - 300mmø CSP 1.6 W.T.
1000mmø CMP C.B. MANHOLE 2.8 W.T. GRATE INV. 477.50
35m - 600mmø CSP 2.0 W.T. INV. @ C.B. 473.44 SPEC. DWG. 22-SP-219
PLAN H-911
PLAN H-784
D.L. 4231
INLET INV. 485.50
88 m - 600 mmø CMP 2.0 W.T.
FIELD CURVE 2
L 1100 CURVE 4
FIELD CURVE 5
L-O CONTROL
L-O CURVE 7
L-O CURVE 8
L 20 CURVE 9
FIELD CURVE 6
BEGIN 2.44m WILDLIFE FENCE
TIE TO EXIST. 600mmø CMP
INV. 473.0
2.44m WILDLIFE FENCE
PLAN 17359
LOT 3
ECLUSION BAY ROAD
8m WIDE CATTLE GUARD SEE DWG. R2-158-025
PL. A-17055
PL. 14517
D.L. 2690
LOT 2
PL. A-11593
PL. A-16986
D.L. 3493
PL. 21432
PLAN H-18359
L. P.I. 1189+92.893
P.I. 1191+23.765 (W. TO N. CONTROL)
L 40 CURVE 1
R 400
Δ 44° 19' 42.6"
Δc 31° 26' 13.1"
AD 208 271
Arc 219.471
Es 32.827
Ls 90
θs 6° 26' 44.8"
L 30 CURVE 2
R 70
Δ 155° 06' 28.3"
Δc 130° 33' 09.1"
AD 351.567 (BACK) 322.2198 (AHEAD)
Arc 1595
Ls 90 (BACK)
θs 24° 33' 19.2" (BACK)
Ls 41.739
θs 2° 16' 28.2"
L.T. 24.8398
S.T. 17.4031
R1 230
R2 270
(AHEAD)
L 1100 CURVE 3
R 380
Δ 22° 48' 41.8"
Δc 9° 14' 29.6"
AD 121.82
Arc 61.292
Es 8.561
Ls 90
θs 6° 47' 06.1"
L-O CURVE 7
R 25
Δ 50° 00' 00"
Arc 21.817
L 1100 CURVE 4
R 244.2
Δ 102° 30' 16.6"
Δc 83° 26' 59.5"
AD 346.8405 (BACK) 345.6846 (AHEAD)
Arc 355.671
Es 147.760
Ls 82.427 (BACK)
θs 9° 40' 11" (BACK)
Ls 80 (AHEAD)
θs 9° 23' 06.2" (AHEAD)
L-O CURVE 8
R 100
Δ 20° 00' 00"
Arc 34.907
L 50 CURVE 5
R 70
Δ 0° 24' 33.4"
AD 13.6133 (BACK) 27.1203 (AHEAD)
Arc 0.500
Ls 32.561
θs 0° 33' 58.2"
L.T 29.8278
S.T. 4.2231
R1 376.4
R2 70
(BACK)
Ls 40 (AHEAD)
θs 16° 42' 12.8" (AHEAD)
L 50 CURVE 6 SEGMENTAL SPIRAL (STA. 49+10.427 TO 50+00)
Ls 89.573
θs 6° 49' 02.8"
R 376.4
L.T. 59 760
S.T 29.898
L 20 CURVE 9
R 300
Δ 25° 25' 35.9
Δc 0° 35' 54.5"
AD 133.108
Arc 3.134
Es 9.942
Ls 130
θs 12° 24' 50.7"
UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories
TOTAL CLEARING & GRUBBING (R2-158-004) 16.9553 ha.
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH
PLAN
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
STA. 1184+05 OKANAGAN CONNECTOR AND 18+90 HWY 97 TO STA 26+45 HWY 97
SCALE 1:1000
DESIGNED DATE
CHECKED DATE
REVISIONS
PREPARED UNDER THE DIRECTION OF
DATE March 21, 1986
RECOMMENDED
DIRECTOR OF HIGHWAY DESIGN AND SURVEYS
DATE Mar 21/86
ACCEPTED FOR CONSTRUCTION
MG Elston
EXECUTIVE DIRECTOR ENGINEERING
DATE 21 Mar 86
INDEX NEG. No FILE No L2-M221-698
PROJECT No C-3736
REGION 2
DRAWING No. R2-158-004
CANCEL PRINTS BEARING EARLIER LETTER


D.L. 4232
PLAN C-8792
BLOCK B
LIMIT OF WORKING EASEMENT
D.L. 3494 CONTROL
2.44 m DEER FENCE
0.6976 ha
L 1100 CONTROL
L 20 CONTROL
R 1000
Δ 7° 18' 00"
Δc 4° 26' 06.8"
AD 88.797
Arc 77.409
Es 2.137
L 20 CONTROL
Ls 50
θs 1° 25' 56.7"
D.L. 3494 ACCESS CONTROL
R 10
Δ 87°00'00"
T 9.490
Arc 15.184
L 20 CONTROL
Ls 50
θs 1° 25' 56.7"
L 20 CONTROL
Ls 50
θs 2° 51' 53"
L 20 CONTROL
R 500
Δ 10° 16' 58"
Δc 4° 33' 11.6"
AD 70.005
Arc 39.734
Es 2.229
L 20 CONTROL
Ls 50
θs 2° 51' 53"
2.44 m WILDLIFE FENCE
LIMIT OF WORKING EASEMENT
5.0 m WIDE CATTLE GUARD SEE DETAIL DWG. R2-158-024
0.0195 ha
0.0440 ha
1.5208 ha
PLAN H-911
0.8687 ha
1.4624 ha
0.4298 ha
P.I. 1194 + 42.252
ONE WAY DEER GATE SEE DETAIL DWG. R2-158-023
FIELD LINE
Ls 140
θs 10° 01' 36"
L 1100 CONTROL
Ls 70
θs 8° 01' 17.1"
L 1100 CONTROL
R 861.723
Δ 6° 49' 13.6"
AD 51.350
Arc 102.579
UNGULATE CROSSING
60.0 m x 4.288 m x 3.772 m
54N STRUCTURAL STEEL
PLATE CULVERT SEE DETAIL
DWG: R2-158-022
ONE WAY DEER GATE SEE DETAIL DWG. R2-158-023
FIELD LINE
Ls 130
θs 8° 45' 46"
FIELD LINE
R 400 Rt.
Δ 30° 30' 00"
Δc 10° 26' 47"
AD 179.536
Arc 72.930
Es 16.713
L 1100 CONTROL
R 250
Δ 35° 50' 38.4"
Δc 19° 48' 04.3"
AD 116.095
Arc 86.399
Es 13.6073
L 1100 CONTROL
Ls 70
θs 8° 01' 17.1"
D.L. 4231
BLOCK A
BLOCK B
TOTAL CLEARING & GRUBBING (R2-158-005) 5.0428 ha.
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH
PLAN
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
STA. 26+45 TO 33+20 HWY 97
SCALE 1:1000
REVISIONS
UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories
PREPARED UNDER THE DIRECTION OF
RECOMMENDED
ACCEPTED FOR CONSTRUCTION
DIRECTOR OF HIGHWAY DESIGN AND SURVEYS
EXECUTIVE DIRECTOR ENGINEERING
INDEX NEG. No. FILE No. PROJECT No. REGION DRAWING No.
L2-M221-698 C-3736 2 R2-158-005
CANCEL PRINTS BEARING EARLIER LETTER


PLAN C-8792
Rem Lot 1
PLAN 16695
BLOCK A
L 20 CONTROL
R 300
Δ 22°43'11.9"
Δc 5°31'52.5"
AD 105.465
Arc 28.962
Es 7.141
L 20 CONTROL
Ls 90
θ 8°35'39.8"
3.0m WIDE CATTLE GUARD SEE DWG R2-158-025
L 20 CONTROL
Ls 90
θs 8°35'39.8"
ONE WAY GATE - SEE DETAIL DWG R2-158-024
2.44m WILDLIFE FENCE
3.0m WORKING EASEMENT
L 20 CONTROL
FIELD LINE
Ls 106.680
θs 8°45'00"
L 20 CONTROL
FIELD LINE
R 349.275 Lt
Δ 30°42'36"
Δc 13°12'36"
AD 149.582
Arc 80.528
Es 14.337
Pcl A
PLAN E-11961
FIELD LINE
Ls 106.680
θs 8°45'00"
GORMAN BROS SAWMILL
PL H-18608
PLAN H-18608
PLAN H-911
0.0952 ha
0.0280 ha
0.7877 ha
0.8162 ha
FIELD LINE
Ls 130
FIELD LINE
R 425 Rt
Δ 19°15'40"
Δc 1°44'08"
AD 137.347
Arc 12.874
Es 7.754
STA 37+79.934
END OF CONTRACT
END 2.44m WILDLIFE FENCE
2.44m WILDLIFE FENCE
PI 37+25.308
BLOCK A
D.L. 4231
D.L. 4056
TOTAL CLEARING & GRUBBING (R2-158-006) 2.6305 ha
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH
PLAN
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
STA 33+20 TO 37+79.265 HWY 97
SCALE 1:1000
REVISIONS
UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories
L2-M221-698
C-3736
2
R2-158-006
CANCEL PRINTS BEARING EARLIER LETTER



DESIGN SPEED 90 km/hr

0 50 100 HORIZ. 0 5 10 VERT.

SCALE Horiz. 1:2000 Vert. 1:200 DESIGNED ... DATE ... CHECKED ... DATE ...

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	REVISIONS

UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

PROFILE (L20 LINE)

COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
STA. 13+63.467 TO STA. 26+00

PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE March 20, 1986	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	MGElston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

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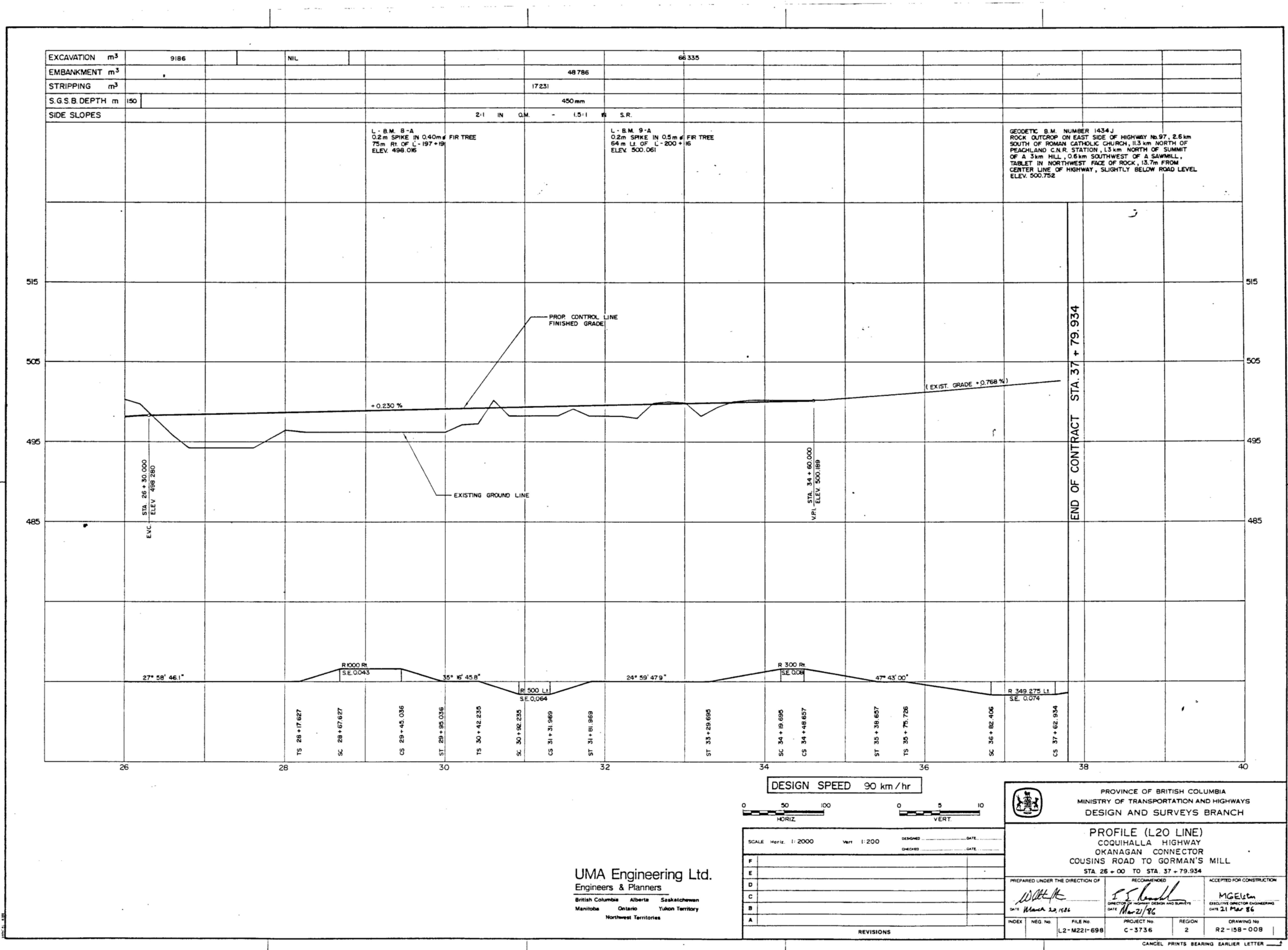
		L2-M221-698	C-3736	2	R2-158-007

CANCEL PRINTS BEARING EARLIER LETTER


EXCAVATION m³
9186
NIL
66335
EMBANKMENT m³
48786
STRIPPING m³
17231
S.G.S.B. DEPTH m
150
450 mm
SIDE SLOPES
2:1 IN O.M. - 1.5:1 IN S.R.
L - B.M. 8-A
0.2m SPIKE IN 0.40m ø FIR TREE
75m Rt. OF L - 197 + 19
ELEV. 498.016
L - B.M. 9-A
0.2m SPIKE IN 0.5m ø FIR TREE
64 m Lt. OF L - 200 + 16
ELEV. 500.061
GEODETIC B.M. NUMBER 1434J
ROCK OUTCROP ON EAST SIDE OF HIGHWAY No.97, 2.6 km SOUTH OF ROMAN CATHOLIC CHURCH, 11.3 km NORTH OF PEACHLAND C.N.R. STATION, 1.3 km NORTH OF SUMMIT OF A 3 km HILL, 0.6 km SOUTHWEST OF A SAWMILL, TABLET IN NORTHWEST FACE OF ROCK, 13.7m FROM CENTER LINE OF HIGHWAY, SLIGHTLY BELOW ROAD LEVEL
ELEV. 500.752
515
505
495
485
PROP. CONTROL LINE FINISHED GRADE
+0.230 %
(EXIST. GRADE +0.768 %)
EXISTING GROUND LINE
E.V.C. STA 26 + 30.000 ELEV 498.280
V.P.I. STA. 34 + 60.000 ELEV. 500.189
END OF CONTRACT STA. 37 + 79.934
27° 58' 46.1"
R1000 Rt.
S.E. 0.043
35° 16' 45.8"
R 500 Lt.
S.E. 0.064
24° 59' 47.9"
R 300 Rt.
S.E. 0.08
47° 43' 00"
R 349.275 Lt.
S.E. 0.074
TS 28 + 17.627
SC 28 + 67.627
CS 29 + 45.036
ST 29 + 95.036
TS 30 + 42.235
SC 30 + 92.235
CS 31 + 31.969
ST 31 + 81.969
ST 33 + 29.695
SC 34 + 19.695
CS 34 + 48.657
ST 35 + 38.657
TS 35 + 75.726
SC 36 + 82.406
CS 37 + 62.934
26
28
30
32
34
36
38
40
DESIGN SPEED 90 km/hr
0 50 100
HORIZ.
0 5 10
VERT.
SCALE Horiz. 1:2000 Vert. 1:200
DESIGNED
CHECKED
DATE
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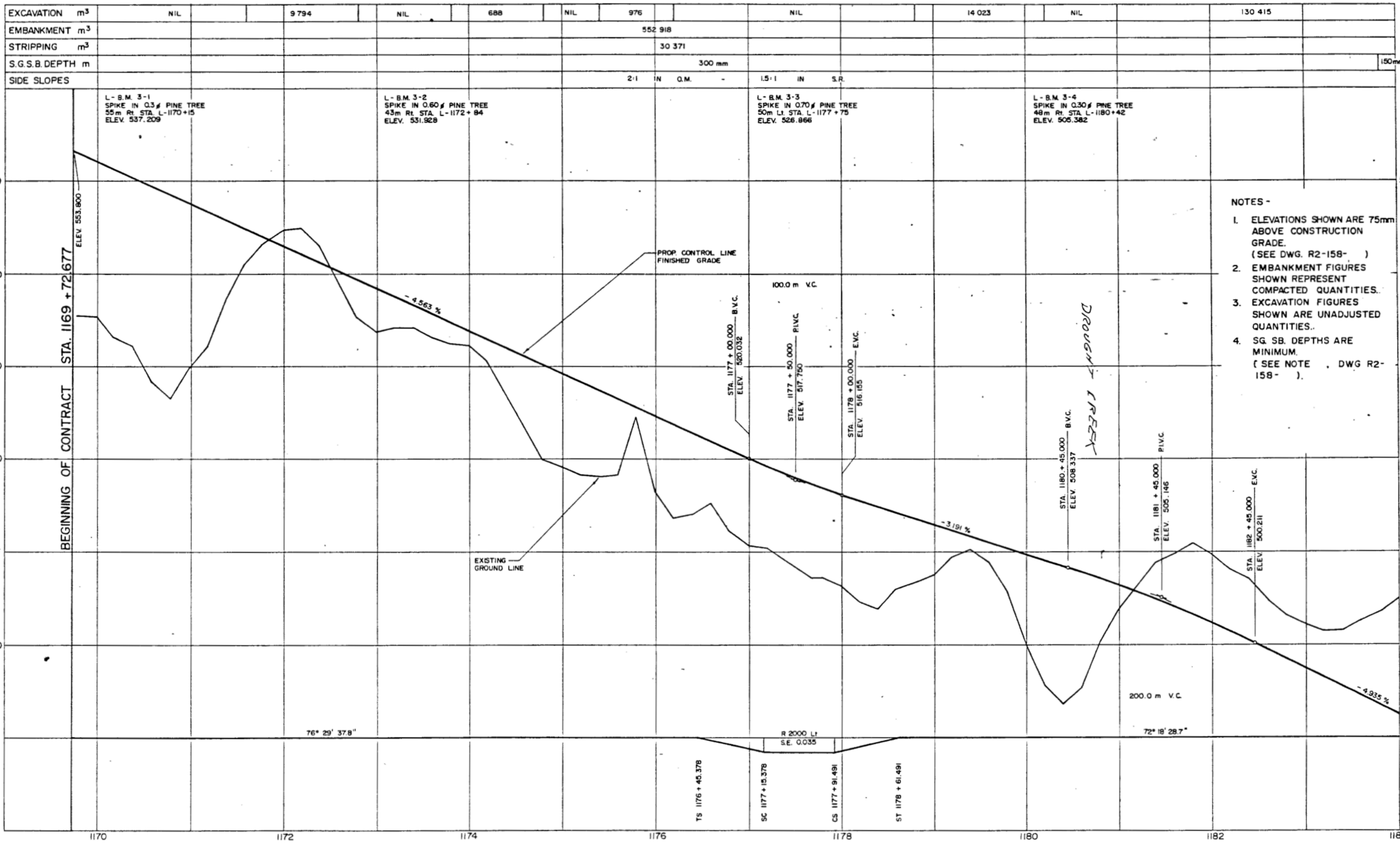
REVISIONS
UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH
PROFILE (L20 LINE)
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
STA. 26 + 00 TO STA. 37 + 79.934
PREPARED UNDER THE DIRECTION OF
DATE March 20, 1986
RECOMMENDED
DIRECTOR OF HIGHWAY DESIGN AND SURVEYS
DATE Mar 21/86
ACCEPTED FOR CONSTRUCTION
MGElston
EXECUTIVE DIRECTOR ENGINEERING
DATE 21 Mar 86
INDEX
NEG. No.
FILE No.
L2-M221-698
PROJECT No.
C-3736
REGION
2
DRAWING No.
R2-158-008
CANCEL PRINTS BEARING EARLIER LETTER



NOTES -

1. ELEVATIONS SHOWN ARE 75mm ABOVE CONSTRUCTION GRADE. (SEE DWG. R2-158-)
2. EMBANKMENT FIGURES SHOWN REPRESENT COMPACTED QUANTITIES.
3. EXCAVATION FIGURES SHOWN ARE UNADJUSTED QUANTITIES.
4. SG. SB. DEPTHS ARE MINIMUM. (SEE NOTE , DWG R2-158-).

DESIGN SPEED 100 km / hr

0 50 100 HORIZ.

0 5 10 VERT.

SCALE Horiz. 1:2000 Vert. 1:200

DESIGNED .... DATE ....

CHECKED .... DATE ....

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REVISIONS

UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories

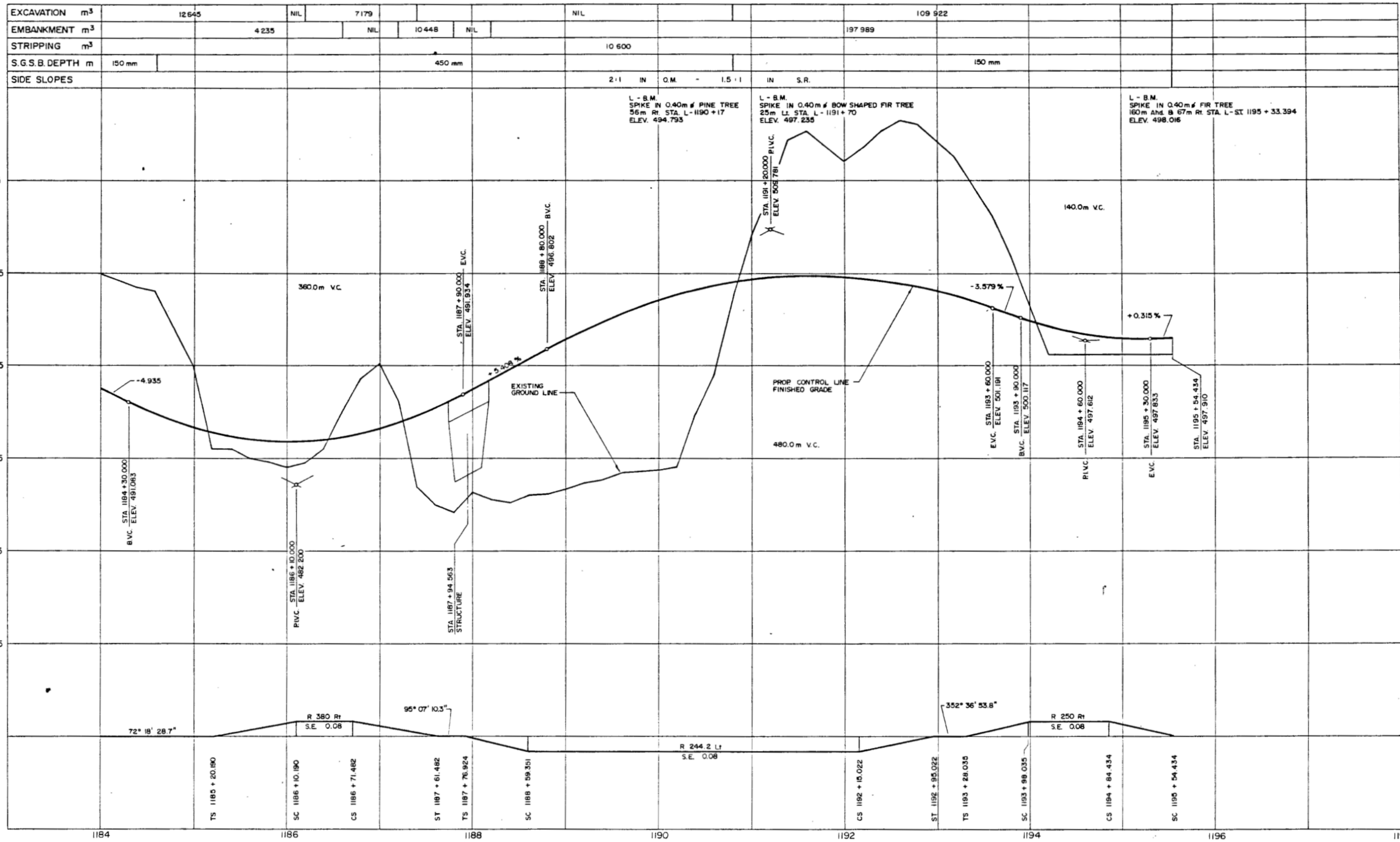
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

PROFILE (L 1100 LINE)
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
STA. 1169 + 72.677 TO STA. 1184 + 00

PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
W. [signature] DATE Mar 20, 1986	[signature] DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	MGElston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

INDEX	NEG No.	FILE No.	PROJECT No.	REGION	DRAWING No.
		L2-M221-698	C-3736	2	R2-158-009

CANCEL PRINTS BEARING EARLIER LETTER



DESIGN SPEED 100 km / hr

DESIGN SPEED 80 km / hr

0 50 100 HORIZ. — 0 5 10 VERT.

UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan Manitoba Ontario Yukon Territory Northwest Territories

SCALE Horiz. 1:2000 Vert. 1:200	DESIGNED .... DATE .... CHECKED .... DATE ....
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REVISIONS	

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

PROFILE (L 1100 LINE)
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
STA. 1184+00 TO STA. 1195+54.434

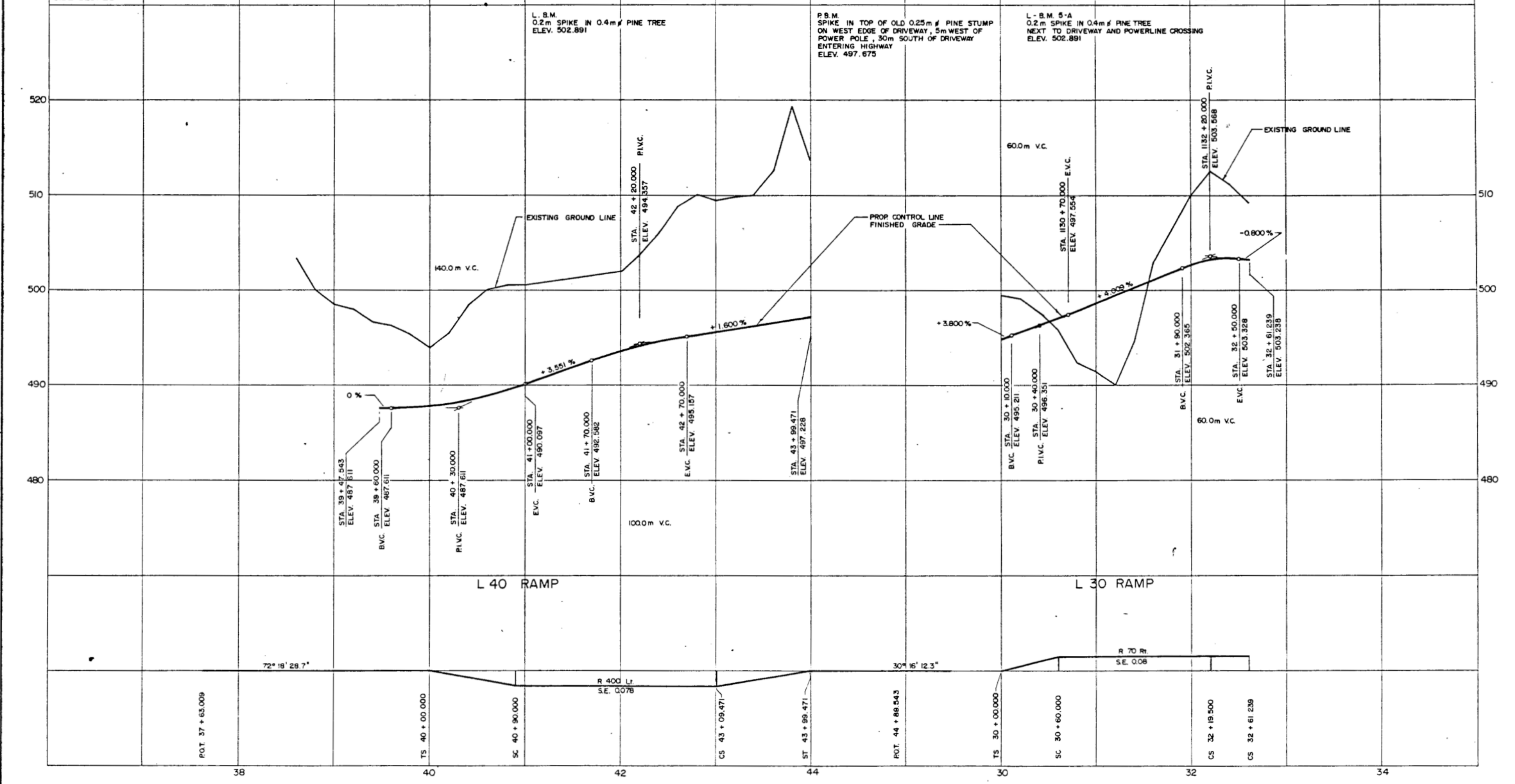
PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
[signature] DATE March 20, 1986	[signature] DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	M.G. Elston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

INDEX	NEG. No.	FILE No.	PROJECT No.	REGION	DRAWING No.
		L2-M221-698	C-3736	2	R2-158-010

FORM H3081

CANCEL PRINTS BEARING EARLIER LETTER

EXCAVATION m³	186 202				1371	NIL	15 770					
EMBANKMENT m³	64				18 783							
STRIPPING m³	6863				2409							
S.G.S.B. DEPTH m	150 mm	450 mm	150 mm		150 mm	450 mm	150 mm					
SIDE SLOPES	2:1 IN O.M. - 1.5:1 IN S.R.				2:1 IN O.M. - 1.5 IN S.R.							



0 50 100 HORIZ.　　0 5 10 VERT.

SCALE Horiz 1:2000 Vert 1:200　DESIGNED .... DATE ....　CHECKED .... DATE ....

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REVISIONS	

UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan Manitoba Ontario Yukon Territory Northwest Territories

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

PROFILE (L 40 & L30)

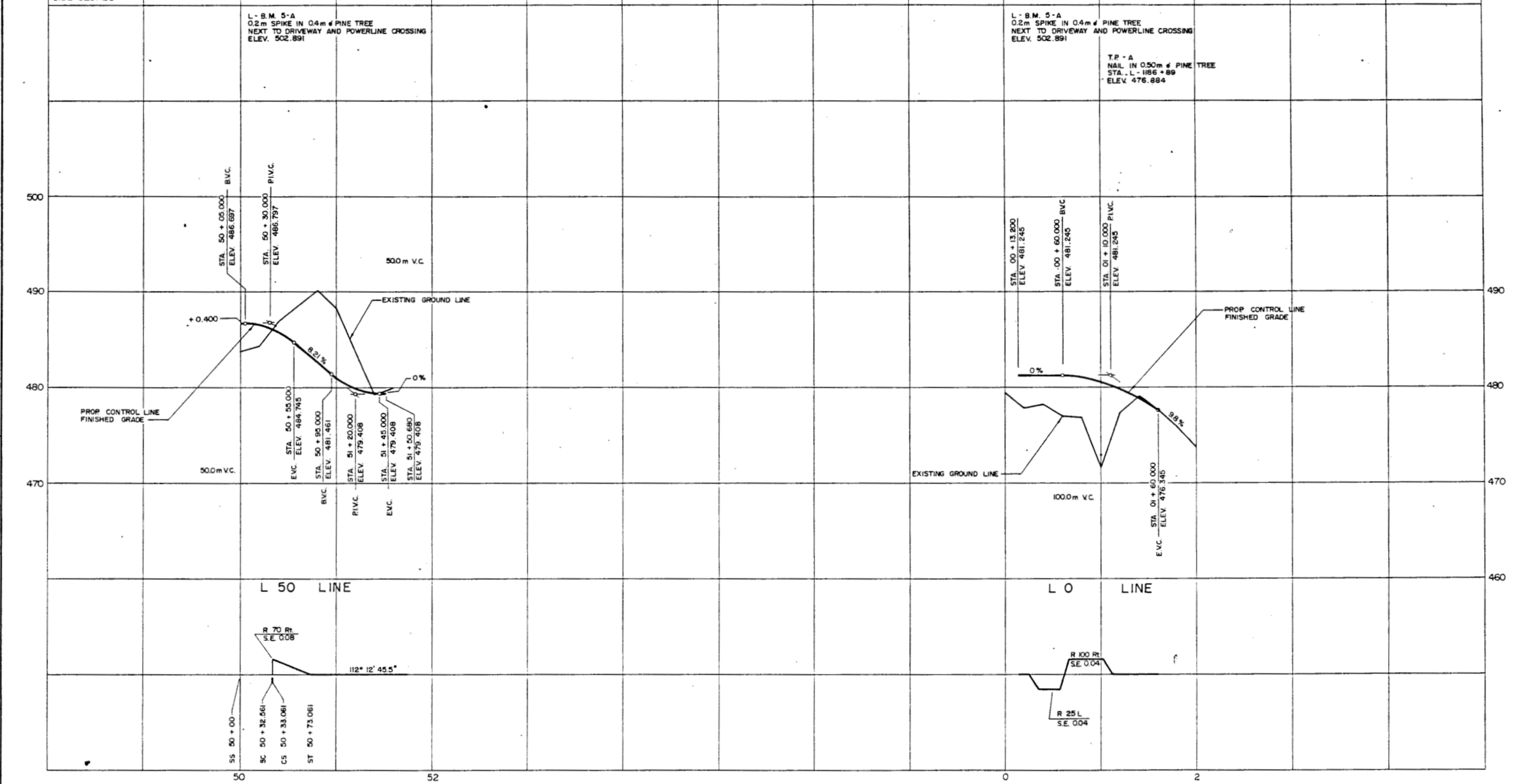
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL

PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE March 22, 1986	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	M G Elston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

INDEX	NEG No.	FILE No.	PROJECT No.	REGION	DRAWING No.
		L2-M221-698	C-3736	2	R2-158-011

CANCEL PRINTS BEARING EARLIER LETTER

	L 50 LINE		L 0 LINE	
EXCAVATION m^3	15 342		NIL	3340
EMBANKMENT m^3	NIL	100	10 147	
STRIPPING m^3	1 238		1 345	
S.G.S.B. DEPTH m	450 mm		150 mm	
SIDE SLOPES	2:1 IN O.M. - 1.5:1 IN S.R.		2:1 IN O.M. - 1.5:1 IN S.R.	



0 50 100 HORIZ.

0 5 10 VERT.

SCALE Horiz. 1:2000 Vert. 1:200

DESIGNED ____ DATE ____

CHECKED ____ DATE ____

REVISIONS
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UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan Manitoba Ontario Yukon Territory Northwest Territories

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

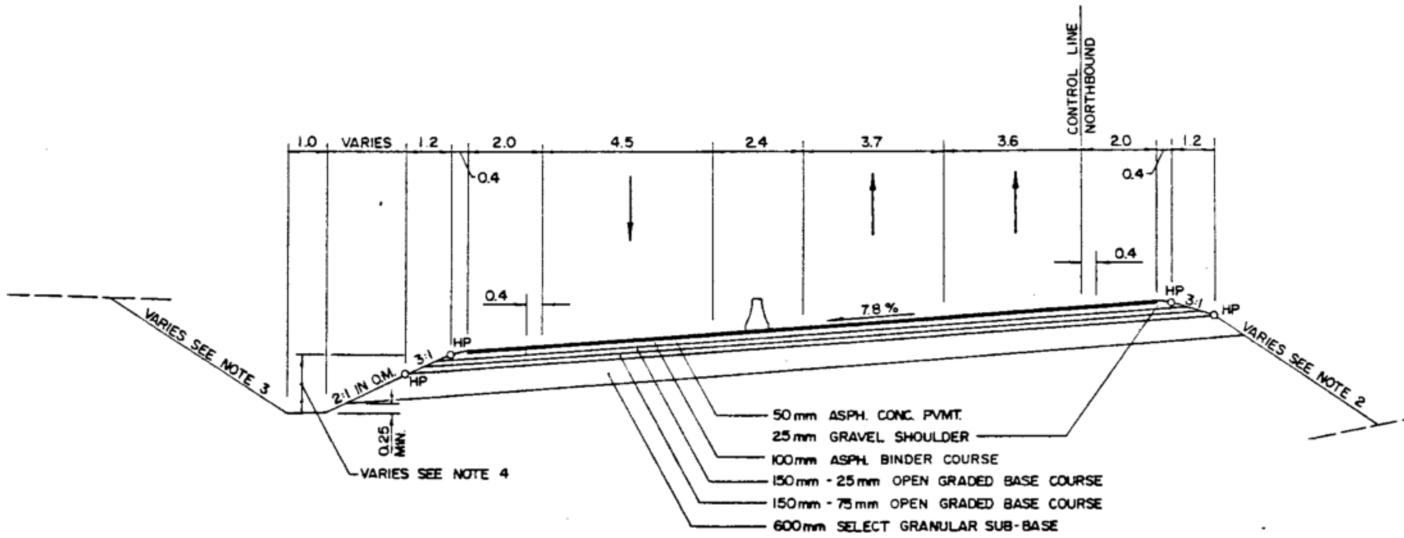
PROFILE (L 50 LINE & L 0 LINE)

COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL

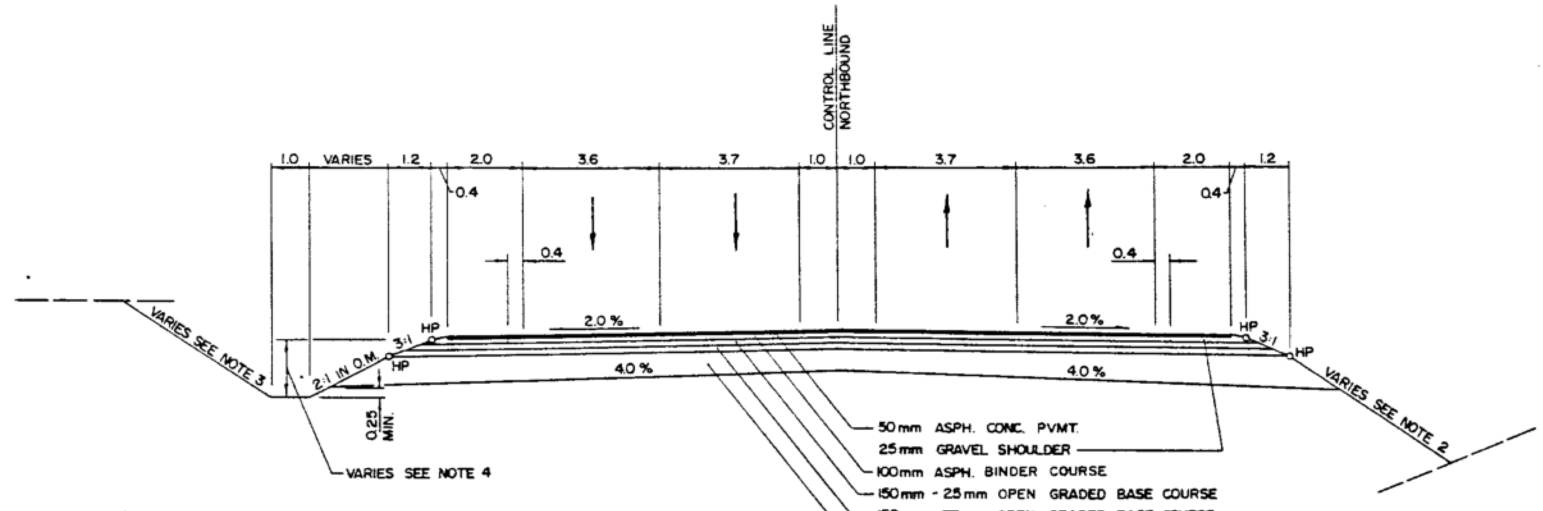
PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE March 22, 1986	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	M G Elston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

INDEX	NEG. No.	FILE No.	PROJECT No.	REGION	DRAWING No.
		L2-M221-698	C-3736	2	R2-158-012

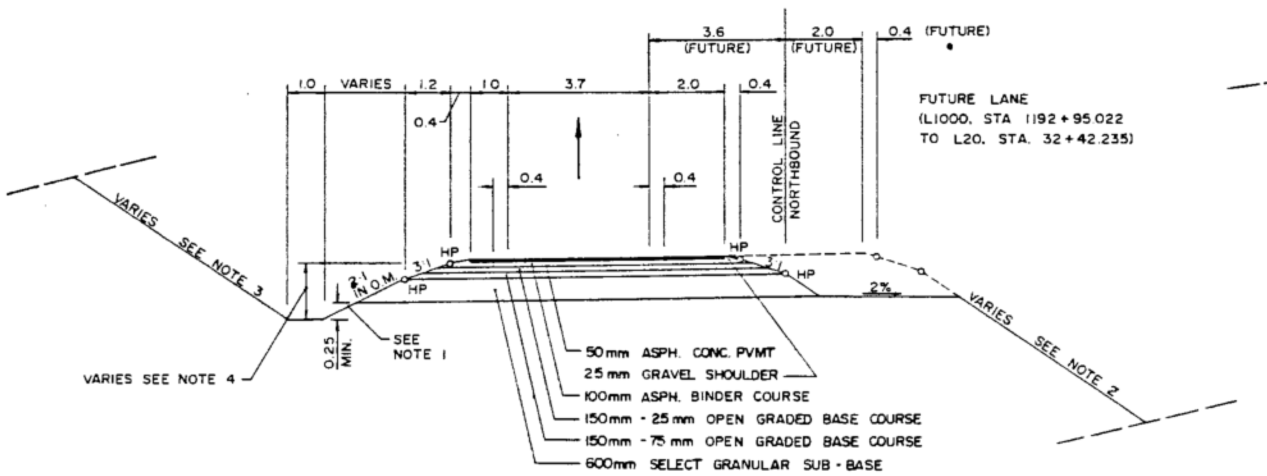
CANCEL PRINTS BEARING EARLIER LETTER



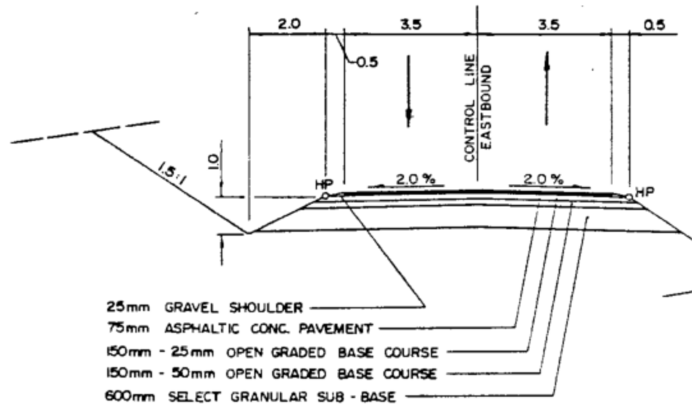
TYP. SECTION - L1100 RAMP N.T.S.
STA. 1187 + 61.482 TO STA. 1191 + 15.425



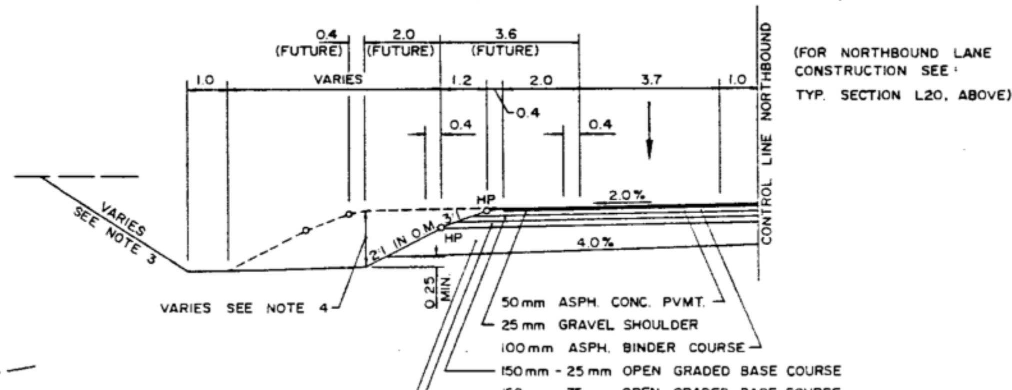
TYP. SECTION - L20 N.T.S.



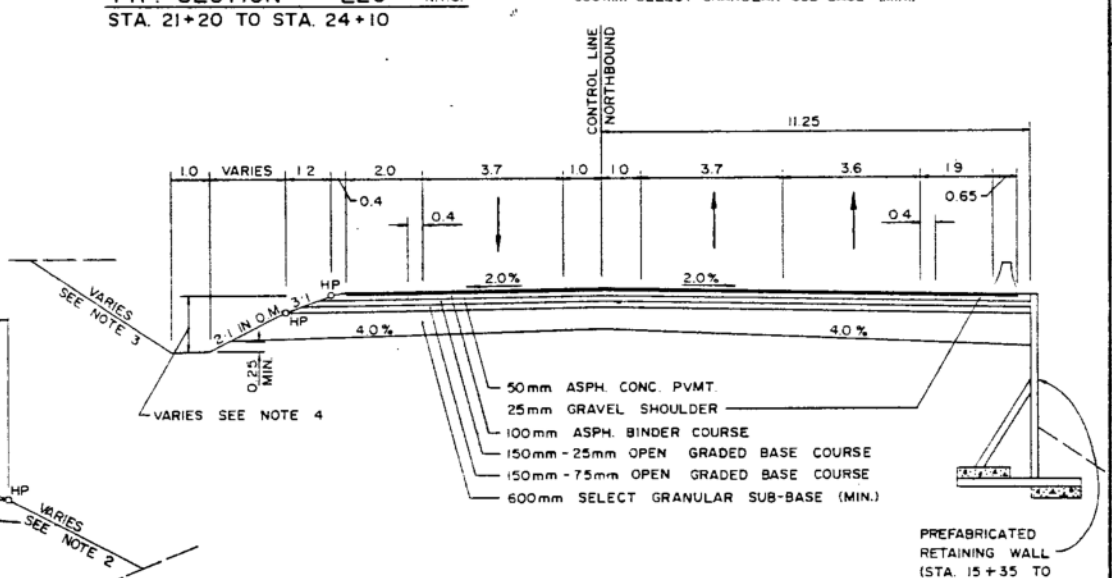
TYP. SECTION - L1100 RAMP N.T.S.
STA. 1191 + 15.425 TO STA. 1194 + 84.434



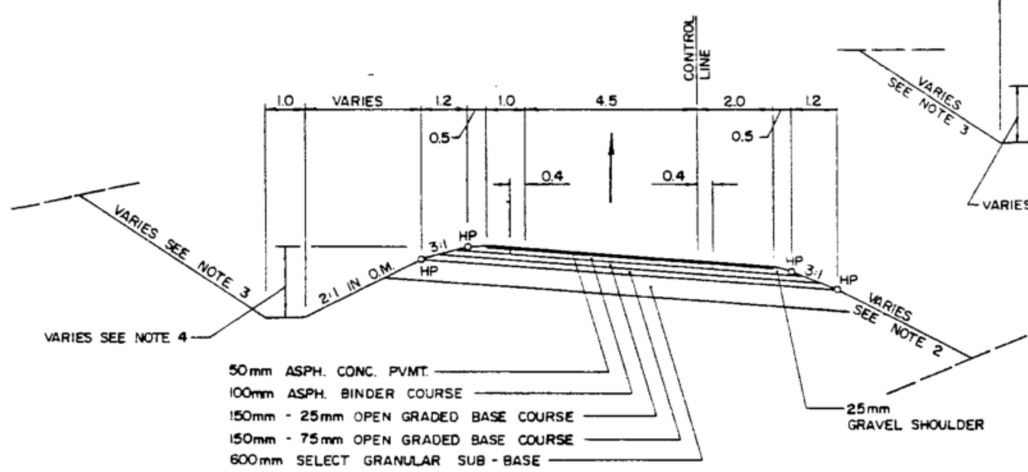
TYP. SECTION - L-0



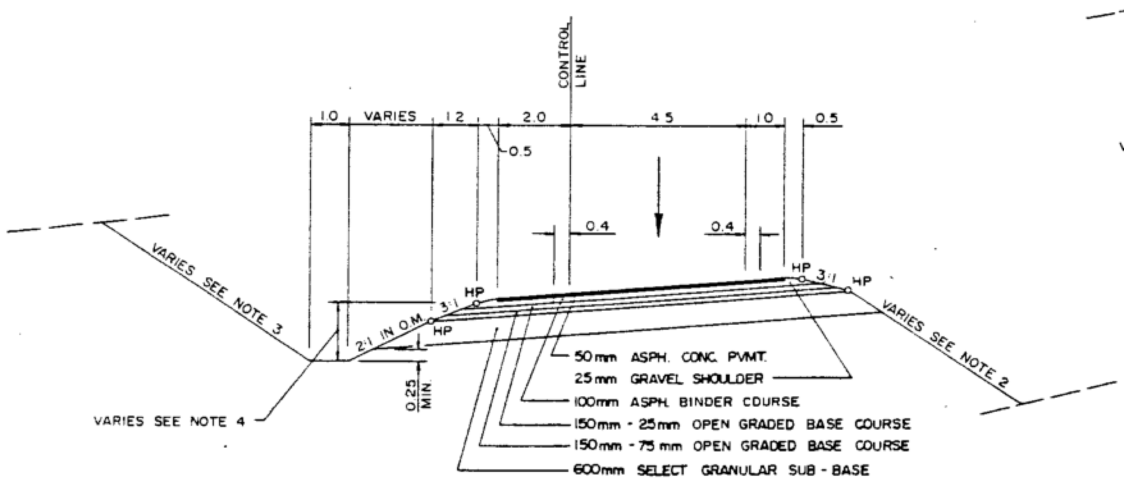
TYP. SECTION - L20 N.T.S.
STA. 21 + 20 TO STA. 24 + 10



TYP. SECTION - L20 N.T.S.
STA. 15 + 35 TO STA. 19 + 80



TYP. SECTION - L30 RAMP, L50 RAMP N.T.S.



TYP. SECTION - L40 RAMP N.T.S.
STA. 40 + 00 TO STA. 43 + 15

FOR NOTES SEE DWG. No. 014

UMA Engineering Ltd.
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SCALE	AS SHOWN	DESIGNED H.B. B M.R. DATE 86-03-17
		CHECKED A.P. DATE 86-03-21
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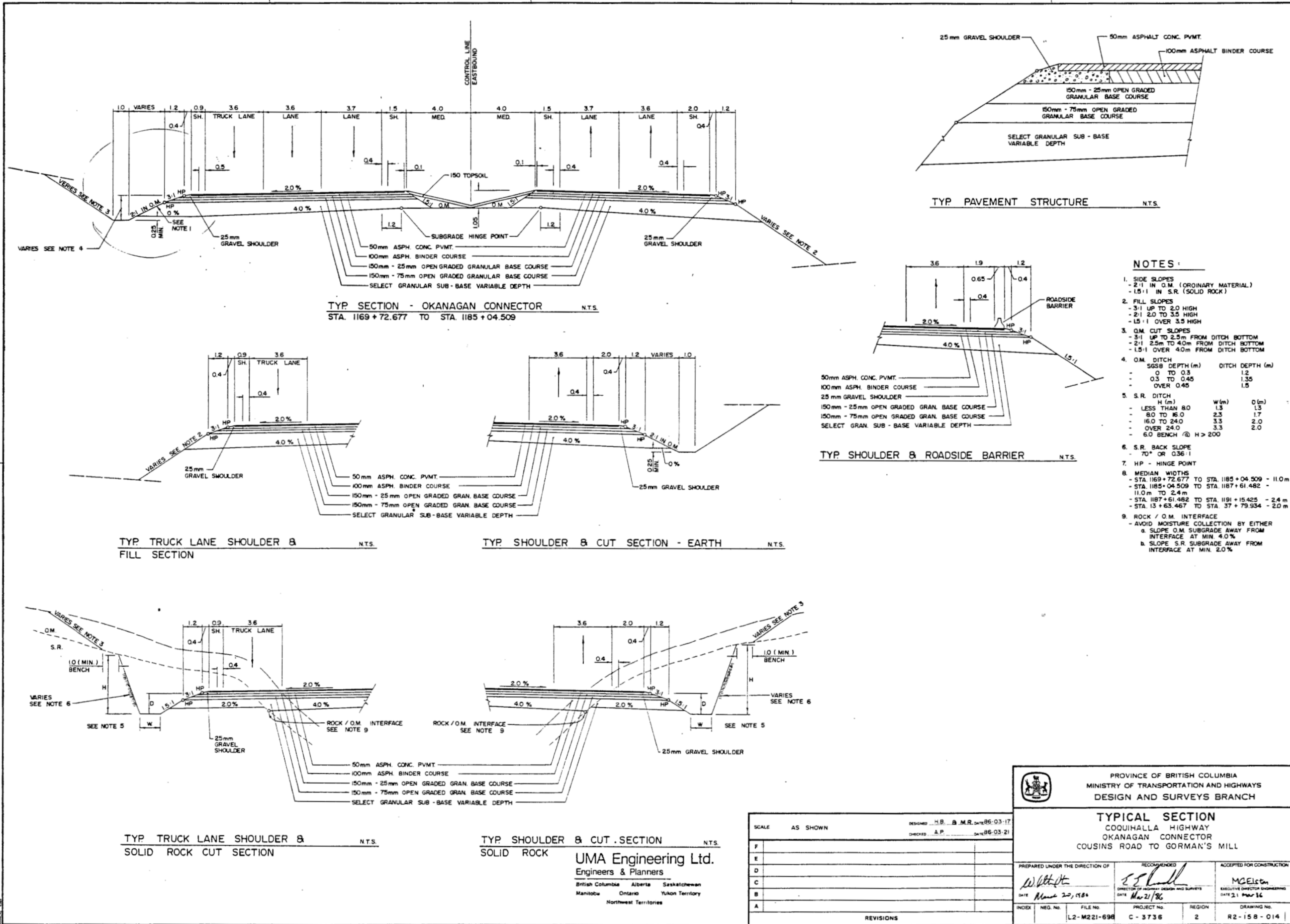
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

TYPICAL SECTION
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL

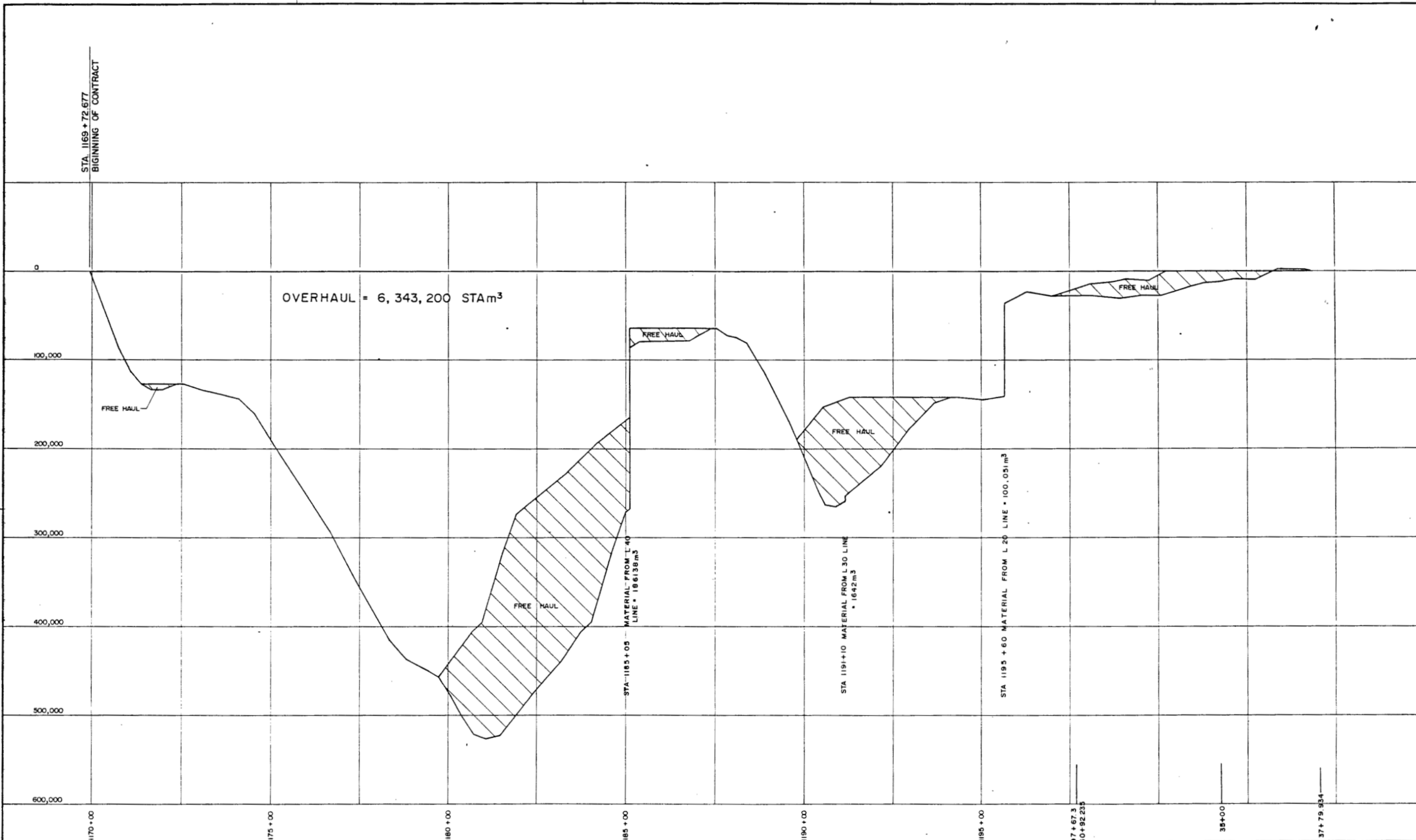
PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE March 20, 1986	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	M.G. Elston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

INDEX	NEG No.	FILE No.	PROJECT No.	REGION	DRAWING No.
		L2-M221-698	C - 3736	2	R2-158-013

CANCEL PRINTS BEARING EARLIER LETTER



TYP. SECTION - OKANAGAN CONNECTOR N.T.S.
STA. 1169 + 72.677 TO STA. 1185 + 04.509
CONTROL LINE EASTBOUND
1.0 VARIES 1.2 0.9 3.6 3.6 3.7 1.5 4.0 4.0 1.5 3.7 3.6 2.0 1.2
SH. TRUCK LANE LANE LANE SH. MED. MED. SH. LANE LANE SH.
150 TOPSOIL
2.0 % 4.0 % 0 %
VARIES SEE NOTE 3
VARIES SEE NOTE 4
VARIES SEE NOTE 2
SEE NOTE 1
25 mm GRAVEL SHOULDER
SUBGRADE HINGE POINT
50mm ASPH. CONC. PVMT.
100mm ASPH. BINDER COURSE
150mm - 25mm OPEN GRADED GRANULAR BASE COURSE
150mm - 75mm OPEN GRADED GRANULAR BASE COURSE
SELECT GRANULAR SUB - BASE VARIABLE DEPTH
TYP. PAVEMENT STRUCTURE N.T.S.
25 mm GRAVEL SHOULDER
50mm ASPHALT CONC. PVMT.
100mm ASPHALT BINDER COURSE
150mm - 25mm OPEN GRADED GRANULAR BASE COURSE
150mm - 75mm OPEN GRADED GRANULAR BASE COURSE
SELECT GRANULAR SUB - BASE VARIABLE DEPTH
TYP. SHOULDER & ROADSIDE BARRIER N.T.S.
ROADSIDE BARRIER
50mm ASPH. CONC. PVMT.
100mm ASPH. BINDER COURSE
25 mm GRAVEL SHOULDER
150mm - 25mm OPEN GRADED GRAN. BASE COURSE
150mm - 75mm OPEN GRADED GRAN. BASE COURSE
SELECT GRAN. SUB - BASE VARIABLE DEPTH
NOTES:
1. SIDE SLOPES
- 2:1 IN O.M. (ORDINARY MATERIAL)
- 1.5:1 IN S.R. (SOLID ROCK)
2. FILL SLOPES
- 3:1 UP TO 2.0 HIGH
- 2:1 2.0 TO 3.5 HIGH
- 1.5:1 OVER 3.5 HIGH
3. O.M. CUT SLOPES
- 3:1 UP TO 2.5m FROM DITCH BOTTOM
- 2:1 2.5m TO 4.0m FROM DITCH BOTTOM
- 1.5:1 OVER 4.0m FROM DITCH BOTTOM
4. O.M. DITCH
SGSB DEPTH (m) DITCH DEPTH (m)
- 0 TO 0.3 1.2
- 0.3 TO 0.45 1.35
- OVER 0.45 1.5
5. S.R. DITCH
H (m) W (m) D (m)
- LESS THAN 8.0 1.3 1.3
- 8.0 TO 16.0 2.3 1.7
- 16.0 TO 24.0 3.3 2.0
- OVER 24.0 3.3 2.0
- 6.0 BENCH @ H > 200
6. S.R. BACK SLOPE
- 70° OR 0.36:1
7. HP - HINGE POINT
8. MEDIAN WIDTHS
- STA. 1169 + 72.677 TO STA. 1185 + 04.509 - 11.0 m
- STA. 1185 + 04.509 TO STA. 1187 + 61.482 - 11.0 m TO 2.4 m
- STA. 1187 + 61.482 TO STA. 1191 + 15.425 - 2.4 m
- STA. 13 + 63.467 TO STA. 37 + 79.934 - 2.0 m
9. ROCK / O.M. INTERFACE
- AVOID MOISTURE COLLECTION BY EITHER
a. SLOPE O.M. SUBGRADE AWAY FROM INTERFACE AT MIN. 4.0 %
b. SLOPE S.R. SUBGRADE AWAY FROM INTERFACE AT MIN. 2.0 %
TYP. TRUCK LANE SHOULDER & FILL SECTION N.T.S.
TYP. SHOULDER & CUT SECTION - EARTH N.T.S.
25mm GRAVEL SHOULDER
TYP. TRUCK LANE SHOULDER & SOLID ROCK CUT SECTION N.T.S.
TYP. SHOULDER & CUT . SECTION SOLID ROCK N.T.S.
1.0 (MIN.) BENCH
VARIES SEE NOTE 6
SEE NOTE 5
ROCK / O.M. INTERFACE SEE NOTE 9
UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan Manitoba Ontario Yukon Territory Northwest Territories
SCALE AS SHOWN
DESIGNED H.B. & M.R. DATE 86-03-17
CHECKED A.P. DATE 86-03-21
REVISIONS
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH
TYPICAL SECTION
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
PREPARED UNDER THE DIRECTION OF
RECOMMENDED
ACCEPTED FOR CONSTRUCTION
DATE March 20, 1986
DIRECTOR OF HIGHWAY DESIGN AND SURVEYS
DATE Mar 21/86
M.G. Elston
EXECUTIVE DIRECTOR ENGINEERING
DATE 21 Mar 86
INDEX NEG. No. FILE No. L2-M221-698 PROJECT No. C - 3736 REGION 2 DRAWING No. R2 - 158 - 014
CANCEL PRINTS BEARING EARLIER LETTER



NOTE:
THIS VOLUME OVERHAUL DIAGRAM IS A PLOT ON WHICH SHRINKAGE AND SWELL ADJUSTMENT FACTORS HAVE BEEN APPLIED TO THE EXCAVATION QUANTITIES. THE VERTICAL SCALE SHOULD THEREFORE NOT TO BE USED TO SCALE. IN SITE EXCAVATION QUANTITIES TO BE OVERHAULED.
THE HAUL FIGURES SHOWN REPRESENT THE ACTUAL ESTIMATED UNADJUSTED EXCAVATION QUANTITIES.

UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories

SCALE	DESIGNED H.B. & M.R. DATE 86-03-17
	CHECKED A.P. DATE 86-03-21
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PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

VOLUME OVERHAUL DIAGRAM
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL

PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
W. A. [signature] DATE March 21/86	E. E. [signature] DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	MCElston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

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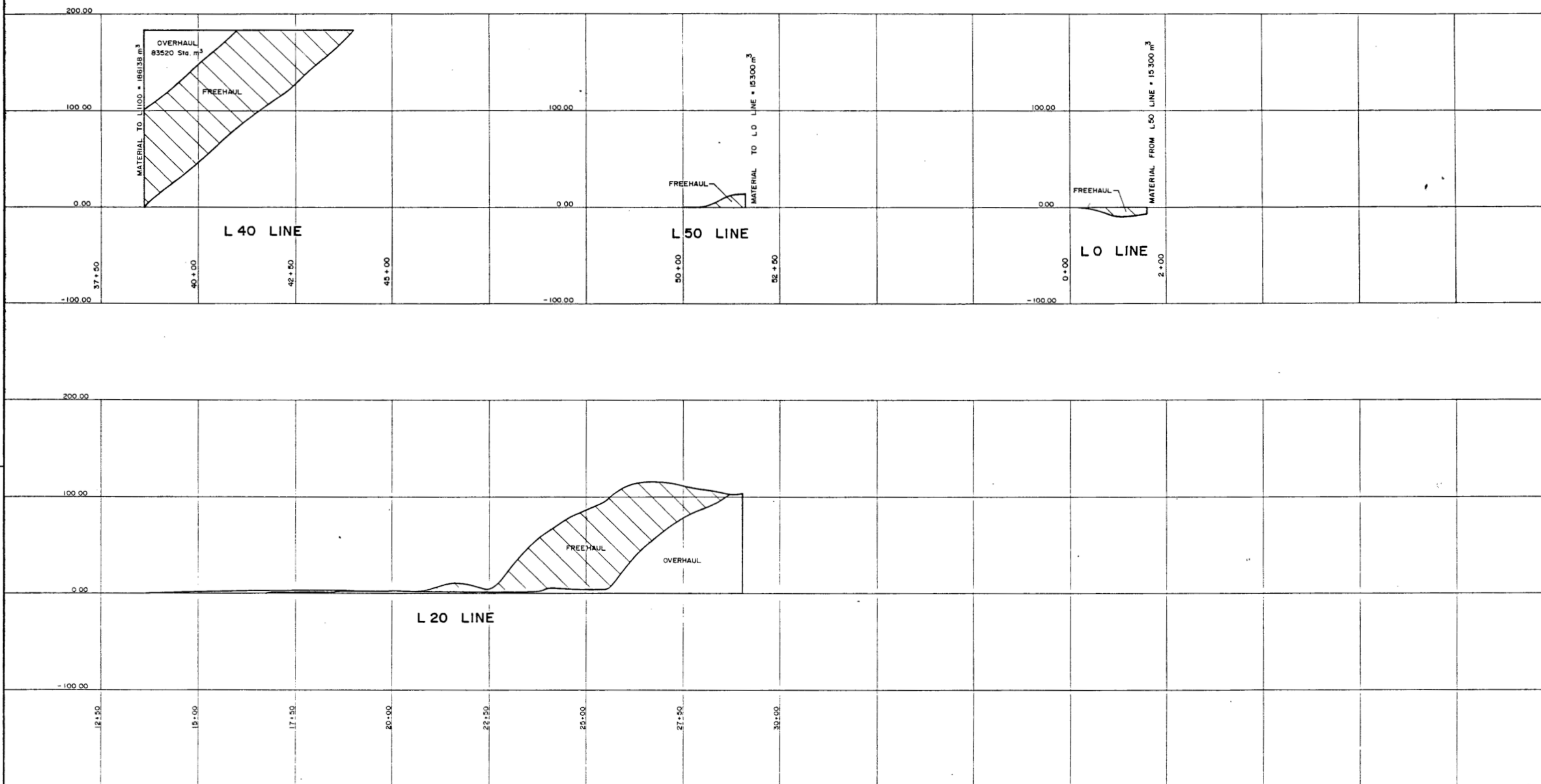
		L2-M221-698	C-3736	2	R2-158-015

CANCEL PRINTS BEARING EARLIER LETTER

FORM H 3081



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Northwest Territories

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	CHECKED A.P. DATE 86·03·21
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PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

VOLUME OVERHAUL DIAGRAM

COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL

PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE March 21/86	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	MGElcton EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

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FORM H 308 I

CANCEL PRINTS BEARING EARLIER LETTER

GRAVEL QUANTITIES

PROJECT KILOMETERS 0 1 2 3

SELECT GRANULAR SUB-BASE

		0–1	1–2	2–3		
L 1100	STA. 1169+72.677 TO STA. 1195+54.434	27 808	22 910	4 690	55 408	TONNES
L 20	STA. 13+63.467 TO STA. 37+79.265	19 976	26 220	3 265	49 461	TONNES
L 30	STA. 30+00.000 TO STA. 32+61.239	1 842	—	—	1 842	TONNES
L 40	STA. 38+60.000 TO STA. 43+99.471	3 809	—	—	3 809	TONNES
L 50	STA. 50+00.000 TO STA. 51+50.680	1 355	—	—	1 355	TONNES
				TOTAL	111 875	TONNES

75 mm OPEN GRADED GRANULAR BASE COURSE

L 1100	STA. 1169+72.677 TO STA. 1195+54.434	4 656	2 420	1 480	8 556	TONNES
L 20	STA. 13+63.467 TO STA. 37+79.265	5 000	8 954	807	14 761	TONNES
L 30	STA. 30+00.000 TO STA. 32+61.239	458	—	—	458	TONNES
L 40	STA. 38+60.000 TO STA. 43+99.471	819	—	—	819	TONNES
L 50	STA. 50+00.000 TO STA. 51+50.680	197	—	—	197	TONNES
				TOTAL	24 791	TONNES

25 mm OPEN GRADED GRANULAR BASE COURSE

L 20	STA. 13+63.467 TO STA. 37+79.265	4 800	8 757	810	14 367	TONNES
L 0	STA. 0+13.200 TO STA. 02+00	460	—	—	460	TONNES
				TOTAL	14 827	TONNES

ASPHALT BINDER COURSE

L 20	STA. 13+63.467 TO STA. 37+79.265	3 882	3 696	18	7 596	TONNES
				TOTAL	7 596	TONNES

ASPHALTIC CONCRETE

L 20	STA. 13+63.467 TO STA. 37+79.265	2 272	2 297	197	4 766	TONNES
L 0	STA. 0+13.200 TO STA. 02+00	146	—	—	146	TONNES
				TOTAL	4 912	TONNES

HIGH FINES SURFACING AGGREGATE

DL 3494		1 238	—	—	1 238	TONNES
				TOTAL	1 238	TONNES

STRUCTURAL BACKFILL

L 1100	STA. 1169+72.677 TO STA. 1195+54.434	2 005	4 757	6 659	13 421	TONNES
				TOTAL	13 421	TONNES

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SCALE
DESIGNED H.B. DATE 86-03-17
CHECKED W.A.P. DATE 86-03-21

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REVISIONS

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

GRAVEL QUANTITIES
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL

PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE March 21/86	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	MG Elston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

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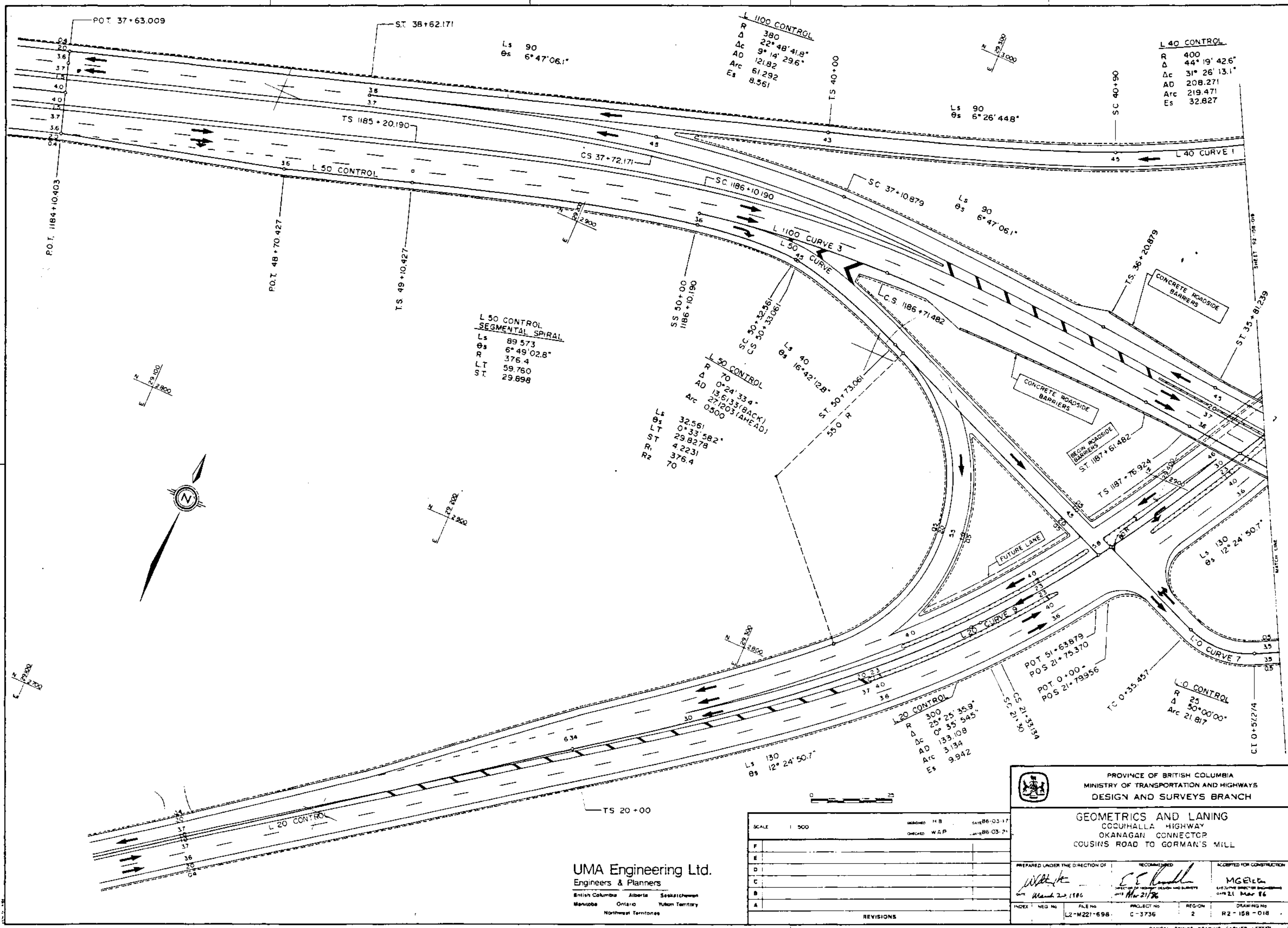
		L2-M221-698	C-3736	2	R2-158-017

CANCEL PRINTS BEARING EARLIER LETTER


L 1100 CONTROL
R 380
Δ 22° 48' 41.8"
Δc 9° 14' 29.6"
AD 121.82
Arc 61.292
Es 8.561
L 40 CONTROL
R 400
Δ 44° 19' 42.6"
Δc 31° 26' 13.1"
AD 208.271
Arc 219.471
Es 32.827
P.O.T. 37+63.009
S.T. 38+62.171
Ls 90
θs 6° 47' 06.1"
TS 40+00
SC 40+90
Ls 90
θs 6° 26' 44.8"
L 40 CURVE 1
TS 1185+20.190
CS 37+72.171
SC 1186+10.190
SC 37+10.879
Ls 90
θs 6° 47' 06.1"
L 50 CONTROL
L 1100 CURVE 3
L 50 CURVE
P.O.T. 1184+10.403
P.O.T. 48+70.427
T.S. 49+10.427
SS 50+00
1186+10.190
SC 50+32.561
CS 50+33.061
C.S. 1186+71.482
T.S. 36+20.879
ST. 35+81.239
CONCRETE ROADSIDE BARRIERS
L 50 CONTROL
SEGMENTAL SPIRAL
Ls 89.573
θs 6° 49' 02.8"
R 376.4
L.T 59.760
S.T. 29.898
L 50 CONTROL
R 70
Δ 0° 24' 33.4"
AD 13.6133 (BACK)
27.1203 (AHEAD)
Arc 0.500
Ls 40
θs 16° 42' 12.8"
ST. 50+73.061
55.0 R
Ls 32.561
θs 0° 33' 58.2"
LT 29.8278
ST 4.2231
R1 376.4
R2 70
CONCRETE ROADSIDE BARRIERS
BEGIN ROADSIDE BARRIERS
ST 1187+61.482
T.S 1187+76.924
FUTURE LANE
Ls 130
θs 12° 24' 50.7"
L 20 CURVE 9
L-O CURVE 7
POT 51+63.879
POS 21+75.370
POT 0+00
POS 21+79.956
TC 0+35.457
CS 21+33.134
SC 21+30
L-O CONTROL
R 25
Δ 50° 00' 00"
Arc 21.817
C.I. 0+57.274
L 20 CONTROL
R 300
Δ 25° 25' 35.9"
Δc 0° 35' 54.5"
AD 133.108
Arc 3.134
Es 9.942
Ls 130
θs 12° 24' 50.7"
TS 20+00
L 20 CONTROL
MATCH LINE
UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories
SCALE 1:500
DESIGNED H.B. DATE 86-03-17
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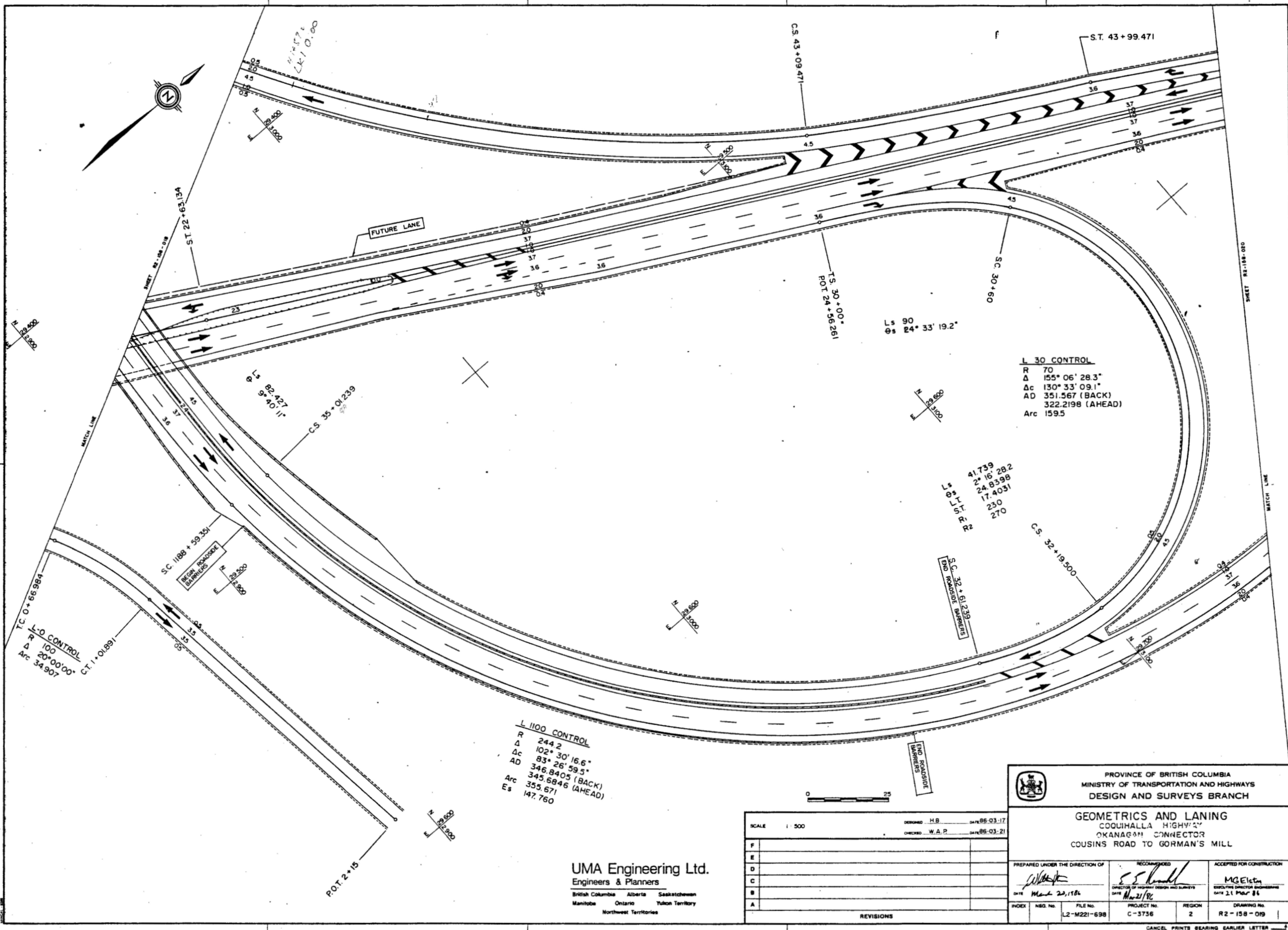
FILE No L2-M221-698
PROJECT No C-3736
REGION 2
DRAWING No R2-158-018
CANCEL PRINTS BEARING EARLIER LETTER



S.T. 43 + 99.471
C.S. 43 + 09.471
S.T. 22 + 63.134
FUTURE LANE
T.S. 30 + 00"
P.O.T. 24 + 56.261
S.C. 30 + 60
Ls 90
θs 24° 33' 19.2"
L 30 CONTROL
R 70
Δ 155° 06' 28.3"
Δc 130° 33' 09.1"
AD 351.567 (BACK)
322.2198 (AHEAD)
Arc 159.5
Ls 82.427
Φ 9° 40' 11"
C.S. 35 + 01.239
Ls 41.739
θs 2° 16' 28.2
L.T. 24.8398
S.T. 17.4031
R1 230
R2 270
C.S. 32 + 19.500
S.C. 32 + 61.239
END ROADSIDE BARRIERS
S.C. 1188 + 59.351
BEGIN ROADSIDE BARRIERS
T.C. 0 + 66.984
C.T. 1 + 01.891
L-0 CONTROL
R 100
Δ 20° 00' 00"
Arc 34.907
L 1100 CONTROL
R 244.2
Δ 102° 30' 16.6"
Δc 83° 26' 59.5"
AD 346.8405 (BACK)
345.6846 (AHEAD)
Arc 355.671
Es 147.760
END ROADSIDE BARRIERS
P.O.T. 2 + 15
MATCH LINE
SHEET R2-158-018
SHEET R2-158-020
0 25
SCALE 1:500
DESIGNED H.B. DATE 86-03-17
CHECKED W.A.P. DATE 86-03-21
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Engineers & Planners
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DIRECTOR OF HIGHWAY DESIGN AND SURVEYS
DATE Mar 21/86
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M.G. Elston
EXECUTIVE DIRECTOR ENGINEERING
DATE 21 Mar 86
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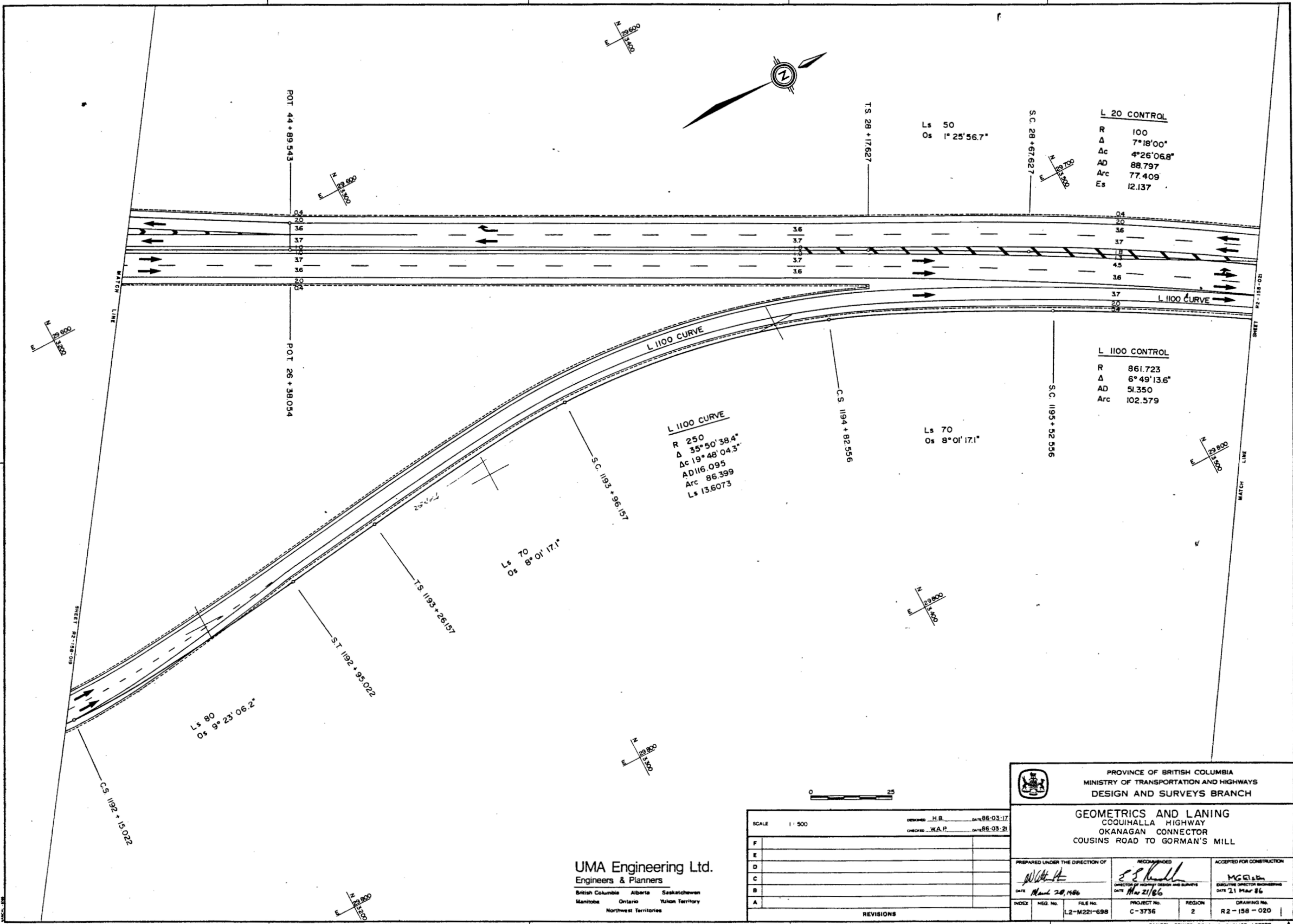
NEG. No.
FILE No. L2-M221-698
PROJECT No. C-3736
REGION 2
DRAWING No. R2-158-019
CANCEL PRINTS BEARING EARLIER LETTER


POT 44+89.543
POT 26+38.054
T.S. 28+17.627
S.C. 28+67.627
Ls 50
Os 1° 25' 56.7"
L 20 CONTROL
R 100
Δ 7°18'00"
Δc 4°26'06.8"
AD 88.797
Arc 77.409
Es 12.137
L 1100 CURVE
L 1100 CONTROL
R 861.723
Δ 6° 49' 13.6"
AD 51.350
Arc 102.579
S.C. 1195+52.556
C.S. 1194+82.556
Ls 70
Os 8° 01' 17.1"
L 1100 CURVE
R 250
Δ 35°50'38.4"
Δc 19°48'04.3"
AD 116.095
Arc 86.399
Ls 13.6073
S.C. 1193+96.157
T.S. 1193+26.157
Ls 70
Os 8° 01' 17.1"
S.T 1192+95.022
Ls 80
Os 9° 23' 06.2"
C.S 1192+15.022
MATCH LINE
SHEET R2-158-021
SHEET R2-158-019
0.4 2.0 3.6 3.7 1.0 3.7 3.6 2.0 0.4
3.6 3.7 3.7 3.6
0.4 2.0 3.6 3.7 1.8 4.5 3.6 3.7 2.0 0.4
N 29.600 E 3.400
N 29.600 E 3.300
N 29.600 E 3.200
N 29.700 E 3.500
N 29.800 E 3.500
N 29.800 E 3.400
N 29.800 E 3.300
N 29.800 E 3.200
0 25
UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan
Manitoba Ontario Yukon Territory
Northwest Territories
SCALE 1:500
DESIGNED H.B. DATE 86-03-17
CHECKED W.A.P. DATE 86-03-21
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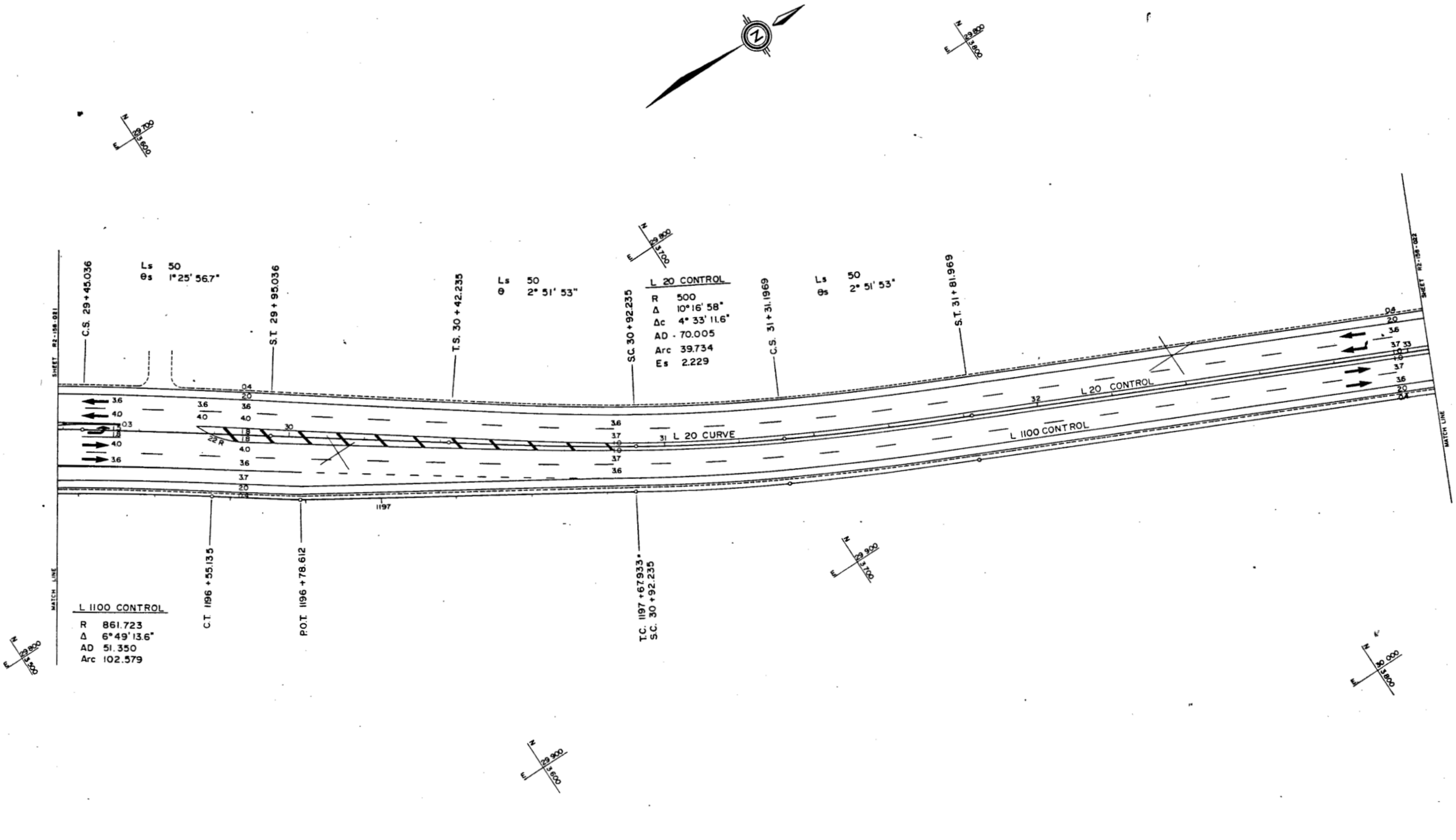
REVISIONS
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH
GEOMETRICS AND LANING
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
PREPARED UNDER THE DIRECTION OF
DATE March 20, 1986
RECOMMENDED
DIRECTOR OF HIGHWAY DESIGN AND SURVEYS
DATE Mar 21/86
ACCEPTED FOR CONSTRUCTION
EXECUTIVE DIRECTOR ENGINEERING
DATE 21 Mar 86
INDEX
NEG. No.
FILE No. L2-M221-698
PROJECT No. C-3736
REGION 2
DRAWING No. R2-158-020
CANCEL PRINTS BEARING EARLIER LETTER



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SCALE	1 : 500	DESIGNED H.B. DATE 86-03-17
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OKANAGAN CONNECTOR
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PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE March 28, 1986	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	M.G. Elston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

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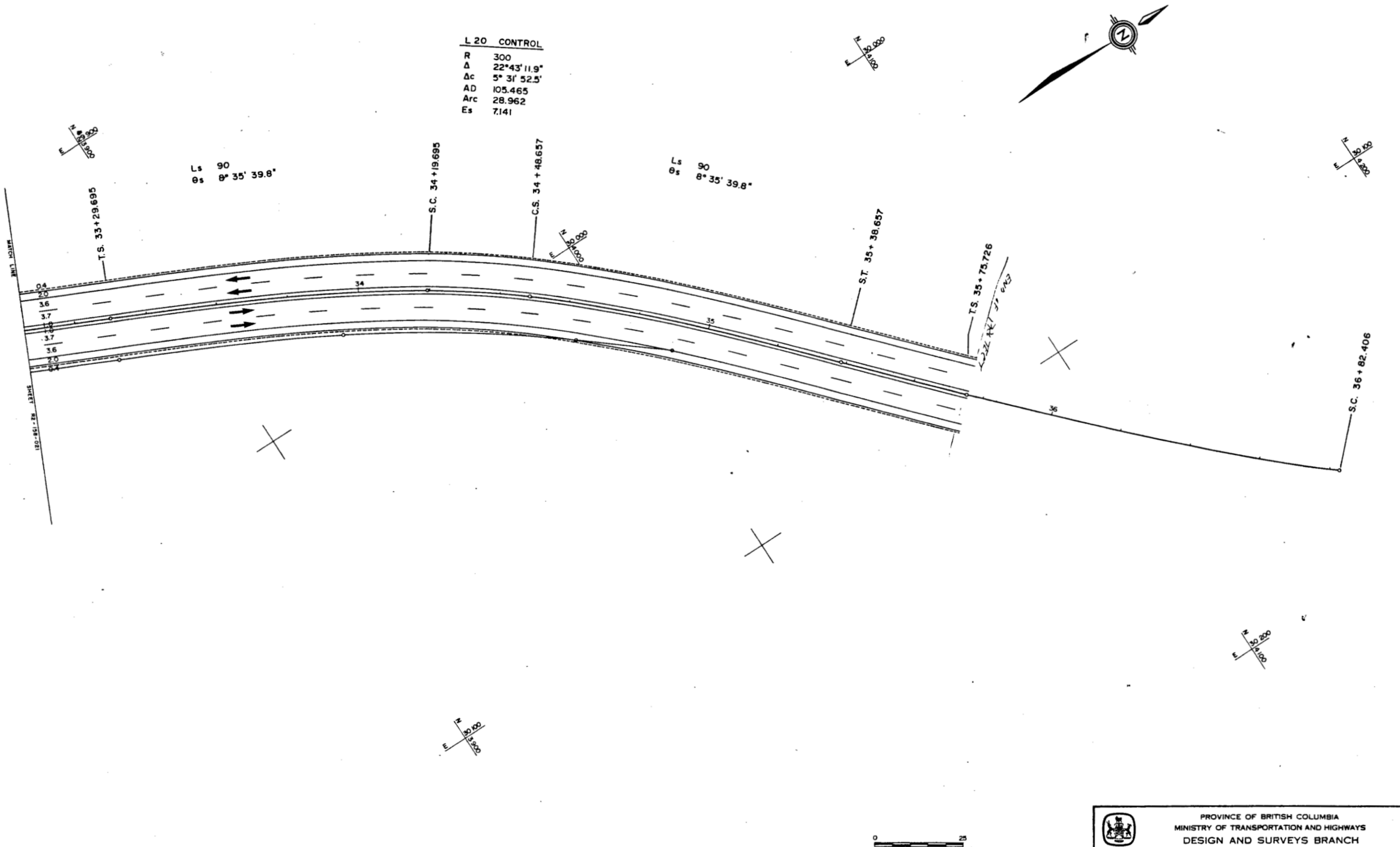
CANCEL PRINTS BEARING EARLIER LETTER



SCALE	1:500	DESIGNED H.B.	DATE 86-03-17
		CHECKED W.A.P.	DATE 86-03-21

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DESIGN AND SURVEYS BRANCH

GEOMETRICS AND LANING
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL

PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE March 20, 1986	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	M G Elston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

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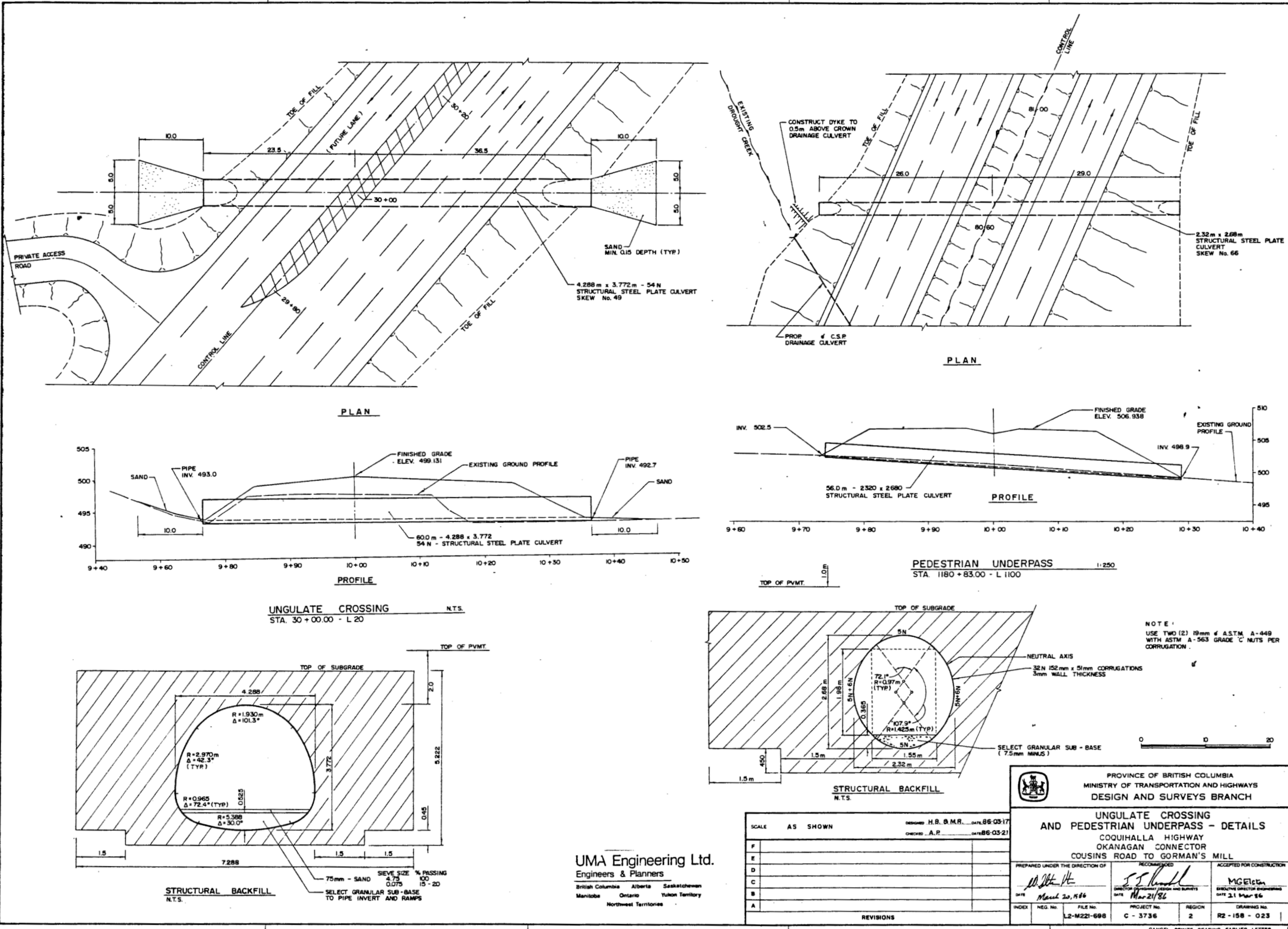
		L2-M221-698	C-3736	2	R2-158-022

FORM H308

CANCEL PRINTS BEARING EARLIER LETTER


TOE OF FILL
(FUTURE LANE)
30+20
30+00
29+80
10.0
23.5
36.5
5.0
PRIVATE ACCESS ROAD
SAND MIN. 0.15 DEPTH (TYP)
4.288 m x 3.772 m - 54 N STRUCTURAL STEEL PLATE CULVERT SKEW No. 49
CONTROL LINE
PLAN
FINISHED GRADE ELEV. 499.131
EXISTING GROUND PROFILE
SAND
PIPE INV. 493.0
PIPE INV. 492.7
60.0 m - 4.288 x 3.772 54 N - STRUCTURAL STEEL PLATE CULVERT
PROFILE
UNGULATE CROSSING N.T.S.
STA. 30 + 00.00 - L 20
TOP OF PVMT.
TOP OF SUBGRADE
4.288
R = 1.930 m Δ = 101.3°
R = 2.970 m Δ = 42.3° (TYP)
R = 0.965 Δ = 72.4° (TYP)
R = 5.388 Δ = 30.0°
3.772
5.222
2.0
0.525
0.45
1.5
7.288
75mm - SAND
SIEVE SIZE % PASSING 4.75 100 0.075 15 - 20
SELECT GRANULAR SUB-BASE TO PIPE INVERT AND RAMPS
STRUCTURAL BACKFILL N.T.S.
CONTROL LINE
EXISTING DROUGHT CREEK
CONSTRUCT DYKE TO 0.5m ABOVE CROWN DRAINAGE CULVERT
TOE OF FILL
81+00
80+60
26.0
29.0
2.32 m x 2.68 m STRUCTURAL STEEL PLATE CULVERT SKEW No. 66
PROP. ⌀ C.S.P. DRAINAGE CULVERT
PLAN
FINISHED GRADE ELEV. 506.938
INV. 502.5
INV. 498.9
EXISTING GROUND PROFILE
56.0 m - 2320 x 2680 STRUCTURAL STEEL PLATE CULVERT
PROFILE
PEDESTRIAN UNDERPASS 1:250
STA. 1180 + 83.00 - L 1100
TOP OF PVMT.
1.0 m
TOP OF SUBGRADE
5N
NEUTRAL AXIS
32 N 152 mm x 51 mm CORRUGATIONS 3mm WALL THICKNESS
72.1° R = 0.97 m (TYP)
107.9° R = 1.425 m (TYP)
5N + 6N
2.68 m
1.98 m
0.365
SELECT GRANULAR SUB - BASE (7.5mm MINUS)
1.5 m
1.55 m
2.32 m
450
STRUCTURAL BACKFILL N.T.S.
NOTE: USE TWO (2) 19mm ⌀ A.S.T.M. A-449 WITH ASTM A-563 GRADE 'C' NUTS PER CORRUGATION.
0 10 20
UMA Engineering Ltd.
Engineers & Planners
British Columbia Alberta Saskatchewan Manitoba Ontario Yukon Territory Northwest Territories
SCALE AS SHOWN
DESIGNED H.B. & M.R. DATE 86-03-17
CHECKED A.P. DATE 86-03-21
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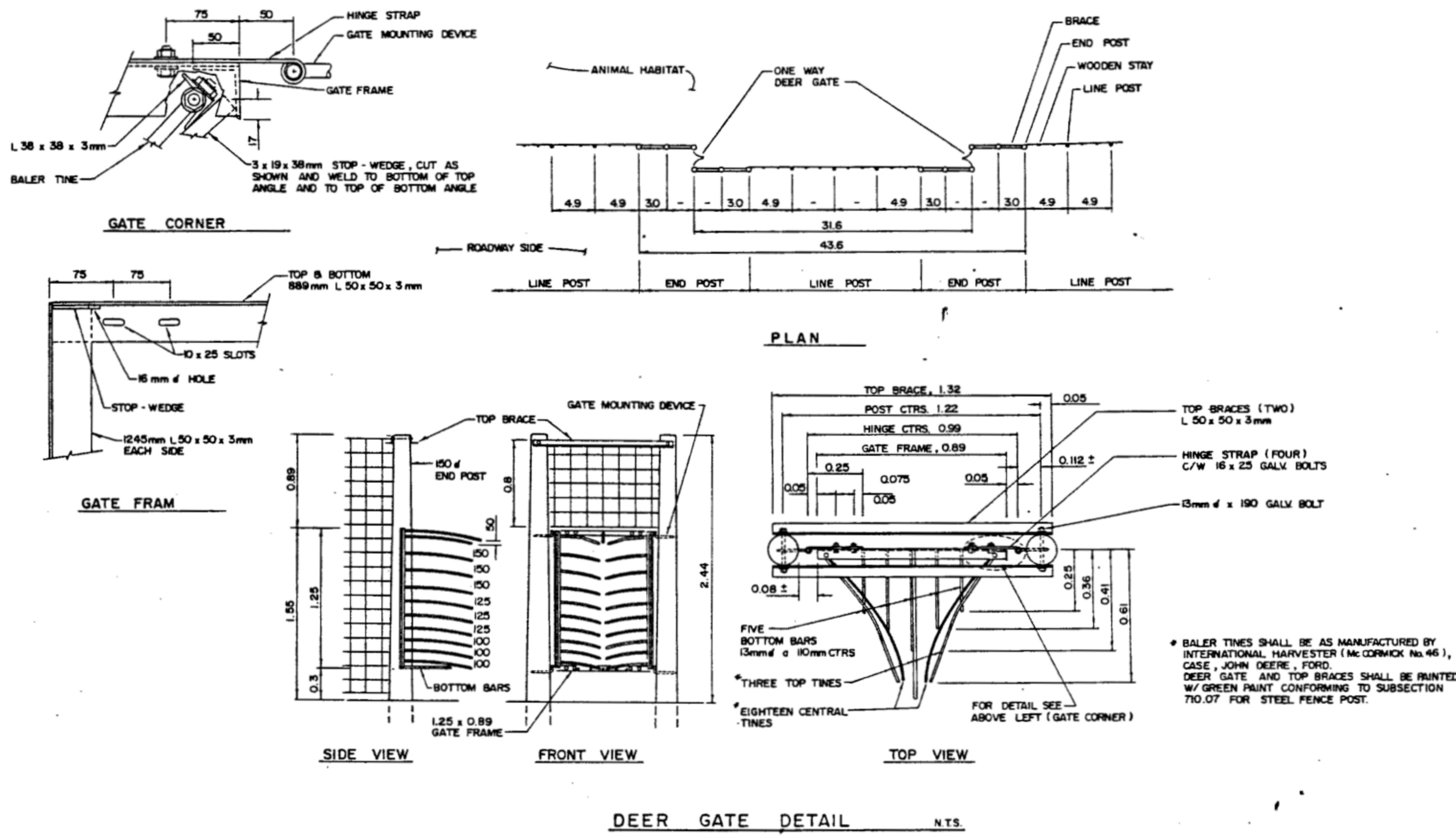
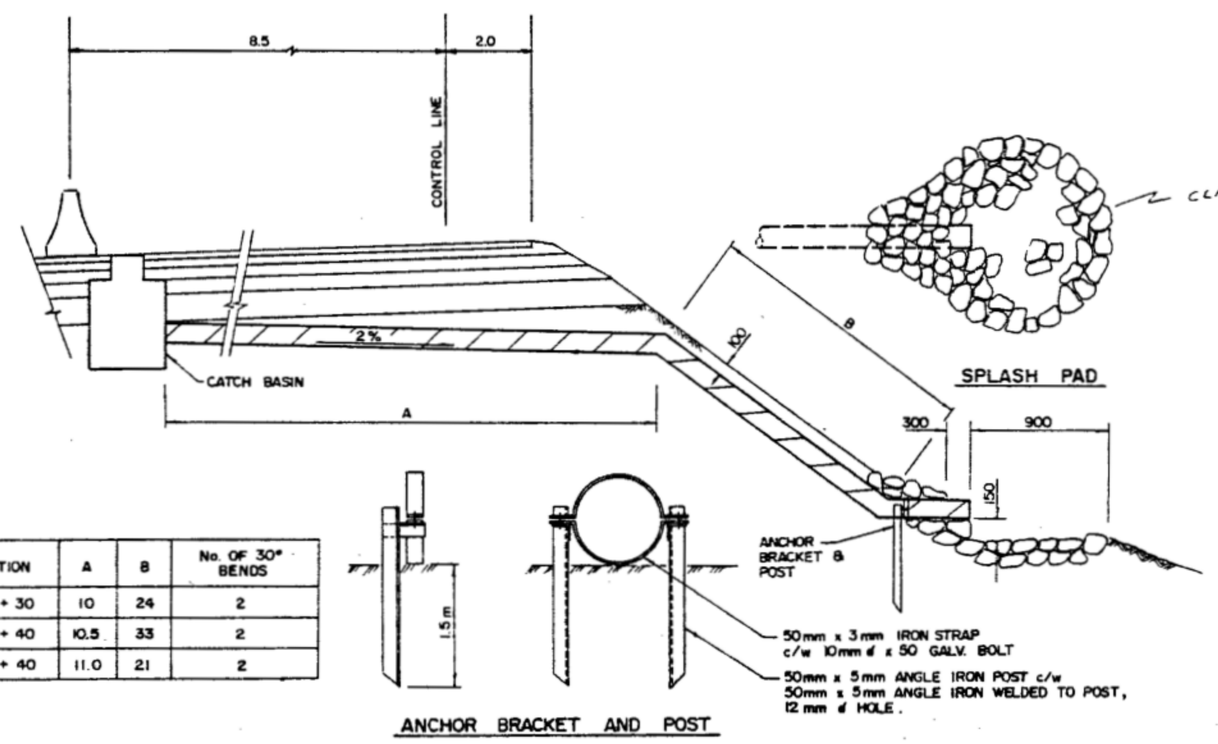
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH
UNGULATE CROSSING AND PEDESTRIAN UNDERPASS - DETAILS
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
PREPARED UNDER THE DIRECTION OF
DATE March 20, 1986
RECOMMENDED
DIRECTOR DESIGN AND SURVEYS
DATE Mar 21/86
ACCEPTED FOR CONSTRUCTION
M.G. Elston
EXECUTIVE DIRECTOR ENGINEERING
DATE 21 Mar 86
INDEX NEG. No. FILE No. L2-M221-698
PROJECT No. C - 3736
REGION 2
DRAWING No. R2 - 158 - 023
CANCEL PRINTS BEARING EARLIER LETTER

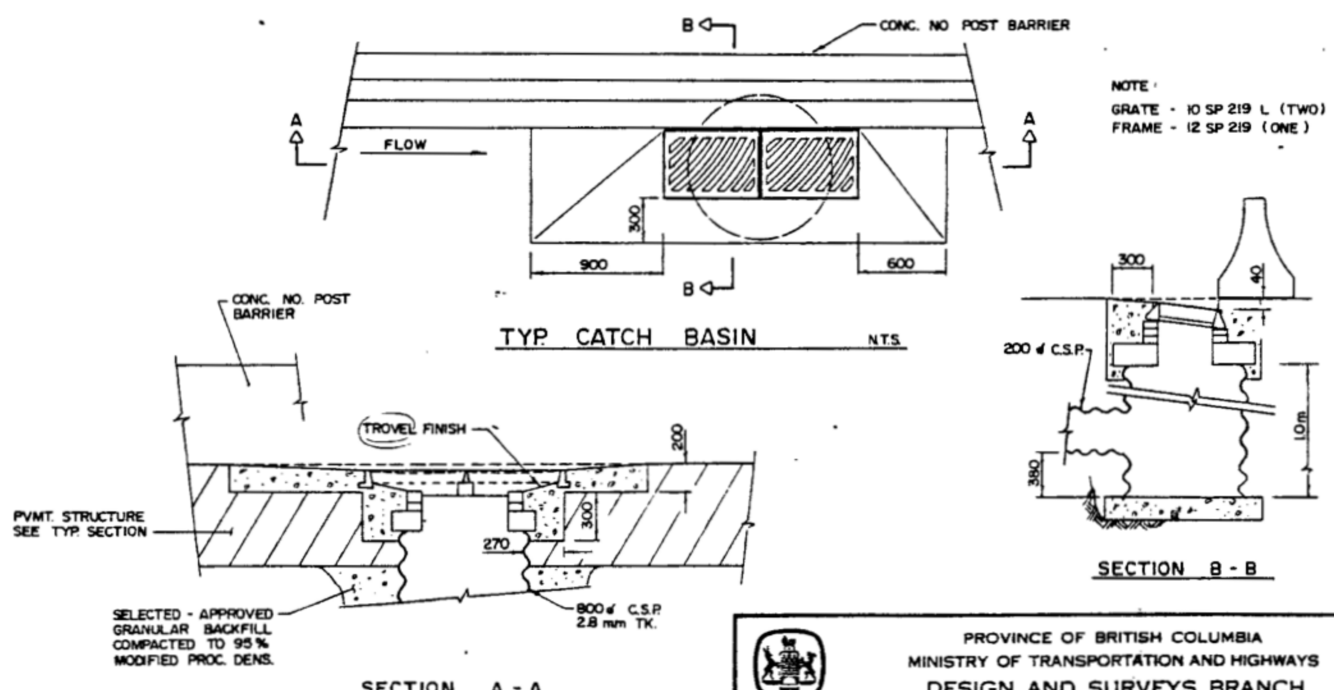


DEER GATE DETAIL N.T.S.



STATION	A	B	No. OF 30° BENDS
1188 + 30	10	24	2
1188 + 40	10.5	33	2
1190 + 40	11.0	21	2

TYP. CATCH BASIN INSTALLATION N.T.S.



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FENCING AND DRAINAGE - DETAILS

COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL

SCALE AS SHOWN
DESIGNED H.B. & M.R. DATE 86-03-17
CHECKED A.P. DATE 86-03-21

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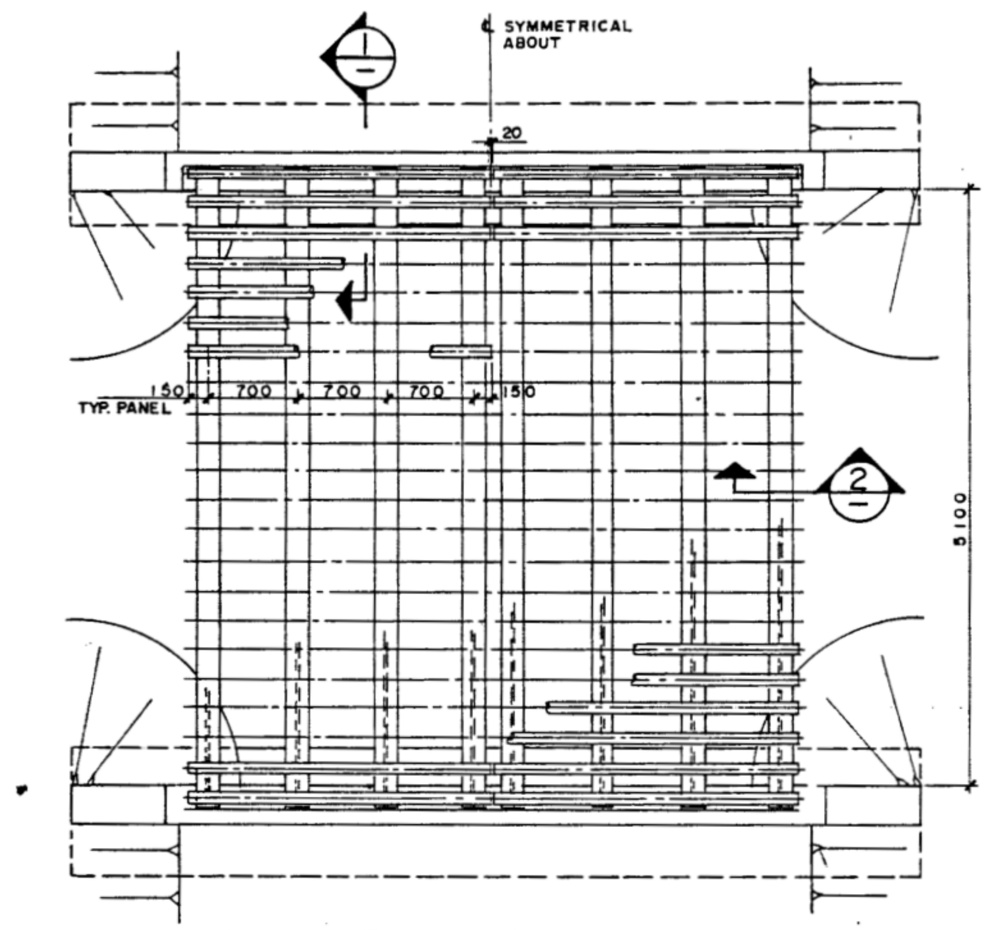
PREPARED UNDER THE DIRECTION OF — DATE March 20, 1986
RECOMMENDED — DIRECTOR OF HIGHWAY DESIGN AND SURVEYS — DATE Mar 21/86
ACCEPTED FOR CONSTRUCTION — M.G. Elston — EXECUTIVE DIRECTOR ENGINEERING — DATE 21 Mar 86

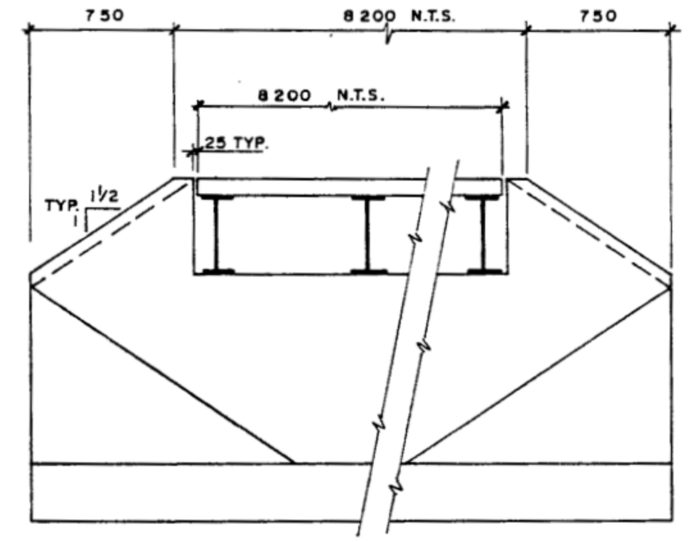
INDEX	NEG. No.	FILE No.	PROJECT No.	REGION	DRAWING No.
		L2-M221-698	C - 3736	2	R2-158-024

CANCEL PRINTS BEARING EARLIER LETTER



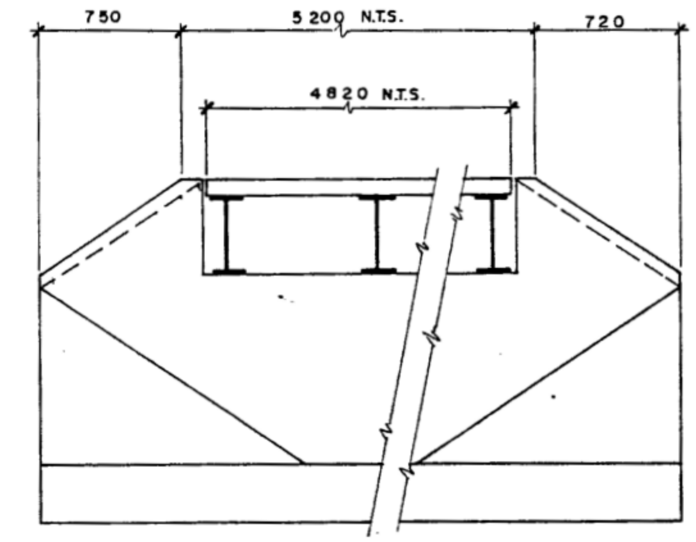
PLAN OF 5m CATTLE GUARD

1: 30



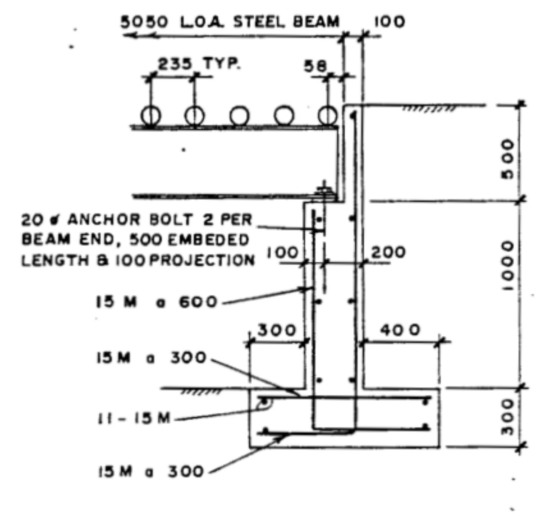
ABUTMENT ELEVATION OF 8m CATTLE GUARD

1: 20



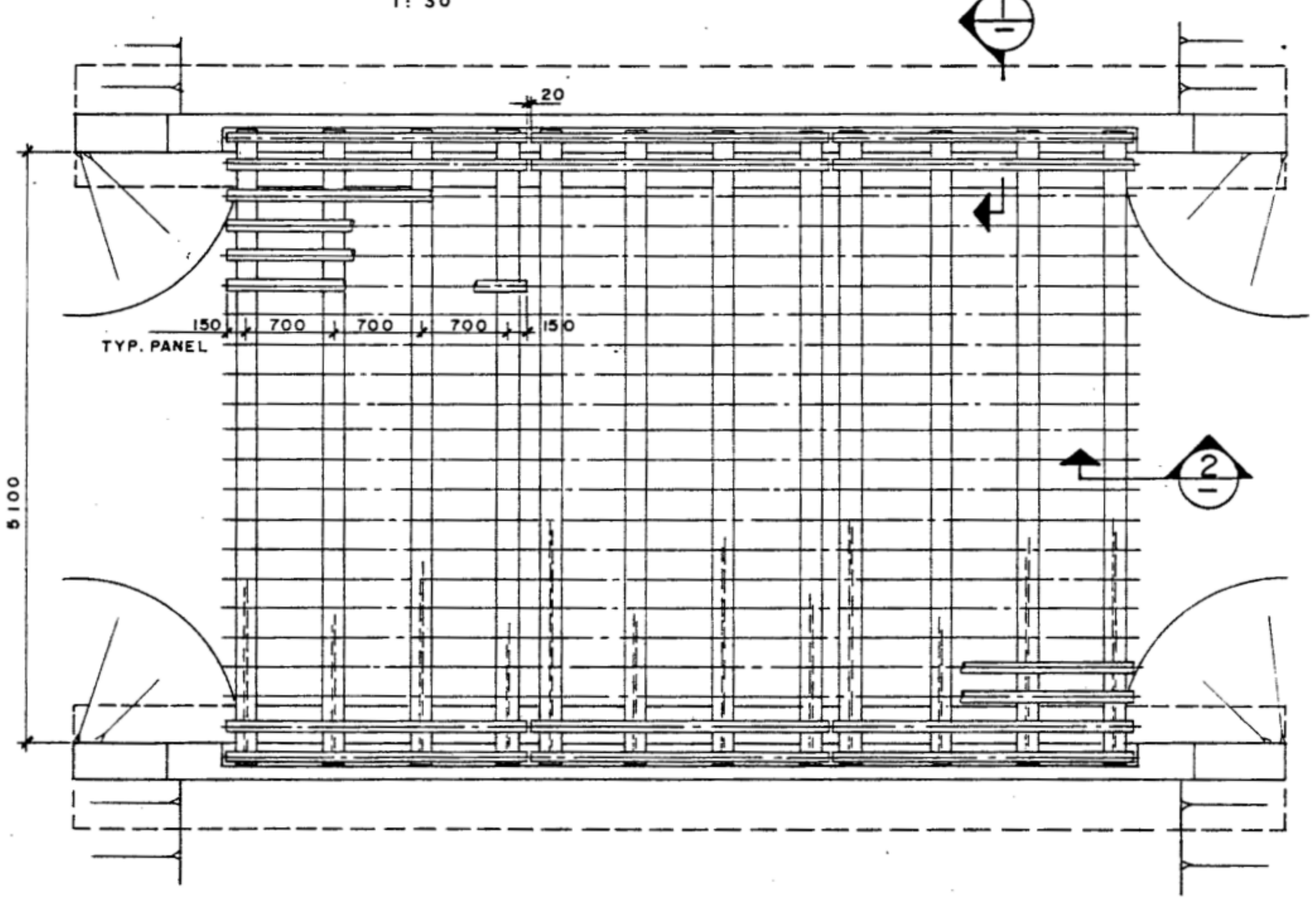
ABUTMENT ELEVATION OF 5m CATTLE GUARD

1: 20



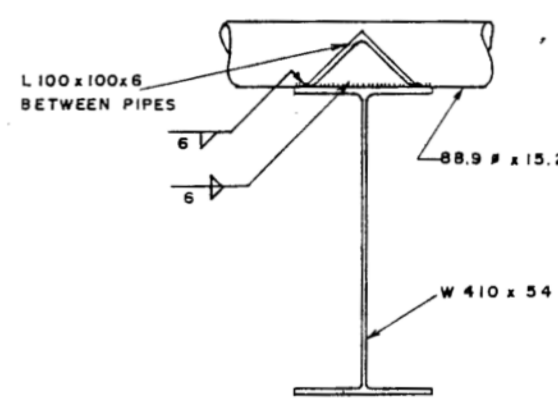
SECTION 1

1: 20



PLAN OF 8m CATTLE GUARD

1: 30



SECTION 2

1: 5

NOTES:

1. REINFORCING STEEL SHALL BE GRADE 400
2. CONCRETE SHALL BE CLASS 'A' ORDINARY FINISH
3. PIPE SHALL BE A.S.T.M. A53 FY = 241 MPa SEAMLESS
4. STRUCTURAL STEEL TO G 40.21 - M 300 W

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	CHECKED ... DATE 86-03-21
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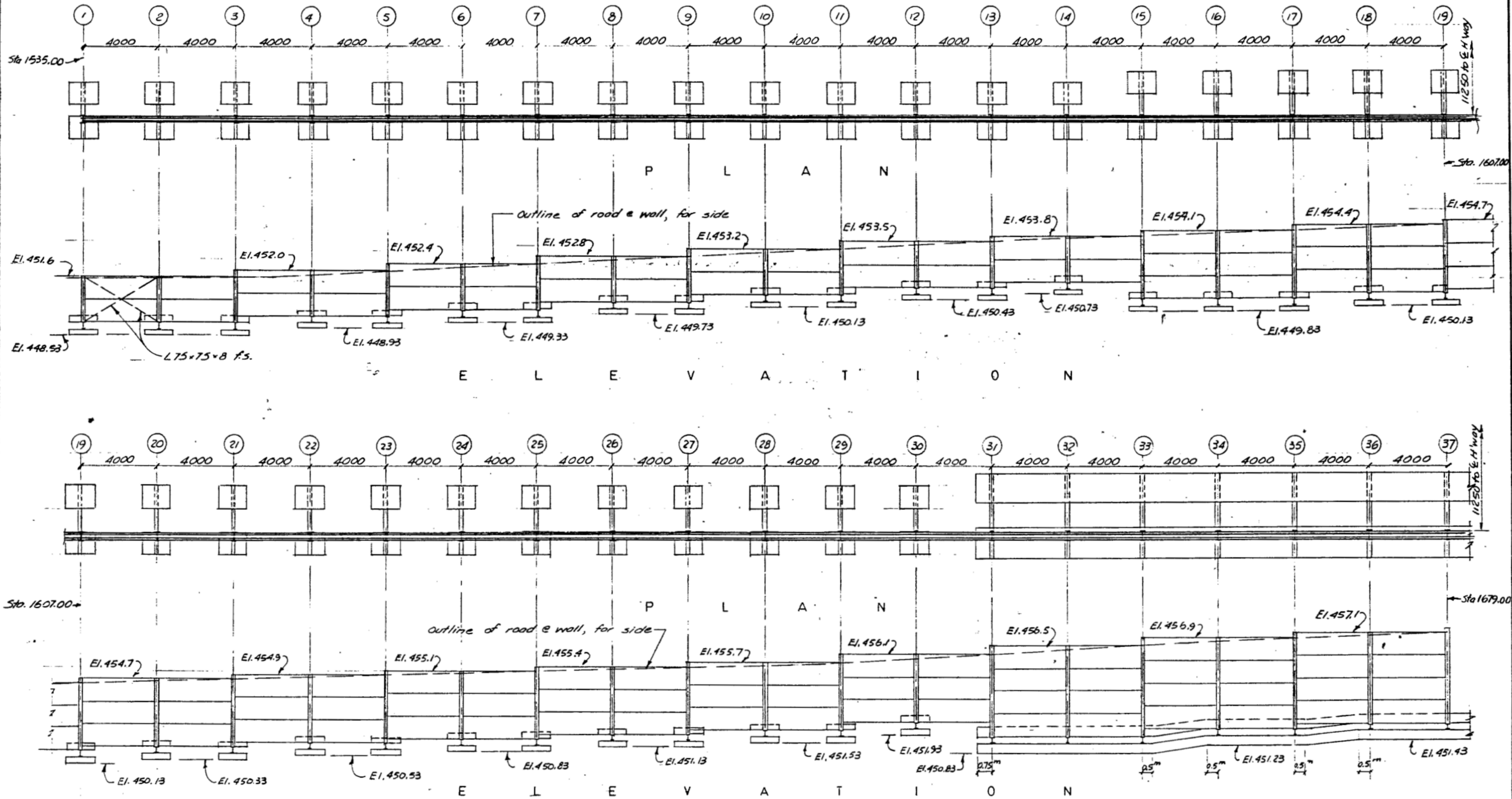
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

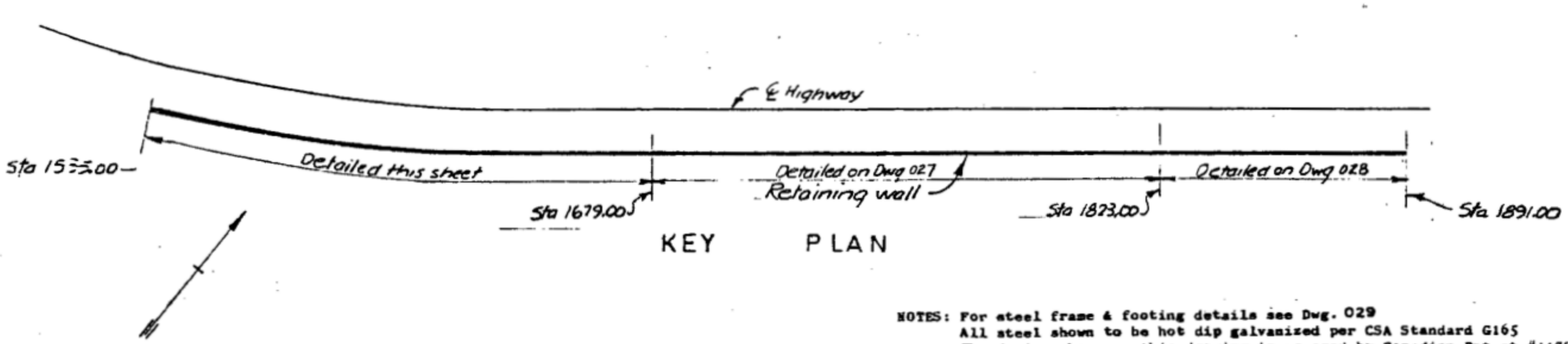
CATTLE GUARD DETAILS
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL

PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE March 20, 1986	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	M.G. Elston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

INDEX	NEG. No.	FILE No.	PROJECT No.	REGION	DRAWING No.
		L2-M221-698	C- 3736	2	R2-158-025

CANCEL PRINTS BEARING EARLIER LETTER





NOTES: For steel frame & footing details see Dwg. 029
All steel shown to be hot dip galvanized per CSA Standard G165
The design shown on this drawing is covered by Canadian Patent #1170850

SCALE 1:100
DESIGNED BN DATE 19/3/86
CHECKED AN DATE 19/3/86

REVISIONS

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Vancouver, B.C.

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

RETAINING WALL - PLAN & ELEVATION
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL

PREPARED UNDER THE DIRECTION OF	APPROVED FOR USE IN CONSTRUCTION	EXAMINED AND ACCEPTED
DATE 19 Mar 1986	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 20/86	EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

INDEX	NEG. No.	FILE No.	PROJECT No.	REGION	DRAWING No.
		L2-M221-698	C-3736	2	R2-158-026

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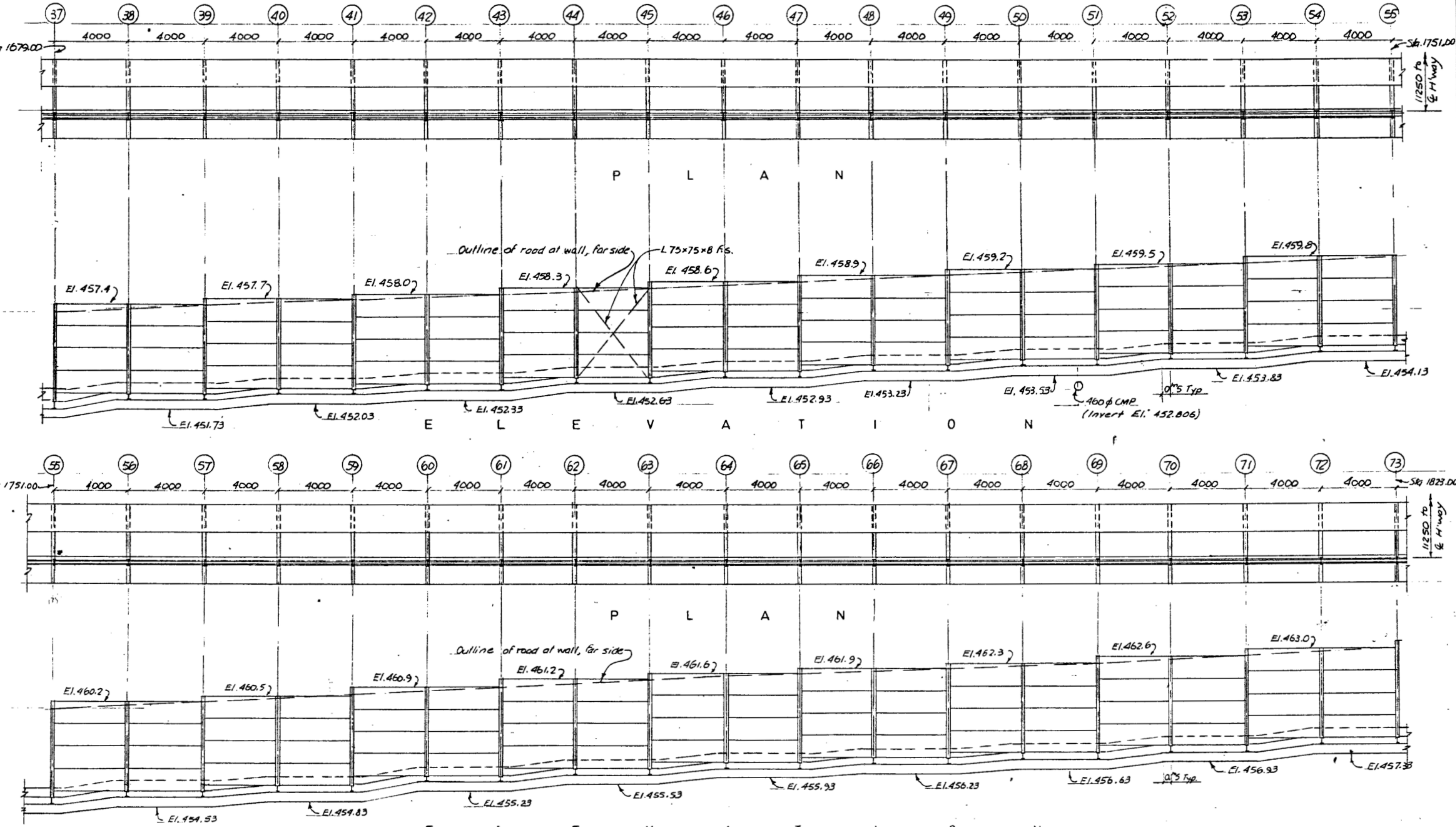

NOTES: For steel frame & footing details see Dwg. 029
All steel shown to be hot dip galvanized per CSA Standard G165
The design shown on this drawing is covered by Canadian Patent #1170850

SCALE 1:100	DESIGNED BN DATE 19/3/86
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PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

RETAINING WALL - PLAN & ELEVATION

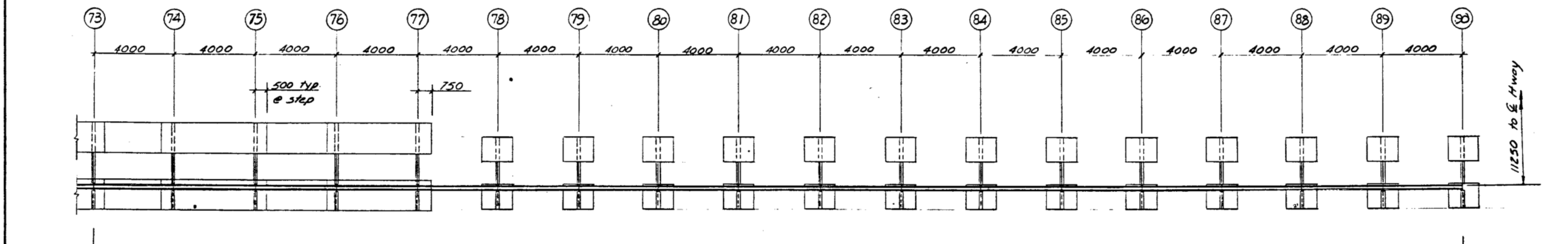
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL

PREPARED UNDER THE DIRECTION OF	APPROVED FOR USE IN CONSTRUCTION	EXAMINED AND ACCEPTED
DATE 19 Mar 1985	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	MG Elston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

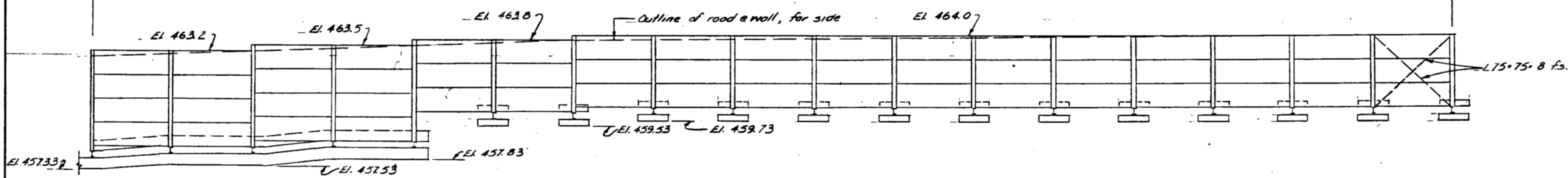
INDEX	NEG. No.	FILE No.	PROJECT No.	REGION	DRAWING No.
		L2-M221-698	C-3736	2	R2-158-027

CANCEL PRINTS BEARING EARLIER LETTER

FORM H 308 H



PLAN



ELEVATION

NOTES: For steel frame & footing details see Dwg. 029
All steel shown to be hot dip galvanized per CSA Standard G165
The design shown on this drawing is covered by Canadian Patent #1170850

SCALE 1:100	DESIGNED BN DATE 19/3/86 CHECKED AN DATE 19/3/86
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RETAINING WALL - PLAN & ELEVATION

COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL

PREPARED UNDER THE DIRECTION OF	RECOMMENDED	ACCEPTED FOR CONSTRUCTION
DATE 19 Mar 1986	DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE Mar 21/86	MGElston EXECUTIVE DIRECTOR ENGINEERING DATE 21 Mar 86

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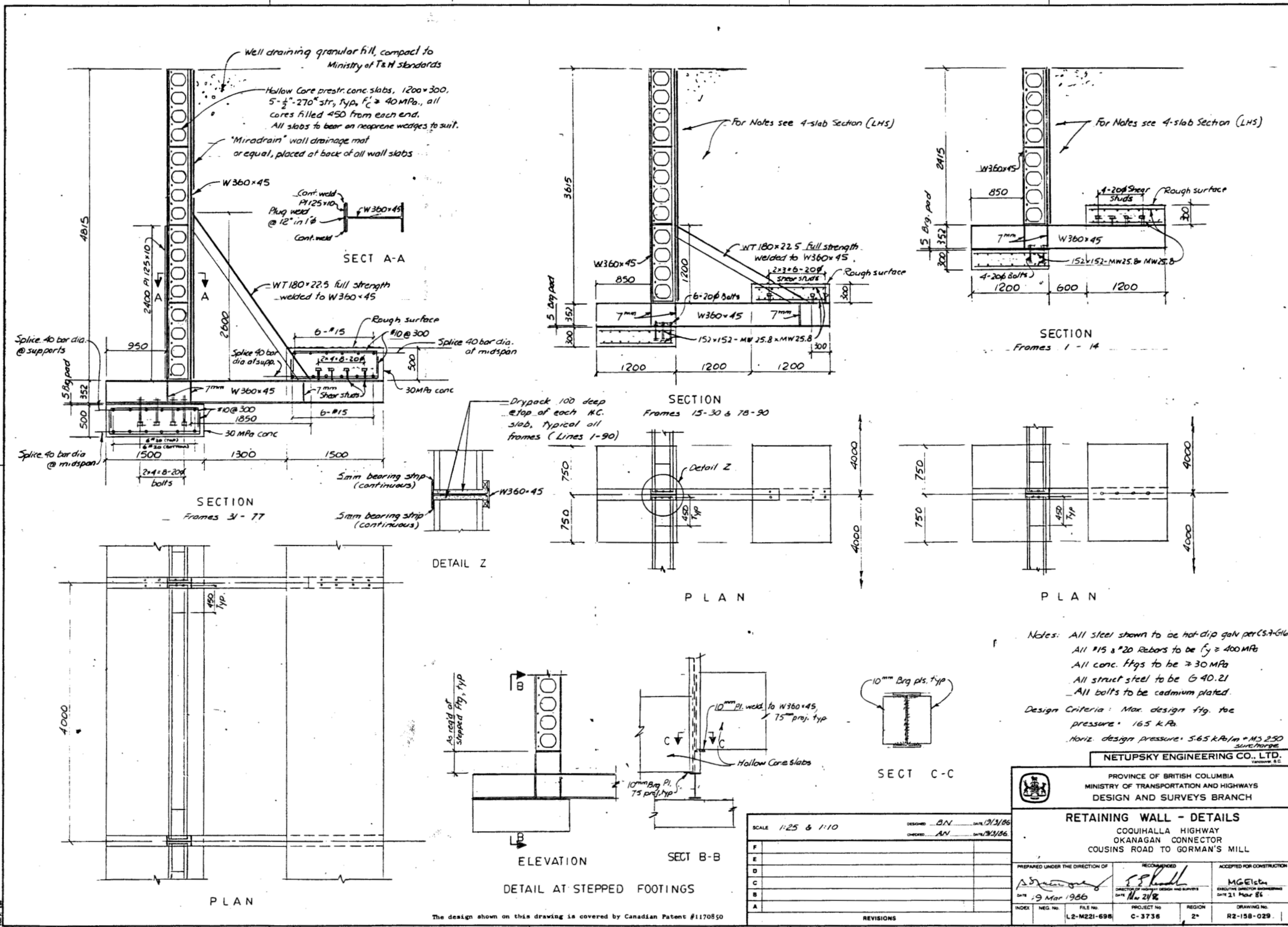
		L2-M221-698	C - 3736	2	R2-158-028

CANCEL PRINTS BEARING EARLIER LETTER

FORM H3081


Well draining granular fill, compact to Ministry of T&H standards
Hollow Core prestr. conc. slabs, 1200×300, 5-½"-270k str, typ, f'c ≥ 40 MPa., all cores filled 450 from each end. All slabs to bear on neoprene wedges to suit.
"Miradrain" wall drainage mat or equal, placed at back of all wall slabs
W360×45
Cont. weld
Pl 125×10
Plug weld @ 12" in 1φ
Cont. weld
W360×45
SECT A-A
WT 180×22.5 full strength welded to W360×45
Rough surface
6-#15
#10 @ 300
2×4-8-20φ
Splice 40 bar dia. at midspan
Splice 40 bar dia. @ supports
Splice 40 bar dia. at supp.
7mm
Shear studs
30 MPa conc
#10 @ 300
1850
6-#15
30 MPa conc
Splice 40 bar dia @ midspan
2×4=8-20φ bolts
4815
2400 Pl 125×10
2600
950
1500
1300
1500
SECTION
Frames 31 - 77
Drypack 100 deep @ top of each HC. slab, typical all frames (Lines 1-90)
5mm bearing strip (continuous)
W360×45
5mm bearing strip (continuous)
DETAIL Z
For Notes see 4-slab Section (LHS)
3615
W360×45
WT 180×22.5 full strength welded to W360×45.
2×3=6-20φ shear studs
Rough surface
6-20φ Bolts
W360×45
152×152-MW25.8×MW25.8
1200
1200
1200
SECTION
Frames 15-30 & 78-90
For Notes see 4-slab Section (LHS)
2415
W360×45
850
4-20φ Shear Studs
Rough surface
W360×45
152×152-MW25.8×MW25.8
4-20φ Bolts
1200
600
1200
SECTION
Frames 1 - 14
Detail Z
4000
750
750
450 Typ
4000
PLAN
4000
750
750
450 Typ
4000
PLAN
Notes: All steel shown to be hot-dip galv per CSA-G164
All #15 & #20 Rebars to be fy ≥ 400 MPa
All conc. ftgs to be ≥ 30 MPa
All struct steel to be G 40.21
All bolts to be cadmium plated.
Design Criteria: Max. design ftg. toe pressure = 165 kPa
Horiz. design pressure: 5.65 kPa/m + MS 250 surcharge
4000
450 Typ
PLAN
As req'd at stepped ftg, typ
ELEVATION
10mm Pl. weld to W360×45, 75mm proj. typ
Hollow Core slabs
10mm Brg Pl. 75 proj. typ
SECT B-B
DETAIL AT STEPPED FOOTINGS
10mm Brg pls. typ
SECT C-C
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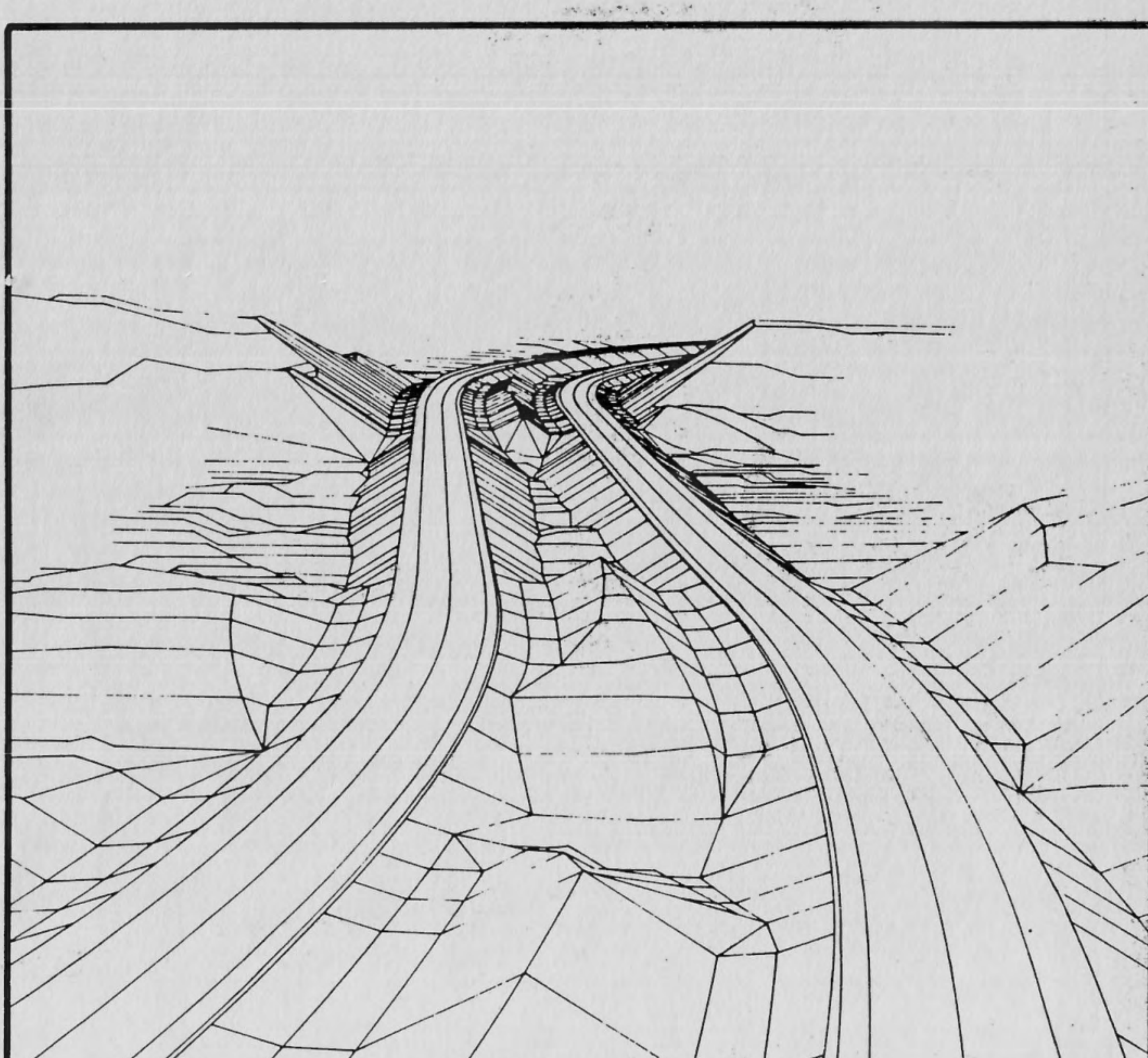
PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH
RETAINING WALL - DETAILS
COQUIHALLA HIGHWAY
OKANAGAN CONNECTOR
COUSINS ROAD TO GORMAN'S MILL
SCALE 1:25 & 1:10
DESIGNED BN DATE 19/3/86
CHECKED AN DATE 19/3/86
REVISIONS
PREPARED UNDER THE DIRECTION OF
DATE 19 Mar 1986
RECOMMENDED
DIRECTOR OF HIGHWAY DESIGN AND SURVEYS
ACCEPTED FOR CONSTRUCTION
M.G.Elston
EXECUTIVE DIRECTOR ENGINEERING
DATE 21 Mar 86
INDEX
NEG. No.
FILE No. L2-M221-698
PROJECT No. C-3736
REGION 2
DRAWING No. R2-158-029
The design shown on this drawing is covered by Canadian Patent #1170850
CANCEL PRINTS BEARING EARLIER LETTER

HIGHWAY DESIGN

Manual Of Standards And Instructions



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Section A.2: HORIZONTAL ALIGNMENT

Section B.1: CROSS SECTIONS

Section B.2: BARRIER DRAWINGS

<u>Highway Safety Drawings</u> Included in Section B.2 but retaining HSE numbers

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Section C.2: INTERCHANGES

Section D.1: CONSTRUCTION ITEMS

Section D.2: SPECIAL PROVISIONS

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Section E.3: STRUCTURES

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Section F.2: UTILITIES

CONTENTS (continued)

Section G: MISCELLANEOUS

Section H: DRAWINGS

SECTION A

ALIGNMENT

A.1 VERTICAL

A.2 HORIZONTAL

Calculation of Stopping Sight Distance, SSD

Design Speed km/h	Running Speed km/h	Perception and Reaction Time	Perception and Reaction Distance	Coeff of Friction Wet pvt.	Braking Distance (Level)	Minimum Stopping Sight Distance Calc.	Minimum Stopping Sight Distance Rounded	Crest Curve SSD
40	40	2.5	27.8	0.38	16.5	44.3	45	45
50	50	2.5	34.7	0.36	27.3	62.0	65	65
60	60	2.5	41.7	0.34	41.7	83.4	85	85
70	70	2.5	48.6	0.32	60.3	108.9	110	110
80	80	2.5	55.6	0.31	81.3	136.9	140	140
90	90	2.5	62.5	0.30	106.3	168.8	170	190
100	98	2.5	68.1	0.30	126.0	194.1	200	220
110	103	2.5	71.5	0.29	144.0	215.5	220	245

SSD Adjustments for Grade

Design Speed km/h	Decrease for Upgrade 3%	Decrease for Upgrade 6%	Decrease for Upgrade 9%	Increase for Downgrade 3%	Increase for Downgrade 6%	Increase for Downgrade 9%
40	–	–	5	–	–	–
50	5	5	10	–	5	10
60	5	5	10	5	10	15
70	5	10	15	5	10	20
80	10	15	20	10	15	30
90	10	20	25	10	20	40
100	10	20	–	15	30	–
110	15	25	–	15	35	–

NOTES:

For design speeds of 60–90 km/h and radii not more than 110% of minimum for the design speed, increase the SSD by 5% for friction loss (See RTAC X.B.2.2).

On crest curves, it has been observed that perception/reaction time is greater by as much as one second at higher speeds; values for Crest Curve SSD are added.

For rationale see X.A.1–1.0

APPROVED J. Lissman HIGHWAY SAFETY ENGINEER DATE 88–07 REVISED	MINISTRY OF TRANSPORTATION AND HIGHWAYS PROVINCE OF BRITISH COLUMBIA MINIMUM STOPPING SIGHT DISTANCE SSD	DESIGN MANUAL A.1–1.0

Stopping Sight Distance, SSD

Minimum stopping sight distance, SSD= $Vt/3.6 + V^2/254f$

Variables:
- assumed initial speed, V, km/h
- perception/reaction time, t, seconds
- coefficient of longitudinal friction, f

In earlier editions of this Manual, it was assumed that top speeds were somewhat lower on wet pavements than on the same pavements in dry weather; hence the use of a reduced Running Speed. However, observations showed that many drivers drive just as fast on wet pavements as they do on dry, except on roads whose design speeds are in the highest end of the range. To allow for this, the assumed Running Speed, for the purpose of calculating the minimum stopping sight distance, is now taken to be equal to the Design Speed up to 90 km/h, and progressively less for higher design speeds.

For approximately 90% of drivers tested in studies, a perception/reaction time of 2.5s was found to be adequate for braking; therefore, 2.5s is used for calculating minimum stopping sight distance. In the case of Crest Curves there is evidence that the perception/reaction time can increase by as much as 1 second at higher speeds. For this reason the S.S.D. applied to Crest Curve Design (A.1-1.1) uses a value of 3.5 seconds for 90 - 110 km/h.

Braking distance on tangent roadway is based on all longitudinal friction being available for braking. In the case of a horizontal curve, a component of the available friction is utilized to supply the lateral force producing centripetal acceleration, leaving reduced friction available for braking. The sharper the curve, the less friction available for braking. The friction loss results in a larger braking distance and therefore a larger stopping sight distance. See RTAC X.B.2.2 for an explanation of the mechanics of this effect.

Sight distance on a horizontal curve is an important parameter in the calculation of lateral clearance. The formula for calculating the required lateral clearance 'C' is:

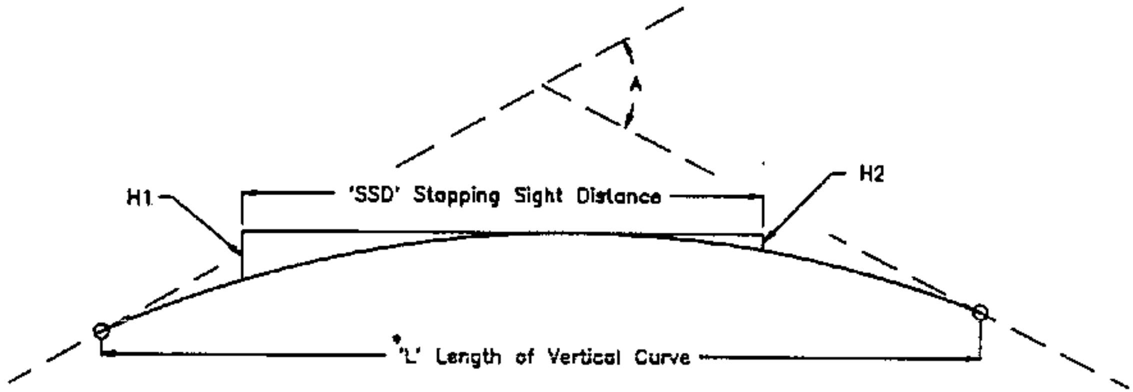
$$C= R_i\left(1-\cos\left[\frac{SSD}{2R_i} * \frac{180}{\pi}\right]\right)$$

Where: R_i = radius at centre of inner lane
SSD = stopping sight distance

A comparison of calculated C's using the design (tangent) stopping sight distances and the larger stopping sight distances caused by friction loss, indicates design clearances to be deficient by up to 11% at speeds of 60 to 90 km/h. To adjust for this the following procedure is to be used:

For Design Speeds of 60 through 90 km/h and radii within 110% of the minimum, Stopping Sight Distance is to be increased by 5%. For Design Speeds outside of this range the correction is not required.

For a full discussion and detailed explanation of the above controls, see:
- RTAC "Manual of Geometric Design Standards for Canadian Roads", 1986 Appendix A
- AASHTO 1984 (the Green Book) Chapters 2 & 3.



*L (in metres) should not be less than design speed in kilometres per hour;
H1 – height of driver's eye – 1.05m;
H2 – height of object – 0.150 m;
A – algebraic difference in grades, percent
K = L/A

Where L>SSD, $K = \dfrac{S^2}{200(\sqrt{H1} + \sqrt{H2})^2} = \dfrac{S^2}{398.745}$

Where L<SSD, $K = \dfrac{2S}{A} - \dfrac{200(\sqrt{H1} + \sqrt{H2})^2}{A^2} = \dfrac{2S}{A} - \dfrac{398.745}{A^2}$

Table of K Values when
L >= SSD only

DESIGN SPEED km/h	Minimum SSD (m)	Minimum Crest K
40	45	5
50	65	11
60	86	18
70	110	30
80	140	50
90	190	90
100	220	120
110	245	150

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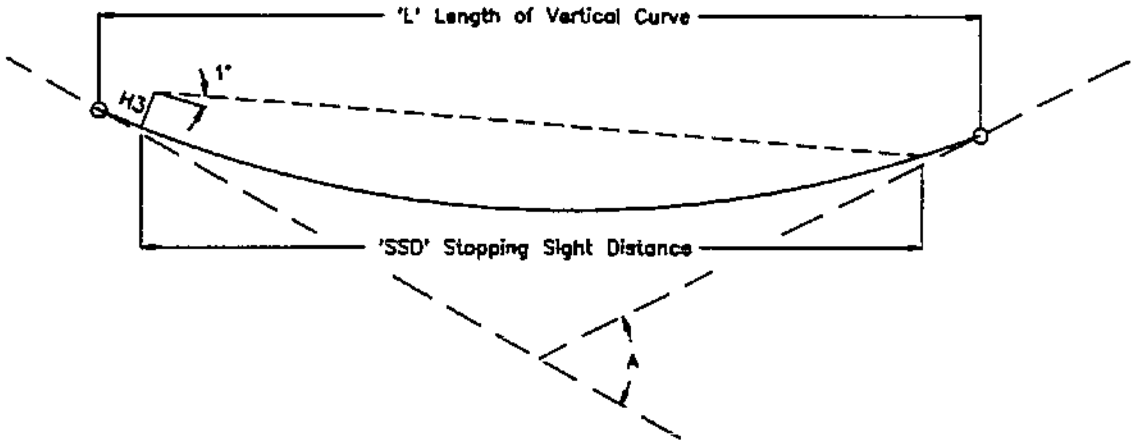
DATE 87-01
REVISED 88-07

MINISTRY OF TRANSPORTATION AND HIGHWAYS
PROVINCE OF BRITISH COLUMBIA

CREST VERTICAL CURVE DESIGN CONTROLS
FOR MINIMUM STOPPING SIGHT DISTANCE

DESIGN MANUAL

A.1–1.1



*L (in metres) should not be less than design speed in kilometres per hour;
H3 – headlight height – 0.6m;
1° – angle of light beam upward from plane of vehicle;
A – algebraic difference in grades, percent
K = L/A

Where L>SSD, $K = \frac{S^2}{200(H3+S[\tan 1°])} = \frac{S^2}{120 + 3.49 \cdot S}$

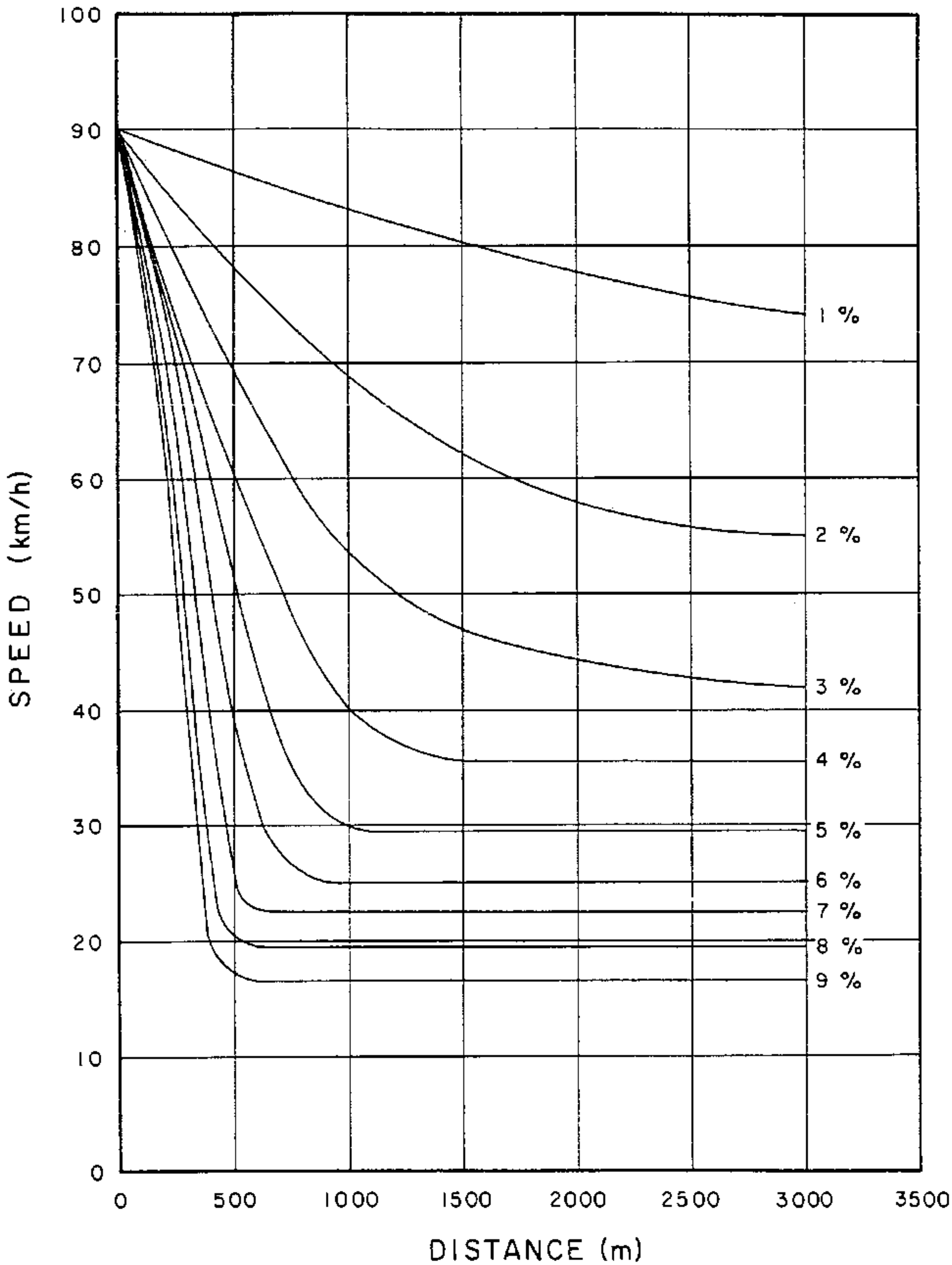
Where L<SSD, $K = \frac{2S}{A} - \frac{200(H3+S[\tan 1°])}{A^2} = \frac{2S}{A} - \frac{120 + 3.49 \cdot S}{A^2}$

Table of K Values when L >= SSD only

DESIGN SPEED km/h	Minimum SSD (m)	Minimum Sag K	
		Headlight Control	Comfort Control*
40	45	7	4
50	65	12	6
60	85	17	9
70	110	24	13
80	140	32	16
90	170	40	21
100	200	49	26
110	220	55	31

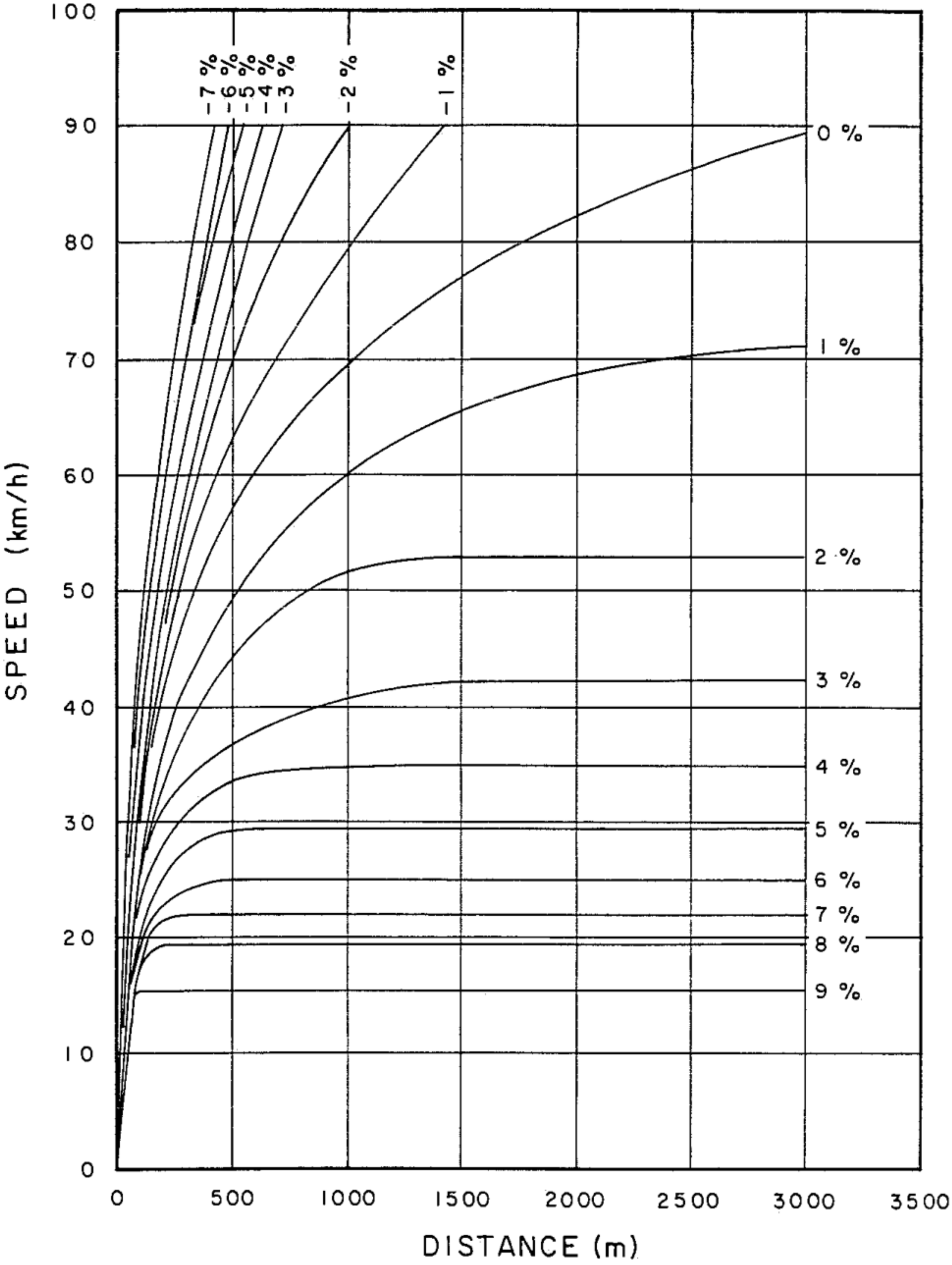
*For use in fully illuminated urban areas only.

APPROVED HIGHWAY SAFETY ENGINEER DATE 87-01 REVISED 88-07	MINISTRY OF TRANSPORTATION AND HIGHWAYS PROVINCE OF BRITISH COLUMBIA SAG VERTICAL CURVE DESIGN CONTROLS FOR MINIMUM STOPPING SIGHT DISTANCE	DESIGN MANUAL A.1–1.2



Speed vs. distance chart on uniform upgrades for trucks with mass:power = 180 g/W (300 lb/hp).

APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DIRECTOR DESIGN AND SURVEYS	SPEED-DISTANCE CURVES Deceleration (Upgrades)	A.I-2.I
DATE 85 - 02 REVISED		



Speed vs. distance chart on uniform up and down grades for trucks with mass : power = 180 g/W (300 lb/hp).

APPROVED DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 85 - 02 REVISED	SPEED—DISTANCE CURVES Acceleration (Up and Dawn Grades)	A.1-2.2

MINISTRY OF TRANSPORTATION AND HIGHWAYS
PROVINCE OF BRITISH COLUMBIA

SUPERELEVATION & SPIRAL LENGTHS
MAXIMUM e = 0.060m/m

DESIGN MANUAL A.2-1.1

APPROVED
HIGHWAY SAFETY ENGINEER
DATE 77-09-29
REVISED 88-07

	40 km/h			50 km/h			60 km/h			70 km/h		
R	e	L2	L4	e	L2	L4	e	L2	L4	e	L2	L4
8000	NC			NC			NC			NC		
5000	NC			NC			NC			NC		
3000	NC			NC			NC			NC		
2000	NC			NC			NC			RC	40	40
1500	NC			NC			RC	40	40	0.020	40	40
1200	NC			NC			RC	40	40	0.023	40	40
1000	NC			RC	30	30	0.021	40	40	0.026	40	40
900	NC			RC	30	30	0.023	40	40	0.028	40	40
800	NC			RC	30	30	0.025	40	40	0.031	40	40
700	NC			0.021	30	30	0.027	40	40	0.033	40	50
650	RC	30		0.022	30	30	0.029	40	40	0.035	40	50
600	RC	30		0.023	30	30	0.030	40	40	0.037	40	50
550	RC	30		0.025	30	30	0.032	40	40	0.038	40	50
500	RC	30		0.027	30	30	0.034	40	40	0.040	40	60
475	RC	30		0.028	30	30	0.035	40	50	0.041	40	60
450	0.021	30		0.029	30	40	0.036	40	50	0.043	40	60
425	0.022	30		0.030	30	40	0.037	40	50	0.044	40	60
400	0.023	30		0.031	30	40	0.038	40	50	0.045	40	60
380	0.024	30		0.032	30	40	0.039	40	50	0.046	40	70
360	0.025	30		0.033	30	40	0.041	40	50	0.047	40	70
340	0.026	30		0.034	30	40	0.042	40	50	0.048	40	70
320	0.027	30		0.035	30	40	0.043	40	60	0.050	40	70
300	0.028	30		0.037	30	40	0.044	40	60	0.051	40	70
290	0.028	30		0.037	30	50	0.045	40	60	0.052	40	70
280	0.029	30		0.038	30	50	0.046	40	60	0.052	50	70
270	0.030	30		0.039	30	50	0.047	40	60	0.053	50	70
260	0.030	30		0.040	30	50	0.047	40	60	0.054	50	80
250	0.031	30		0.040	30	50	0.048	40	60	0.055	50	80
240	0.032	30		0.041	30	50	0.049	40	60	0.055	50	80
230	0.033	30		0.042	30	50	0.050	40	60	0.056	60	80
220	0.034	30	N/A	0.043	30	50	0.051	40	70	0.057	60	80
210	0.035	30		0.044	30	50	0.052	40	70	0.058	60	80
200	0.036	30		0.045	30	50	0.053	40	70	0.059	60	80
190	0.037	30		0.046	30	60	0.054	40	70	0.060	70	80
180	0.038	30		0.047	40	60	0.055	50	70	Min R 190m		
170	0.039	30		0.048	40	60	0.056	50	70			
160	0.040	30		0.049	40	60	0.057	50	70			
150	0.041	30		0.051	40	60	0.058	50	70			
145	0.042	30		0.051	40	60	0.059	50	80			
140	0.043	30		0.052	40	60	0.059	60	80			
135	0.044	30		0.053	40	60	0.060	60	80			
130	0.044	30		0.053	40	60	Min R 135m					
125	0.045	30		0.054	40	70						
120	0.046	30		0.055	40	70						
115	0.047	30		0.056	40	70						
110	0.048	30		0.057	40	70						
105	0.049	30		0.057	50	70						
100	0.050	30		0.058	50	70						
95	0.051	30		0.059	50	70						
90	0.052	40		0.060	50	70						
85	0.053	40		Min R 90m								
80	0.054	40										
75	0.055	40										
70	0.056	40										
65	0.058	40										
60	0.059	40										
55	0.060	40										
	Min R 55m											

	80 km/h			90 km/h			100 km/h			110 km/h			
R	e	L2	L4	e	L2	L4	e	L2	L4	e	L2	L4	R
8000	NC			NC			NC			NC			8000
5000	NC			NC			NC			RC	60	60	5000
3000	NC			RC	50	50	0.020	50	60	0.024	60	60	3000
2000	RC	40	40	0.023	50	50	0.027	50	60	0.032	60	60	2000
1500	0.024	40	50	0.029	50	50	0.033	50	60	0.038	60	70	1500
1200	0.028	40	50	0.033	50	60	0.038	50	70	0.043	60	80	1200
1000	0.032	40	50	0.037	50	60	0.042	50	70	0.048	60	90	1000
900	0.034	40	50	0.039	50	60	0.044	50	80	0.050	60	90	900
800	0.036	40	60	0.042	50	70	0.047	50	80	0.053	60	100	800
700	0.039	40	60	0.045	50	70	0.050	60	90	0.056	70	100	700
650	0.041	40	60	0.046	50	80	0.052	60	90	0.058	80	100	650
600	0.042	40	60	0.048	50	80	0.053	60	90	0.060	80	110	600
550	0.044	40	70	0.050	50	80	0.055	70	100	Min R 600m			
500	0.046	40	70	0.052	50	80	0.057	70	100				
475	0.047	40	70	0.053	60	90	0.058	80	100				
450	0.049	50	70	0.054	60	90	0.059	80	100				
425	0.050	50	80	0.055	60	90	0.060	80	100				
400	0.051	50	80	0.057	70	90	Min R 440m						
380	0.052	50	80	0.058	70	90							
360	0.053	50	80	0.059	70	100							
340	0.054	50	80	0.060	80	100							
320	0.056	60	80	Min R 340m									
300	0.057	60	90										
290	0.057	60	90										
280	0.058	70	90										
270	0.059	70	90										
260	0.059	70	90										
250	0.060	70	90										
	Min R 250m												

e Max 0.06m/m

e Superelevation

NC Normal Crown Section

RC Remove adverse crown and superelevate at normal rate

L2 MINIMUM spiral for two lanes and ramps

L4 MINIMUM spiral for four lanes with up to 2.4m median

For 6 Lanes: above dashed line, use L4; below dashed line use L4 * 1.3 and round to the nearest 10m

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HIGHWAY SAFETY ENGINEER
DATE 77-09-29
REVISED 88-07

MINISTRY OF TRANSPORTATION AND HIGHWAYS
PROVINCE OF BRITISH COLUMBIA

SUPERELEVATION & SPIRAL LENGTHS MAXIMUM e = 0.080m/m

DESIGN MANUAL
A.2-1.2

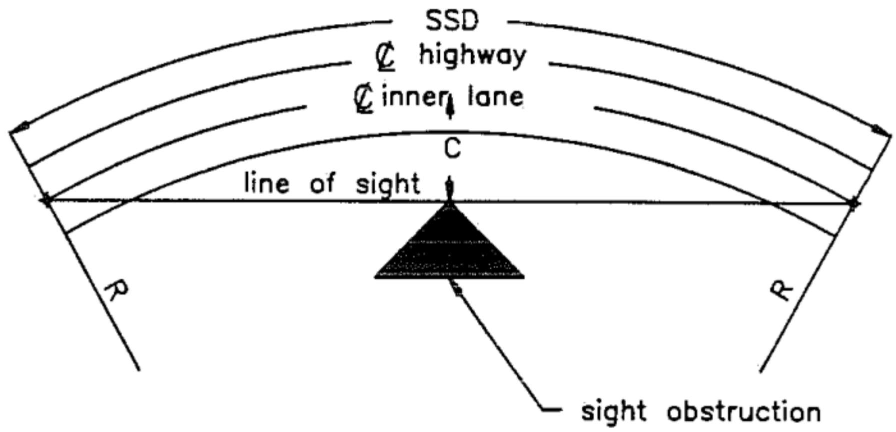
	40 km/h			50 km/h			60 km/h			70 km/h		
R	e	L2	L4	e	L2	L4	e	L2	L4	e	L2	L4
8000	NC			NC			NC			NC		
5000	NC			NC			NC			NC		
3000	NC			NC			NC			NC		
2000	NC			NC			NC			RC	40	40
1500	NC			NC			RC	40	40	0.021	40	40
1200	NC			NC			0.020	40	40	0.026	40	40
1000	NC			RC	30	30	0.023	40	40	0.029	40	40
900	NC			RC	30	30	0.025	40	40	0.032	40	50
800	NC			0.020	30	30	0.027	40	40	0.035	40	50
700	NC			0.023	30	30	0.030	40	40	0.038	40	50
650	RC	30		0.024	30	30	0.032	40	40	0.040	40	60
600	RC	30		0.026	30	30	0.034	40	50	0.042	40	60
550	RC	30		0.028	30	30	0.036	40	50	0.045	40	60
500	0.021	30		0.030	30	40	0.039	40	50	0.047	40	70
475	0.022	30		0.031	30	40	0.040	40	50	0.049	40	70
450	0.023	30		0.032	30	40	0.042	40	50	0.051	40	70
425	0.024	30		0.033	30	40	0.043	40	60	0.052	40	70
400	0.025	30		0.035	30	40	0.045	40	60	0.054	40	80
380	0.026	30		0.036	30	40	0.046	40	60	0.056	40	80
360	0.027	30		0.038	30	50	0.048	40	60	0.057	40	80
340	0.028	30		0.039	30	50	0.049	40	60	0.059	40	80
320	0.030	30		0.041	30	50	0.051	40	70	0.061	40	90
300	0.031	30		0.042	30	50	0.053	40	70	0.063	50	90
290	0.032	30		0.043	30	50	0.054	40	70	0.064	50	90
280	0.033	30		0.044	30	50	0.055	40	70	0.065	50	90
270	0.034	30		0.045	30	50	0.056	40	70	0.066	50	90
260	0.034	30		0.046	30	60	0.058	40	70	0.067	50	90
250	0.035	30		0.048	30	60	0.059	40	80	0.069	50	100
240	0.036	30		0.049	30	60	0.060	40	80	0.070	50	100
230	0.037	30		0.050	40	60	0.061	40	80	0.071	60	100
220	0.039	30	N/A	0.051	40	60	0.063	40	80	0.072	60	100
210	0.040	30		0.053	40	60	0.064	40	80	0.074	60	100
200	0.041	30		0.054	40	60	0.066	40	80	0.075	60	110
190	0.043	30		0.056	40	70	0.067	40	90	0.077	70	110
180	0.044	30		0.057	50	70	0.069	50	90	0.078	70	110
170	0.046	30		0.059	50	70	0.070	50	90	0.080	70	110
160	0.047	30		0.061	50	70	0.072	50	90			
150	0.049	30		0.063	50	70	0.074	50	100			
145	0.050	30		0.064	50	80	0.075	60	100			
140	0.051	40		0.065	50	80	0.076	60	100			
135	0.052	40		0.066	50	80	0.077	60	100			
130	0.053	40		0.067	50	80	0.078	60	100			
125	0.055	40		0.068	50	80	0.079	60	100			
120	0.056	40		0.069	50	80	0.080	70	100			
115	0.057	40		0.071	50	80						
110	0.058	40		0.072	50	90						
105	0.060	40		0.073	50	90						
100	0.061	40		0.075	50	90						
95	0.063	40		0.076	60	90						
90	0.064	40		0.078	60	90						
85	0.066	40		0.079	60	90						
80	0.068	50		0.080	60	100						
75	0.070	50										
70	0.072	50										
65	0.074	50										
60	0.076	50										
55	0.078	50										
50	0.080	50										
	Min R 50m			Min R 80m			Min R 120m			Min R 170m		

	80 km/h			90 km/h			100 km/h			110 km/h			
R	e	L2	L4	e	L2	L4	e	L2	L4	e	L2	L4	R
8000	NC			NC			NC			NC			8000
5000	NC			NC			NC			RC	60	60	5000
3000	NC			RC	50	50	0.022	50	60	0.026	60	60	3000
2000	0.021	40	50	0.026	50	50	0.030	50	60	0.036	60	70	2000
1500	0.027	40	50	0.032	50	50	0.038	50	70	0.044	60	80	1500
1200	0.031	40	50	0.038	50	60	0.044	50	80	0.051	60	90	1200
1000	0.036	40	60	0.043	50	70	0.050	50	90	0.057	60	100	1000
900	0.039	40	60	0.046	50	80	0.053	50	90	0.061	60	110	900
800	0.042	40	60	0.049	50	80	0.057	50	100	0.065	60	120	800
700	0.046	40	70	0.053	50	90	0.061	60	110	0.070	70	130	700
650	0.048	40	70	0.056	50	90	0.063	60	110	0.073	80	130	650
600	0.050	40	80	0.058	50	100	0.066	60	110	0.076	80	130	600
550	0.053	40	80	0.061	50	100	0.069	70	120	0.079	90	140	550
500	0.056	50	80	0.064	50	100	0.072	70	120	0.080	90	140	500
475	0.058	50	90	0.066	60	110	0.074	80	130	Min R 530m			
450	0.059	50	90	0.068	60	110	0.076	80	130				
425	0.061	50	90	0.069	60	110	0.078	80	130				
400	0.063	50	100	0.071	70	120	0.079	90	140				
380	0.065	50	100	0.073	70	120	0.080	90	140				
360	0.066	50	100	0.075	70	120	Min R 390m						
340	0.068	60	100	0.077	80	120							
320	0.070	60	110	0.078	80	130							
300	0.072	60	110	0.080	90	130							
290	0.073	70	110	Min R 300m									
280	0.074	70	110										
270	0.075	70	110										
260	0.076	70	110										
250	0.077	70	120										
240	0.079	80	120										
230	0.080	80	120										
	Min R 230m												

e Max 0.08 m/m

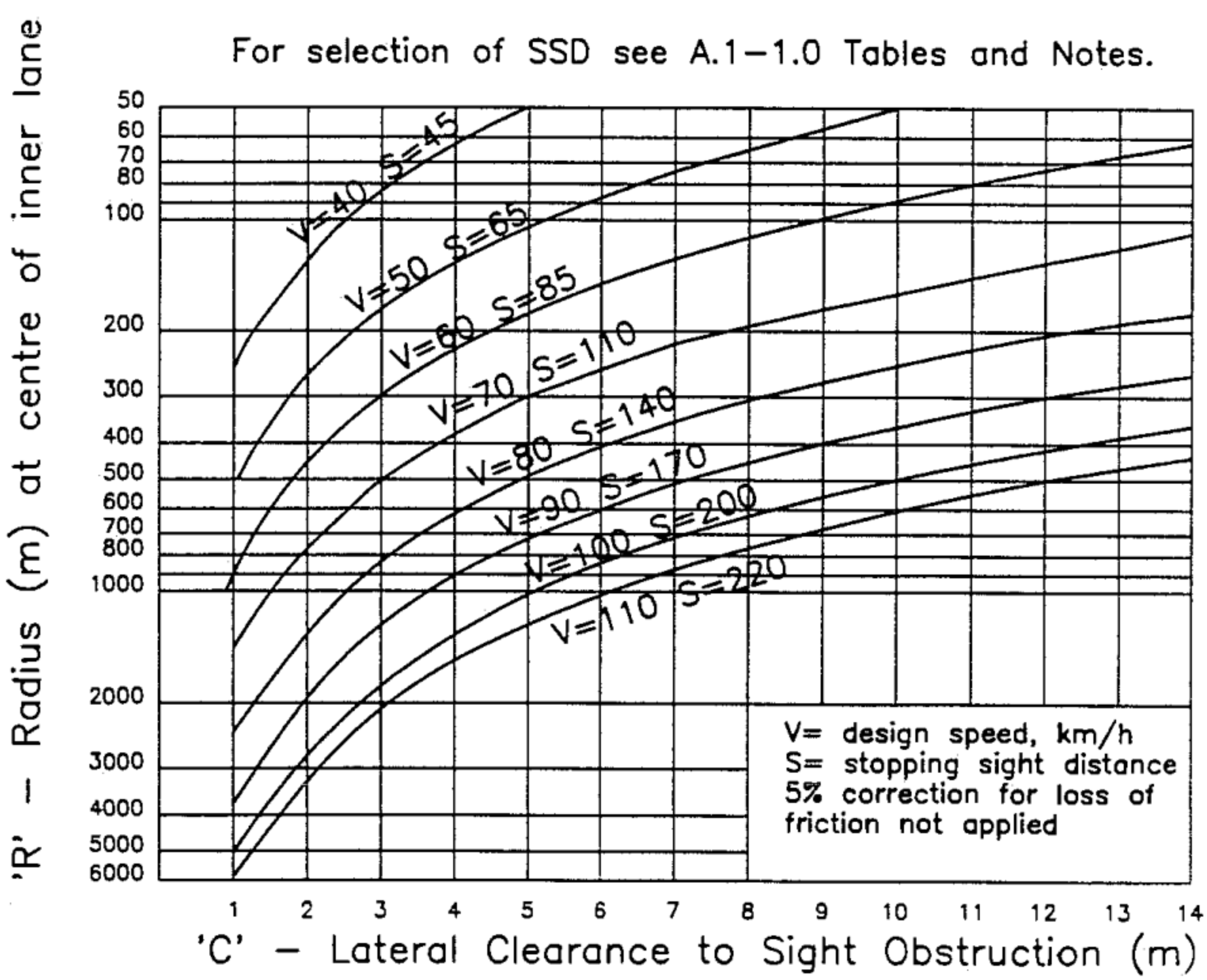
- e — Superelevation
- NC — Normal Crown Section
- RC — Remove adverse crown and superelevate at normal rate
- L2 — MINIMUM spiral for two lanes and ramps
- L4 — MINIMUM spiral for four lanes with up to 2.4m median

For 6 Lanes: above dashed line, use L4; below dashed line use L4 * 1.3 and round to the nearest 10m.



$$C = R\left(1 - \cos 28.65 \frac{SSD}{R}\right)$$

For selection of SSD see A.1–1.0 Tables and Notes.



APPROVED J. Lisman HIGHWAY SAFETY ENGINEER	MINISTRY OF TRANSPORTATION AND HIGHWAYS PROVINCE OF BRITISH COLUMBIA	DESIGN MANUAL
DATE 87–07 REVISED 88–07	LATERAL CLEARANCE FOR MINIMUM STOPPING SIGHT DISTANCE	A.2–2.1

The desirable minimum sight distance at driveways is as follows:-

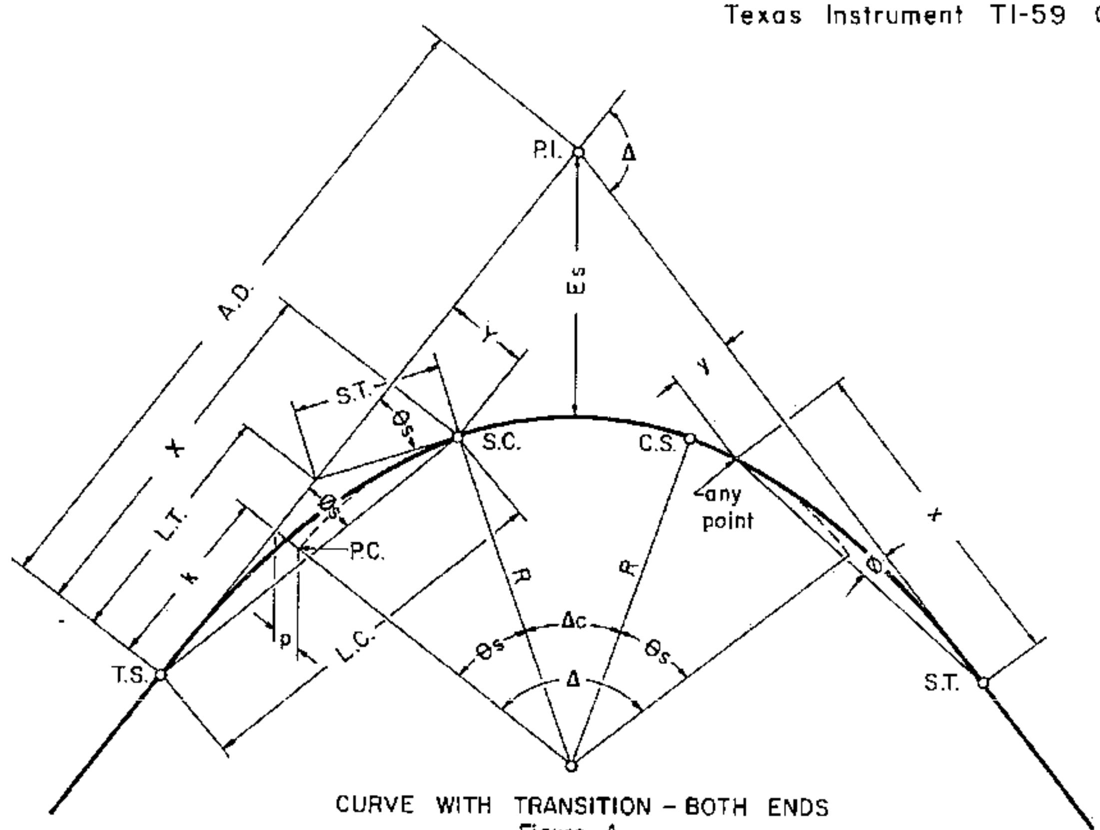
(a) Residential and Farm - 1.7 x Highway Speed in km/h.

(b) Commercial and Industrial - 2.8 x Highway Speed in km/h.

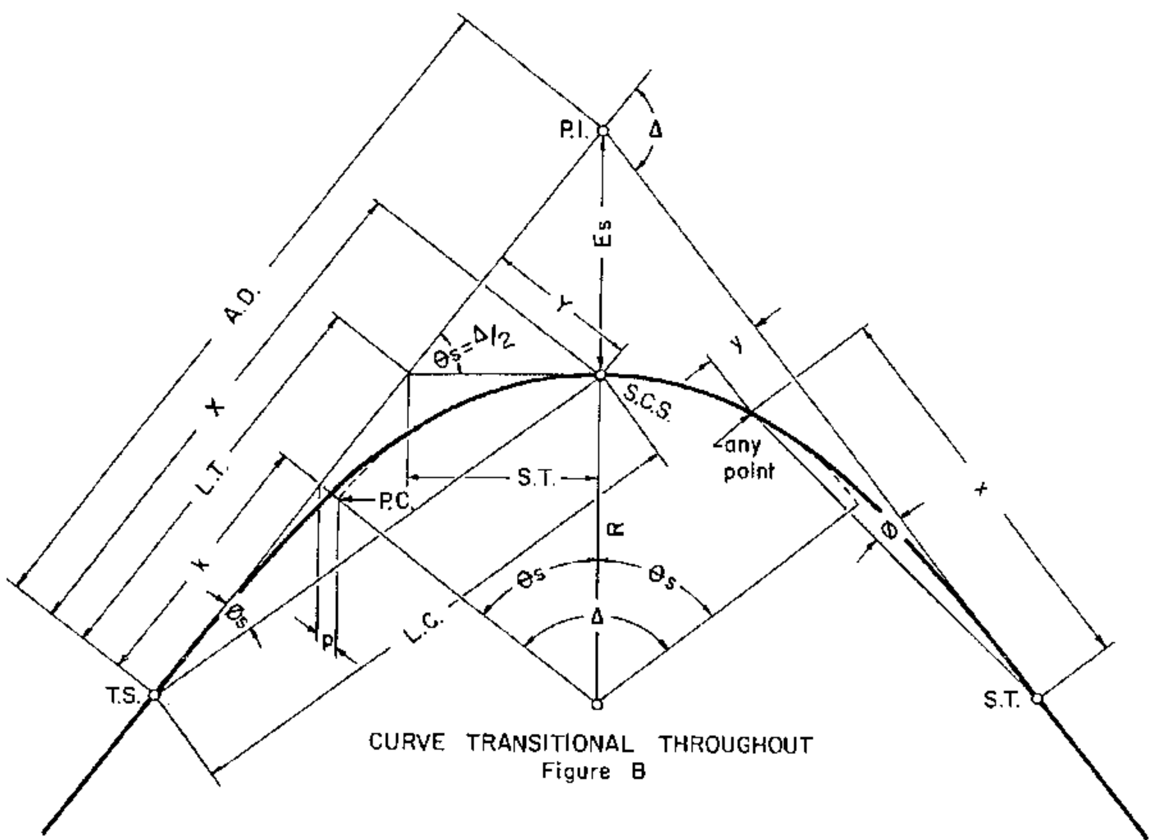
These two figures represent 6 and 10 second gaps, these being the minimum generally acceptable gaps for making left turns on to the highway. The highway speed is an anticipated low volume hour travelled speed, which may be greater than the posted speed.

The sight distance is measured along the highway from an eye height of 0.9 m placed 3.1 m from the lane edge, to an object 0.9 m high in whichever lane gives the least distance.

The standards are often critical on inside curves in cut.



CURVE WITH TRANSITION - BOTH ENDS
Figure A



CURVE TRANSITIONAL THROUGHOUT
Figure B

Nomenclature used in programming the Texas Instrument TI-59 Calculator.

TI 59	STANDARD		
PI	P.I.	Point of intersection of the main tangents	
TS	T.S.	Tangent to Spiral: common point of tangent and spiral - beginning of spiral	
SC	S.C.	Spiral to Curve: common point of spiral and circular curve - beginning of circular curve	
CS	C.S.	Curve to Spiral: common point of circular curve and spiral - end of circular curve	
ST	S.T.	Spiral to Tangent: common point of spiral and tangent - end of spiral	
SCS	S.C.S.	Mid-point of a curve which is transitional throughout	
R	R	Radius of the circular curve	
RS	r	Radius of a curve at any length on the spiral	
LS	Ls	Length of spiral between T.S. and S.C.	
L	ℓ	Length between any two points on the spiral	
AD	A.D.	Tangent distance P.I. to T.S. or S.T.; apex distance	
ES	Es	External distance from P.I. to centre of circular curve portion or to S.C.S. of a curve transitional throughout	
A	Arc	Length of circular curve from S.C. to C.S.	
I	Δ	Intersection angle between the tangents of the entire curve	
D	Δc	Intersection angle between tangents at the S.C. and at the C.S., or the central angle of a circular curve	
TH	θs	Spiral Angle: The intersection angle between the tangent of the complete curve and the tangent at the S.C.	
TH	θ	Intersection angle between tangent of complete curve and tangent at any other point on the spiral	
PH	øs	Deflection angle from tangent at T.S. to S.C.	
PH	ø	Deflection angle from tangent at any point on spiral to any other point on spiral	
LT	L.T.	Long tangent distance of spiral only	
ST	S.T.	Short tangent distance of spiral only	
LC	L.C.	Long chord of the spiral curve; distance from T.S. to S.C.	
P	P	Offset distance from the tangent of P.C. of circular curve produced	
K	k	Distance from T.S. to point on tangent opposite the P.C. of the circular curve produced	
XS, YS	X, Y	Coordinates of S.C. from T.S.	
X, Y	x, y	Coordinates of any other point on spiral from the T.S.	
T	Tc	Tangent distance P.I. to B.C. or E.C.	Circular Curve only
BC	B.C.	Beginning of curve	Circular Curve only
EC	E.C.	End of curve	Circular Curve only
A	Arc	Length of curve from B.C. to E.C.	Circular Curve only
D	Δc	Intersection angle between the tangents	Circular Curve only
E	Ec	External distance from P.I. to centre of curve	Circular Curve only

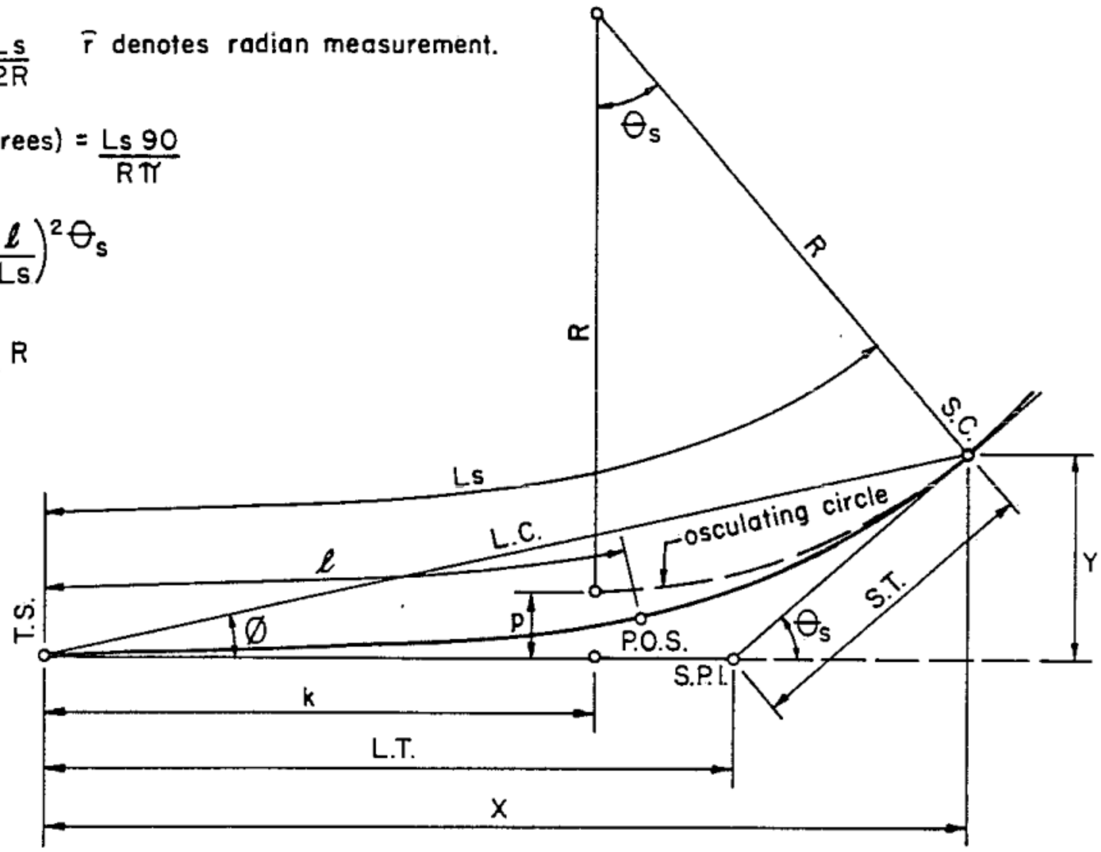
APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DIRECTOR DESIGN AND SURVEYS	TRANSITION AND CIRCULAR CURVE SYMBOLS	A.2 - 3.1
DATE 79-02-02 REVISED 80-11-05		

$\theta_{s\hat{r}} = \dfrac{Ls}{2R}$ $\quad \hat{r}$ denotes radian measurement.

$\theta_s \text{ (degrees)} = \dfrac{Ls\ 90}{R\pi}$

$\theta_\ell = \left(\dfrac{\ell}{Ls}\right)^2 \theta_s$

$r = \dfrac{Ls\ R}{\ell}$



$$X = Ls\left(1 - \frac{\theta_{s\hat{r}}^2}{5 \times 2!} + \frac{\theta_{s\hat{r}}^4}{9 \times 4!} - \frac{\theta_{s\hat{r}}^6}{13 \times 6!} + \text{---}\right)$$

For any point on the spiral substitute:

1. ℓ for Ls
2. $\theta_{\ell\hat{r}}$ for $\theta_{s\hat{r}}$

$$Y = Ls\left(\frac{\theta_{s\hat{r}}}{3 \times 1!} - \frac{\theta_{s\hat{r}}^3}{7 \times 3!} + \frac{\theta_{s\hat{r}}^5}{11 \times 5!} - \frac{\theta_{s\hat{r}}^7}{15 \times 7!} + \text{---}\right)$$

$$k = \frac{Ls}{2}\left(1 - \frac{\theta_{s\hat{r}}^2}{5 \times 3!} + \frac{\theta_{s\hat{r}}^4}{9 \times 5!} - \frac{\theta_{s\hat{r}}^6}{13 \times 7!} + \text{---}\right) = X - R \sin \theta_s$$

$$L.T. = X - \frac{Y}{\tan \theta_s}$$

$$p = \frac{Ls}{2}\left(\frac{\theta_{s\hat{r}}}{3 \times 2!} - \frac{\theta_{s\hat{r}}^3}{7 \times 4!} + \frac{\theta_{s\hat{r}}^5}{11 \times 6!} - \frac{\theta_{s\hat{r}}^7}{15 \times 8!} + \text{---}\right) = Y - R + R \cos \theta_s$$

$$S.T. = \frac{Y}{\sin \theta_s}$$

$$L.C. = \sqrt{X_s^2 + Y_s^2} \qquad \varnothing_s = \text{arc tan}\left(\frac{Y_s}{X_s}\right) = \frac{\theta_s}{3} - C_s \text{ where } C_s \text{ (in seconds)} = 0.0031\,\theta_s^3$$

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DATE 82-11-01 REVISED	SPIRAL FORMULAE	A.2-3.2

POLICY:

It is preferable to use a connecting spiral between two curves of different radii and mandatory when the radius of the flatter curve is more than 50% greater than the radius of the sharper curve.

PROCEDURE:

There are two distinct cases where a segmental spiral would be used. First, where the spiral is used to transition between the superelevation rates of the two curves. In this case the speed is uniform throughout the alignment. The second case is when the connecting spiral is primarily used for a speed-change facility, as between a highway curve and an interchange loop.

Case 1: 80 km/h; max. $e = 0.080$; $R1 = 600$ m; $R2 = 230$ m. What is La length? From superelevation chart A.2-1.2: Minimum Ls for $R = 230$ m is 80 m.

$$\text{Minimum segmental spiral (La)} = Ls(R1-R2)/R1 = 49.333 \text{ m}$$

Use La = 50 m *See Note

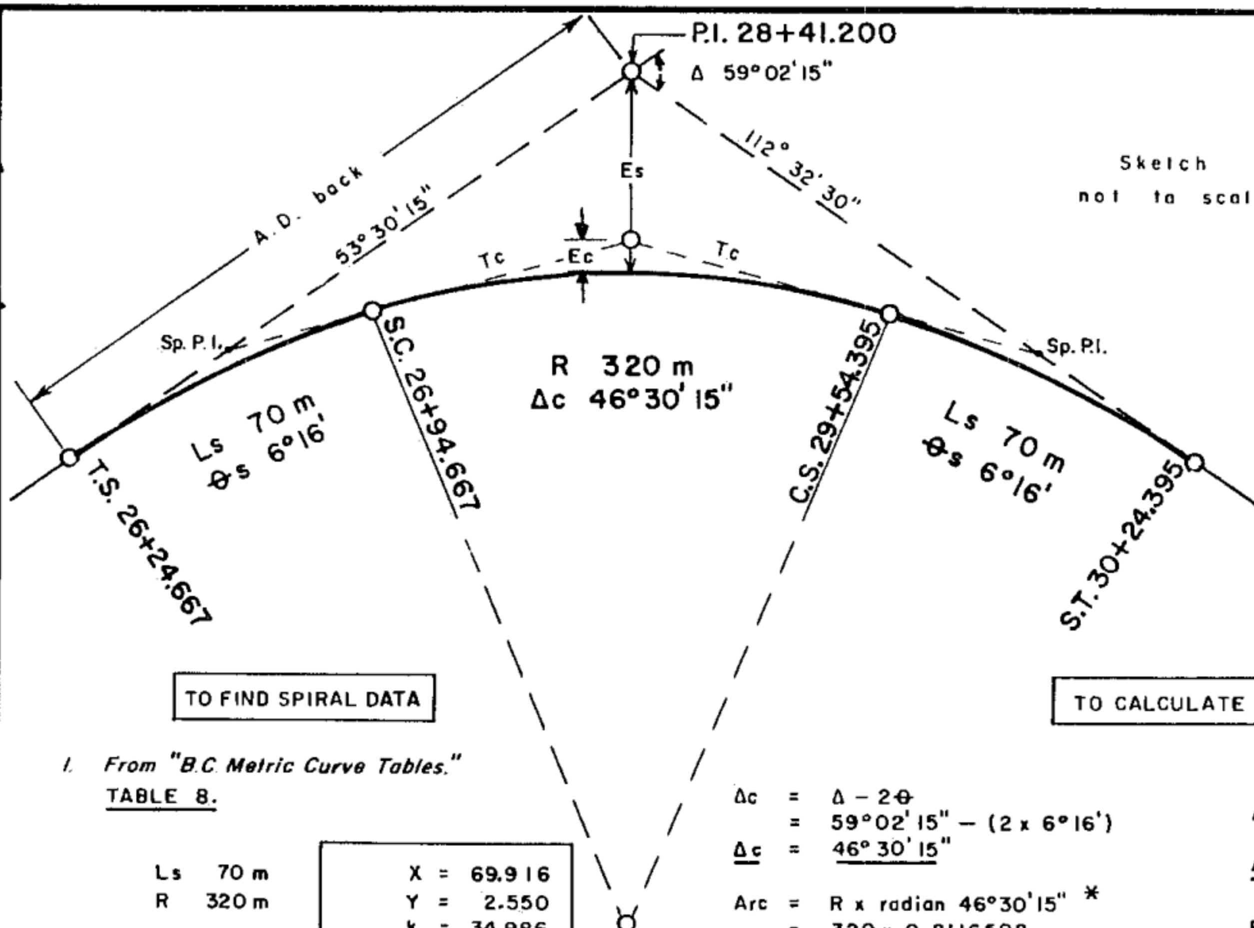
Case 2: 135 m of segmental spiral is required for deceleration from a highway curve of 250 m at 70 km/h to an interchange loop of 50 m at 40 km/h. What is the length of the total spiral?

From the above equation, $Ls = LaR1/(R1-R2) = 168.750 \text{ m}$

Note: Whenever a calculated La is rounded, the Ls generated by the new La length will have to be recalculated for the detailed calculations of the segmental spiral data.

Example: The new Ls length from Case 1 -

$$Ls = LaR1/(R1-R2) = 81.081 \text{ m}$$



Sketch not to scale

GIVEN

Design Speed 80 km/h
Radius 320 m
Ls 70 m
Δ 59°02'15"

FIND

Curve Data.

TO FIND SPIRAL DATA

1. *From "B.C. Metric Curve Tables."*
TABLE 8.

Ls	70 m	X =	69.916
R	320 m	Y =	2.550
		k =	34.986
		p =	0.638
		L.T.	46.696
Theta (θs) =	6° 16'	S.T. =	23.360
Phi (ϕs) =	2°05'19"	L.C. =	69.963

$$\text{Theta } (\theta s) = \frac{Ls}{2R}\left(\frac{180}{\pi}\right)$$

OR $\boxed{\theta s = \frac{Ls}{R}\left(\frac{90}{\pi}\right)}$

$$= \frac{70}{320}\ 28.6479 = 6.26673°$$

$$\theta s = 6°\,16'$$

TO CALCULATE CURVE DATA

$$\Delta c = \Delta - 2\theta$$
$$= 59°02'15" - (2 \times 6°16')$$
$$\Delta c = 46°30'15"$$

$$\text{Arc} = R \times \text{radian } 46°30'15" \ *$$
$$= 320 \times 0.8116508$$
$$\text{Arc} = 259.728$$

$$Tc = R \tan\frac{\Delta c}{2}$$
$$= 320 \times 0.429677$$
$$Tc = 137.497$$

$$Ec = \frac{R}{\cos\frac{\Delta c}{2}} - R$$
$$= 320 \div 0.918777 - 320$$
$$Ec = 28.289$$

$$A.D. = (R+p)\tan\frac{\Delta}{2} + k$$
$$A.D. = 216.533$$

$$Es = \frac{R+p}{\cos\frac{\Delta}{2}} - R$$
$$= \frac{320.638}{0.870195} - 320$$
$$Es = 48.467$$

* **NOTE**

$$1 \text{ degree} = \frac{\pi}{180} \text{ radian}$$
$$\therefore 46°30'15" = 46.5041667\left(\frac{\pi}{180}\right)$$
$$= 0.8116508 \text{ radian}$$

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B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

CIRCULAR CURVE WITH EQUAL SPIRAL TRANSITIONS

DESIGN MANUAL No A.2-4.1

CIRCULAR CURVE WITH UNEQUAL SPIRAL TRANSITIONS

B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

APPROVED
DIRECTOR DESIGN AND SURVEYS
DATE 79-06-06
REVISED 82-11-01

DESIGN MANUAL No. A.2 - 4.2

GIVEN: R 100
Δ 60°
Ls1 40
Ls2 75

FIND: A.D. ahd.
A.D. back
Curve data

From B.C. Metric Curve Tables
T.5 → L.S. 40, R 100

k_1	19.973
p_1	0.666
L.T.	26.723
S.T.	13.384
θ_{s1}	11° 27' 33"

$\underline{t} = R \tan\frac{\Delta}{2}$
$= 100 \tan 30°$
$= \underline{57.735}$

Not to scale

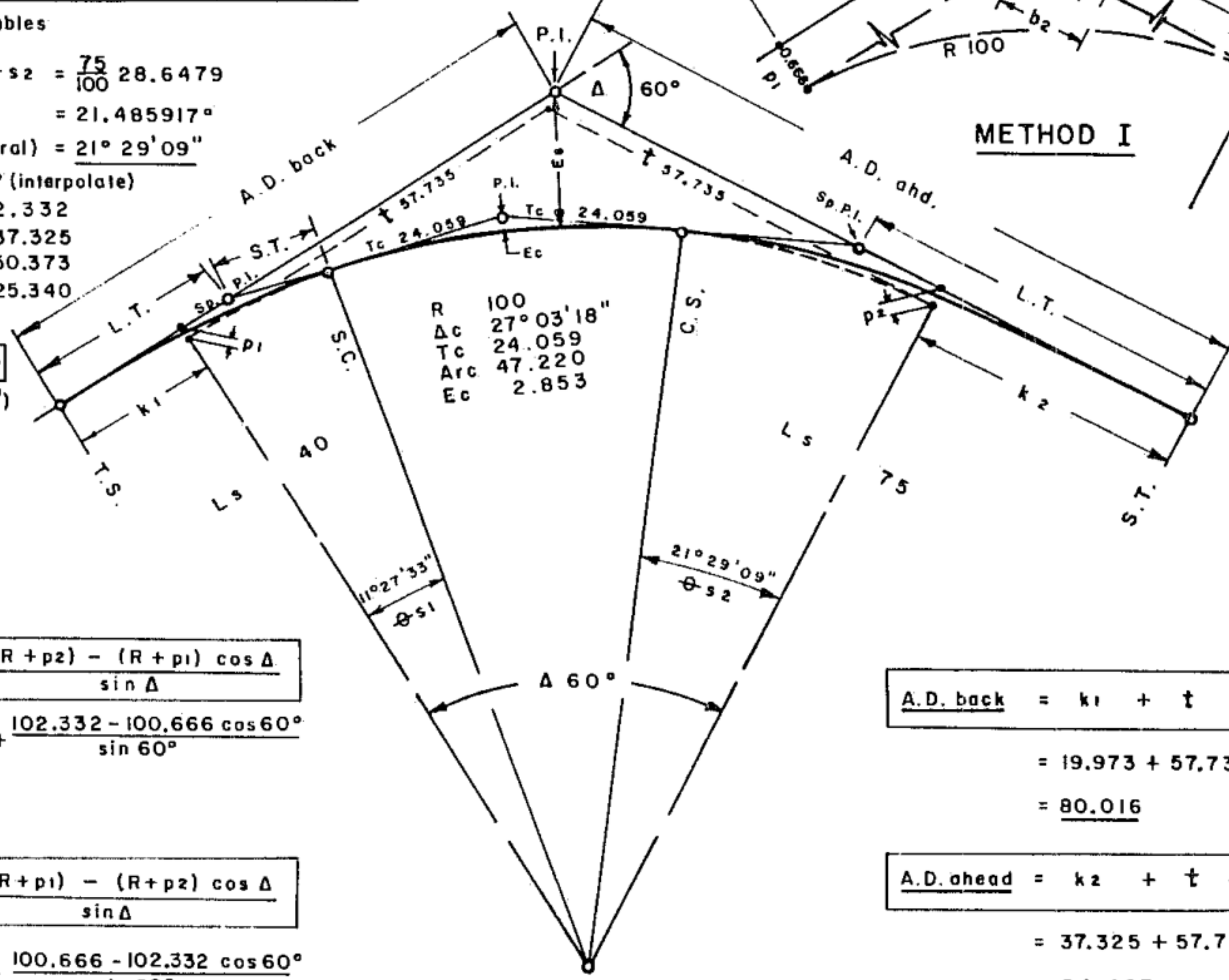
Ls 75 not given in Tables

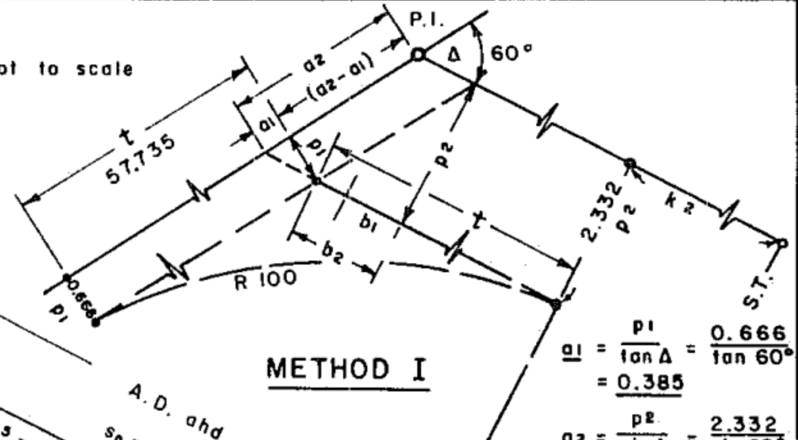
$\boxed{\theta_s = \frac{Ls}{R}\left(\frac{90}{\pi}\right)}$ $\therefore\ \theta_{s2} = \frac{75}{100}\,28.6479$
$= 21.485917°$

From Table C (Unit Spiral) = $\underline{21° 29' 09"}$

T. 71 → Theta 21.486° (interpolate)
p_2 0.031094 x 75 = 2.332
k_2 0.497666 x 75 = 37.325
L.T. 0.671645 x 75 = 50.373
S.T. 0.337863 x 75 = 25.340

$\boxed{\Delta c = \Delta - (\theta_{s1} + \theta_{s2})}$
$= 60° - (32°56'42")$
$= \underline{27° 03' 18"}$





METHOD I

$\underline{a_1} = \frac{p_1}{\tan\Delta} = \frac{0.666}{\tan 60°}$
$= \underline{0.385}$

$\underline{a_2} = \frac{p_2}{\sin\Delta} = \frac{2.332}{\sin 60°}$
$= \underline{2.693}$

$\underline{(a_2 - a_1)} = \underline{2.308}$

$\underline{b_1} = \frac{p_1}{\sin\Delta} = \frac{0.666}{\sin 60°}$
$= \underline{0.769}$

$\underline{b_2} = \frac{p_2}{\tan\Delta} = \frac{2.332}{\tan 60°}$
$= \underline{1.346}$

$\underline{(b_2 - b_1)} = \underline{0.577}$

$\boxed{\underline{\text{A.D. back}} = k_1 + t + (a_2 - a_1)}$
$= 19.973 + 57.735 + 2.308$
$= \underline{80.016}$

$\boxed{\underline{\text{A.D. ahead}} = k_2 + t - (b_2 - b_1)}$
$= 37.325 + 57.735 - 0.577$
$= \underline{94.483}$

METHOD II

$\boxed{\underline{\text{A.D. back}} = k_1 + \frac{(R + p_2) - (R + p_1)\cos\Delta}{\sin\Delta}}$
$= 19.973 + \frac{102.332 - 100.666 \cos 60°}{\sin 60°}$
$= \underline{80.016}$

$\boxed{\underline{\text{A.D. ahead}} = k_2 + \frac{(R + p_1) - (R + p_2)\cos\Delta}{\sin\Delta}}$
$= 37.325 + \frac{100.666 - 102.332 \cos 60°}{\sin 60°}$
$= \underline{94.483}$

$\boxed{\underline{Es} = \sqrt{(\text{A.D. back} - k_1)^2 + (R + p_1)^2} - R}$
$= \sqrt{(80.016 - 19.973)^2 + (100 + 0.666)^2} - 100 = \underline{17.213}$ (formula valid only if Es is on a Circular Curve)

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

THREE TRANSITION COMPOUND CURVE
— GENERAL LAYOUT —

DESIGN MANUAL No. A.2-4.4

EXAMPLE 1

Proceeding from flatter to sharper curve

GIVEN: $\Delta I = 42° 03'$
$R_1 = 600$
$R_2 = 230$
$Ls_1 = 50$
$Ls_2 = 80$
$La = 50$

FIND: All curve data

CASE 1

$\boxed{\Delta_1}$ and $\boxed{\Delta_2}$ are not given.

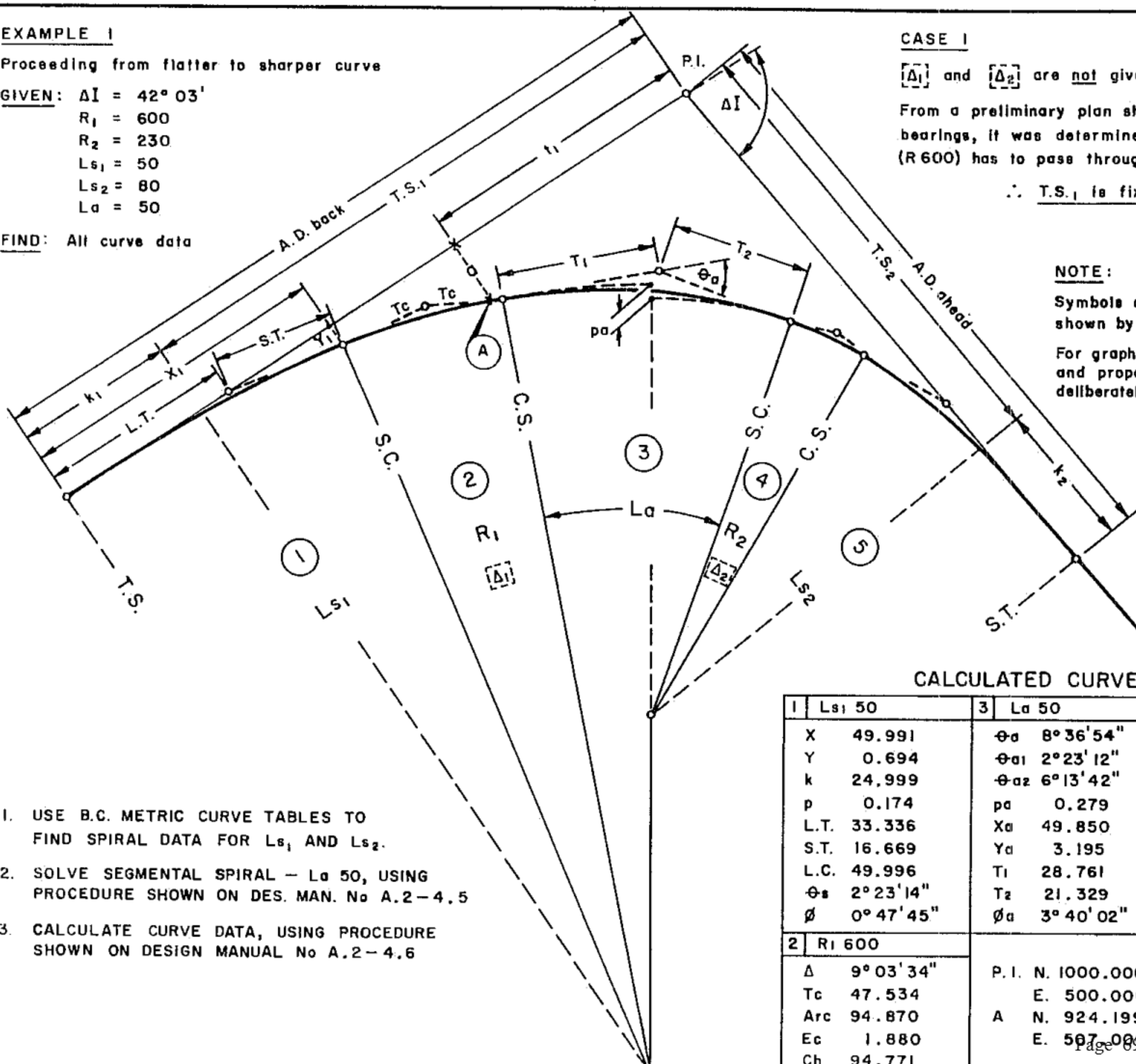
From a preliminary plan showing P.I., ΔI and bearings, it was determined that curve (2) (R 600) has to pass through point (A);

$\therefore$ T.S.$_1$ is fixed

NOTE:

Symbols and nomenclature as shown by Design Man. No A.2-3.1

For graphical reasons, scale and proportions are distorted deliberately.



1. USE B.C. METRIC CURVE TABLES TO FIND SPIRAL DATA FOR Ls_1 AND Ls_2.
2. SOLVE SEGMENTAL SPIRAL — La 50, USING PROCEDURE SHOWN ON DES. MAN. No A.2-4.5
3. CALCULATE CURVE DATA, USING PROCEDURE SHOWN ON DESIGN MANUAL No A.2-4.6

CALCULATED CURVE DATA

1	Ls_1 50
X	49.991
Y	0.694
k	24.999
p	0.174
L.T.	33.336
S.T.	16.669
L.C.	49.996
θ_s	2°23'14"
ϕ	0°47'45"

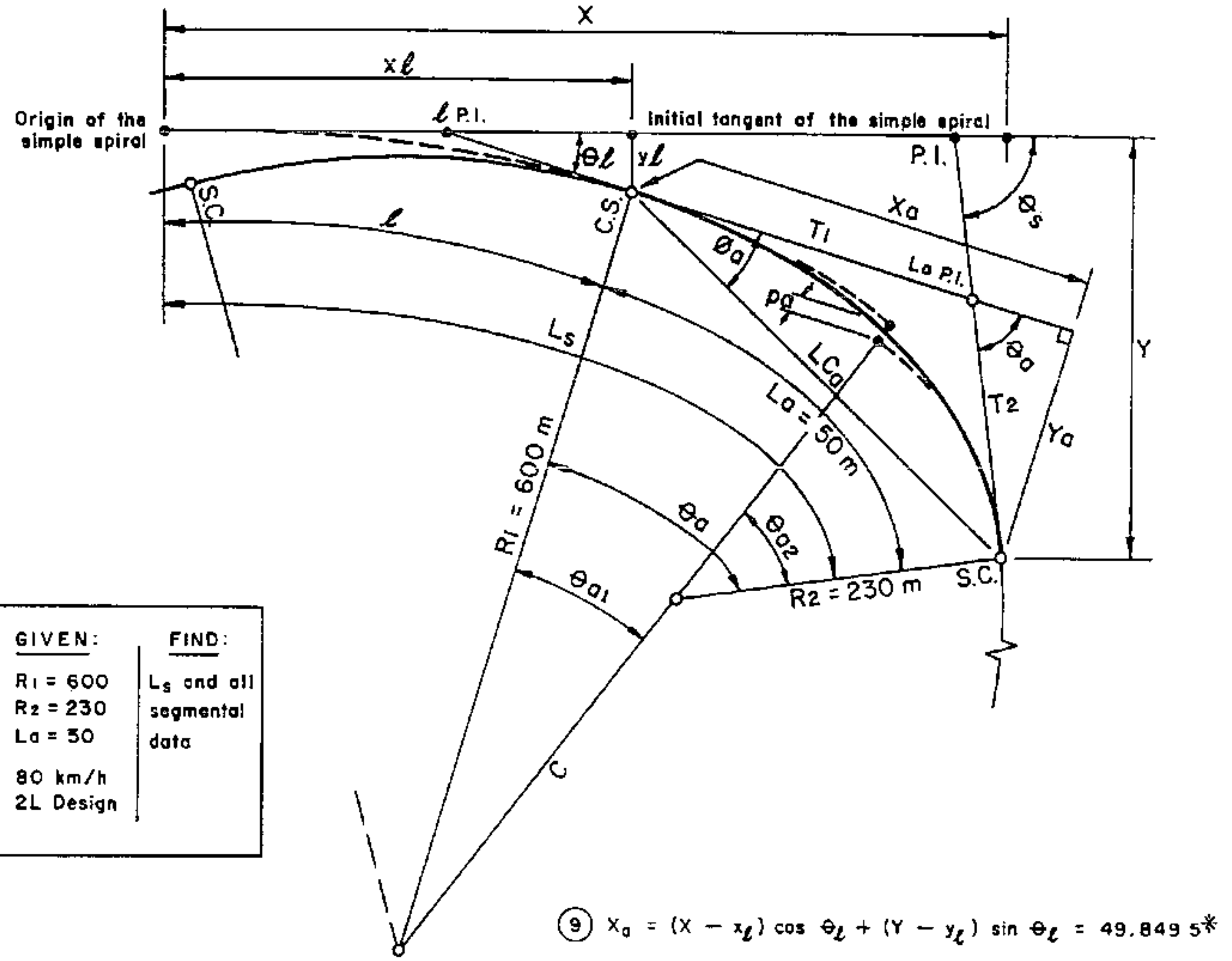
2	R_1 600
Δ	9°03'34"
Tc	47.534
Arc	94.870
Ec	1.880
Ch	94.771

3	La 50
θ_a	8°36'54"
θ_{a1}	2°23'12"
θ_{a2}	6°13'42"
pa	0.279
Xa	49.850
Ya	3.195
T_1	28.761
T_2	21.329
ϕ_a	3°40'02"

P.I.	N.	1000.000
	E.	500.000
A	N.	924.199
	E.	507.000

4	R_2 230
Δ	12°01'26"
Tc	24.222
Arc	48.267
Ec	1.272
Ch	48.178

5	Ls_2 80
X	79.758
Y	4.628
k	39.960
p	1.158
L.T.	53.418
S.T.	26.744
L.C.	79.893
θ_{s2}	9.575
ϕ_2	3°19'14"



GIVEN:	FIND:
R1 = 600 R2 = 230 La = 50 80 km/h 2L Design	Ls and all segmental data

(1) $L_a = 50$ (see A.2 – 3.3)

(2) $L_s = L_a\left(1 + \dfrac{R_2}{R_1 - R_2}\right) = 81.081$

(3) $\theta_s = \dfrac{L_s}{R_2} \times \dfrac{90}{\pi} = 10.099° = 10°05'57''$

(4) $\theta_a = L_a\left(\dfrac{1}{R_2} + \dfrac{1}{R_1}\right)\dfrac{90}{\pi} = 8.615° = 8°36'54''$

(5) $\ell = L_s - L_a = 31.081$

(6) $\theta_\ell = \dfrac{\ell}{R_1} \times \dfrac{90}{\pi} = 1.484° = 1°29'02''$

(7) From Unit Spiral Tables $\theta_s = 10.099°$
interpolate (or use spiral formulae A.2 – 3.2)
$X = 80.829 \quad Y = 4.753$

(8) From Unit Spiral Tables $\theta_\ell = 1.484°$
interpolate (or use spiral formulae A.2 – 3.2)
$x_\ell = 31.079 \quad y_\ell = 0.268$

(9) $X_a = (X - x_\ell)\cos\theta_\ell + (Y - y_\ell)\sin\theta_\ell = 49.8495$*

(10) $Y_a = (Y - y_\ell)\cos\theta_\ell - (X - x_\ell)\sin\theta_\ell = 3.1951$*

(11) $\theta_{a1} = \arctan\left(\dfrac{X_a - (R_2 \sin\theta_a)}{R_1 - [Y_a + (R_2\cos\theta_a)]}\right) = 2°23'12''$

(12) $\theta_{a2} = \theta_a - \theta_{a1} = 6°13'42''$

(13) $C = R_1 - R_2 - p_a$
$= \sqrt{[X_a - (R_2\sin\theta_a)]^2 + \{R_1 - [Y_a + (R_2\cos\theta_a)]\}^2}$
$= 369.721$

(14) $T_1 = X_a - \dfrac{Y_a}{\tan\theta_a} = 28.760$

(15) $T_2 = \dfrac{Y_a}{\sin\theta_a} = 21.330$

(16) $\phi_a = \arctan\left(\dfrac{Y_a}{X_a}\right) = 3°40'02''$

(17) $LC_a = \sqrt{X_a^2 + Y_a^2} = 49.952$

*For sufficient accuracy of T_1 and T_2, use at least 4 decimal places

APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DIRECTOR DESIGN AND SURVEYS	THREE TRANSITION COMPOUND CURVE – SEGMENTAL SPIRAL –	A.2 – 4.5
DATE 79 – 05 – 07 REVISED 82 – 11 – 01		

APPROVED

DIRECTOR DESIGN AND SURVEYS

DATE 79-05-07

REVISED 82-11-01

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS

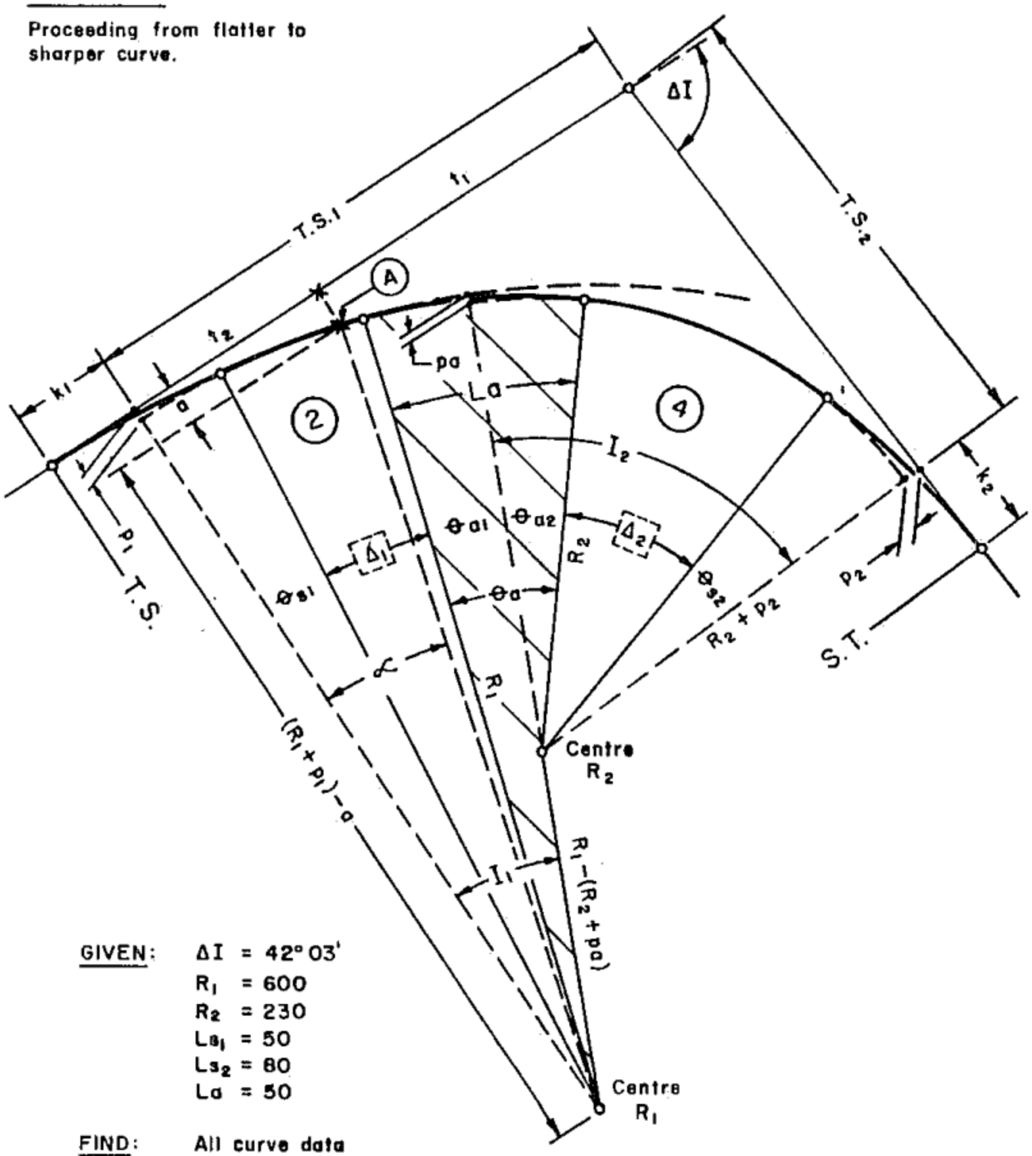
DESIGN AND SURVEYS BRANCH

THREE TRANSITION COMPOUND CURVE — CALCULATION —

DESIGN MANUAL No. A.2-4.6

EXAMPLE 1

Proceeding from flatter to sharper curve.



GIVEN:
$\Delta I = 42°03'$
$R_1 = 600$
$R_2 = 230$
$Ls_1 = 50$
$Ls_2 = 80$
$La = 50$

FIND: All curve data

FIGURE 2

CALCULATION PROCEDURE

Solve curve data for La (see Design Manual No A.2-4.5).

From coördinates of (A): $a = 7.0$ $t_1 = 75.801$

Centre of R_1 and T.S.$_1$ become fixed.

$$\cos\alpha = \frac{(R_1+p_1)-a}{R_1} = \frac{600.160-7.0}{600} \quad \therefore \alpha = 8°39'35''$$

$$t_2 = R_1 \sin\alpha = 600 \sin 8°39'35'' = 90.340$$

$$\text{T.S.}_1 = t_1 \ldots\ldots 75.801 + t_2 \ldots 90.340 = 166.141$$

$$\cos I_2 = \frac{\text{T.S.}_1 \sin\Delta I - (R_2+p_2) + (R_1+p_1)\cos\Delta I}{R_1 - R_2 - pa}$$

$$= \frac{166.141 \sin 42°03' - 231.158 + 600.174 \cos 42°03'}{369.7208}$$

$$I_2 = 28°13'00''$$

$$\boxed{\Delta_2} = I_2 - (\theta a_2 + \theta s_2)$$
$$= 28°13'00'' - (6°13'42'' + 9°57'52'')$$
$$= 12°01'26''$$

$$I_1 = \Delta I - I_2$$
$$= 42°03'00'' - 28°13'00''$$
$$= 13°50'00''$$

$$\boxed{\Delta_1} = I_1 - (\theta a_1 + \theta s_1)$$
$$= 13°50'00'' - (2°23'12'' + 2°23'14'')$$
$$= 9°03'34''$$

$$\text{T.S.}_2 = \frac{(R_1+p_1) - (R_2+p_2)\cos\Delta I - (R_1 - R_2 - pa)\cos I_1}{\sin\Delta I}$$

$$= \frac{600.174 - 231.158 \cos 42°03' - (369.721)\cos 13°50'}{\sin 42°03'}$$

$$= 103.807$$

AD back $= \text{T.S.}_1 + k_1 = 166.141 + 24.999 = 191.140$

AD ahead $= \text{T.S.}_2 + k_2 = 103.807 + 39.960 = 143.767$

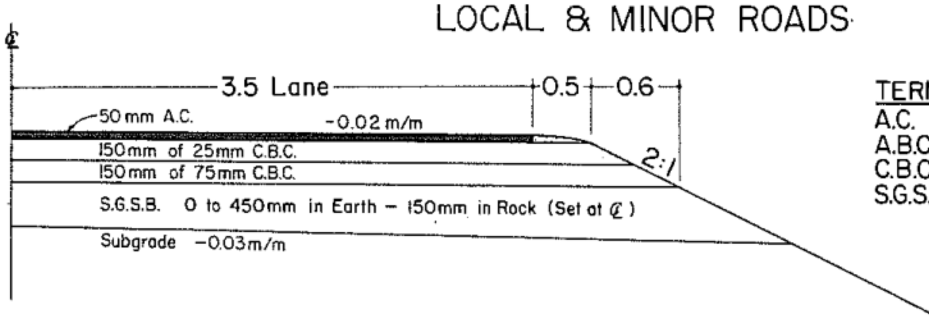
SECTION B

CROSS-SECTION ELEMENTS

B.1 TYPICAL SECTIONS

B.2 BARRIER PLACEMENT

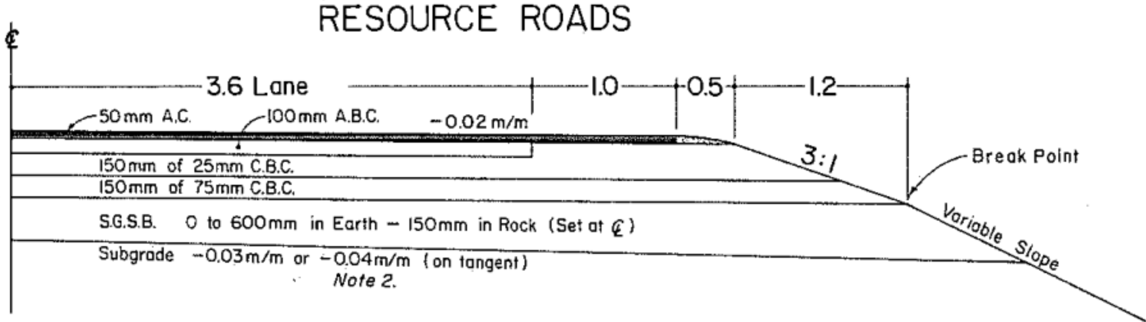
LOCAL & MINOR ROADS



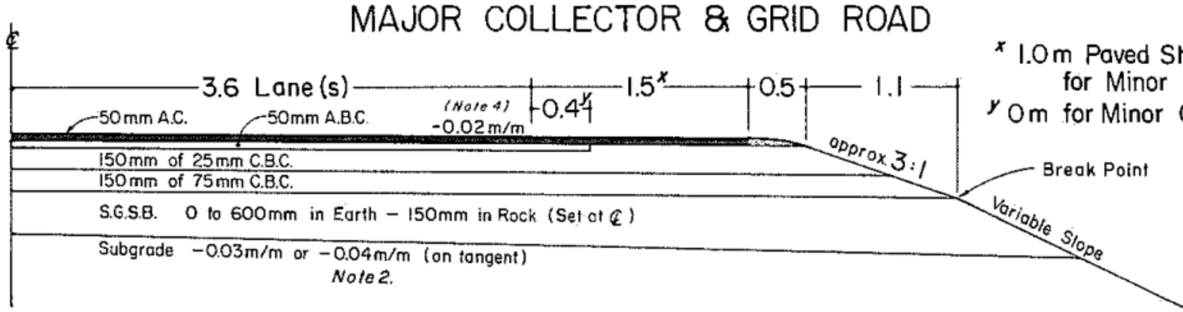
TERMS:

A.C.	Asphaltic Concrete
A.B.C.	Asphaltic Binder Course
C.B.C.	Crushed Base Course
S.G.S.B.	Select Granular Sub Base

RESOURCE ROADS



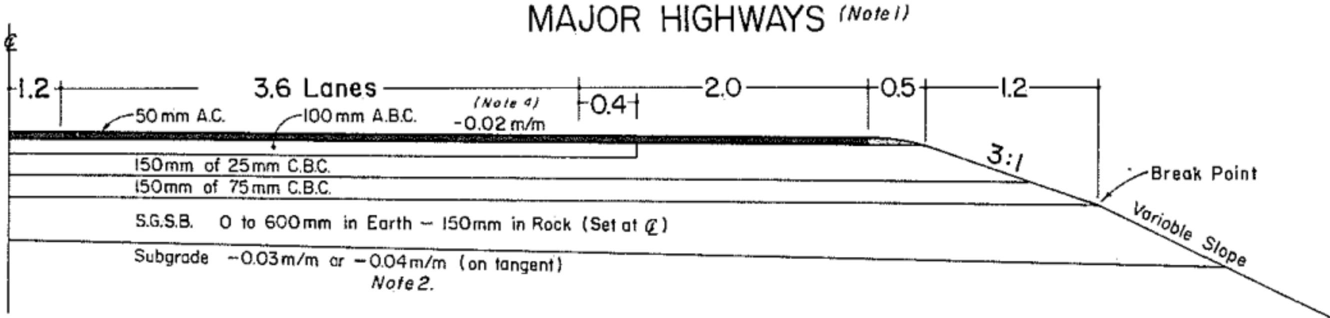
MAJOR COLLECTOR & GRID ROAD



x 1.0m Paved Shoulder for Minor Collector

y 0m for Minor Collector

MAJOR HIGHWAYS *(Note 1)*

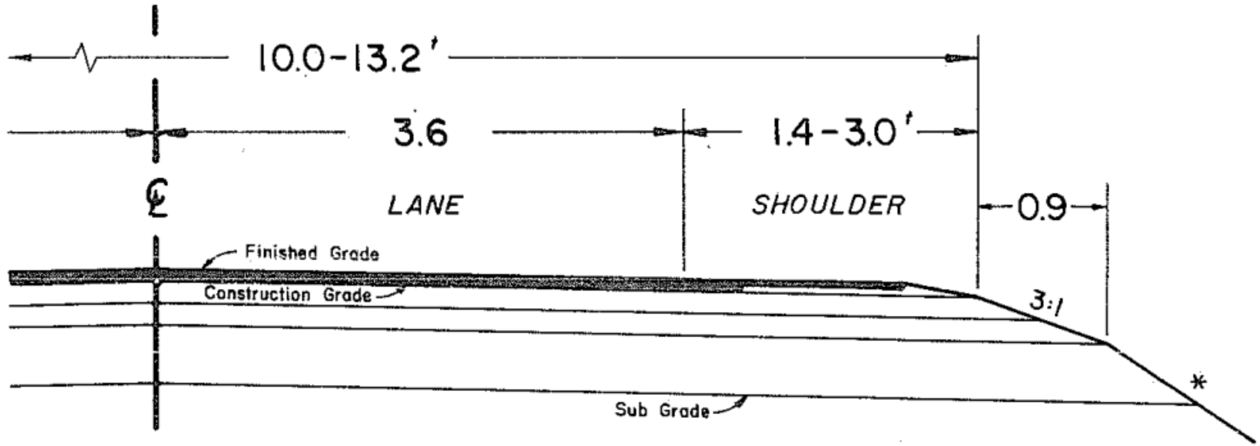


NOTE:

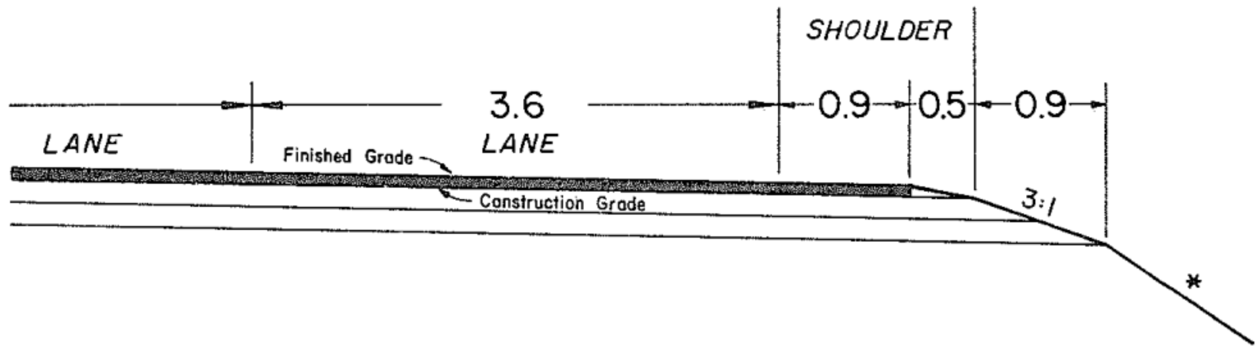
1. See B.1-5.0 for Expressway and Freeway details.
2. -0.04m/m to be used in Earth (wet conditions) only, or as directed by Geotechnical Branch.
3. See 'Cut' and 'Fill' Drawings for slope details.
4. Auxiliary lanes on a 4 lane design to have -0.03m/m pavement crossfall.

APPROVED MGElston EXECUTIVE DIRECTOR OF ENGINEERING	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH **TYPICAL SECTIONS** PAVEMENT, GRAVEL & SHOULDER DETAIL	DESIGN MANUAL No. **B.1-1.0**
DATE 1987.01.07 86-05-30 REVISED 87-01		

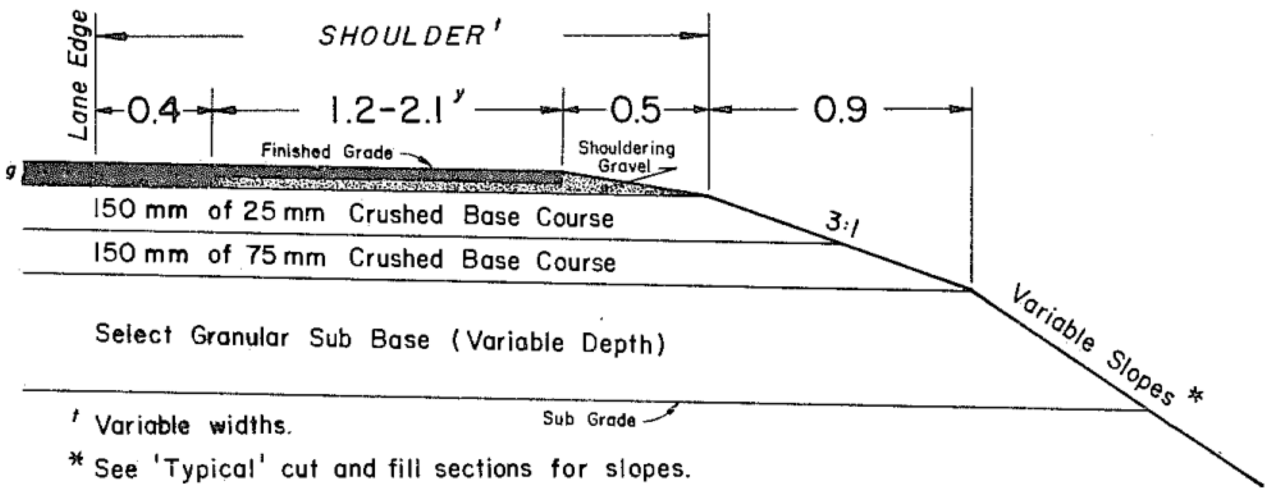
TYPICAL ROADWAY



TRUCK LANE



SHOULDER DETAIL



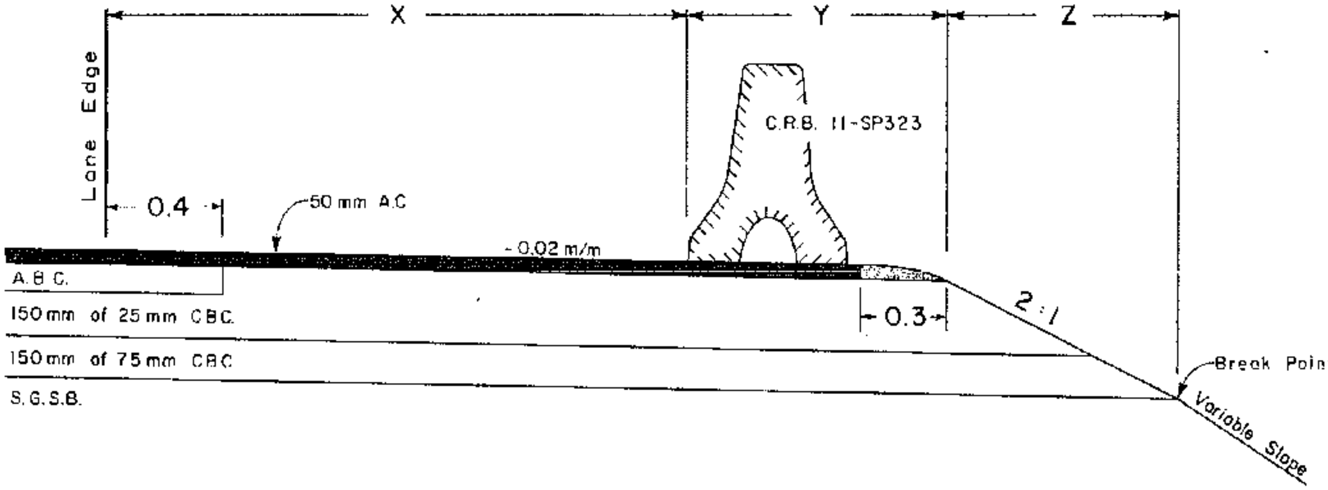
' Variable widths.

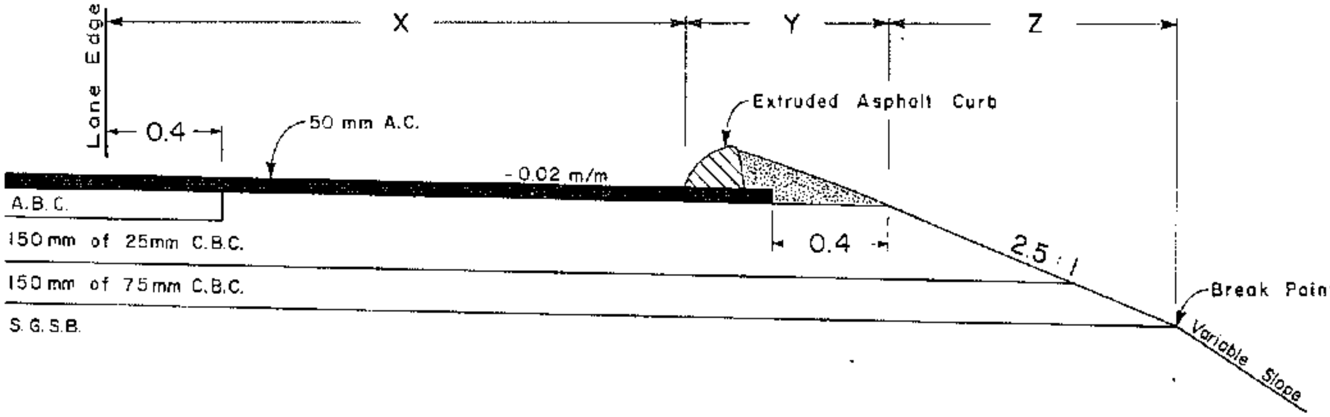
* See 'Typical' cut and fill sections for slopes.

y For widths 0.5 to 1.1 m use two (2) lifts of asphalt; 1.2 to 2.1 m use one (1) lift.

g 75 mm asphalt paving.

APPROVED (signature) DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 84 – 06 REVISED 85 – 02	TYPICAL SECTIONS (Paving & Shoulder Details)	B.I- I.O



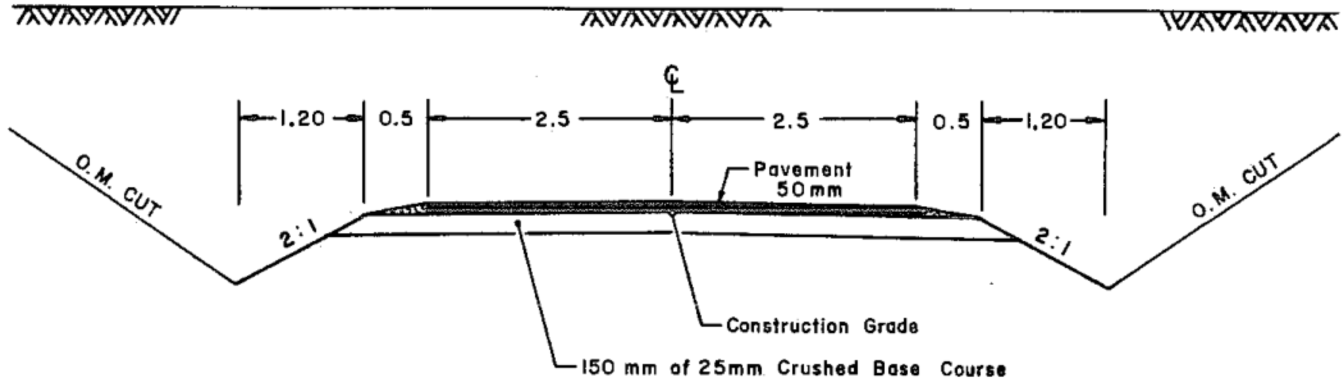


CLASSIFICATION	A.B.C. mm	X	C.R.B.		CURB	
			Y	Z	Y	Z
FREE / EXPRESSWAY	100	2.5	0.9	0.8	0.7	1.0
Mt. FREE / EXPRESSWAY	100	2.0	0.9	0.8	0.7	1.0
MAJOR HIGHWAY	100	2.0	0.9	0.8	0.7	1.0
MAJOR COLLECTOR	50	1.5	0.9	0.7	0.7	0.9*
MINOR COLLECTOR y	50	1.0	0.9	0.7	0.7	0.9*
RESOURCE ROAD	100	1.0	0.9	0.8	0.7	1.0

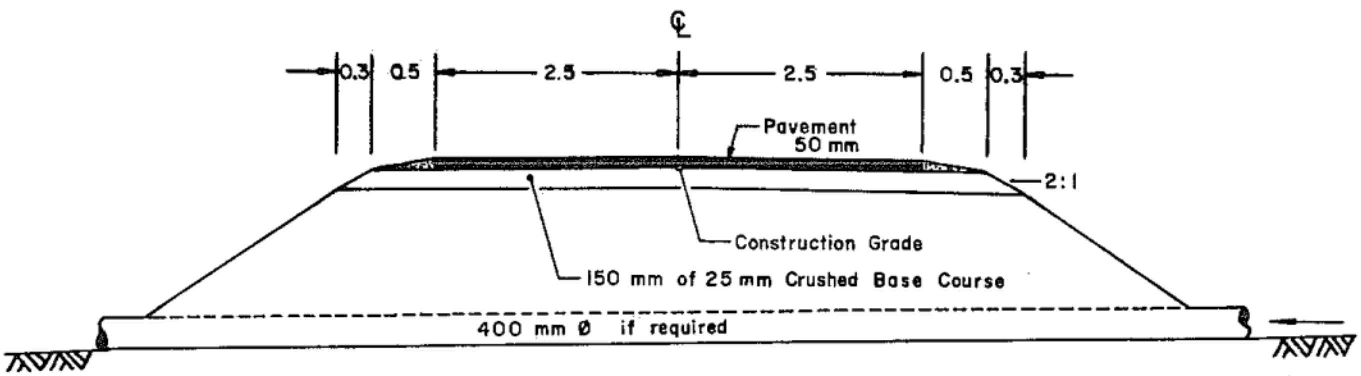
* 2.5:1 slope is approximate for collectors

y A.B.C. ends at lane edge for Minor Collector only

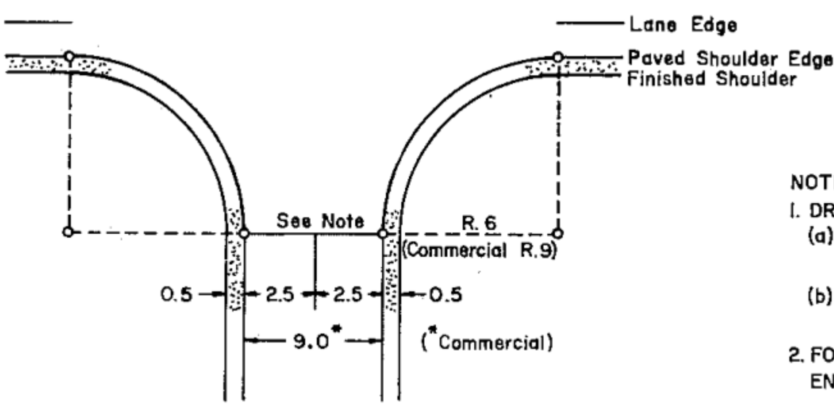
APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
MG Elston EXECUTIVE DIRECTOR OF ENGINEERING DATE 1987.01.06 87-01 REVISED	SHOULDER DETAIL WITH ROADSIDE BARRIER AND DRAINAGE CURB	B.1-1.2



TYPICAL CUT SECTION



TYPICAL FILL SECTION

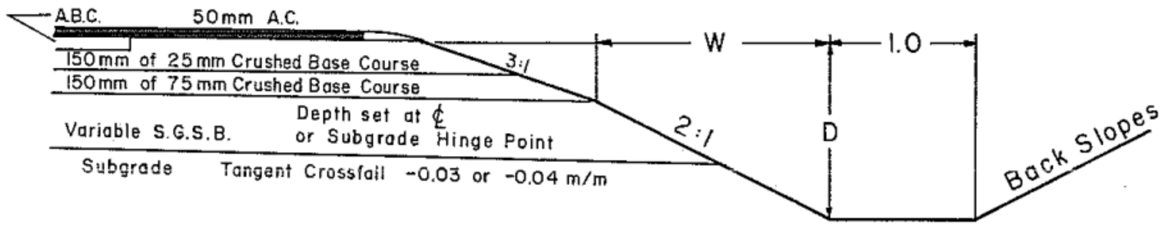


NOTES:

1. DRIVEWAY TO BE PAVED AS FOLLOWS:
   (a) Existing gravel access pave to end of radius.
   (b) Existing paved access all regrading to be paved.
2. FOR CONCRETE SIDEWALK & DRIVEWAY ENTRANCE DETAIL SEE 26-SP 219.

APPROVED DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 77-01-11 REVISED 87-01	**DRIVEWAYS**	B.1-1.3

MAJOR HIGHWAYS & ROADS



4 Lane Design

S.G.S.B. Depth (mm)	Subgrade Crossfall -0.03 m/m D (m)	-0.03 m/m W (m)	-0.04 m/m D (m)	-0.04 m/m W (m)
0 - 300	1.05	1.30	1.20	1.60
301 - 450	1.20	1.60	1.35	1.90
451 - 600	1.35	1.90	1.50	2.20

NOTE:

For 2 Lane Design, decrease 'D' by 0.15m and 'W' by 0.3m.

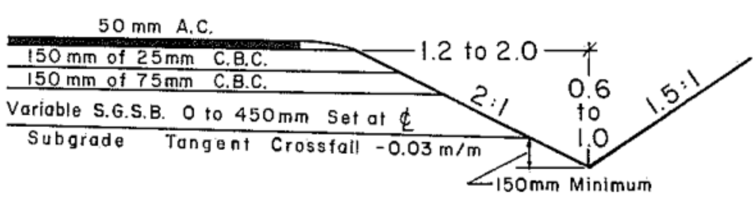
Auxiliary lanes, on a 4 Lane Design, to have -0.03 m/m pavement crossfall. 4 Lane 'D' and 'W' values to be used.

-0.04 m/m subgrade in Earth (wet conditions) only, or as directed by Geotechnical Branch.

Back Slopes
- 3:1 for up to 2.2m height;
- 3:1 for up to 2.7m height for less than 100m along alignment;
- 2:1 for 2.2-3.5m height except as stated above;
- 2:1 for 2.7-4.0m height for less than 100m along alignment;
- 1.5:1 for greater than 3.5m height except as stated above.

Cut height is the vertical distance from the outside ditch point to the top of the cut (toe).

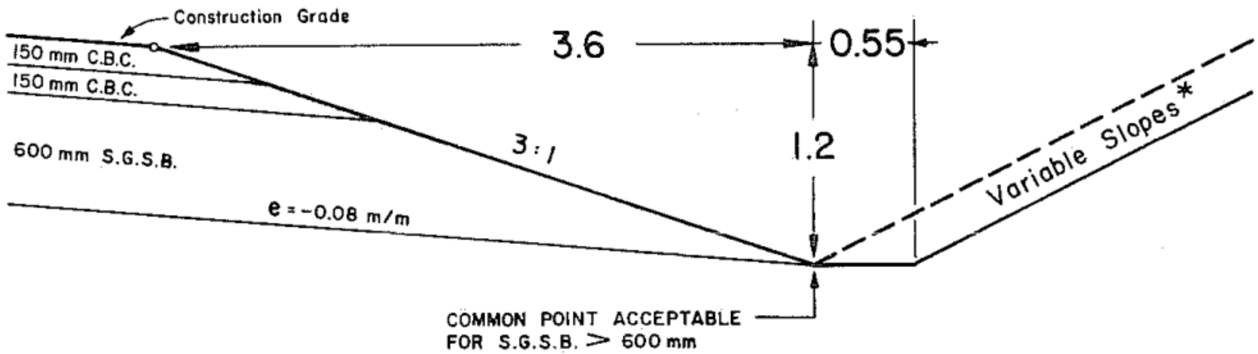
MINOR ROADS



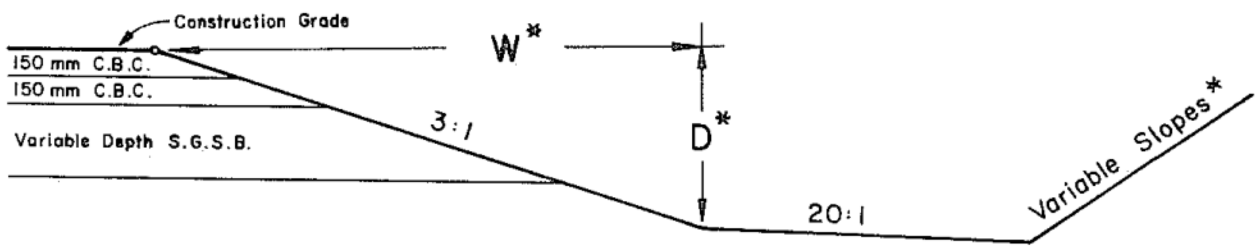
APPROVED [signature] DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	
DATE 86-05	**EARTH CUT SECTIONS**	**BI-2.0**
REVISED 87-01		

DITCH DETAIL

(DEEP GRAVEL AND SUPERELEVATION)



SIDE BORROW

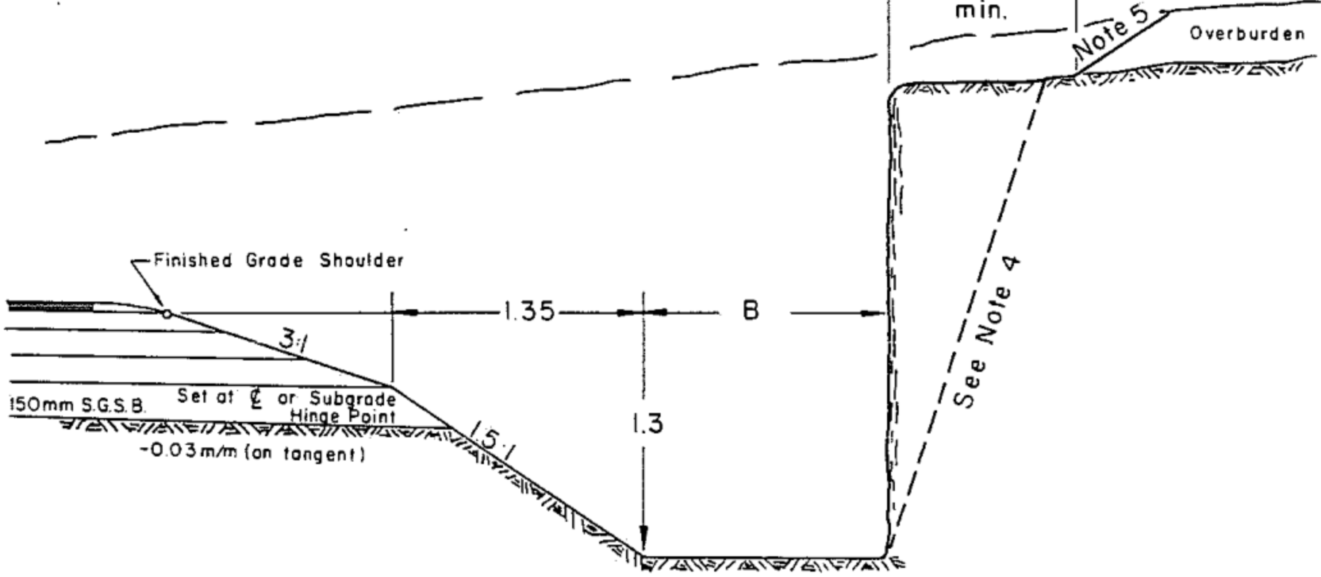


NOTE: To be used where terrain applicable.

* See D/M № B.1-2.0 for slopes and ditch widths & depths.

APPROVED E. E. Lendel [signature] DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 84-06 REVISED 85-02	TYPICAL CUT SECTIONS (Deep Gravel & Side Borrow)	B.1-2.1

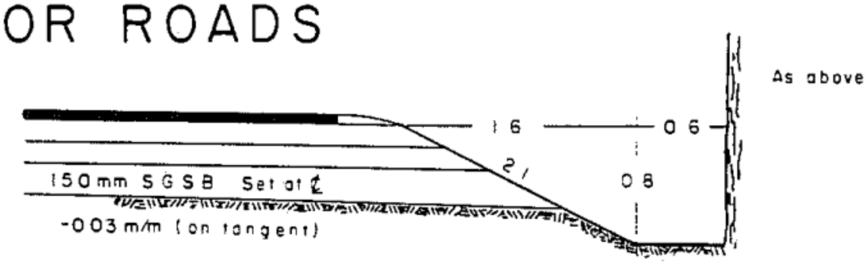
MAJOR HIGHWAYS & ROADS



Ditch Bottom Width: 'B'

1.25m – cut height less than 8m;
1.25m – cut height up to 10m for less than 100m along alignment;
2.75m – cut height of 8m or more except as stated above.

MINOR ROADS



NOTES:

1. Rock cut height is measured from the outside ditch point to the top of the rock face.
2. All rock cuts to be excavated to subgrade line.
3. A geological investigation is to be carried out for all cuts greater than 8m.
4. Use vertical backslope unless flatter slope is required by geological investigation.
5. Overburden slope is normally 1.5:1, but can be variable, depending on the type of material.

APPROVED

DIRECTOR DESIGN AND SURVEYS

DATE 86-05

REVISED 87-07

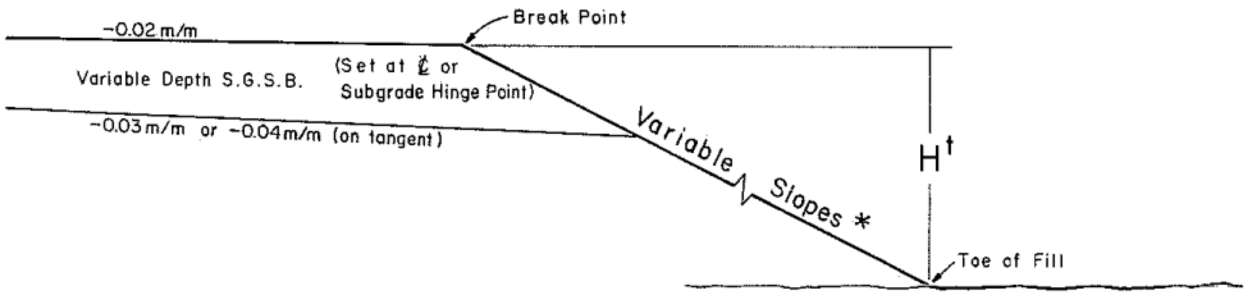
B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

SOLID ROCK CUT SECTION

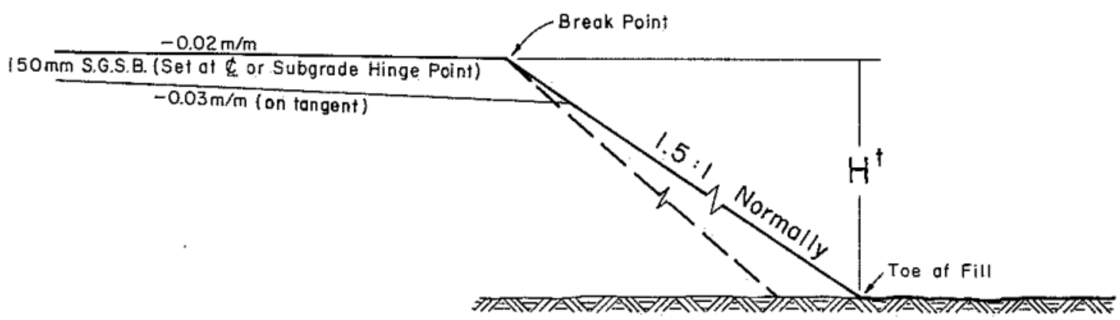
DESIGN MANUAL No

B.1-2.2

EARTH



ROCK



† Fill height (H) is the vertical distance from the break point (Bottom of Base Course Layers at the shoulders) to the toe.

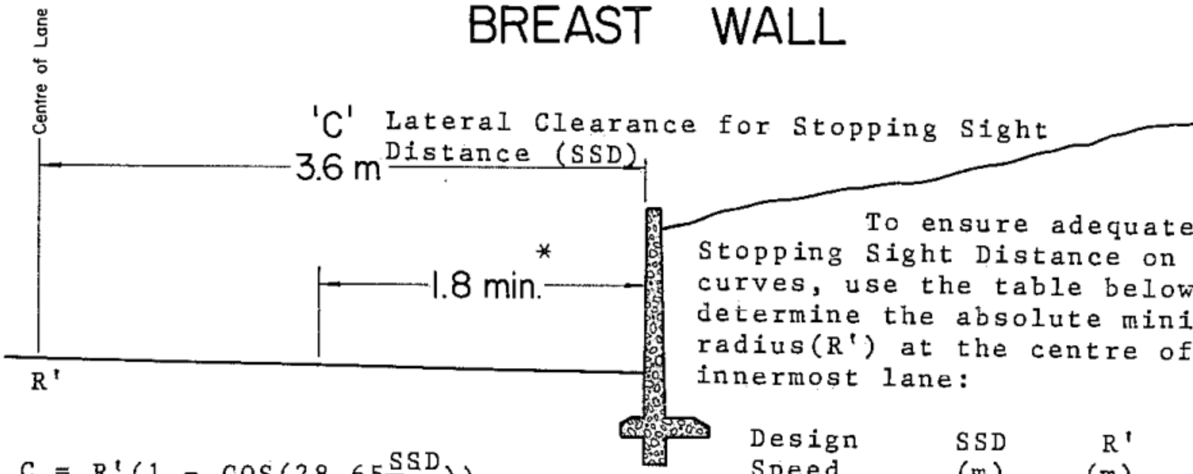
* <u>EARTH</u> 3:1 slope for up to 2.2 m height;
3:1 slope for up to 2.7 m height for less than 100 m along alignment;
2:1 slope for 2.2 – 3.5 m height except as stated above;
2:1 slope for up to 4.0 m height for less than 100 m along alignment;
1.5:1 slope for greater than 3.5 m height except as stated above.
Minor Roads: 2:1 slope for up to 2.2 m height; 1.5:1 slope for 2.2 m height or more.

<u>ROCK</u> 1.5:1 slope normally; 1.25:1 minimum for special cases.

Consideration can be given to using 4:1 cut and fill slopes (earth only) in flat country.

APPROVED DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 84-06 REVISED 87-01	TYPICAL FILL SECTIONS (Earth & Rock)	B.1-2.3

BREAST WALL



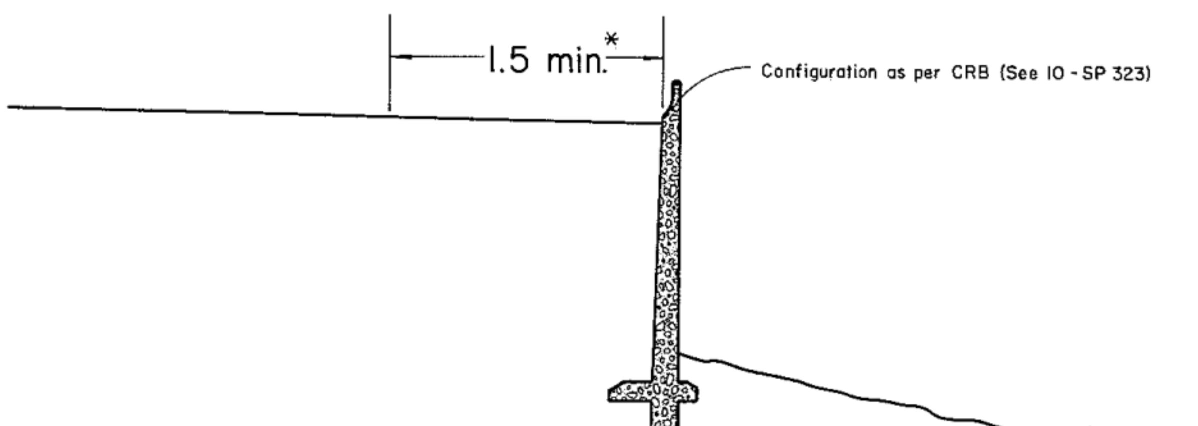
To ensure adequate Stopping Sight Distance on inside curves, use the table below to determine the absolute minimum radius(R') at the centre of the innermost lane:

Design Speed	SSD (m)	R' (m)
50	56.96	112
60	74.93	194
70	96.25	321
80	119.41	495
90	145.68	736
100	169.81	1000
110	195.22	1323

$$C = R'\left(1 - \cos\left(28.65\frac{SSD}{R'}\right)\right)$$

Use this formula for solving 'C'

RETAINING WALL

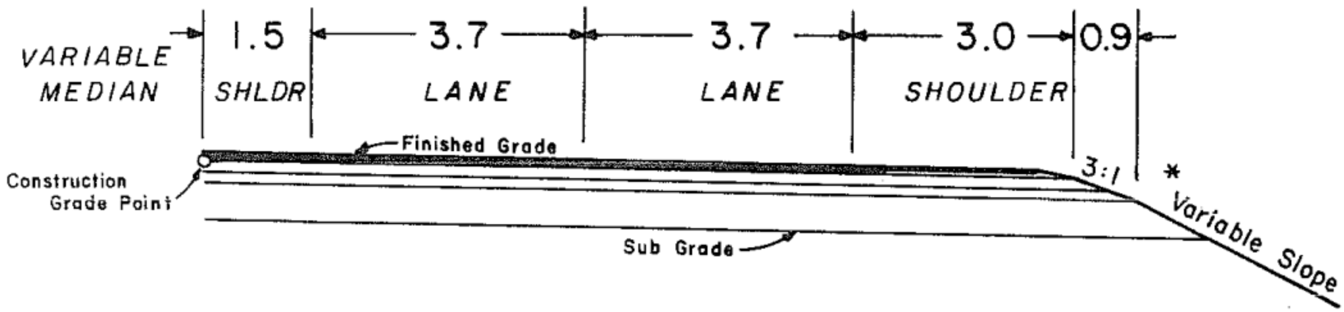


* Desirable width is same as project paved shoulder.

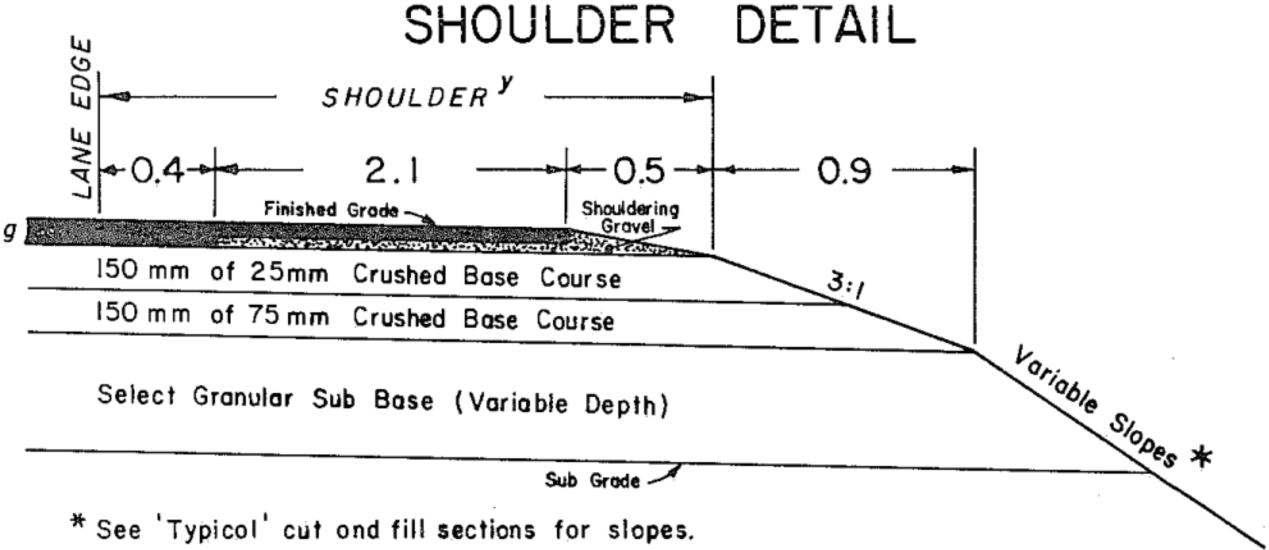
This drawing is for lateral clearance only. Consult other sources for wall designs.

APPROVED DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 87 – 01 REVISED	TYPICAL WALL SECTIONS	B.1-2.4

TYPICAL FREEWAY



SHOULDER DETAIL

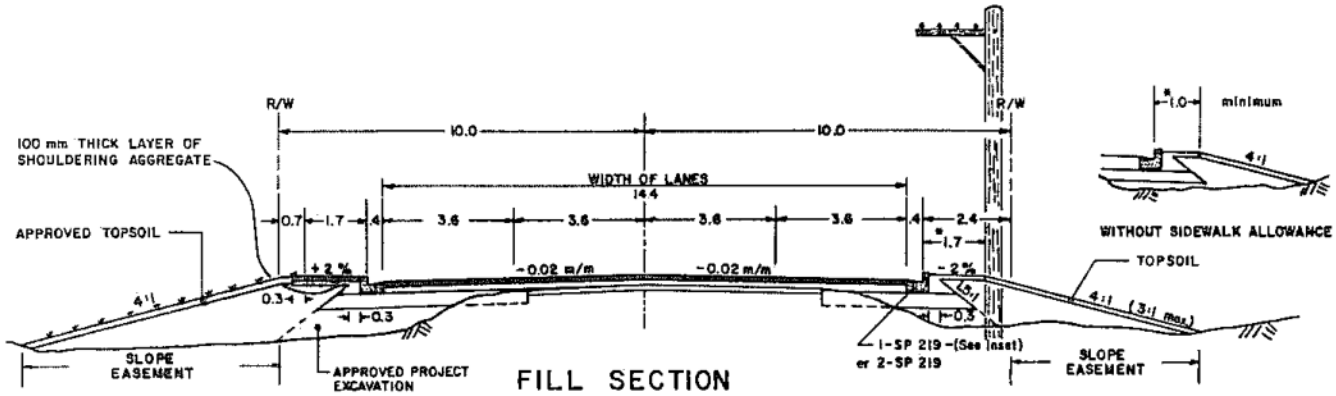


* See 'Typical' cut and fill sections for slopes.

y Use two (2) lifts of asphalt for 0.4 m; one (1) lift for 2.1 m; gravel for 0.5 m.

g Asphalt paving; 1 lift = 40mm, 2 lifts = 75mm.

APPROVED DIRECTOR DESIGN AND SURVEYS	B. C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No
DATE 85-02 REVISED	TYPICAL FREEWAY SECTIONS (Laning, Paving & Shoulder Details)	B.1-3.0



FILL SECTION

SLOPE DETAILS

When Slope Easements Cannot be Obtained, Construct wall or Obtain R/W Required to Contain Slope as Follows:

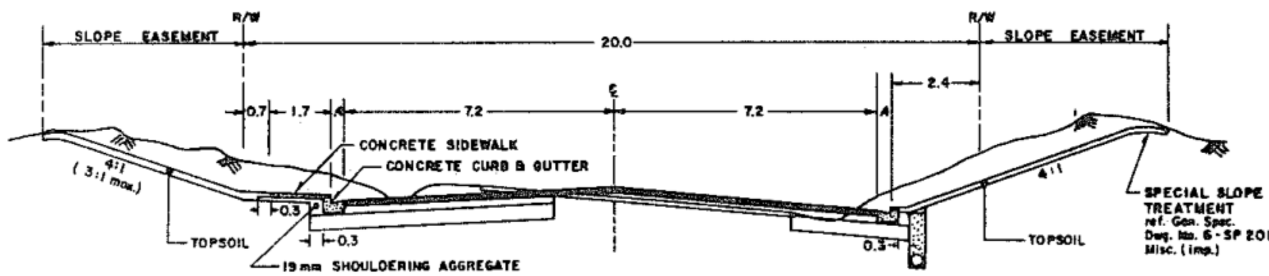
- 2:1 when cut/fill is 0 to 3.5 m above/below top of curb
- 1.5:1 " " " " over 3.5 m " " " " "

Topsoil all cuts and fills.

- 150 mm thick on slopes 3:1 or flatter
- 100 mm thick on slopes 2:1 or steeper

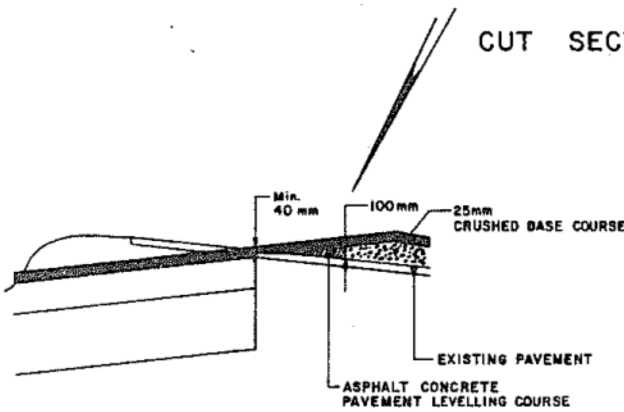
LANE DETAILS

1. Two way left turn lane:
   - used when design speed is 60 km/h or less.
   - minimum width 3.6 m.
2. Raised median 4.6 m.
3. Increase outside curb lane to 3.8 m when design speed is 70-80 km/h
4. Increase inside lane to 4.0 m when adjacent to raised median.
5. Parking lane 2.5 m.



CUT SECTION

SUB-DRAIN - as required
- Dwg. No. 6-SP 210

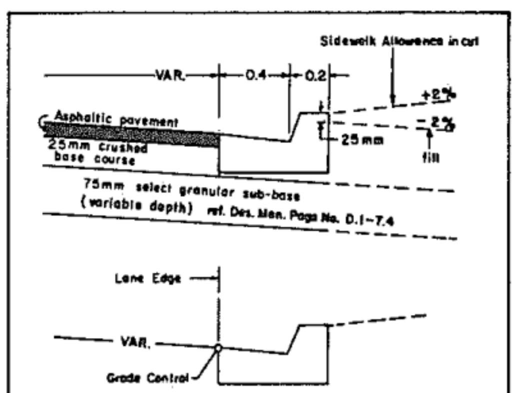


PAVEMENT OVERLAY

(WHERE EXISTING STRENGTH PERMITS)

NOTES:

- GRIND PAVEMENT WHERE APPLICABLE -
- MINIMUM RESIDUAL PAVEMENT 35 mm THICK-
- MINIMUM OVERLAY THICKNESS 40 mm.-
- IF THE INTERSECTION OF PAVEMENTS CAUSE WATER ENTRAPMENT, REMOVE ENOUGH EXISTING PAVEMENT TO PROVIDE DRAINAGE.

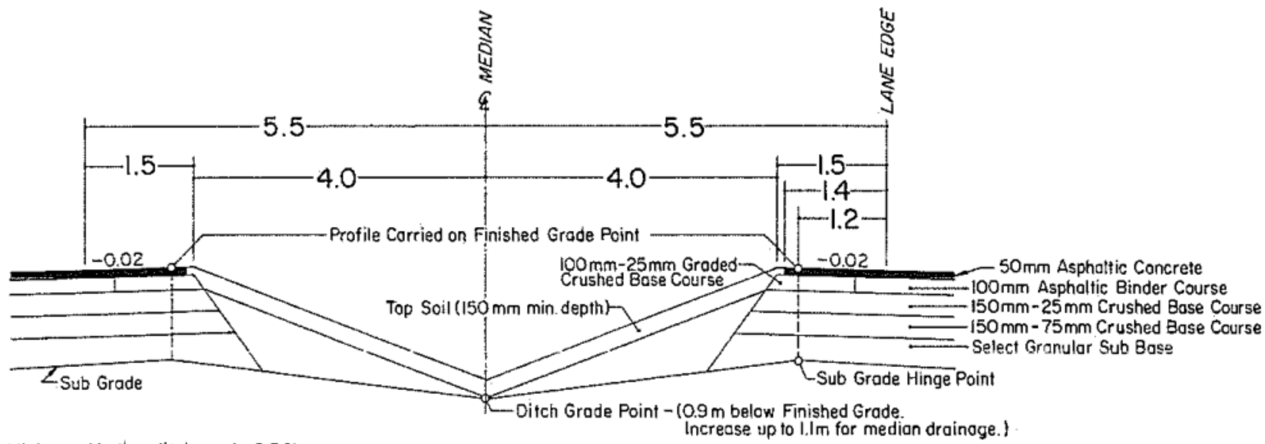


INSET

ALL DIMENSIONS IN METRES
UNLESS OTHERWISE SPECIFIED

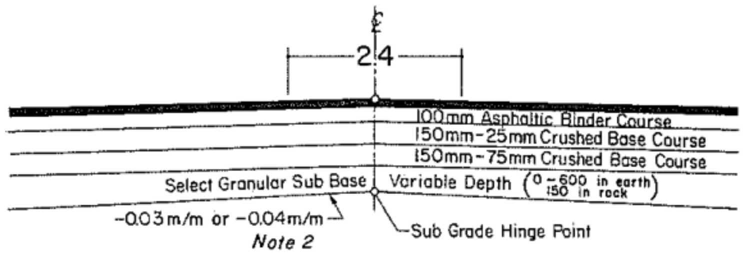
APPROVED BY	BRITISH COLUMBIA MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
M G Elston EXECUTIVE DIRECTOR OF ENGINEERING	URBAN ARTERIAL TYPICAL SECTIONS	B.1-4.0
DATE 84 - 06		
REVISED 85 - 02		

MINIMUM DEPRESSED MEDIAN

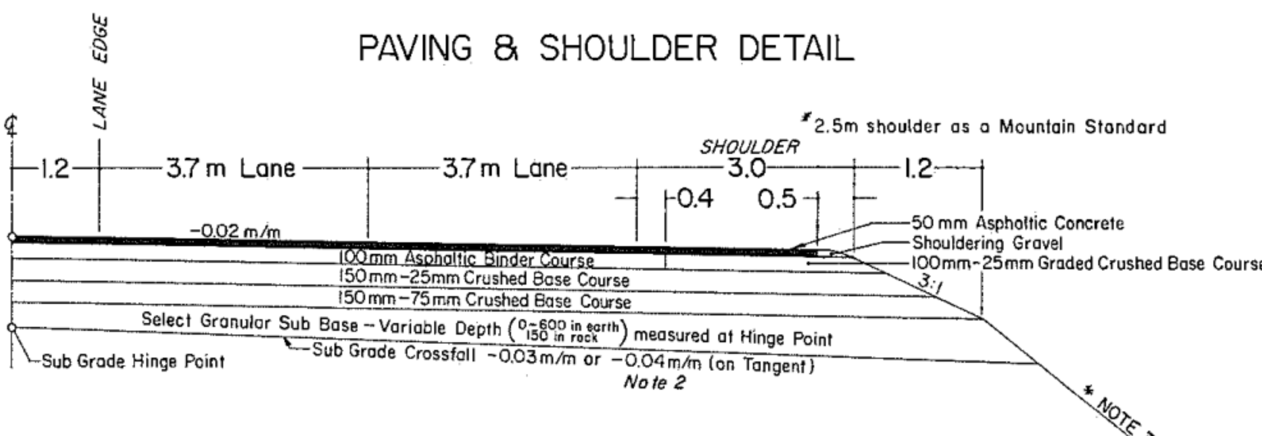


Minimum Median ditch grade 0.5%.
Median development to 6 lanes will be assessed at time of need.

MINIMUM RAISED MEDIAN



PAVING & SHOULDER DETAIL



NOTE:

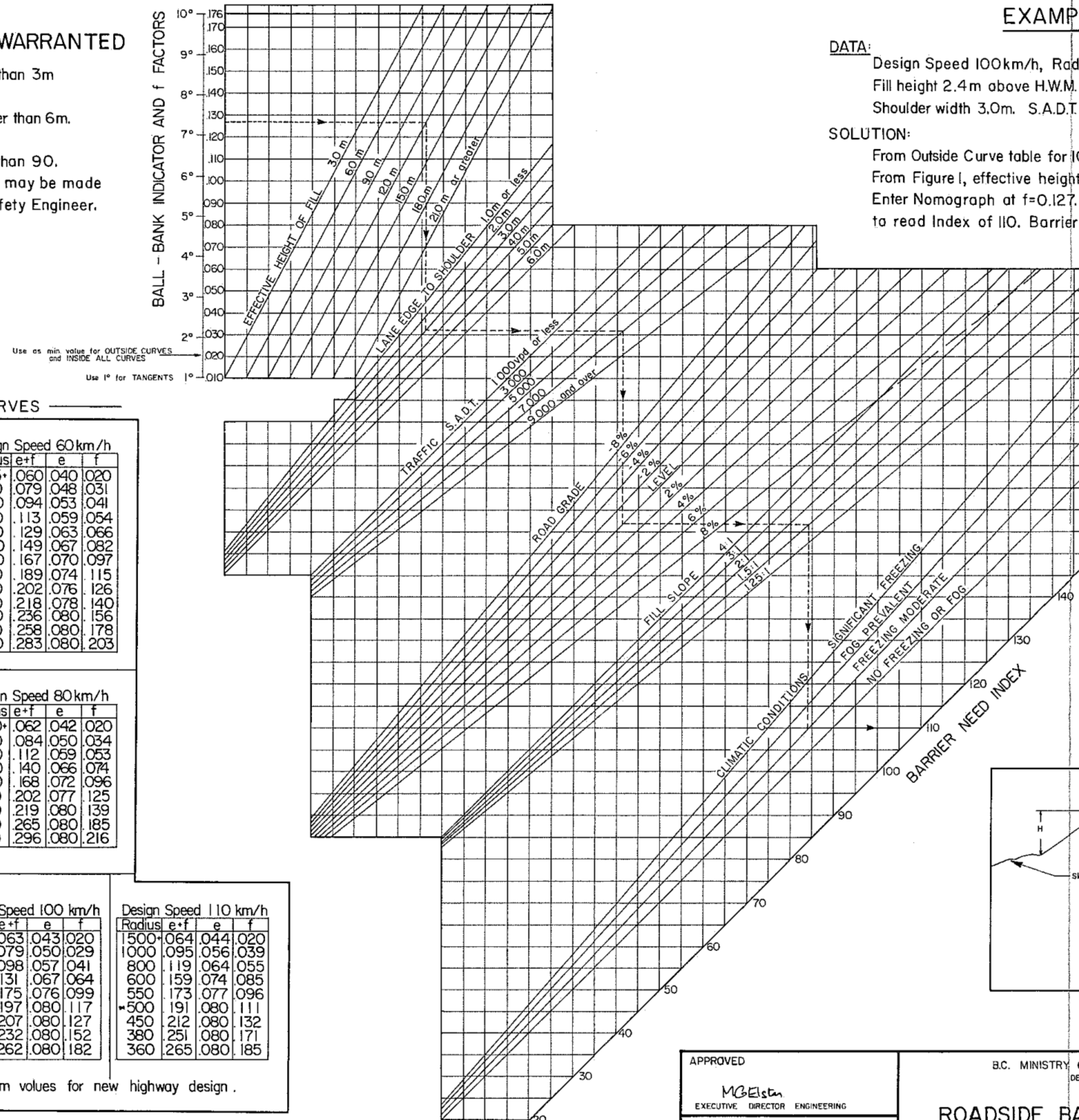
1. Horizontal and Vertical design is at the median centreline with the elevation transferred to the Grade Points, 1.2m inside the median lane edges.
2. -0.04m/m to be used in Earth (wet conditions) only, or as directed by Geotechnical Branch.
3. See 'Cut' and 'Fill' Drawings for slope details.
4. Auxiliary lanes are to have -0.03m/m pavement crossfall on tangent.

APPROVED MGElston EXECUTIVE DIRECTOR OF ENGINEERING DATE 86-05-30 REVISED 87-01	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH **FREEWAYS & EXPRESSWAYS** Median, Pavement and Shoulder Details	DESIGN MANUAL No. **B.1-5.0**

BARRIER USUALLY NOT WARRANTED

1. When in a cut or on a fill with less than 3m effective height.
2. When overall shoulder width is greater than 6m.
3. When fill slope is flatter than 4 to1.
4. When Barrier Need Index is less than 90.

Exceptions to these restrictions may be made with approval of the Highway Safety Engineer.



EXAMPLE

DATA:

Design Speed 100km/h, Radius 380m (Outside Curve)
Fill height 2.4m above H.W.M. Depth of still water 1.2m Fill slope 1.5:1
Shoulder width 3.0m. S.A.D.T. 7,000 vpd. Freezing moderate

SOLUTION:

From Outside Curve table for 100km/h, f=.127 for 380m radius
From Figure 1, effective height of fill is 2.4+(8x1.2)=12m
Enter Nomograph at f=0.127. Follow dashed line through to read Index of 110. Barrier warranted

OUTSIDE CURVES

Design Speed 50 km/h

Radius	e+f	e	f
330+	.060	.040	.020
300	.066	.042	.024
250	.079	.048	.031
220	.089	.051	.038
190	.104	.056	.048
170	.116	.059	.057
150	.131	.063	.068
130	.151	.067	.084
110	.179	.072	.107
90	.219	.078	.141
*80	.246	.080	.166
75	.262	.080	.182
70	.281	.080	.201

Design Speed 60 km/h

Radius	e+f	e	f
475+	.060	.040	.020
360	.079	.048	.031
300	.094	.053	.041
250	.113	.059	.054
220	.129	.063	.066
190	.149	.067	.082
170	.167	.070	.097
150	.189	.074	.115
140	.202	.076	.126
130	.218	.078	.140
*120	.236	.080	.156
110	.258	.080	.178
100	.283	.080	.203

Design Speed 70 km/h

Radius	e+f	e	f
630+	.061	.041	.020
450	.086	.051	.035
360	.107	.057	.050
270	.143	.066	.077
230	.168	.071	.097
190	.203	.077	.126
*170	.227	.080	.147
160	.241	.080	.161
150	.250	.080	.177

Design Speed 80 km/h

Radius	e+f	e	f
800+	.062	.042	.020
600	.084	.050	.034
450	.112	.059	.053
360	.140	.066	.074
300	.168	.072	.096
250	.202	.077	.125
*230	.219	.080	.139
190	.265	.080	.185
170	.296	.080	.216

Design Speed 90 km/h

Radius	e+f	e	f
1050+	.061	.041	.020
800	.080	.049	.031
600	.106	.058	.048
450	.142	.067	.075
380	.168	.073	.095
320	.199	.078	.121
*300	.213	.080	.133
250	.255	.080	.175
230	.277	.080	.197

Design Speed 100 km/h

Radius	e+f	e	f
1250+	.063	.043	.020
1000	.079	.050	.029
800	.098	.057	.041
600	.131	.067	.064
450	.175	.076	.099
*400	.197	.080	.117
380	.207	.080	.127
340	.232	.080	.152
300	.262	.080	.182

Design Speed 110 km/h

Radius	e+f	e	f
1500+	.064	.044	.020
1000	.095	.056	.039
800	.119	.064	.055
600	.159	.074	.085
550	.173	.077	.096
*500	.191	.080	.111
450	.212	.080	.132
380	.251	.080	.171
360	.265	.080	.185

* These curve radii are minimum values for new highway design.

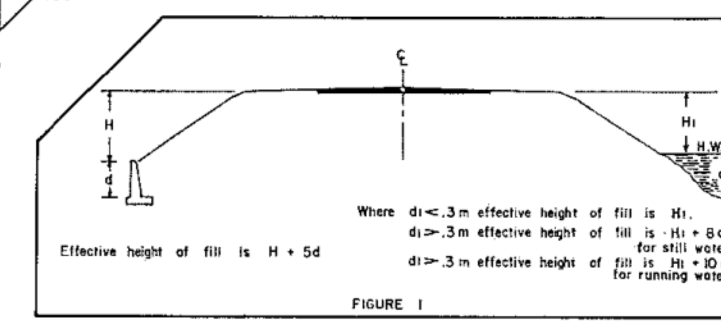


FIGURE 1

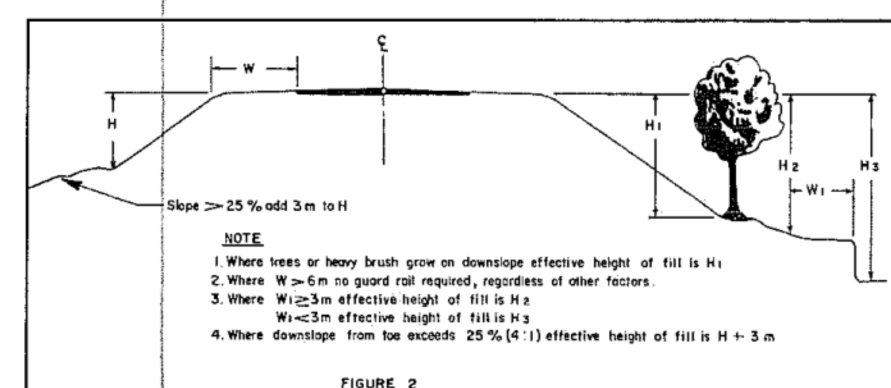


FIGURE 2

APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
M G Elston EXECUTIVE DIRECTOR ENGINEERING	ROADSIDE BARRIER INDEX WARRANT	B.2-1.1
DATE 82-02-23 REVISED 87-06		

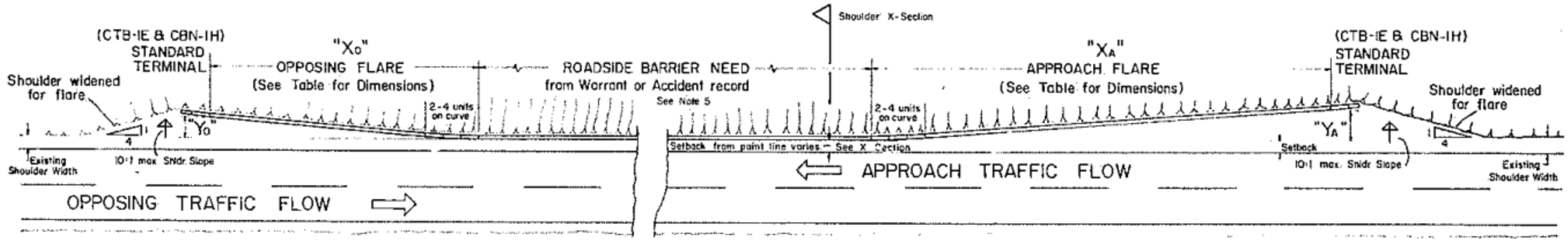
APPROVED
(J. LISMAN)
HIGHWAY SAFETY ENGINEER
DATE 82-
REVISED 87-01

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS
HIGHWAY SAFETY ENGINEERING BRANCH

FLARES & TERMINALS FOR CRB
(LAYOUT)

DESIGN MANUAL No. HSE 82-07

See Drawing HSE 83-03 for Flare End Treatments in Cut and Fill, etc., situations.

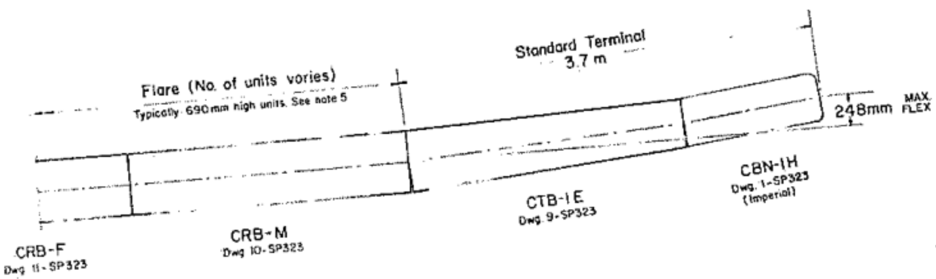


LAYOUT PLAN of P.C. CONC. BARRIER FLARES
(See Drawing HSE 82-11 for Assembly Elevations)

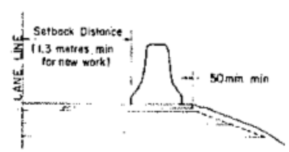
LAYOUT DIMENSIONS of FLARES

Travel Speed	APPROACH FLARE			OPPOSING FLARE		
km/hr	X_A	Y_A	No. of Units	X_O	Y_O	No. of Units
100	59.9	3.4	24	32.5	1.8	13
90	52.4	3.4	21	30.0	1.8	12
80	47.4	3.4	19	27.4	1.8	11
70	42.4	3.3	17	22.4	1.7	9
60	34.9	3.2	14	17.4	1.6	7
50	27.5	3.1	11	14.9	1.5	6

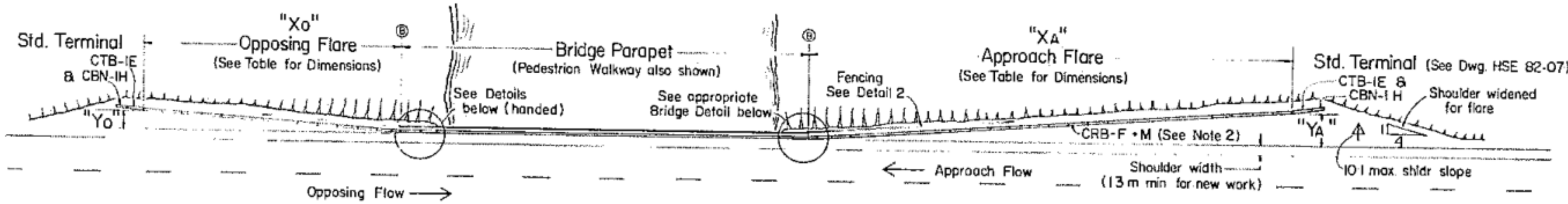
NOTES
1. All dimensions in metres unless otherwise noted.
2. Table of layout dimensions is derived from 1977 AASHTO "Guide for Selecting, Locating and Designing Traffic Barriers."
3. Both Approach and Opposing Flares are required for roadside barrier on all undivided highways. Opposing Flare may not be required on a divided highway with Median Barrier in place.
4. Number of units shown in table may be increased but never reduced.
5. Roadside barrier will usually be 690 mm high. In special cases, 810 mm high-CMB units may be used. In this event, transition - CTB-2 units will be needed to link the 810 mm high - CMB to the 690 mm high - CRB.
6. See Manual of Policy and Procedure, Chapter 13, for uses of Traffic Barriers. (1984 amendments to come)



DETAILS OF STANDARD TERMINAL



Shoulder Cross Section
(See Design Manual 8.1-1.2)

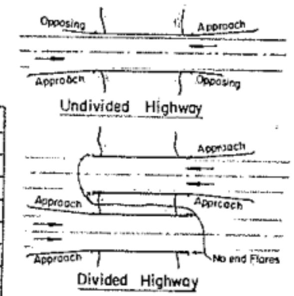


Layout Plan of P.C. Conc. Barrier Flares at Bridges

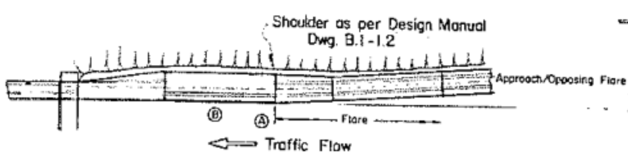
See Drawing HSE 83-03 for treatments of Bridge Approaches at Rock Cuts, Gorges etc. where additional barrier is needed.

Opposing Flare						
TRAVEL SPEED km/hr	Xo (metres)	Yo (metres)	Bridge Transition & CMB-F	No. of Units in Flare CTB-2	CRB-F	CRB-M
100	31.3	1.7	(1 each)	1	6	6
90	31.3	1.9	(1 each)	1	6	6
80	26.2	1.7	(1 each)	1	5	5
70	21.2	1.6	(1 each)	1	4	4
60	21.2	1.9	(1 each)	1	4	4
50	16.2	1.6	(1 each)	1	3	3

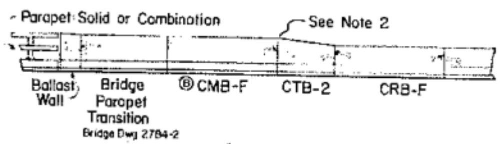
Approach Flare						
TRAVEL SPEED km/hr	XA (metres)	YA (metres)	Bridge Transition & CMB-F	No. of Units in Flare CTB-2	CRB-F	CRB-M
100	61.2	3.5	(1 each)	1	12	12
90	51.2	3.3	(1 each)	1	10	10
80	46.2	3.3	(1 each)	1	9	9
70	41.2	3.2	(1 each)	1	8	8
60	36.2	3.2	(1 each)	1	7	7
50	26.3	3.0	(1 each)	1	5	5



Application of Flare Barrier Treatments

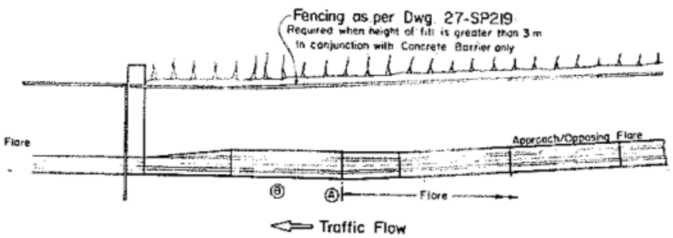


Plan

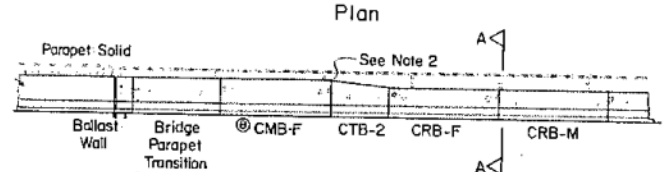


Elevation

Detail 1
Flare from Concrete Bridge Parapet



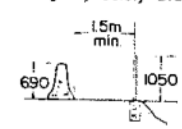
Plan



Elevation

Detail 2
Flare from Concrete Bridge Parapet with Pedestrian Walkway

NOTES
1. All dimensions in mm unless otherwise noted.
2. Units in flare will normally be CRB (690 mm). Very high bridges and fill heights may require more 810 mm high CMB-F & M units between CTB-2 and Bridge Transition Unit.
3. Table of layout dimensions is derived from 1977 AASHTO "Guide for Selecting, Locating and Designing Traffic Barriers".
4. See Manual of Policy and Procedure, chapter 13, for uses of Traffic Barriers.
5. Read with Bridge Contract, Design Manual, & Highway Safety Drawings.



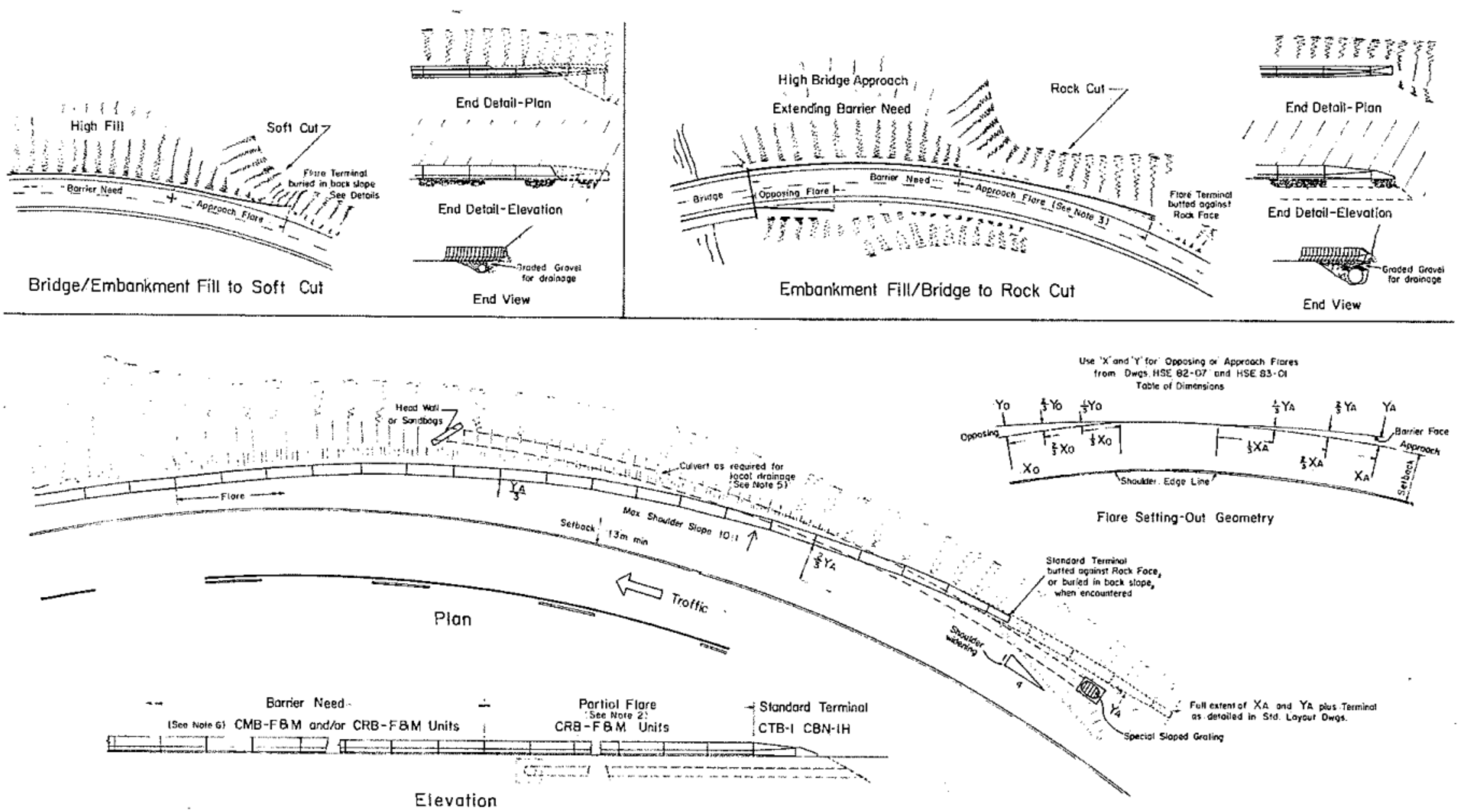
Section A-A

APPROVED (J. LISMAN)
HIGHWAY SAFETY ENGINEER
DATE 83-
REVISED 87-01

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS
HIGHWAY SAFETY ENGINEERING BRANCH

FLARES FOR CRB AT BRIDGE ENDS (LAYOUT)

DESIGN MANUAL No. HSE 83-01



Notes

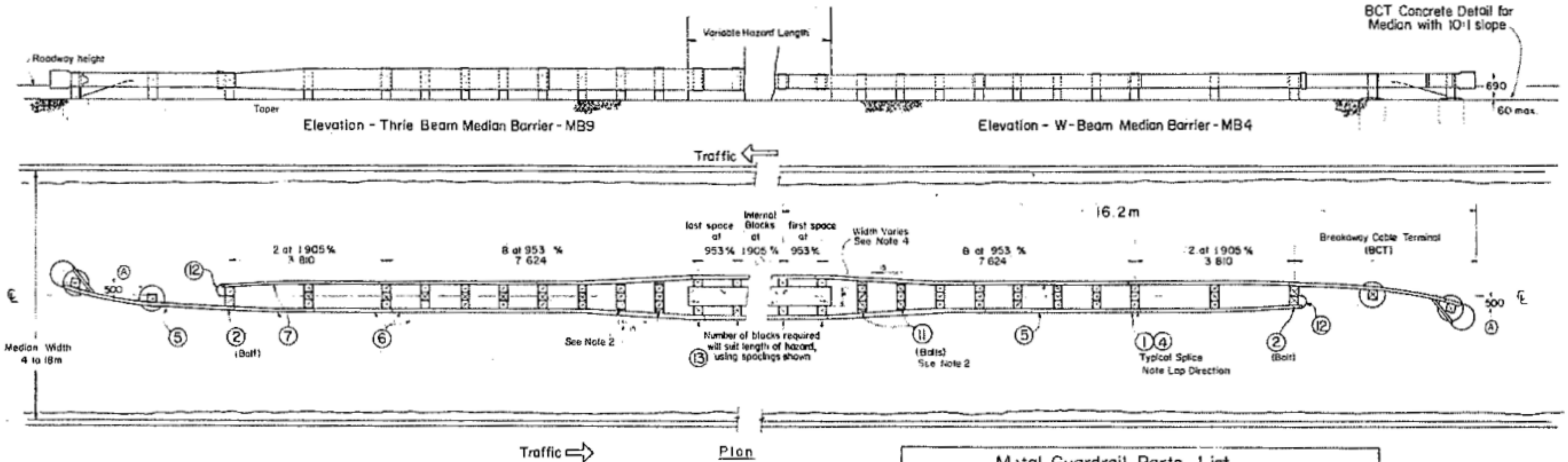
1. This Drawing must be read in conjunction with Standard Layout Dwgs HSE 82-07 or HSE 83-01
2. Due to proximity of Rock Face, full Flare length may not be available. Install partial Flare plus Terminal to butt against rock face, or bury in back slope
3. If a pedestrian walkway occurs on Bridge Approach Flare side, shorten Flare Length to create space between rock face and barrier.
4. Setting out dimensions for partial or curved Flares derived from Standard Layout drawings.
5. Culvert details as per Design and Surveys Manual, section E, when required.
6. CMB units only used for roadside application in special cases.
7. See Manual of Policy and Procedure, Chapter 13, for uses of Traffic Barriers.

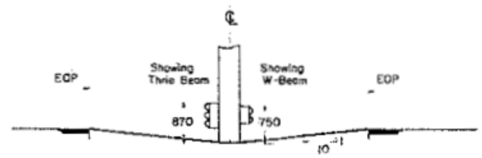
APPROVED
(J. LISMAN)
HIGHWAY SAFETY ENGINEER
DATE 83-
REVISED 87-01

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS
HIGHWAY SAFETY ENGINEERING BRANCH

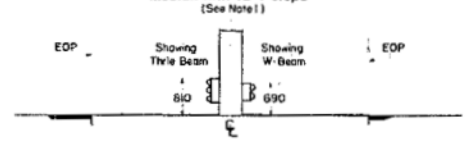
BARRIER LAYOUTS
(at CUT & FILL, and on CURVES)

DESIGN MANUAL No.
HSE 83-03

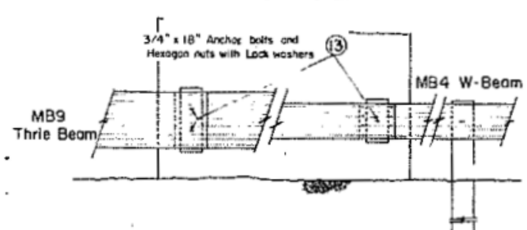




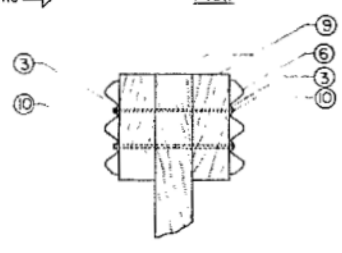
Barrier Height Dimensions for Median with 10:1 slope
(See Note 1)



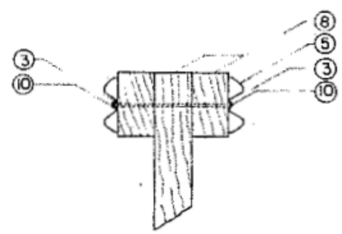
Barrier Height Dimensions for Flat Median



Barrier to Hazard Connection



MB9-Median Thrie Beam



MB4-Median W Beam

Metal Guardrail Parts List

Part N°	* U.S. Part N°	Description
1-4	See Drawing 1-SP312 for listing and info (*) notes	
(A) 5	RE-3 [4 at 3'-1/2" +12'-6"]-73	G4 W Beam
(A) 6	RE-63 [4 at 3'-1/2" +12'-6"]-76	G9 Thrie Beam
7-9	See Drawing 1-SP312 for listing and info (*) notes	
10	F-3 [25"]-76	5/8" Button Head Bolt and Recess Nut
11	F-3 [suit length to site]-76	" See Note 2
12	RE-6-79	W Beam End Section (Rounded)
13	(local parts)	3/4" x 18" (457mm) Anchor Bolts and Hexagon nuts with Lock washers

Notes

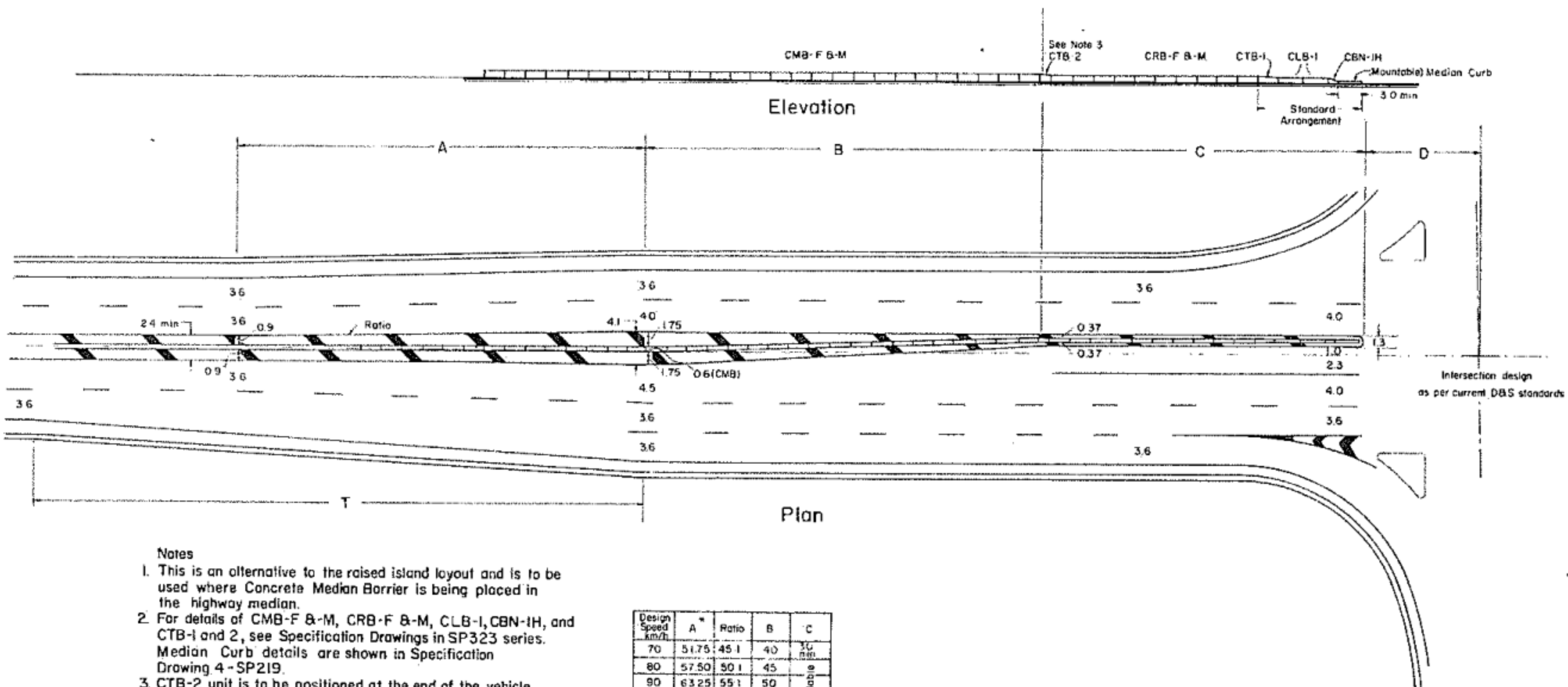
1. Median slope affects placement height of barrier. Slopes steeper than 10:1 will require heights greater than shown. Contact the Highway Safety Engineer.
2. Flares of 15:1 match vehicle speeds. Adjust block-out dimensions to suit this requirement and width of hazard by adding shaped pieces. Bolt lengths to suit.
3. See Drawing 1-SP312 for Metal Barrier (G4 and G9) details. See Drawing 2-SP312 for BCT details.
4. This arrangement for max. hazard width of 670mm. For wider, contact Highway Safety Engineer.
5. (A) Median may require some grading to smooth irregularities and prepare site for beam installation.

APPROVED
(J. LISMAN)
HIGHWAY SAFETY ENGINEER
DATE 83-
REVISED 87-01

MB4/MB9 TREATMENTS OF HAZARD
(in 4-18 m wide Unpaved Medians)

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS
HIGHWAY SAFETY ENGINEERING BRANCH

DESIGN MANUAL No.
HSE 83-13



Notes

1. This is an alternative to the raised island layout and is to be used where Concrete Median Barrier is being placed in the highway median.
2. For details of CMB-F &-M, CRB-F &-M, CLB-I, CBN-IH, and CTB-I and 2, see Specification Drawings in SP323 series. Median Curb details are shown in Specification Drawing 4-SP219.
3. CTB-2 unit is to be positioned at the end of the vehicle storage lane. Increase/decrease number of CRB units by F & M pairs to match dimension "C".
4. See Design Manual No. CI-2.5 for Intersection design guides.

Design Speed km/h	A*	Ratio	B	C
70	51.75	45:1	40	30 min
80	57.50	50:1	45	Variable
90	63.25	55:1	50	
100	69.00	60:1	55	

* 2.4 m Median Values

APPROVED

I. LISMAN

HIGHWAY SAFETY ENGINEER

DATE 84 -

REVISED 87 - 01

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS

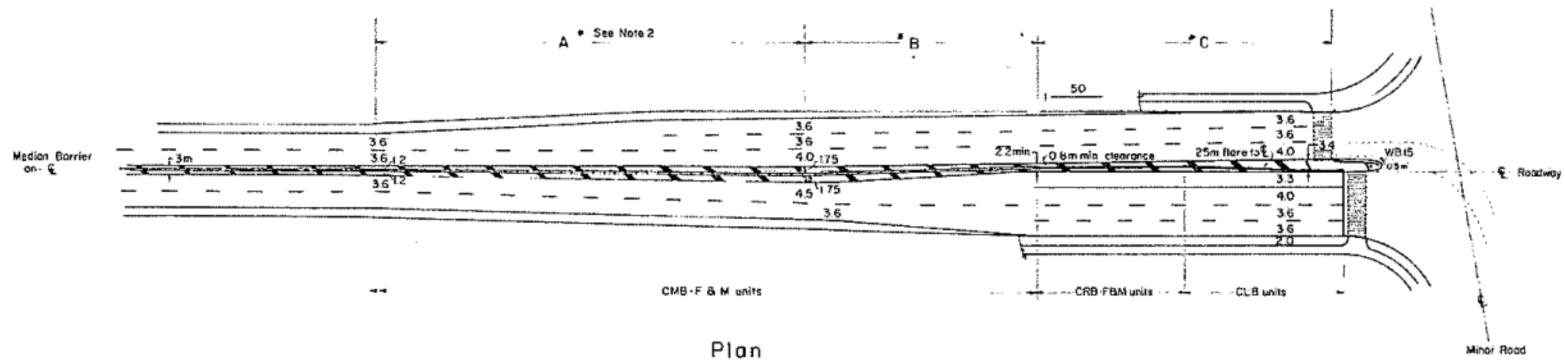
HIGHWAY SAFETY ENGINEERING BRANCH

MEDIAN BARRIER LAYOUTS

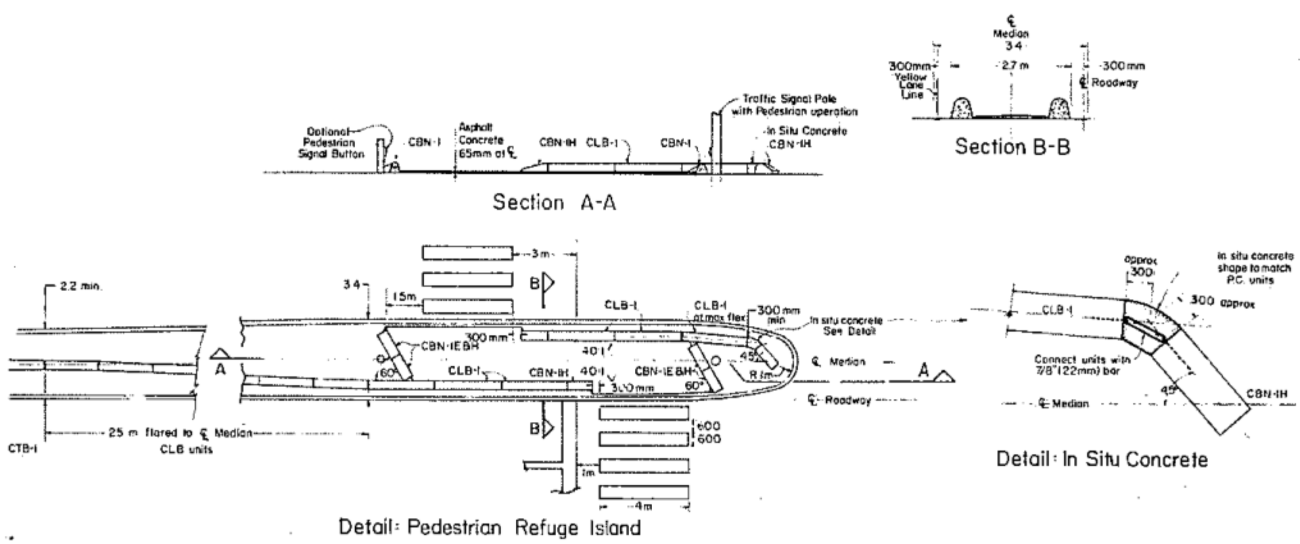
(for Left Turn Slots)

DESIGN MANUAL No.

HSE 84-01



Plan



Section B-B

Section A-A

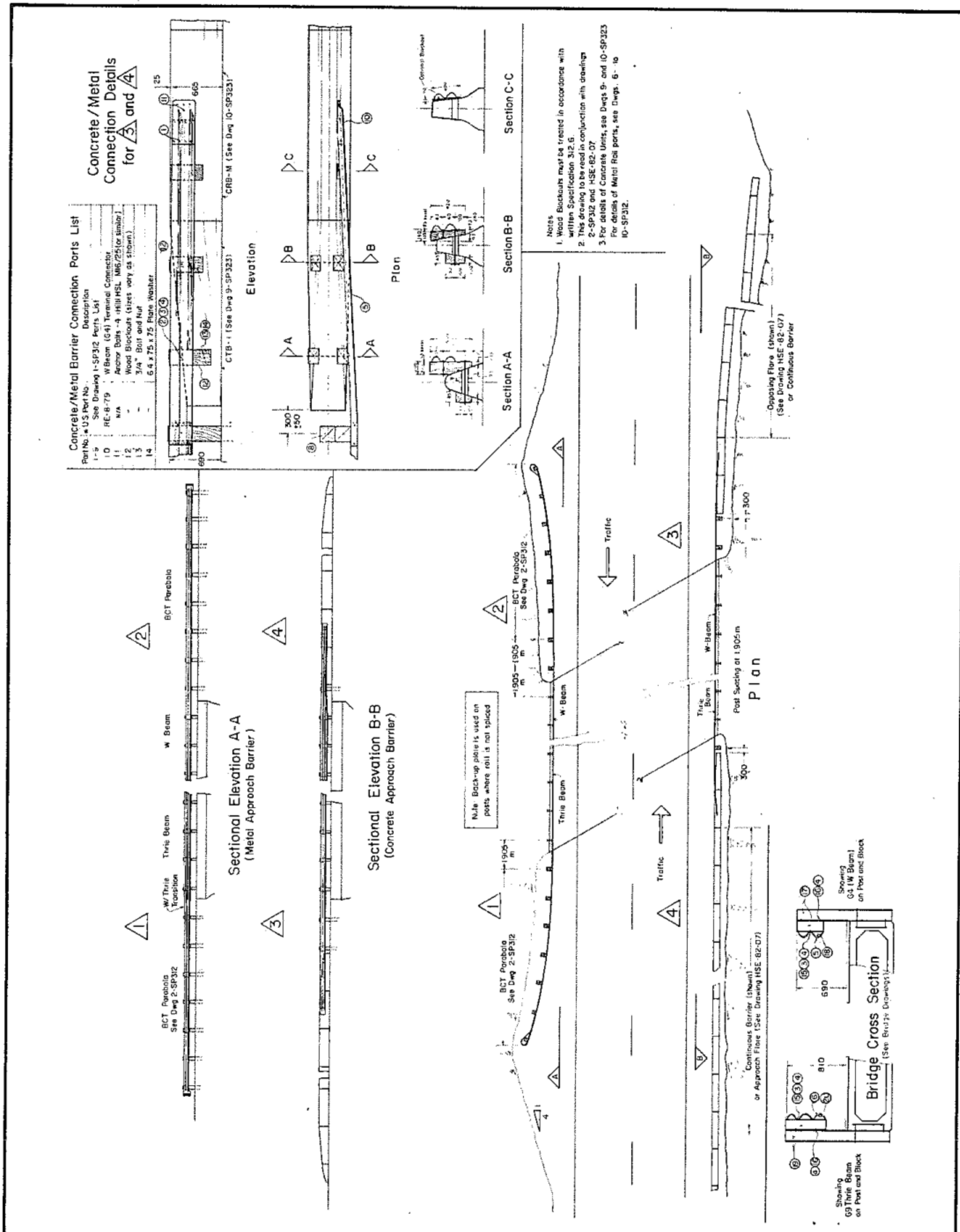
Detail: Pedestrian Refuge Island

Detail: In Situ Concrete

Notes

1. See Specification Drawings in the SP323 series for details of units.
*2. Dimensions "A", "B" and "C" are as given in Design & Surveys drawing C.I-2.5.
3. Asphalt Concrete in Pedestrian Refuge Island is to be poured after P.C. units have been positioned.
4. See Design Manual C.I-2.5 for intersection design guides.
5. [illegible] this layout to new suburban intersections (on request to Highway Safety Engineer.)

APPROVED (J. LISMAN) HIGHWAY SAFETY ENGINEER	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS HIGHWAY SAFETY ENGINEERING BRANCH	DESIGN MANUAL No.
DATE 84-	PEDESTRIAN CROSSING REFUGE	HSE 84-02
REVISED 87-01	(Layout with CMB)	



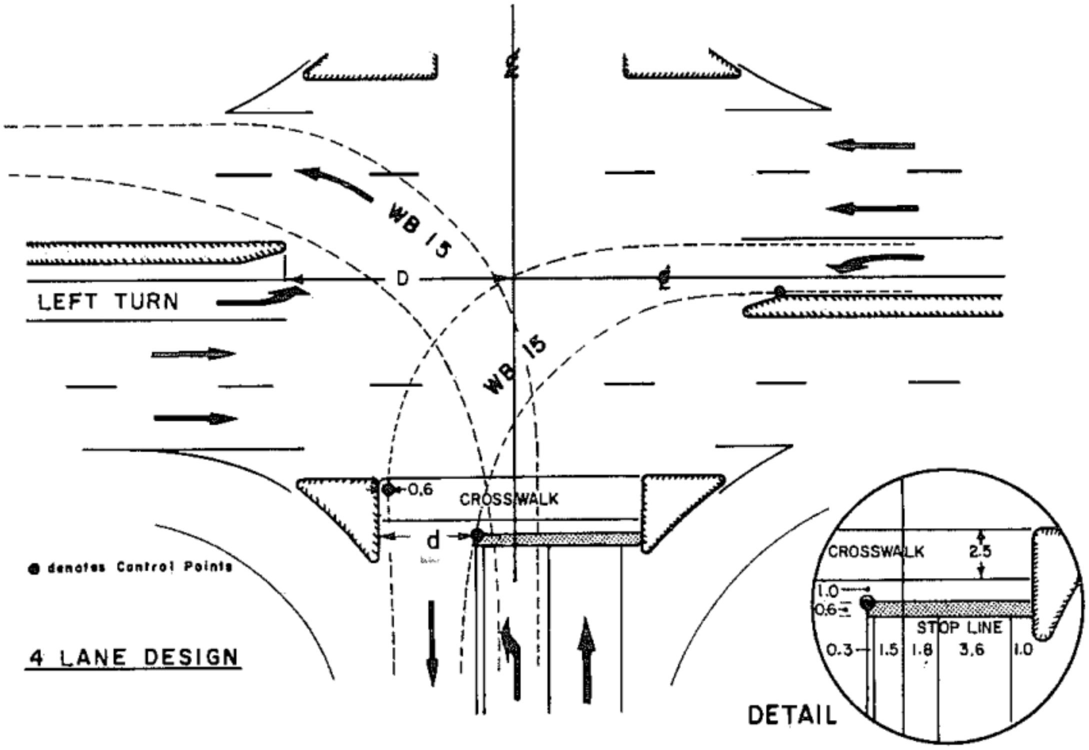
APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS HIGHWAY SAFETY ENGINEERING BRANCH	DESIGN MANUAL No.
J. Lisman (J. LISMAN) HIGHWAY SAFETY ENGINEER	APPROACH BARRIER LAYOUTS (for Bridges with Service Level I Parapets)	HSE 84-03
DATE 84 -		
REVISED 87 - 01		

SECTION C

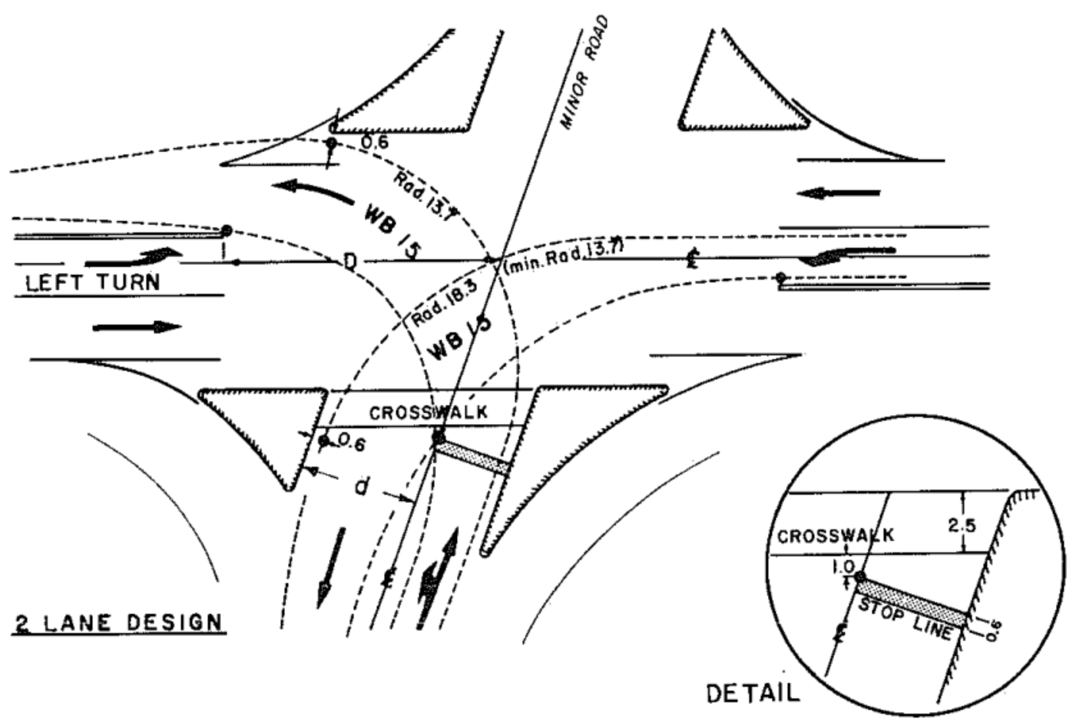
MISCELLANEOUS

C.1 AT-GRADE INTERSECTION

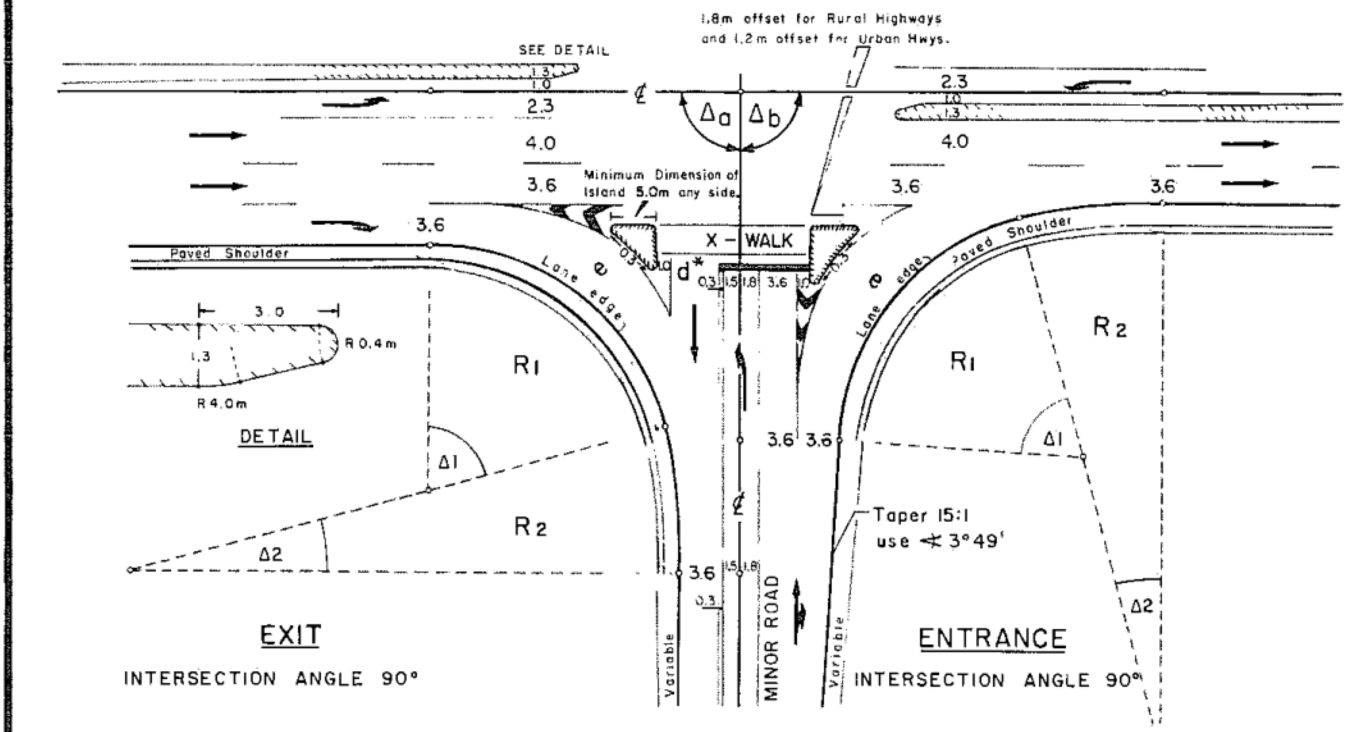
C.2 GRADE SEPARATIONS & INTERCHANGES



'd' variable - minimum 5.5 m



APPROVED:	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH INTERSECTION DESIGN WHEEL PATH CONTROL POINTS 2 AND 4 LANE HIGHWAYS	DESIGN MANUAL No C.1 – 1.0
DATE 77-09-29 REVISED 79-11-15		



4 LANE DESIGN

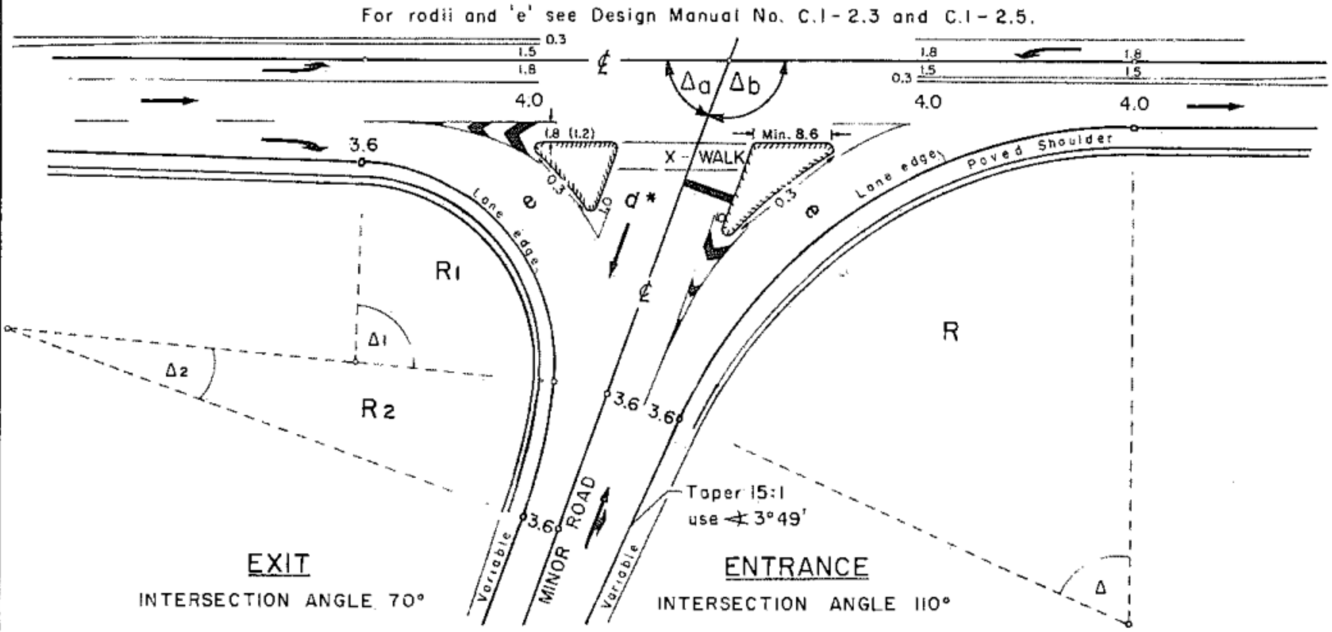
SEE DESIGN MANUAL NO. C.1 – 1.0 FOR WHEEL PATH CONTROL

* Turning Lane width 'd': use Template WB 15 + 0.6m (minimum 5.5m)

All curb radii to be 0.5m when using extruded curb on islands

Minimum 13.0 m Arc length (R2)

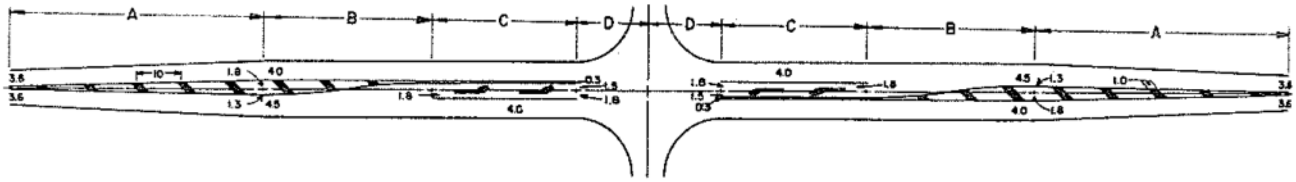
For radii and 'e' see Design Manual No. C.1 – 2.3 and C.1 – 2.5.



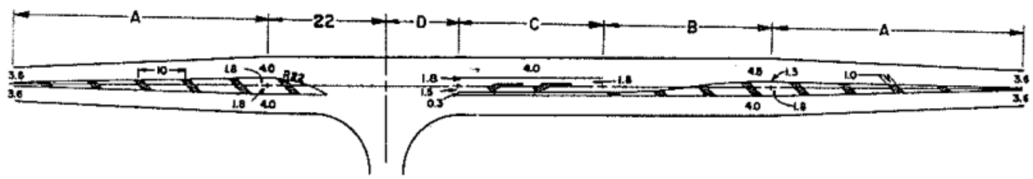
2 LANE DESIGN

NOT TO SCALE

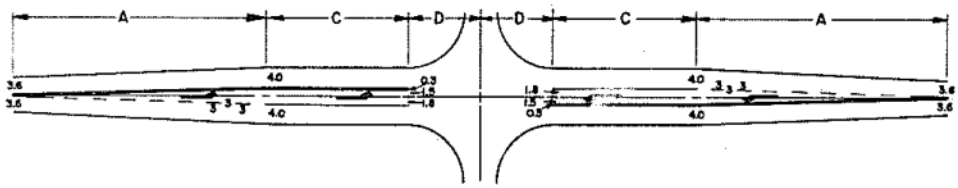
APPROVED BY: [signature] DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH INTERSECTION LAYOUT DIAGRAM 2 AND 4 LANE HIGHWAYS	DESIGN MANUAL No. C.1 – 1.1
DATE 78-02-08 REVISED 87 – 01		



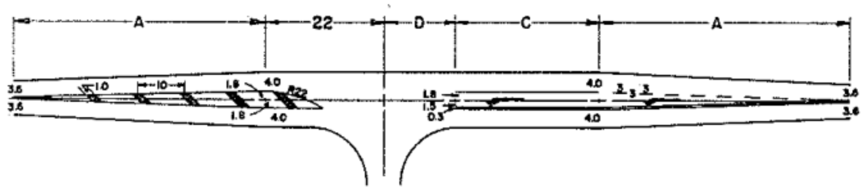
TYPE B RURAL



TYPE A RURAL



TYPE B URBAN



TYPE A URBAN

METRIC

URBAN

DESIGN SPEED	DIMENSION A	DIMENSION A *TAPERS
50 km/h	54 m	30 : 1

RURAL

DESIGN SPEED	DIMENSION A	DIMENSION B	DIMENSION A*TAPERS
50 km/h	54 m	35 m	30 : 1
60 km/h	72 m	35 m	40 : 1
70 km/h	81 m	40 m	45 : 1
80 km/h	90 m	45 m	50 : 1
90 km/h	99 m	50 m	55 : 1
100 km/h	108 m	55 m	60 : 1

*When designing off-centre turn slots DIMENSION A is calculated using the above taper ratios.

DIMENSION C - Length required for Vehicle Storage.

DIMENSION D - Length required for Vehicle Turning Path.

ALL DIMENSIONS ARE IN METRES.

APPROVED MGElston EXECUTIVE DIRECTOR ENGINEERING	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE FEB. 1977 REVISED 81-09-21	TYPICAL LEFT TURN LANE LAYOUT AT INTERSECTIONS	C.1 - 2.1

APPROVED BY:

DATE 77-11-25

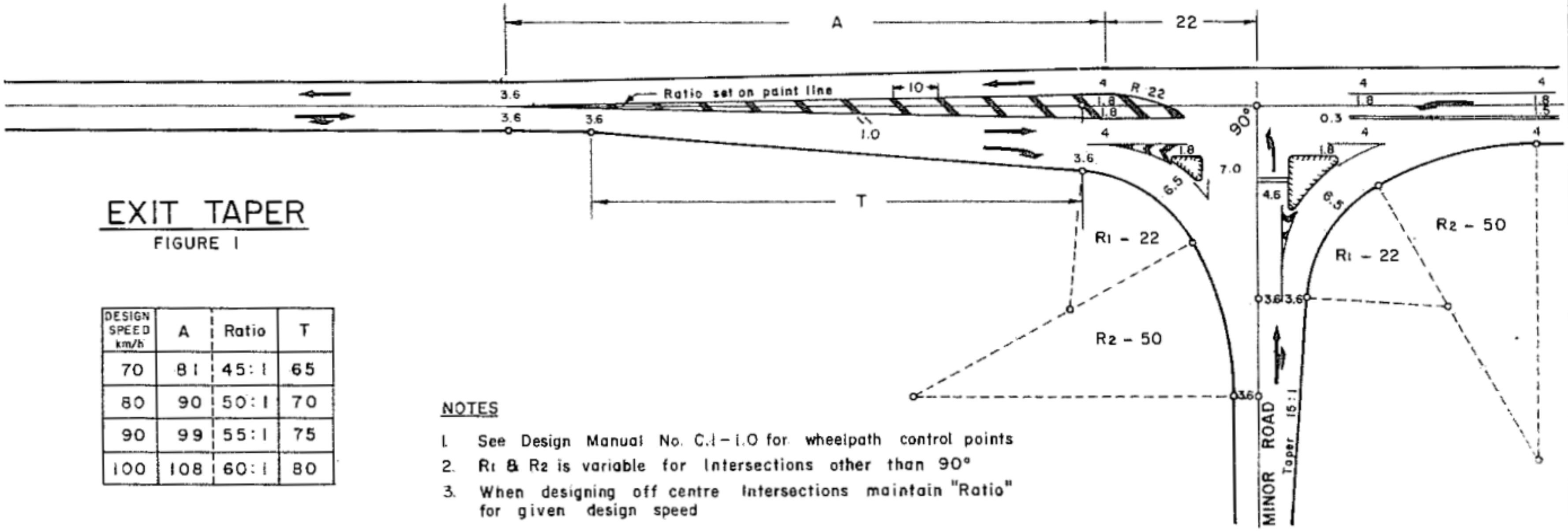
REVISED 82-04-30

B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

ARTERIAL HIGHWAY T'INTERSECTION

EXIT TAPER and PARALLEL DECELERATION LANE

DESIGN MANUAL No. C.I – 2.2



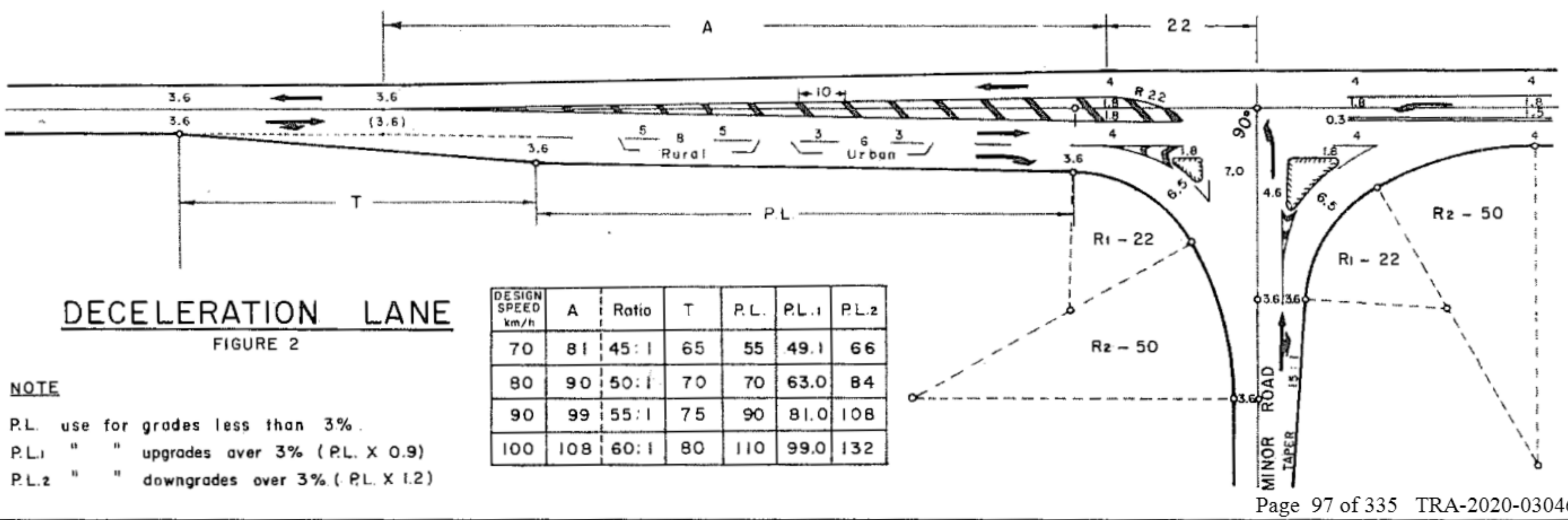
EXIT TAPER

FIGURE 1

DESIGN SPEED km/h	A	Ratio	T
70	81	45:1	65
80	90	50:1	70
90	99	55:1	75
100	108	60:1	80

NOTES

1. See Design Manual No. C.I – I.O for wheelpath control points
2. R_1 & R_2 is variable for Intersections other than 90°
3. When designing off centre Intersections maintain "Ratio" for given design speed



DECELERATION LANE

FIGURE 2

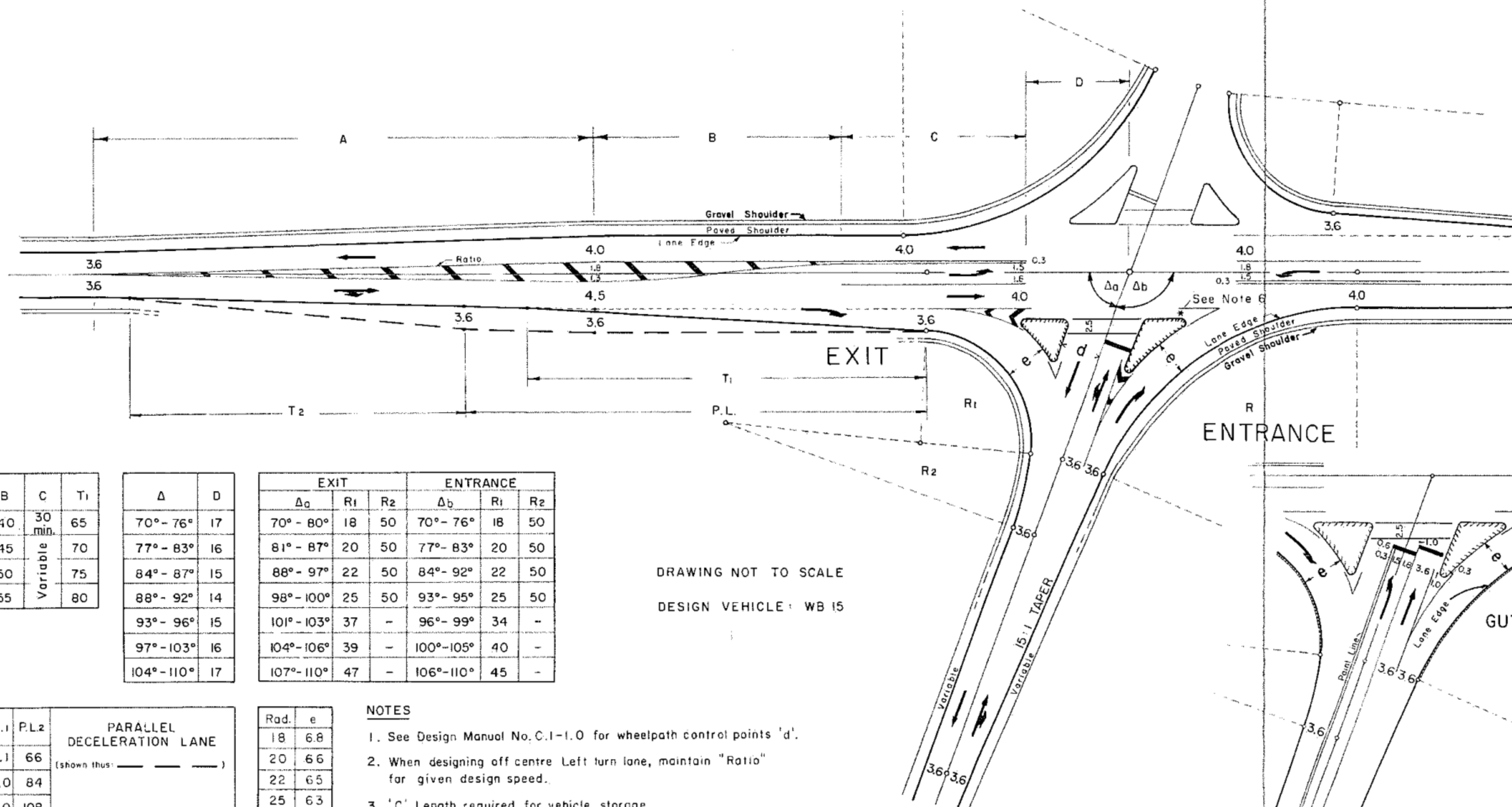
DESIGN SPEED km/h	A	Ratio	T	P.L.	P.L.1	P.L.2
70	81	45:1	65	55	49.1	66
80	90	50:1	70	70	63.0	84
90	99	55:1	75	90	81.0	108
100	108	60:1	80	110	99.0	132

NOTE

P.L. use for grades less than 3%

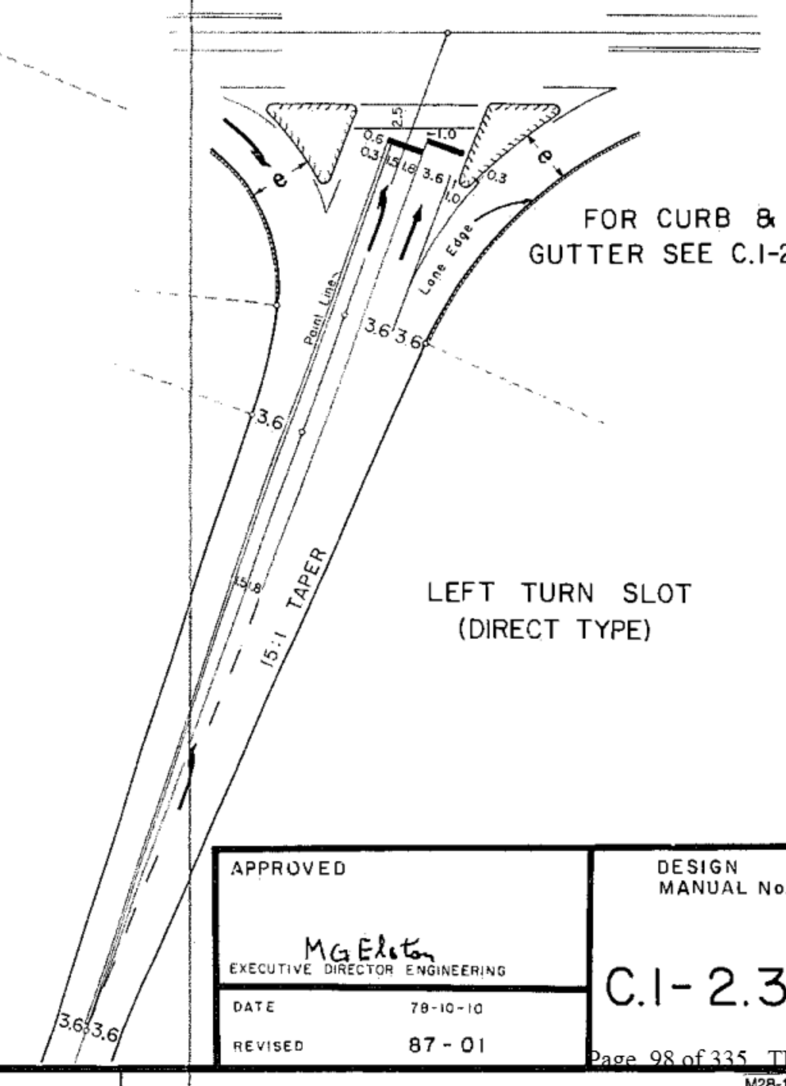
P.L.1 " " upgrades over 3% (P.L. X 0.9)

P.L.2 " " downgrades over 3% (P.L. X 1.2)



DRAWING NOT TO SCALE

DESIGN VEHICLE: WB 15



FOR CURB & GUTTER SEE C.1-2.5

LEFT TURN SLOT (DIRECT TYPE)

DESIGN SPEED km/h	A	Ratio	B	C	T1
70	81	45:1	40	30 min.	65
80	90	50:1	45	Variable	70
90	99	55:1	50		75
100	108	60:1	55		80

Δ	D
70° - 76°	17
77° - 83°	16
84° - 87°	15
88° - 92°	14
93° - 96°	15
97° - 103°	16
104° - 110°	17

EXIT			ENTRANCE		
Δa	R1	R2	Δb	R1	R2
70° - 80°	18	50	70° - 76°	18	50
81° - 87°	20	50	77° - 83°	20	50
88° - 97°	22	50	84° - 92°	22	50
98° - 100°	25	50	93° - 95°	25	50
101° - 103°	37	-	96° - 99°	34	-
104° - 106°	39	-	100° - 105°	40	-
107° - 110°	47	-	106° - 110°	45	-

DESIGN SPEED km/h	T2	P.L.	P.L.1	P.L.2
70	65	55	49.1	66
80	70	70	63.0	84
90	75	90	81.0	108
100	80	110	99.0	132

PARALLEL DECELERATION LANE (shown thus: — — —)

NOTE

P.L. use for grades less than 3%

P.L.1 use for upgrades over 3% (P.L. x 0.9)

P.L.2 use for downgrades over 3% (P.L. x 1.2)

Rad.	e
18	6.8
20	6.6
22	6.5
25	6.3
34	6.0
37	5.9
39	5.9
40	5.9
45	5.8
47	5.8
50	5.7

NOTES

1. See Design Manual No. C.1-1.0 for wheelpath control points 'd'.
2. When designing off centre Left turn lane, maintain "Ratio" for given design speed.
3. 'C' Length required for vehicle storage.
4. Right turn deceleration lanes (Parallel lanes: P.L.) should be provided on the Highway when right turning vehicles exceed 10% of the total approach volume.
5. Left turn slots (Direct type) should be provided on minor roads when left turning vehicles exceed 20 per hour.
6. 1.8m offset for Rural Highways
   1.2m offset for Urban Highways
7. Design width 'e' is for WB 15 vehicles. For other conditions use template wheelpath plus 1.0 m.
8. 'd' variable - minimum 5.5 m.
9. Min. dimension of island 5.0 m any side.

B.C. MINISTRY OF TRANSPORTATION & HIGHWAYS

DESIGN AND SURVEYS BRANCH

TYPICAL HIGHWAY INTERSECTION

2 LANE DESIGN - EXIT TAPER AND PARALLEL DECELERATION LANE

APPROVED	M G Elston EXECUTIVE DIRECTOR ENGINEERING	DESIGN MANUAL No. C.1-2.3
DATE	78-10-10	
REVISED	87-01	

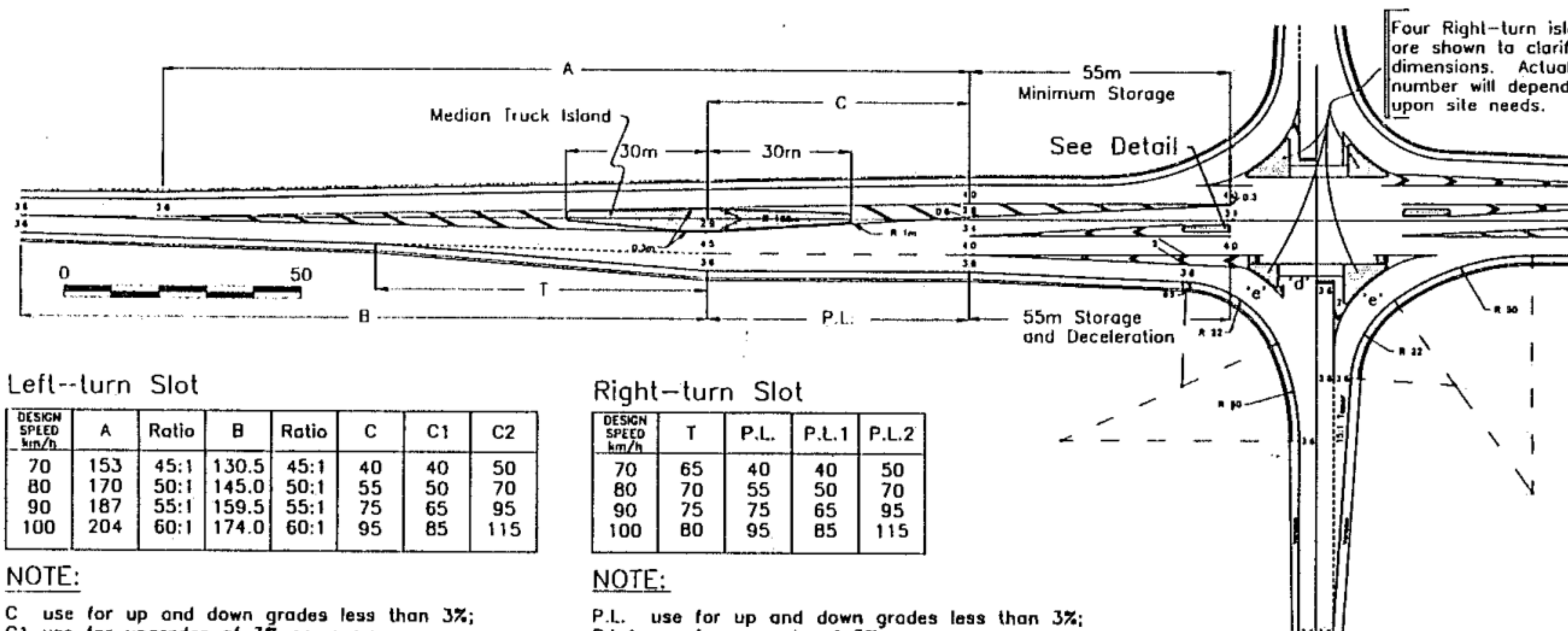
M28-1806

MINISTRY OF TRANSPORTATION AND HIGHWAYS
PROVINCE OF BRITISH COLUMBIA

TYPICAL HIGHWAY INTERSECTION
2-LANE DESIGN FOR LONG LOAD LOGGING TRUCKS

APPROVED (J.Cligman)
HIGHWAY SAFETY ENGINEER
DATE 88-07
REVISED

DESIGN MANUAL C.1-2.4



Left-turn Slot

DESIGN SPEED km/h	A	Ratio	B	Ratio	C	C1	C2
70	153	45:1	130.5	45:1	40	40	50
80	170	50:1	145.0	50:1	55	50	70
90	187	55:1	159.5	55:1	75	65	95
100	204	60:1	174.0	60:1	95	85	115

NOTE:

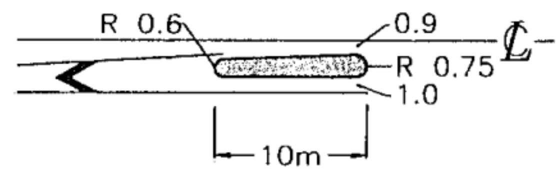
C use for up and down grades less than 3%;
C1 use for upgrades of 3% or more;
C2 use for downgrades of 3% or more.

Right-turn Slot

DESIGN SPEED km/h	T	P.L.	P.L.1	P.L.2
70	65	40	40	50
80	70	55	50	70
90	75	75	65	95
100	80	95	85	115

NOTE:

P.L. use for up and down grades less than 3%;
P.L.1 use for upgrade of 3% or more;
P.L.2 use for downgrade of 3% or more.

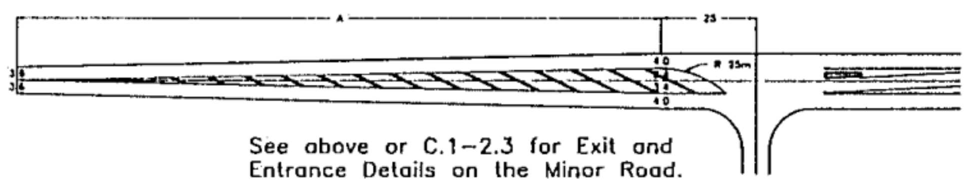


Left-turn Truck Island Detail

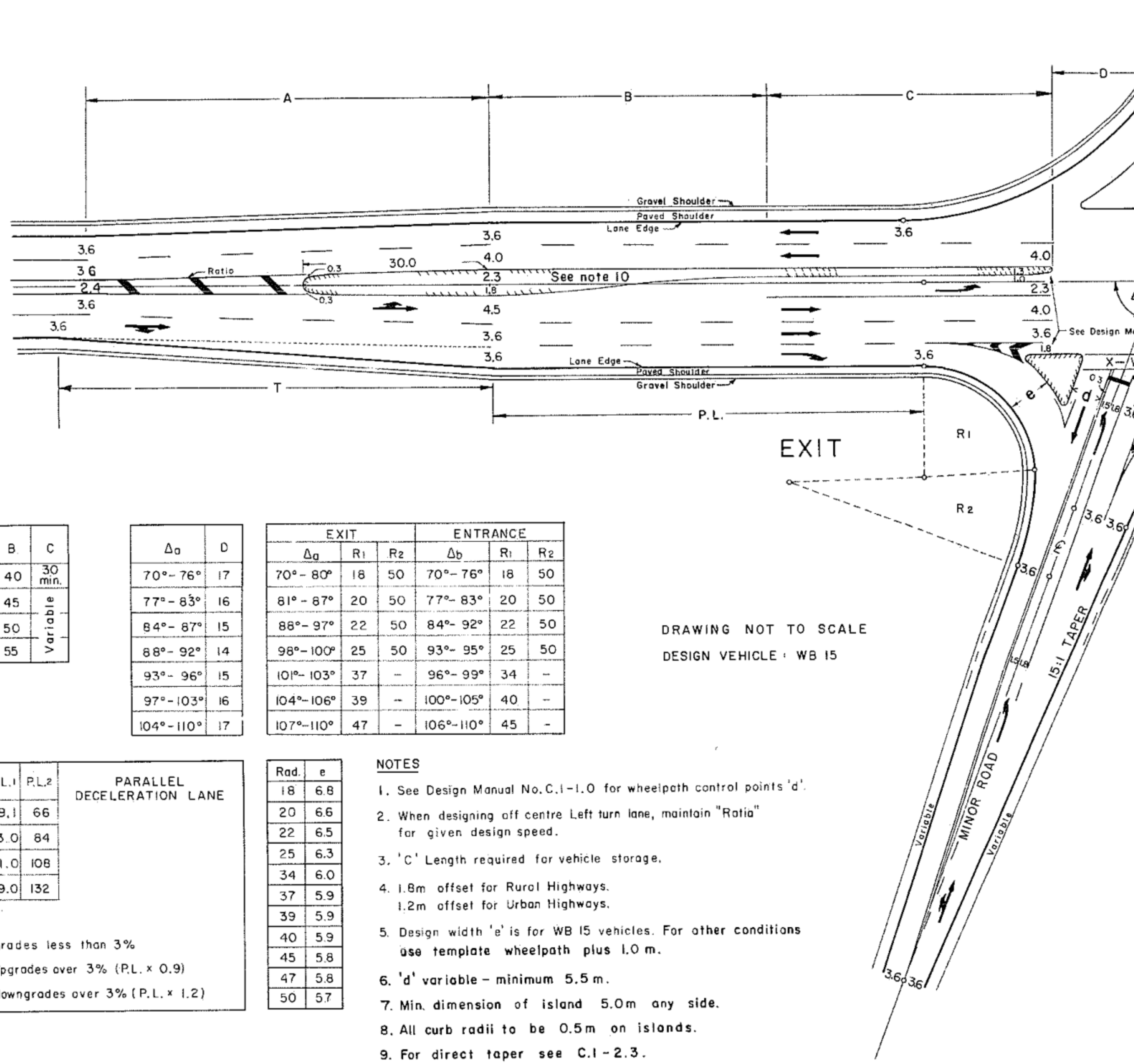
NOTES:

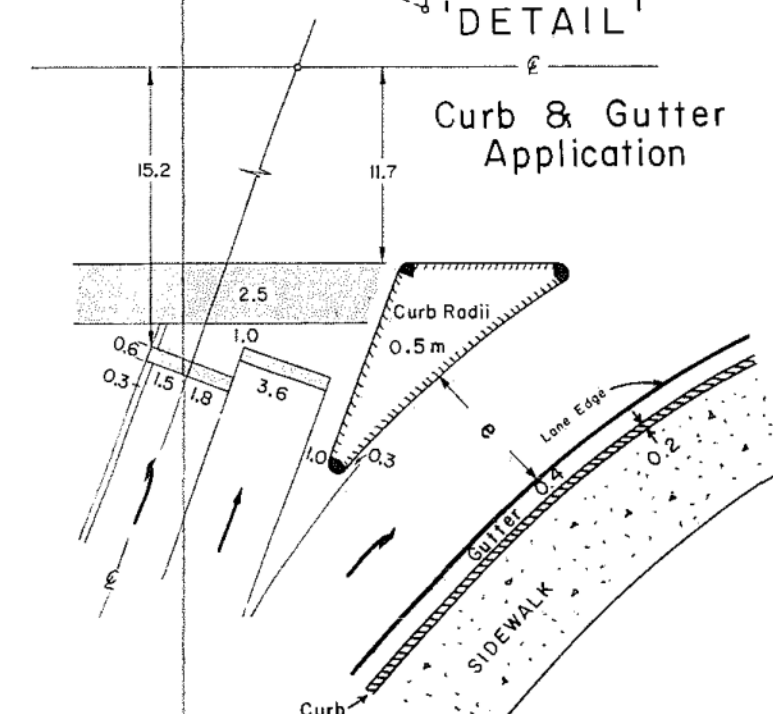
1. 'd' variable. See C.1-1.0 for Wheel Path Control Points. Use LLT 18/21 Template
2. 'e' variable. Use LLT 18/21 Wheelbase Template plus 1.0m
3. When truck islands installed they shall be laid on top of finished pavement, to allow for possible future removal.
4. See X.C.1-2.4 for discussion of appropriate island use.

T-Intersection
Typical Left-turn Layout



See above or C.1-2.3 for Exit and Entrance Details on the Minor Road.





DESIGN SPEED km/h	A	Ratio	B	C
70	49.5	45:1	40	30 min.
80	55	50:1	45	Variable
90	60.5	55:1	50	
100	66	60:1	55	

Δ_a	D
70°- 76°	17
77°- 83°	16
84°- 87°	15
88°- 92°	14
93°- 96°	15
97°-103°	16
104°-110°	17

EXIT			ENTRANCE		
Δ_a	R_1	R_2	Δ_b	R_1	R_2
70°- 80°	18	50	70°- 76°	18	50
81°- 87°	20	50	77°- 83°	20	50
88°- 97°	22	50	84°- 92°	22	50
98°-100°	25	50	93°- 95°	25	50
101°-103°	37	-	96°- 99°	34	-
104°-106°	39	-	100°-105°	40	-
107°-110°	47	-	106°-110°	45	-

PARALLEL DECELERATION LANE

DESIGN SPEED km/h	T	P.L.	P.L.1	P.L.2
70	65	55	49.1	66
80	70	70	63.0	84
90	75	90	81.0	108
100	80	110	99.0	132

NOTE

P.L. use for grades less than 3%

P.L.1 use for upgrades over 3% (P.L. × 0.9)

P.L.2 use for downgrades over 3% (P.L. × 1.2)

Rad.	e
18	6.8
20	6.6
22	6.5
25	6.3
34	6.0
37	5.9
39	5.9
40	5.9
45	5.8
47	5.8
50	5.7

NOTES

1. See Design Manual No. C.1-1.0 for wheelpath control points 'd'.
2. When designing off centre Left turn lane, maintain "Ratio" for given design speed.
3. 'C' Length required for vehicle storage.
4. 1.8m offset for Rural Highways. 1.2m offset for Urban Highways.
5. Design width 'e' is for WB 15 vehicles. For other conditions use template wheelpath plus 1.0 m.
6. 'd' variable - minimum 5.5 m.
7. Min. dimension of island 5.0m any side.
8. All curb radii to be 0.5m on islands.
9. For direct taper see C.1-2.3.
10. Median barrier may be used as an alternative to the raised island. See B.2-1.3.

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS

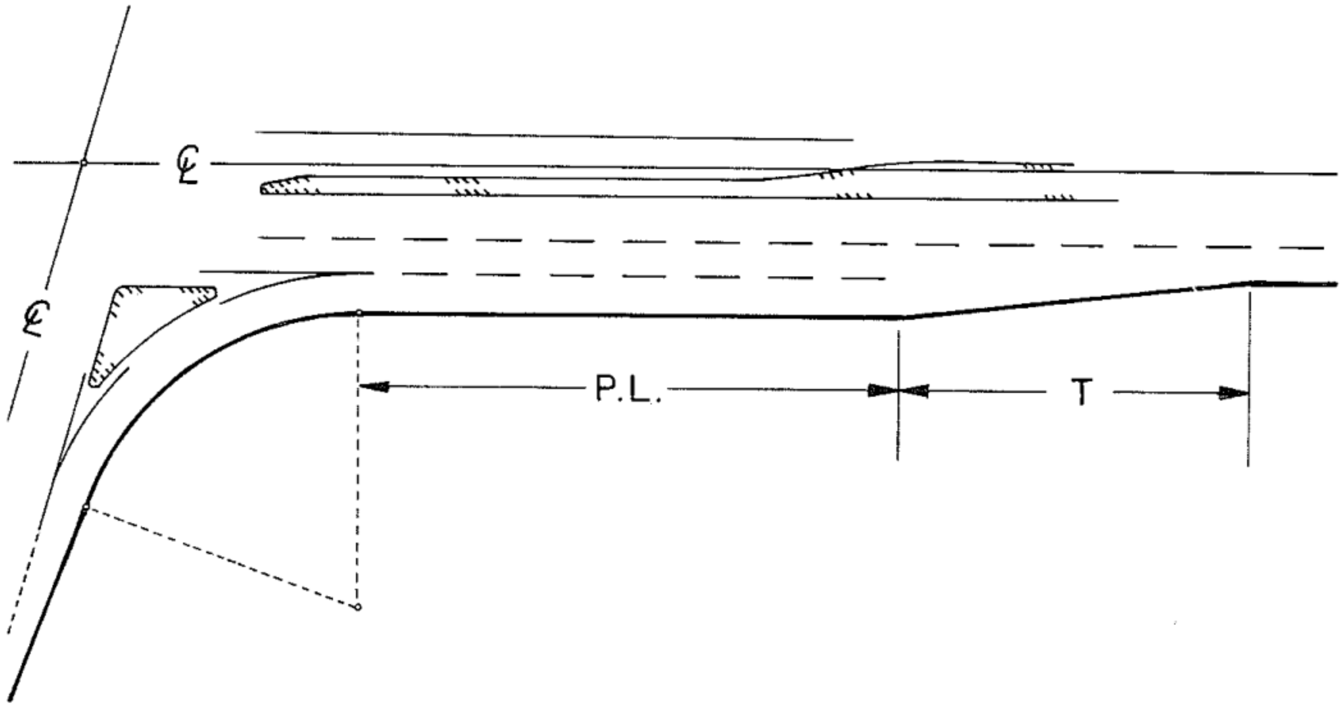
TYPICAL HIGHWAY INTERSECTION
4 LANE DESIGN 2.4m MEDIAN
PARALLEL DECELERATION LANE

APPROVED BY
MGElston
EXECUTIVE DIRECTOR ENGINEERING

DATE 80-03-04
REVISED 87-01

DESIGN MANUAL No.
C.1-2.5

M28-1807



DESIGN SPEED km/h	T m	PARALLEL LANE — P.L. (m)				
		RAMP SPEED km/h				
		STOP	20	30	40	50
80	70	165	150	135	110	80
90	80	220	210	190	165	135
100	85	295	280	265	235	195

NOTE :

1. All grades less than 3% use P.L.
2. Upgrades 3 - 5% use P.L. x 1.4
3. Upgrades over 5% use P.L. x 1.6
4. Downgrades over 3% use P.L. x 0.6

APPROVED

DIRECTOR DESIGN AND SURVEYS

DATE 82-03-29

REVISED 87-01

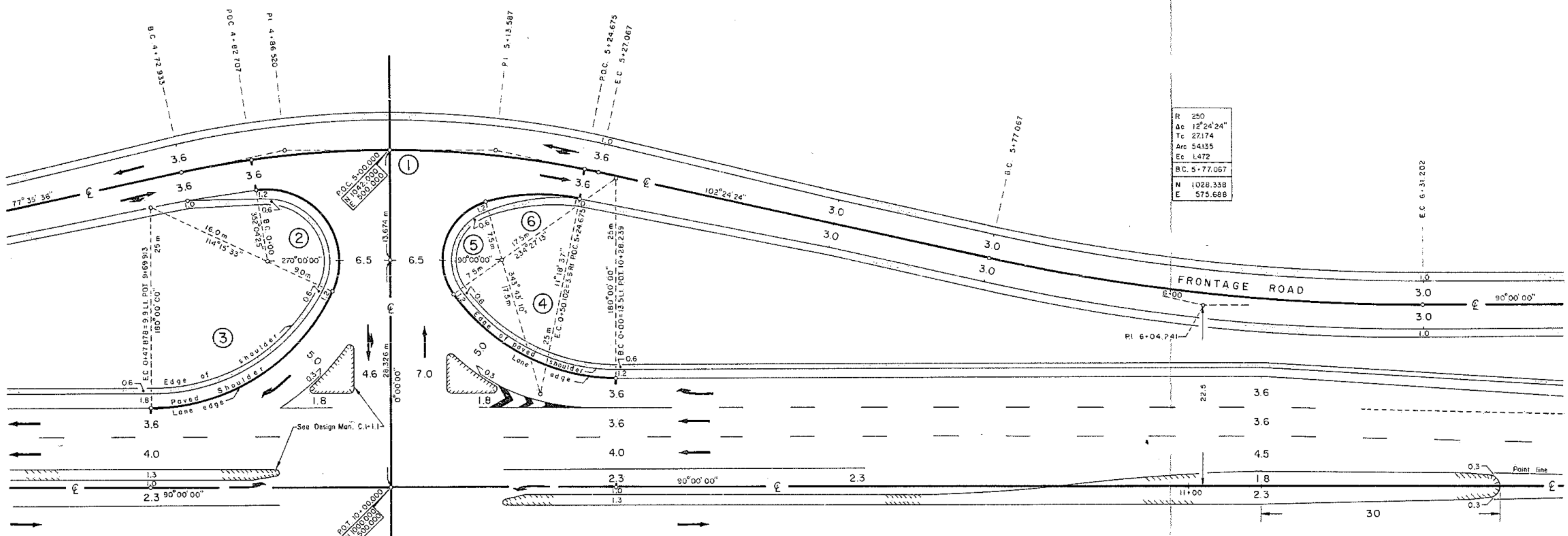
B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS

DESIGN AND SURVEYS BRANCH

TYPICAL HIGHWAY INTERSECTION PARALLEL ACCELERATION LANE

DESIGN MANUAL No.

C.1 - 2.6



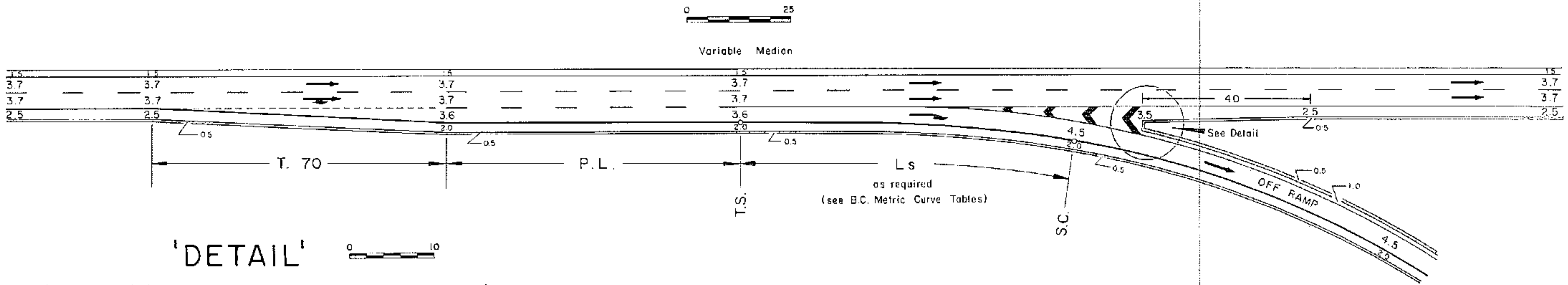
NOTE: All bearings to be set out in the full circle system.
(clockwise from North)

INTERSECTION			CURVES		
Half of Curve 1	2	3	4	5	6
R 125 Δc 12°24'24" Tc 13.587 Arc 27.067 Ec 0.736	R 9 Δc 122°11'08" Tc 16.299 Arc 19.193 Ec 9.618	R 25 Δc 65°44'27" Tc 16.155 Arc 28.685 Ec 4.765	R 25 Δc 54°27'13" Tc 12.863 Arc 23.760 Ec 3.115	R 7.5 Δc 109°15'57" Tc 10.566 Arc 14.303 Ec 5.458	R 25 Δc 27°35'27" Tc 6.138 Arc 12.039 Ec 0.743
P.O.C. 5+00	B.C. 0+00	E.C. 0+47.878	B.C. 0+00	P.C.C. 0+23.760	E.C. 0+50.102
N 1042.000 E 500.000	N 1037.240 E 483.259	N 1009.900 E 469.913	N 1013.500 E 528.239	N 1023.965 E 507.898	N 1036.041 E 523.808

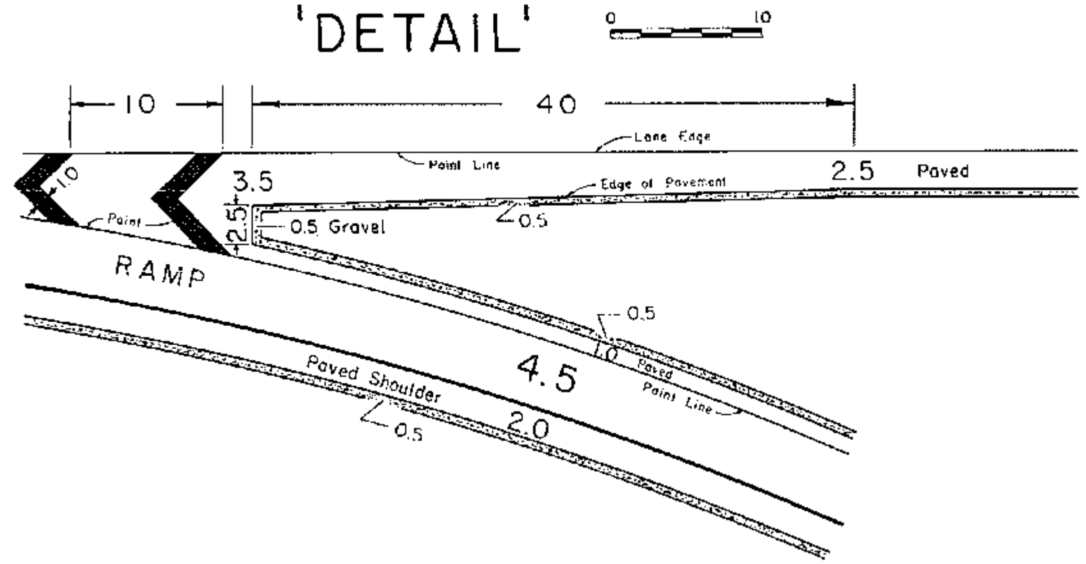
DESIGN SPEED 90 km/h
Design Vehicle WB12

0 — 10 m

APPROVED MG Elston EXECUTIVE DIRECTOR ENGINEERING	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 80-03-04	FRONTAGE ROAD — BULB DESIGN	C.1 – 2.7
REVISED 81-09-25			



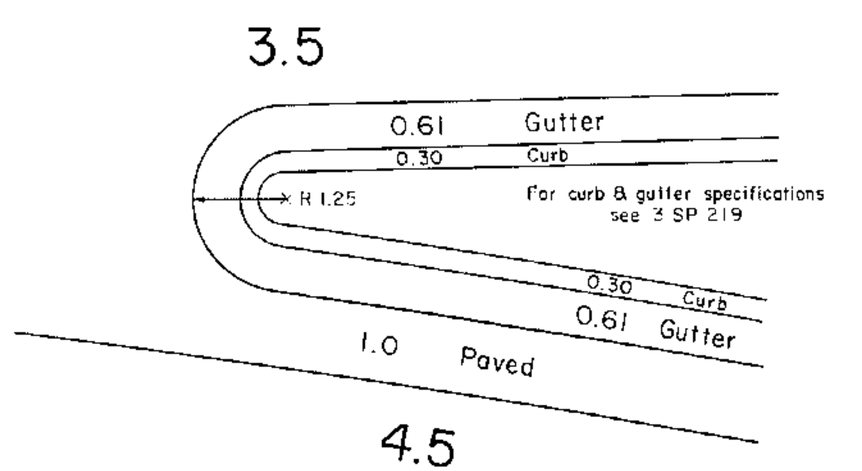
'DETAIL'



RAMP SPEED km/h	PARALLEL LANE P.L. All Grades < 3%	Up Grades 3 to 5%	Up Grades > 5%	Down Grades 3 to 5%	Down Grades > 5%
30	120	103	86	154	188
40	110	94	78	142	174
50	100	85	70	130	160
60	90	76	62	118	146
70	80	68	56	104	128
80	70	60	50	90	110

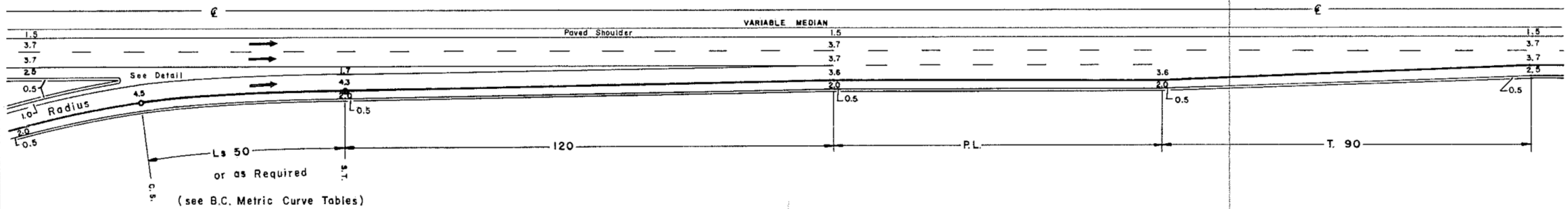
BASED ON HIGHWAY
DESIGN SPEED 110 km/h

'Curb & Gutter Applications'

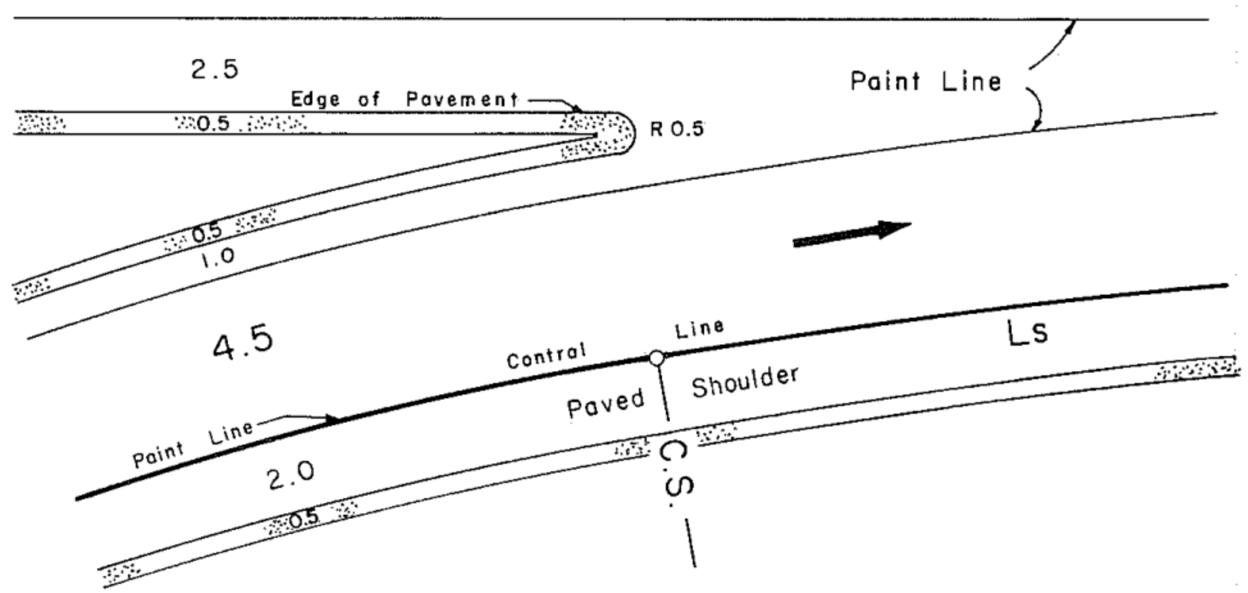


APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS	DESIGN MANUAL No.
M.G.Elston 1985-03-11 EXECUTIVE DIRECTOR ENGINEERING	DESIGN AND SURVEYS BRANCH	
DATE 81-01-30	DECELERATION LANE FOR FREEWAYS AND EXPRESSWAYS	C.2-1.1
REVISED 87-01		

M28-1808



DETAIL



MINIMUM PARALLEL LANE LENGTHS

RAMP SPEED km/h	P.L. for 100 km/h All Grades <3%	Up Grade 3–5%	Up Grade >5%	Down Grade >3%
30	135	280	415	60
40	115	275	405	60
50	75	230	370	60
60	60	155	290	60
70	60	60	145	60
80	60	60	60	60

RAMP SPEED km/h	P.L. for 110 km/h All Grades <3%	Up Grade 3–5%	Up Grade >5%	Down Grade >3%
30	225	400	590	80
40	195	390	585	80
50	165	360	575	80
60	110	325	550	80
70	80	210	440	80
80	80	80	265	80

For >10% trucks, truck speed rather than ramp speed may control P.L.

BRITISH COLUMBIA MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

ACCELERATION LANE
FOR FREEWAYS AND EXPRESSWAYS

APPROVED BY
M.G. Elston
EXECUTIVE DIRECTOR ENGINEERING
DATE 1981-01-30
REVISED 87-01

DESIGN MANUAL No.
C.2-1.2

SECTION D

CONSTRUCTION ITEMS & SPECIAL PROVISIONS

D.1 CONSTRUCTION ITEMS

D.2 SPECIAL PROVISIONS

Province of British Columbia
Ministry of Transportation and Highways

ELECTORAL DISTRICT
PROJECT NO.
HIGHWAY NO.
(RE)CONSTRUCTION: TO
STATION TO STATION BK.=
STATION AH. TO STATION
km
LANDMARK INVENTORY - SEGMENT
km TO km

SCHEDULE OF APPROXIMATE QUANTITIES AND UNIT PRICES

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	c
1.	Mobilization (See Special Provisions, Clause_____) Move in and Move out	L.S.				
	PART I - GRADING					
2.	Clearing and Grubbing (See Special Provisions, Clause_____)					
	(a) Clearing	ha				
	(b) Grubbing	ha				
3.	Roadway Drainage Excavation 300 m Freehaul (See Special Provisions, Clause_____)					
	(a) Type "A"	m^3				
	(b) Type "B"	m^3				
	(c) Type "C"	m^3				
	(d) Type "D"	m^3				
	(e) Type "D", Borrow	m^3				
	(f) Organic Stripping (and Waste Material)	m^3				
	(g) Topsoil	m^3				
4.	Overhaul on Excavation (See Special Provisions, Clause_____)	1000 Sta. m				
5.	Pavement Ripping (See Special Provisions, Clause_____)	m^3				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
6.	Increasing Compaction and Watering (See Special Provisions, Clause____)					
	(a) Increasing Compaction of Top 0.3 m of Subgrade, Section 201.22	m^2				
	(b) Watering in Accordance With Section 201.23	kL				
7.	Base Course & Sub-Base Aggregates Section 202 (See Special Provisions, Clause____)					
	(a) Select Granular Sub-Base 100% to Pass 75mm Square Mesh Screen	t				
	(b) [Well Graded,] [Intermediate Graded,] Crushed Base [or Open Graded] Course 100% to Pass 75mm Square Mesh Screen	t				
	(c) [Well Graded,] Crushed Base [Intermediate Graded,] Course, From [or Open Graded] Stockpile 100% to Pass 75mm Square Mesh Screen	t				
	(d) [Well Graded,] [Intermediate Graded,] Crushed Base [or Open Graded] Course 100% to Pass 25mm Square Mesh Screen	t				
	(e) [Well Graded,] Crushed Base [Intermediate Graded,] Course, From [or Open Graded] Stockpile 100% to Pass 25mm Square Mesh Screen	t				
	(f) Crushed Granular Surfacing 100% to Pass 19mm Square Mesh Screen	t				
	(g) Crushed Granular Surfacing, From Stockpile, 100% to Pass 19mm Square Mesh Screen	t				
8.	Gravel Blanket (See Special Provisions, Clause____)					
9.	Rock Blanket (See Special Provisions, Clause____)					
10.	Gravel Facing (See Special Provisions, Clause____)					

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
11.	Bridge End Fill (See Special Provisions, Clause____)	t				
12.	Haul on Granular Base, Gravel Blankets, Facing and Bridge End Fills (See Special Provisions, Clause____)	t				
	(a) First Kilometre	t				
	(b) Second Kilometre	t				
	. . .	t				
	. . .	t				
	(l) Twelfth Kilometre	t				
13.	Fencing and Farm Gates (See Special Provisions, Clause____)	t				
	(a) Fencing, Type "__", (Dwg. No.__-SP203)	m				
	(b) Gates,__m Opening (Dwg. No.__-SP203)	Each				
14.	Foundation Excavation					
	(a) Type "A"	m^3				
	(b) Type "B"	m^3				
	(c) Type "C"	m^3				
	(d) Type "D"	m^3				
15.	Culverts (See Special Provisions, Clause____)	t				
	(a)	m				
	(b)	m				
	(c)	m				
	(d)	m				
	(e)	m				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
15.	<u>Culverts</u> (continued)					
	(f)	m				
	(g)	m				
	(h) Each* is used for Elbows, etc.	Each*				
	(i)	Each*				
	(Delivery to site and installation in accordance with Section 210. Foundation Excavation to be paid under Item ___. All pipe to be supplied to Contractor, f.o.b. ____________________, B.C.					
16.	<u>Structural Steel Plate Pipe</u> (See Special Provisions, Clause____)					
	(a)	m				
	(b)	m				
	(c)	m				
	(d)	m				
	(Delivery to site and installation in accordance with Section 210. Foundation Excavation to be paid under Item ___. All pipe to be supplied to Contractor, f.o.b. ____________________, B.C.					
17.	<u>Precast Concrete Catch Basins, Manholes and Catch Basin Manholes</u> (See Special Provisions, Clause____)					
	(a) Catch Basins (Dwg. No.__-SP219)	Each				
	(b) ___Manholes (Dwg. No.__-SP219)	Each				
	(i) 0 - 2 m	Each				
	(ii) 2 - 3 m	Each				
	(iii) 3 - 4 m	Each				
	(c) ___Catch Basin Manholes (Dwg. No.__-SP219)	Each				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
18.	Storm Drains					
	(a)	m				
	(b)	m				
	(c)	m				
	(d)	m				
	(e)	m				
	(f)	m				
	(g)	Each*				
	Each* is used for Tees, Wyes, etc.					
	(h)	Each*				
	(i) Bedding and Backfill	m^3				
	(Delivery to site and installation in accordance with Section 219. Foundation Excavation to be paid under Item ___. All pipe to be supplied to Contractor, f.o.b. ____________________, B.C.					
19.	Metal Bin Wall (See Special Provisions, Clause___)					
	(a) Delivery to Site and Erection. All Materials to be Supplied to the Contractor, f.o.b.____________, B.C.	m^2				
	(b) Structural Backfill	t				
20.	Concrete Crib Retaining Wall (See Special Provisions, Clause___)					
	(a) Delivery to Site and Erection. All Materials to be Supplied to the Contractor, f.o.b.____________, B.C.	m^2				
	(b) Structural Backfill	t				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
*21.	Concrete Retaining Wall (See Special Provisions, Clause___)					
	(a) Class"__" Concrete, Supplied in Place	m^3				
	(b) Supply and Place Reinforcing Steel	kg				

*When a "CONCRETE CONSTRUCTION" section is included in the Schedule, include this item in that section.

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
22.	Riprap (See Special Provisions, Clause___)					
	(a) Hand Laid	m^3				
	(b) Loose	m^3				
23.	Sandbags, Supplied in Place (See Special Provisions, Clause___)	Each				
24.	Chain Link Mesh, Supply and Install (See Special Provisions, Clause___)	m^2				
25.	Shotcreting, Supplied in Place (See Special Provisions, Clause___)	m^3				
26.	Rock Bolts, Supply and Install (See Special Provisions, Clause___)	m				
27.	Accommodation of Government Employees (See Special Provisions, Clause___)	Month				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
28.	Plant Mixed Portland Cement Treated Base Course (See Special Provisions, Clause____)					
	(a) Cement Treated Base Course, Supplied in Place	t				
	(b) Spray Bituminous Seal	L				
	(c) Sand Cover	t				
29.	Asphaltic Plant Mixed Stabilized Base (See Special Provisions, Clause____)					
	(a) Class"__", Medium Mix, Supplied in Place	t				
	(b) Integral Curb (Dwg.No. 5-SP223)	m				
30.	Spray Primer (See Special Provisions, Clause____)	L				
31.	Asphalt Levelling Course					
	Class"___", Medium Mix, Supplied in Place	t				
32.	Asphalt Concrete Pavement (See Special Provisions, Clause____)	L				
	(a) Class"__", Medium Mix, Supplied in Place	t				
	(b) Class"__", Medium Mix, f.o.b. Plant	t				
33.	Extruded Asphalt Curb (See Special Provisions, Clause____)					
	Type"___" (Dwg.No. 6-SP223)	m				
34.	Extruded Concrete Curb (See Special Provisions, Clause____)					
	(a) Drawing No. 17-SP219	m				
	(b) Type"___" (Dwg.No. 6-SP223)	m				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
35.	Drainage Outlets (In Accordance with Section 226)					
	(a) 200mm Diameter Corrugated Metal Pipe	m				
	(b) Cast Iron Catch Basin (Dwg.No. 1-SP226)	Each				
36.	Shouldering Aggregate, Supplied in Place	t				
37.	Shoulder Work	km				
38.	Precast Reinforced Concrete No Post Barrier					
	(a) 18" Type "B" (Dwg.No.1-SP323)	m				
	(b) 27" Type "A" (Dwg.No.2-SP323)	m				
	(c) CTB-3 (Dwg.No.8-SP323)	m				
	(d) CTB-1 (Dwg.No.9-SP323)	m				
	(e) CRB-M&F (Dwg.Nos.10&11-SP323)	m				
	(f) CTB-2 (Dwg.No.12-SP323)	m				
	(g) CMB-M&F (Dwg.Nos.13&14-SP323)	m				
	(h) CPB-M&F (Dwg.No.15-SP323)	m				
	(i) CDB-1 (Dwg.No.16-SP323)	m				
	Taking delivery, hauling to the site and installation. All barrier to be supplied to Contractor, f.o.b.____________, B.C.					
39.	Allowance for Adjustment of Haul (See Special Provisions, Clause____)	Prov. Sum				
40.	Allowance for Payments Under Specifications Section 223.43 (See Special Provisions, Clause____)	Prov. Sum				
41.	Allowance for Handwork (See Special Provisions, Clause____)	Prov. Sum				
42.	Preparatory Work at Railway (and Bridge) Crossings (See Special Provisions, Clause____)	Prov. Sum				

Province of British Columbia
Ministry of Transportation and Highways

ELECTORAL DISTRICT
PROJECT NO.
HIGHWAY NO.
(RE)CONSTRUCTION: TO
STATION TO STATION BK.=
STATION AH. TO STATION
km
LANDMARK INVENTORY - SEGMENT
km TO km

SCHEDULE OF APPROXIMATE QUANTITIES AND UNIT PRICES

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	c
1.	Mobilization (See Special Provisions, Clause_____) Move in and Move out	L.S.				
	PART I - GRADING					
2.	Clearing and Grubbing (See Special Provisions, Clause_____)					
	(a) Clearing	ha				
	(b) Grubbing	ha				
3.	Roadway Drainage Excavation 300 m Freehaul (See Special Provisions, Clause_____)					
	(a) Type "A"	m^3				
	(b) Type "B"	m^3				
	(c) Type "C"	m^3				
	(d) Type "D"	m^3				
	(e) Type "D", Borrow	m^3				
	(f) Organic Stripping (and Waste Material)	m^3				
	(g) Topsoil	m^3				
4.	Overhaul on Excavation (See Special Provisions, Clause_____)	1000 Sta. m				
5.	Pavement Ripping (See Special Provisions, Clause_____)	m^3				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
6.	Increasing Compaction and Watering (See Special Provisions, Clause____)					
	(a) Increasing Compaction of Top 0.3 m of Subgrade, Section 201.22	m^2				
	(b) Watering in Accordance With Section 201.23	kL				
7.	Base Course & Sub-Base Aggregates Section 202 (See Special Provisions, Clause____)					
	(a) Select Granular Sub-Base 100% to Pass 75mm Square Mesh Screen	t				
	(b) [Well Graded,] [Intermediate Graded,] Crushed Base [or Open Graded] Course 100% to Pass 75mm Square Mesh Screen	t				
	(c) [Well Graded,] Crushed Base [Intermediate Graded,] Course, From [or Open Graded] Stockpile 100% to Pass 75mm Square Mesh Screen	t				
	(d) [Well Graded,] [Intermediate Graded,] Crushed Base [or Open Graded] Course 100% to Pass 25mm Square Mesh Screen	t				
	(e) [Well Graded,] Crushed Base [Intermediate Graded,] Course, From [or Open Graded] Stockpile 100% to Pass 25mm Square Mesh Screen	t				
	(f) Crushed Granular Surfacing 100% to Pass 19mm Square Mesh Screen	t				
	(g) Crushed Granular Surfacing, From Stockpile, 100% to Pass 19mm Square Mesh Screen	t				
8.	Gravel Blanket (See Special Provisions, Clause____)					
9.	Rock Blanket (See Special Provisions, Clause____)					
10.	Gravel Facing (See Special Provisions, Clause____)					

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
11.	Bridge End Fill (See Special Provisions, Clause____)	t				
12.	Haul on Granular Base, Gravel Blankets, Facing and Bridge End Fills (See Special Provisions, Clause____)	t				
	(a) First Kilometre	t				
	(b) Second Kilometre	t				
	. . .	t				
	. . .	t				
	(l) Twelfth Kilometre	t				
13.	Fencing and Farm Gates (See Special Provisions, Clause____)	t				
	(a) Fencing, Type "__", (Dwg. No.__-SP203)	m				
	(b) Gates,__m Opening (Dwg. No.__-SP203)	Each				
14.	Foundation Excavation					
	(a) Type "A"	m^3				
	(b) Type "B"	m^3				
	(c) Type "C"	m^3				
	(d) Type "D"	m^3				
15.	Culverts (See Special Provisions, Clause____)	t				
	(a)	m				
	(b)	m				
	(c)	m				
	(d)	m				
	(e)	m				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
15.	Culverts (continued)					
	(f)	m				
	(g)	m				
	(h)	Each*				
	Each* is used for Elbows, etc.					
	(i)	Each*				
	(Delivery to site and installation in accordance with Section 210. Foundation Excavation to be paid under Item ___. All pipe to be supplied to Contractor, f.o.b. ____________________, B.C.					
16.	Structural Steel Plate Pipe (See Special Provisions, Clause____)					
	(a)	m				
	(b)	m				
	(c)	m				
	(d)	m				
	(Delivery to site and installation in accordance with Section 210. Foundation Excavation to be paid under Item ___. All pipe to be supplied to Contractor, f.o.b. ____________________, B.C.					
17.	Precast Concrete Catch Basins, Manholes and Catch Basin Manholes (See Special Provisions, Clause____)					
	(a) Catch Basins (Dwg. No.__-SP219)	Each				
	(b) ___Manholes (Dwg. No.__-SP219)	Each				
	(i) 0 - 2 m	Each				
	(ii) 2 - 3 m	Each				
	(iii) 3 - 4 m	Each				
	(c) ___Catch Basin Manholes (Dwg. No.__-SP219)	Each				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	AMOUNT ¢
18.	Storm Drains					
	(a)	m				
	(b)	m				
	(c)	m				
	(d)	m				
	(e)	m				
	(f)	m				
	(g)	Each*				
	Each* is used for Tees, Wyes, etc.					
	(h)	Each*				
	(i) Bedding and Backfill	m^3				
	(Delivery to site and installation in accordance with Section 219. Foundation Excavation to be paid under Item ___. All pipe to be supplied to Contractor, f.o.b. ____________________, B.C.					
19.	Metal Bin Wall (See Special Provisions, Clause___)					
	(a) Delivery to Site and Erection. All Materials to be Supplied to the Contractor, f.o.b.____________, B.C.	m^2				
	(b) Structural Backfill	t				
20.	Concrete Crib Retaining Wall (See Special Provisions, Clause___)					
	(a) Delivery to Site and Erection. All Materials to be Supplied to the Contractor, f.o.b.____________, B.C.	m^2				
	(b) Structural Backfill	t				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
*21.	Concrete Retaining Wall (See Special Provisions, Clause___)					
	(a) Class"__" Concrete, Supplied in Place	m^3				
	(b) Supply and Place Reinforcing Steel	kg				

*When a "CONCRETE CONSTRUCTION" section is included in the Schedule, include this item in that section.

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
22.	Riprap (See Special Provisions, Clause___)					
	(a) Hand Laid	m^3				
	(b) Loose	m^3				
23.	Sandbags, Supplied in Place (See Special Provisions, Clause___)	Each				
24.	Chain Link Mesh, Supply and Install (See Special Provisions, Clause___)	m^2				
25.	Shotcreting, Supplied in Place (See Special Provisions, Clause___)	m^3				
26.	Rock Bolts, Supply and Install (See Special Provisions, Clause___)	m				
27.	Accommodation of Government Employees (See Special Provisions, Clause___)	Month				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	c
28.	Plant Mixed Portland Cement Treated Base Course (See Special Provisions, Clause____)					
	(a) Cement Treated Base Course, Supplied in Place	t				
	(b) Spray Bituminous Seal	L				
	(c) Sand Cover	t				
29.	Asphaltic Plant Mixed Stabilized Base (See Special Provisions, Clause____)					
	(a) Class"__", Medium Mix, Supplied in Place	t				
	(b) Integral Curb (Dwg.No. 5-SP223)	m				
30.	Spray Primer (See Special Provisions, Clause____)	L				
31.	Asphalt Levelling Course					
	Class"___", Medium Mix, Supplied in Place	t				
32.	Asphalt Concrete Pavement (See Special Provisions, Clause____)	L				
	(a) Class"__", Medium Mix, Supplied in Place	t				
	(b) Class"__", Medium Mix, f.o.b. Plant	t				
33.	Extruded Asphalt Curb (See Special Provisions, Clause____)					
	Type"___" (Dwg.No. 6-SP223)	m				
34.	Extruded Concrete Curb (See Special Provisions, Clause____)					
	(a) Drawing No. 17-SP219	m				
	(b) Type"___" (Dwg.No. 6-SP223)	m				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	c
35.	Drainage Outlets (In Accordance with Section 226)					
	(a) 200mm Diameter Corrugated Metal Pipe	m				
	(b) Cast Iron Catch Basin (Dwg.No. 1-SP226)	Each				
36.	Shouldering Aggregate, Supplied in Place	t				
37.	Shoulder Work	km				
38.	Precast Reinforced Concrete No Post Barrier					
	(a) 18" Type "B" (Dwg.No.1-SP323)	m				
	(b) 27" Type "A" (Dwg.No.2-SP323)	m				
	(c) CTB-3 (Dwg.No.8-SP323)	m				
	(d) CTB-1 (Dwg.No.9-SP323)	m				
	(e) CRB-M&F (Dwg.Nos.10&11-SP323)	m				
	(f) CTB-2 (Dwg.No.12-SP323)	m				
	(g) CMB-M&F (Dwg.Nos.13&14-SP323)	m				
	(h) CPB-M&F (Dwg.No.15-SP323)	m				
	(i) CDB-1 (Dwg.No.16-SP323)	m				
	Taking delivery, hauling to the site and installation. All barrier to be supplied to Contractor, f.o.b.____________, B.C.					
39.	Allowance for Adjustment of Haul (See Special Provisions, Clause____)	Prov. Sum				
40.	Allowance for Payments Under Specifications Section 223.43 (See Special Provisions, Clause____)	Prov. Sum				
41.	Allowance for Handwork (See Special Provisions, Clause____)	Prov. Sum				
42.	Preparatory Work at Railway (and Bridge) Crossings (See Special Provisions, Clause____)	Prov. Sum				

1. In order to provide sufficient space for placing of unsuitable material during construction, additional Right-of-Way width is to be provided beyond the slope stake point to contain the wasted material piled 1.2 m high. Generally, this material is pushed each way from centre line.

2. In built up areas where (1) is not possible, definite areas must be allocated, and noted in the Special Provisions.

For short projects where the 150 mm depth of 75 mm Crushed Base Course is in the region of 20 000 tonnes or less, it is likely it will not be economical to include this item unless there is a ready source available, i.e. from Ministry crusher, stockpile, or by purchase.

Thus if the quantity of Crushed Base Course is small and not readily available, it shall be deleted and replaced by Select Granular Sub Base. In this case if the Select Granular Sub Base is predominantly sand, the 25 mm Crushed Base Course shall be increased to 225 mm depth.

Include installation of drainage curb and outlets for paved surfaces for O.M. fills if:-

1. O.M. fill is over 3 m high.

2. Grade is over 4%.

3. Superelevation is over 6%.

4. Any superelevated pavement is wider than 15 m.

<u>NOTE:</u>

- Asphalt curbs for rural projects.
- Concrete curbs for urban projects and other areas where there is considerable development.

1. To prevent unsightly and excessive humping in the centre of raised traffic islands, the following note should appear on the drawings or in the Special Provisions:-
"Curbed island surfaces to be paved shall lie in a plane parallel to road superelevation and/or grade."
All of the note may not apply, and thus only the applicable portions need be shown.

2. Extruded concrete curb shall be used for traffic islands. Small protector islands used with 2 way left turn lanes shall be solid concrete.

3. Guidelines for surfacing traffic islands are given in Circular G56/79. Policy Guidelines for Landscape Design. The alternatives are:-
   a. Asphalt paving involving backfill with 19 mm crushed gravel and capping with a 50 mm lift of asphalt.
   b. Grouted stone paving using available cobbles or shot rock.
   c. Concrete paving where island ramps are required (see Design Manual No. C.1-1.3).
   d. Grass or low growth planting where islands are unusually large.

Where a Contractor's Work Camp is required, it shall generally be left to the Contractor to select a site, and it will be his responsibility to make application to the appropriate agencies.

If a Camp is required in an area of special interest such as a park or reserve, then the designer shall determine where camps would be acceptable and refer to the site(s) in the Special Provisions. Formal application would still be the responsibility of the Contractor.

Some guidelines for the choice of work camp sites are as follows:-

1. The prime requirement is a good water source.

2. Size: (a) Minimum 1.2 hectares, preferably 2 hectares.

   (b) Minimum width 60 metres.

3. As close to the middle of job as possible.

4. A minimum of grading or clearing, AND WITH GOOD NATURAL DRAINAGE.

5. Access to the site by private automobile.

Items 3, 4 and 5 have to be adjusted to actual conditions.

1. When designating a gravel pit, assure that the area shown is sufficient to include a crusher and stockpile site. If the gravel pit report indicates a crusher and stockpile site, show this on the plan drawing.

1. One complete set of plan prints showing slope points (working drawings acceptable) are to be submitted with all design projects.

These will allow a quick check of right-of-way requirements, and are also of interest to the Construction Project Supervisor especially where utility poles have to be relocated.

1. Pre-tender meetings shall be arranged with the Director of Construction and/or Regional Manager of Construction for each Contract project prior to submittal to the Executive Director Engineering for approval.

2. Half-size prints of all the project drawings, copy of the draft Special Provisions and an unpriced Schedule should be forwarded to the Construction Project Supervisor at least two weeks in advance of the meeting.

3. Notes shall be made of all desirable changes. Some items may require further discussion with the Director of Highway Design and Surveys, or the Senior Highway Design Engineer prior to acceptance.

4. For Urban curb and gutter design, meetings shall be arranged with either the Director of Construction or the Director of Paving depending on which Branch will supervise construction.

1. All design information is to be included in design folders using available H____ forms. (See D.1-39.7)

2. All items on estimate (including materials) must have the quantity substantiated by entry in design folders. Figures used for estimate must be boxed in red and clearly denoted by the term 'Estimate'.

3. All Design Folder information shall be forwarded to the Regional Manager of Construction or the Construction Branch Project Supervisor; or to the Regional Director or District Highways Manager if the Project is to be constructed by Day Labour.

All design information is to be included in design folders using available 'H' forms as below:

FORM TITLE	NUMBER	FOLDER
APPROXIMATE ESTIMATE OF GRADING & EMBANKMENT QUANTITIES	H 756	3
ASPHALT PAVEMENT	H 754	2
CLASSIFICATION REPORT	H 740	4
CLEARING, GRUBBING & RIGHT-OF-WAY AREAS	H 749	1
CLEARING & GRUBBING SUMMARY	H 750	1
COMPACTION OF SUBGRADE	H 755	2
CONCRETE CULVERTS	H 743	1
CONCRETE RETAINING WALLS	H 746	1
C.S.P. CULVERTS	H 741	1
CULVERT SUMMARY	H 742	1
FENCING & GATES	H 745	1
FOUNDATION EXCAVATION SUMMARY	H 744	1
GRADE SHEET	H 78	2
GRAVEL PIT	H 761	4
GRAVEL QUANTITIES & HAUL	H 753	2
GUIDE RAILS & BARRIERS	H 748	1
MATERIAL QUANTITY SUMMARY	H 757	3
METAL BIN WALLS & CONCRETE CRIB WALLS	H 747	1
OVERHAUL	H 759	3
PARTY CHIEF'S FIELD REPORT	H 762	4
QUANTITY CHECK	H 758	3
SOILS CLASSIFICATION & DESIGN SUMMARY	H 760	4
STREAM FLOW CALCULATIONS	H 751	1
TRAVERSE TABLE	H 101	2
UTILITY POLES TO BE MOVED	H 96	1

ROADWAY DEFINITIONS - R.T.A.C.

1. Freeway: A divided highway for through traffic with full control of access by grade separations at intersections.

2. Expressway: A divided highway for through traffic with access only at intersections.

   Some intersections may be grade separated.

3. Arterial: A street or highway usually on a continuous route, primarily for through traffic with land access a secondary consideration.

4. Collector: A street or road performing the dual function of land access and the distribution of traffic between arterials and local roads.

5. Local A street or road providing land access with little or no provision for through traffic.

OVERPASS: Structure carrying highway over road or railway.

UNDERPASS: Structure carrying road or railway over highway.

FLYOVER: Structure carrying one way traffic of highway over same highway.

SHOO-FLY: Temporary railway diversion used during the construction of a highway underpass.

INTERCHANGE: Grade separated intersection.

For other definitions see "Glossary" in R.T.A.C. Manual

1. An estimate for seeding costs is to be included in the Schedule of Approximate Quantities and Unit Prices under 'Additional Materials' as a lump sum price.

2. The following prices are to be applied on a per hectare basis for all Regions:-

Seeding and Fertilizing	Mulching
$ 740/ ha	$1,750/ ha

The Mulching cost includes Seeding and Fertilizing.

3. Solid rock areas are not to be included.

4. Mulching is to be applied on earth slopes steeper than 2:1 or where erosion could be a problem. Mulching is not required on gravel areas as this prevents seed from being washed into voids between the gravel.

5. 0.5 hectares per kilometre are to be added to the estimate to allow for areas between toes and the Right-of-Way boundaries.

An estimate for legal survey costs is to be included in 'The Schedule of Approximate Quantities and Unit Prices' under 'Miscellaneous' as a lump sum price.

The following prices are to be applied on a per kilometre basis:-

1.	Urban subdivision area	$ 6,000
2.	Rural subdivision area	$ 4,000
3.	Townships and/or District Lots	$ 2,900
4.	Unsurveyed crown land	$ 2,100

If existing legal survey posting is sparse, the above prices should be increased by 20%.

______________________ ELECTORAL DISTRICT

PROJECT NO. ________

______________________ HIGHWAY

(RE-)CONSTRUCTION ______________________

Enquiries

Requests for clarification of the Special Provisions, Specifications and/or Drawings should be addressed to the Director of Construction, Ministry of Transportation and Highways, 940 Blanshard Street, Victoria, British Columbia, V8W 3E6 - Telephone Numbers 387-3276 or 387-3278.

SPECIAL PROVISIONS

__. Location of Project

N O T E

The issue of typical/standard Special Provision clauses is restricted to concerned Ministry Branches and actual consultants. However, individual requests will be considered upon receipt of a written request to:-

Ministry of Transportation and Highways
Design and Surveys Branch
940 Blanshard Street
Victoria, British Columbia
V8W 3E6

ATTENTION: Standards Branch

For convenience and easy reference the following three pages list the Specifications Sections and Standard SP/Miscellaneous Drawings contained in the General Specifications for Highway Construction available for the sum of $25.00 from the Contract Documents Office at the above address.

GENERAL SPECIFICATIONS SECTIONS

190 - General Requirements - Highway Construction
191 - Preliminary and General - Bridge Construction
192 - Preliminary and General - Ferry Terminals
194 - Traffic Control
195 - Protection of the Environment
200 - Clearing and Grubbing
201 - Roadway and Drainage Excavation
202 - Granular Surfacing, Base and Sub-bases
203 - Wire Fence and Farm Gates
204 - Guard Rail
205 - Riprap
206 - Stone Paving
207 - Foundation Excavation
208 - Dry Masonry Walls
209 - Mortar Rubble Masonry Walls
210 - Culverts
211 - Concrete for Highway Bridges and Major Structures
212 - Reinforcing Steel for Concrete Structures
213 - Timber Bridges - Construction
214 - Timber Piling - Construction
215 - Bridges
216 - Painting of Steel Structures
217 -
218 - Concrete for Minor Works
219 - Concrete Curb and Gutter and Storm Drainage
220 - Asphalt Stabilized Base Course Mixed in Place
221 -
222 - Plant Mixed Portland Cement Treated Base Course
223 - Asphalt Concrete Paving
224 - Bituminous Seal Coat
225 - Production and Stockpiling of Asphalt Mix
226 - Standard Highway Drainage Outlets
227 -
228 -
229 - Chain Link Mesh (Slope Protection)
230 - Landscaping
231 -
232 - Metal Bin Walls
233 - Concrete Crib Retaining Wall
234 -
235 - Traffic Signals and Roadway Lighting Installation

300 - Wire Rope
301 - Structural Steelwork
302 - Reinforcing
303 - Timber - Materials
304 - Timber - Fabrication
305 - Timber - Glued Laminated
306 - Round Timber Piles
307 - Preservative Treatment
308 - Paint
309 - Steel and Iron
310 - Portland Cement
311 - Asphalt Materials for Highway Use
312 - Guard Rail (See Temporary Specification Notes on Dwg. 1-SP312)
313 -
314 - Admixtures for Portland Cement Concrete
315 - Treated Wood Fence Posts
316 - Galvanized Steel and Wire Fencing
317 -
318 - Plastic Drainage Pipe
319 - Calcium Chloride and Sodium Chloride
320 - Corrugated Steel Pipe
321 - Traffic Paint
322 - Plastic Traffic Cones
323 - Precast Reinforced Concrete Barriers

STANDARD DRAWINGS

MISC. DWG. #	STD. (SP) #	
ex 186-6 to 186-11		Culverts: See SP210 series
186-12		Mortar Rubble Masonry Retaining Wall
186-13		Typical Highway Section - Dry Masonry Walls
ex 186-15		Guardrail: See SP312 series
ex 186-16F to 186-16K		No Post: See SP323 series for concrete traffic barriers
ex 186-17		Standard Wire Fence Type "A") See 1-SP203 and
ex 186-21		Standard Wire Fence Type "B") Special Provisions
ex 186-28		Standard Wire Fence Type "C") for Modifications
186-22		Standard Farm Gate with Wood Posts
ex.186-27, -32, -34		Cattleguards: Prefabricated Steel Units to be Used
186-35		Chain Link Mesh Installation - Slope Protection
ex 186-37		Asphalt Curb: See SP226 series
186-38		Standard 24 Foot Cattle Guard
186-39		Standard Wire Fence with Steel T-Bar Posts
186-40		Standard Farm Gate for Steel T-Bar Fencing
	1-SP190	Scale House
	1-SP194	Contractor's Name Tab (Rev. 82:07)
	2-SP194	Standard Temporary Highway Delineator
	1-SP201	Typical Sidehill Rock Section and Rock Cut
	2-SP201	Typical Section Side Borrow (ex 316-4)
	3-SP201	Typical Section Earth Cut (ex 316-6)
	4-SP201	Typical Retaining Wall Section
	5-SP201	Typical Section Rock or Earth Fill and Shoulder Paving Detail (ex 316-8)
	6-SP201	Special Slope Treatment (ex 316-9)
	1-SP203	Standard Wire Fences (A, B and Revised C)
	1-SP210	End Walls for 450 mm to 1050 mm Pipe (ex 186-6)
	2-SP210	End Walls for 1200 mm to 1650 mm Pipe (ex 186-7)
	3-SP210	Pipe Culvert Layouts for End Walls (ex 186-8)
	4-SP210	End Wall for Skewed Culvert (ex 186-10)
	5-SP210	Concrete Cradle for Culvert Pipe (ex 186-11)
214-1		Pile Point
	1-SP219	Combined curb and gutter (ex 275-1A & 1B)
	2-SP219	Mountable curb and gutter (new)
	3-SP219	Valley curb and gutter (ex 370)
	4-SP219	Island or Median Curb (ex 17-SP219 of 1978)
	6-SP219	Concrete Catch Basin (ex 275-3)
	7-SP219	Precast Reinforced Concrete Catch Basin (ex 275-5)
	8-SP219	Corrugated Steel Catch Basin (new)
	10-SP219	Catch Basin Grate (ex 289-A)
	11-SP219	Catch Basin Frame (ex 289)
	12-SP219	Twin-Inlet Catch Basin Frame (new)
	13-SP219	Grate Installation Depressed Gutter (ex 275-4)
	14-SP219	Prefabricated Curb Inlet (new)
	15-SP219	Trapping Hood (ex 289-5)
	17-SP219	Combined Concrete Catch Basin and Manhole (ex 275-2A & 354-2)
	18-SP219	Precast Concrete combined Catch Basin and Manhole (ex 354-3)
	19-SP219	Concrete Manhole (ex 354)
	20-SP219	Precast Reinforced Concrete Manhole (ex 354-1)
	21-SP219	Prefabricated Concrete Tee Manholes (new)
	22-SP219	Corrugated Steel Manhole - main smaller than riser (new)
	23-SP219	Corrugated Steel Manhole - main larger than riser (new)
	24-SP219	Manhole Frame #12 (ex 289-4)
	25-SP219	Manhole Cover #1 (ex 289-3)
	26-SP219	Concrete Sidewalk and Driveway Entrance (new)
	27-SP219	Sidewalk Fence (ex 344 and 344-1)
	28-SP219	Typical Reinforced Concrete Steps (ex 371)

STANDARD DRAWINGS (continued)

MISC. DWG. #	STD. (SP) #	
	1-SP223	Diagrammatic) - Drum Mix Plants (ex
	2-SP223	Asphalt Circulating) - Batch type (223/18
	3-SP223	& Proportioning Systems) - Continuous Mix Plants (series
224-10		Grading Chart for Seal Coat Cover Aggregate
	1-SP226	Cast Iron Catch Basin (ex 226-1A)
	2-SP226	Installation of Curb, Barriers, Catch Basin and Drainage Outlets (ex 226-2)
	3-SP226	Integral Asphalt Curb (ex 327)
	4-SP226	Drainage Curbs (ex 186-37)
	5-SP226	Asphalt Curb Drainage Outlet (Rural) (new)
	40.1-SP235	Concrete Pedestal (Formed)
	40.2-SP235	Concrete Pedestal for Special Davit and Signal Pole (Formed)
	40.3-SP235	Concrete Pedestal (Sonotube)
	41 -SP235	Conduit Entrance - Cabinet to Pole
	42.1-SP235	Junction Box Details (Plastic)
	42.2-SP235	Junction Box Details (Plastic)
	42.3-SP235	Junction Box Details (Concrete)
	43 -SP235	Post Mounted Flasher
	44.1-SP235	Signal Head Mounting Details
	44.2-SP235	Signal Head Mounting Details
	45 -SP235	Pedestrian Pushbutton
	46 -SP235	Pole Mounting Clamp
	47.1-SP235	Frangible Base Details - 9.2 & 10.7 m luminaire poles
	47.2-SP235	Frangible Base Details for 13.7 m luminaire poles
	47.3-SP235	Frangible Base Details for 13.7 m luminaire poles Safe-T-Base installation instructions
	48 -SP235	Overhead Lamp Standard Wiring
	49 -SP235	Controller Pedestal Details
	50.1-SP235	Illuminated Davit Sign
	50.2-SP235	Illuminated Davit Sign
	51 -SP235	Fire Signal Details
	52 -SP235	Details of Backguying of Standards
ex 275-1A to 275-5 and 289 to 289-5		Concrete Curb and Gutter, Catch Basin and Manholes } See SP 219 series
	1-SP311	Asphalt Truck Tank Sampling Valve
	1-SP312	Guardrail - Steel W-Beam with installation notes
	2-SP312	BCT - Breakaway Cable Terminal Assembly
	3-SP312	THRIE - Beam Steel Guardrail
313		Typical Concrete Retaining Wall
ex 316-1,2,4, 6,7 and 8		Typical Sections - Sidehill, cut, side borrow) see SP201 earth cut, retaining wall, rock or earth fill) series
ex 316-9		Special Slope Treatment: see 6-SP201 (82:08)
	1-SP323 (Imperial)	18" x 10'0" No-Post Barrier, Type B (ex 186-16F)
	NOTE: 1-SP323 (Imp)	includes CBN-1, 457 mm Bullnose end
	2-SP323 (Imperial)	27" x 8'0" No-Post Barrier, Type A (ex 186-16K)
	8-SP323	27" to 690 mm CTB - 3 (E & H) Transition
	9-SP323	690 mm to 457 mm CTB - 1 Transition
	10-SP323 & 11-SP323	690 mm CRB-M & CRB-F Roadside Barrier
	12-SP323	810 to 690 mm CTB-2 Transition
	13-SP323 & 14-SP323	810 mm CMB-M & CRB-F Median Barrier
ex 326		Typical Cross Section - Required Shouldering: see 5-SP201
ex 327		Asphalt Curb: See SP226 series
ex 344 & 334-1		Sidewalk Fence: See SP219 series
347		Standard Metal Bin Wall
348		Standard Concrete Crib Retaining Wall
ex 354 to 354-3 & ex 370 & 371		Concrete Curb & Gutter,) Catch Basin and Manholes) See SP219 series

ELECTORAL DISTRICT

PROJECT NO.

HIGHWAY

(RE-)CONSTRUCTION

Enquiries

Requests for clarification of the Special Provisions, Specifications and/or Drawings should be addressed to the Director of Construction, Ministry of Transportation and Highways, 940 Blanshard Street, Victoria, British Columbia, V8W 3E6 - Telephone Numbers 387-3276 or 387-3278.

SPECIAL PROVISIONS

. Location of Project

. Scope of Project

. Work by Others

__ . Drawings

The drawings accompanying these Special Provisions and forming the basis of this Contract are hereinafter referred to as the Drawings and are listed in detail as follows:-

!NOTE: Standard Specifications (SP) or Miscellaneous Drawing Numbers are to be referenced in the "Order of Contents" (the Index)!

__ . Cross Sections

Cross sections of the Project are available for inspection at the office of the Ministry of Transportation and Highways at

....

!NOTE: In some cases it may be necessary to include the cross sections as project drawings.!

__ . Reference Information

The following reference information is available for examination at the office of the Ministry of Transportation and Highways at

....

!Such As Geotechnical Investigation - plans, seismic profiles and sections (but not reports), drill logs, drill cores and samples and gravel pit investigation.!

No responsibility will be assumed by the Ministry for any interpretation which the Contractor may make in using the above information.

. Specifications and Requirements

These Special Provisions, together with the Contract Drawings, shall be read and construed in conjunction with, and shall take precedence over the listed and otherwise applicable "General Specifications for Highway Construction" and associated Standard Specifications (SP) Drawings.

Otherwise all work shall be in accordance with the "General Specifications for Highway Construction" issued by the Ministry as referred to in the Tender Notice.

However any section of the General Specifications bound herein may contain revisions which shall apply to this Contract and shall take precedence over a similarly numbered section issued previously. Sections printed on pink paper have been converted to metric measure, by either a hard or soft conversion.

The Contractor's attention is drawn to the units of size and quantity generally used in the documentation of the Project. If any material required in the metric or imperial measure is suggested for use by the Contractor in the other measure, then, provided that the change will not unfavourably affect the design, size, mass or strength of the item, the substitution may be approved by the Engineer upon written submission by the Contractor. No variation in the Contract unit price or amount will normally be permitted for such substitution.

. Contract Completion Date and Program

The whole of the Work as specified shall be completed not later than

....

The Contractor shall submit to the Engineer for the pre-construction meeting or acceptance of the Tender, whichever is the sooner, a detailed list of equipment and program showing the order in which, and the methods by which, it is proposed to carry out the Works. Adequate particulars shall be furnished of the arrangements, methods, materials, construction plans of temporary works which the Contractor proposes to supply, use or construct. The following items shall be included in the program:-

(a) Clearing, grubbing and burning;

(b) Sub-grade excavation and embankments;

( )

( )

( ) Clean-up and vacate site.

Works not included in this Contract may be performed by others concurrently with this Contract and scheduled in accordance with the above-mentioned completion time.

Time is of the essence of this Contract.

. Materials Supplied by the Ministry

The Ministry will supply the materials as listed hereunder, f.o.b. truck the Contractors job site yard (or) .... (or rail):

( ) Corrugated Steel Pipe (culvert - storm sewer).
( ) Structural Steel Plate Culvert Materials.
( ) Storm Sewer Pipe.
( ) Manhole Frames and Covers.
( ) Catch Basin Frames and Gratings.
( ) Catch Basins (Cast Iron - Corrugated Steel).
( ) Precast Concrete Catch Basins and Lids.
( ) Precast Concrete Manhole Sections and Lids.
( ) Binwall Material.
( ) Portland Cement.
( ) Asphalt Primer, Asphalt Cement.
( ) Guard Rail.
( ) Precast Concrete Barriers.

The Contractor's attention is drawn to Clause 190.9 and in particular to his responsibility for unloading materials (except where specifically part of the Supplier's responsibility by the originating Purchase Order) and the acceptance and any rejection of materials supplied by the Ministry.

!NOTE: Optional Paragraph Following!

Owing to the length of the project and the time for completion, the Ministry will not be ordering all materials immediately to avoid storage problems. The Contractor shall therefore keep the Engineer advised two months in advance of his proposed construction schedule to allow sufficient time to procure materials for various phases of the work. It shall be the Contractor's responsibility to satisfy himself that materials will be available before commencing any phase of the work.

. Utilities

The Contractor's attention is drawn to the relocation and/or proximity of the

and to the general requirements of Clause 190.19.

Utility	Representative	Telephone No.

!NOTE: List all lines, poles, pipes or conduits, etc. above. Also name each Utility and the utility's responsible representative's name and telephone number.!

. Protection of the Environment

!NOTE: *Use either the non-fish bearing or fish-bearing clause(s) following as is applicable!*

No fish-bearing streams, lakes or other bodies of water, or other sensitive or special use areas are designated for this Project but the general restraints in regard to the protection of any water or drainage course shall be as set out in Clauses 1 (a) through 1 (d) of Section 195.

!OR!

Fish-bearing streams, lakes or other bodies of water listed as follows, and all referred to as "designated streams" which are subject to the restraints set out in Section 195 are as follows:-

1

2

3

!NOTE: *List the name of streams, lakes etc. and stations above!*

Any activity within the wetted perimeter of any "designated stream" shall be carried out only between...................
and....................

Sensitive or potential problem areas subject to the restraints set out in Section 195 are as follows:-

The following officials shall be notified at least 5 working days prior to commencement of any activity within the wetted perimeter of any of the above designated streams.

Federal; Fisheries & Oceans Canada:

Name	Title ....
Address	Telephone # ....

Provincial; Fish & Wildlife Branch, Ministry of the Environment

Name	Title ....
Address	Telephone # ....

!NOTE: *Where applicable add the following:!*

Additional restraints are:-

. Protection of Railway Property

!*NOTE:* *Where applicable use the following:!*

In addition to the general requirements of Clause 190.32 for the protection of railway property the Contractor shall be responsible for the following procedures and protective measures:-

( ) Prior to commencement of any works, field inspection with the Contractor's Superintendent, the Ministry's Engineer and the Railway's Division Engineer and/or his representative will be necessary in order to obtain a schedule of work and relative information regarding work methods, etc., in the area, and to familiarize the Contractor with equipment, planking and other protective measures necessary to the Railway's safe operation, including action to be taken to move additional equipment to the site immediately should any major slide take place as a result of unforeseen circumstances.

( ) Work at locations where trees, rocks, slides, etc., are liable to be disturbed and foul Railway track, is to be programmed so that no more than two locations, each covering a distance no greater than 300 m on the track, are worked at one time.

( ) Work is to be carried out in such a manner as to keep the quantity of rock or other material falling on the track to a minimum. No rock or other material is to be purposely handled in such a manner that it would land on or be sufficiently close to the track, where it might be a hazard to the operation of trains or other railway forces or equipment.

Although it is virtually impossible to prevent some rock falling on or close to the track during blasting and clearing, the following is required to protect railway operations:-

( ) The Railway will provide men on the track to protect train movement or other operations.

( ) The Highway Contractor shall keep sufficient equipment of size suitable to Railway's Division Engineer available at the track to immediately remove any material fouling the track. In the event of track being rendered impassable for any reason as a result of highway operations, the Contractor's machinery and/or men are to be used as required to restore the line.

( ) The Contractor shall blanket the track with planks and/or gravel subject to the approval of the Railway Company.

( ) The Contractor shall provide at his expense a flagperson with radio equipment at each temporary railway crossing. If any additional flagpersons are required for advance communication the costs will be borne by the Ministry.

( ) Blasting or other work which might endanger the railway track, operation or personnel, shall not proceed without specific coordination with the Railway Company and its schedule and shall have the approval of the Engineer.

The above protection conditions are incidental to the cost of Excavation.

!NOTE: *Review Sections 190 and 194 and include here (before "Insurance" and "Mobilization" special provisions) any necessary amplification or requirements such as for:-*

Engineers Office and telephone.

Construction Camp, etc.

Closing the Highway.

Detours.

Haul route crossing of highway.!

. Insurance

The Contractor shall comply with the requirements of the Insurance Specification H.619 (or) ....

No separate payment will be made for insurance coverage, the cost thereof is to be included in the bid prices.

!NOTE 1: *Where unusual conditions of risk occur especially in built-up areas, canyons and the like have the General Liability insurance coverage of $1,000,000. checked with the Director of Construction as to any increase to $2,000,000., $5,000,000. or more and where necessary include the following as a new 2nd paragraph to the above:-*

The coverage under Clause 3 of the Insurance Specifications for Third Party Insurance comprehensive general liability including non-owned auto-insurance shall be increased to inclusive limits of not less than $...............!

!NOTE 2: *Change Insurance Specification number from H.619 above and in "Order of Contents" to H.620 when C.N. Railway is involved and to H.621 for C.P. Railway!*

!NOTE 3: *If B.C. Railway is involved use H.619 and state the following:-*

The Named Insured under Clause 2 shall also include the British Columbia Railway and any of its employees, servants or agents.

Under Clause 9 Evidence of Coverage, the Contractor shall also forward a certified copy of the policies to the Real Estate Agent Mr. ...., B. C. Railway, 1200 - 1177 West Hastings Street, Vancouver, B. C., V6E 2N6.!

!NOTE 4: *Use similiar worded clause to Note 3 where B. C. Hydro (or other authority) requires protection and note any increased protection requirements.!*

!NOTE 5: *Where a bridge or other major structure is included as a separate PART of the Contract, change the Insurance Specifications above from H.619 to H.616 (H.620 to H.617 or H.621 to H.618) and add the following as a new next-to-last paragraph above:-*

Direct Damage/Builders Risk insurance shall be in accordance with Clause 4 of the Insurance Specifications but for the full value of PART ...., ... (Bridge or Structure) of the Contract with an additional amount of $............ included to cover the value of materials supplied by the Ministry.!

. Mobilization

Payment in the amount of 75% of the lump sum bid under the Schedule Item for Mobilization will be authorized on the progress estimate after the Contractor's camp (if applicable), shop, office and equipment are on the site and work has commenced on the Project. The remaining 25% will be authorized, provided the equipment has been removed from the Project and the camp cleaned up to the satisfaction of the Engineer, within 60 days of completion or with the final progress estimate, whichever comes first.

The lump sum bid under this item may not exceed 5% of the total tender.

Should the tender show a sum in excess of 5% of the total tender, the Ministry will reduce the amount to the maximum allowable, and the new figure shall prevail both for the purpose of determining low tender and for payment to the Contractor.

!NOTE: Alternative for Urban Curb and Gutter Work all as follows:-

Payment in the amount of 50% of the lump sum bid under the Schedule Item for Mobilization will be authorized on the progress estimate after the road equipment starts working on the Project. A further 25% will be authorized when the asphalt plant starts producing asphalt mix and the remaining 25% will be authorized on the final progress estimate.

The lump sum bid under this item may not exceed 5% of the total tender.

Should the tender show a sum in excess of 5% of the total tender, the Ministry will reduce the amount to the maximum allowable, and the new figure shall prevail both for the purpose of determining low tender and for payment to the Contractor.!

. Clearing and Grubbing

( ) Payment Areas Generally

( ) Clearing and Grubbing shall be carried out and paid for over the entire area within the clearing and grubbing boundaries and/or the right-of-way boundaries as shown on the Drawings, or as directed by the Engineer.

( ) A total of .... hectares (acres) has been included in Schedule Items ..... and ..... for clearing and grubbing the .... and .... gravel (and borrow) pits.

( ) No payment will be made for clearing and grubbing for the areas where the grade is constructed in the bed of the .... River (or) .... Lake.

( ) "Special Clearing"

Special Clearing shall be carried out on the following areas, shown hatched on the Drawings, or where directed by the Engineer:-

Sta. - Sta.
Sta. - Sta.

Through these areas all trees and stumps shall be "close-cut" at ground level, and all logs removed. No grubbing shall be carried out.

Care shall be taken to avoid breaking the "surface mat" of the peat. The Contractor is therefore advised that it may not be permissible to utilize heavy construction equipment on the areas for piling and burning or for removal of the logs.

The Contractor will be paid his unit price bid for Schedule Item ..... Clearing. In addition, although no grubbing is to be done, to compensate the Contractor for piling, burning, and removal of the logs in a manner suitable to the Engineer, he will be paid his price bid for Item ..... Grubbing. Such payment shall be accepted as full compensation in connection with this "Special Clearing".

( ) Disposal Areas

Clearing only shall be carried out on the following areas, shown hatched and designated "Disposal Area" on the Drawings or where directed by the Engineer:-

Sta. - Sta.
Sta. - Sta.

Through these areas all trees and stumps shall be "close-cut" at ground level, and all logs removed. No grubbing shall be carried out.

The price bid for Schedule Item ..... shall be accepted as full compensation to clear disposal areas.

. Clearing and Grubbing (continued)

( ) Right-of-Way and Notice to Proceed

Right-of-way purchases have not been completed. The Contractor's attention is therefore drawn to the fact that the project can only be opened up on the direction and where directed by the Engineer.

( ) Forest Fire Prevention

The Contractor is advised that he is required to comply with all Regulations covering Forest Fire Prevention as issued by the Ministry of Forests. Copies of these regulations may be obtained from the local Regional or District Manager, Ministry of Forests.

( ) Merchantable Timber

For the purpose of this Contract, merchantable timber shall be as defined by the Ministry of Forests for the various species in the areas involved.

All merchantable timber in areas designated for clearing *!see note below!* shall become the property of the Contractor and will be for the Contractor's disposal.

!NOTE: Clearing in Indian Reserves, add the following phrase to second paragraph above where noted:- "excepting areas in Indian Reserves" and the following third paragraph:-

Within the Indian Reserve all merchantable timber shall be cold decked along the edge of the right-of-way for disposition by the Indian Band.!

Merchantable timber shall be marked, prior to removal, with registered timber marks. The Contractor shall obtain from the Ministry of Forests a cutting permit and a timber mark before commencing his operations. It shall be the Contractor's responsibility to comply with the forestry regulations and directives in this regard.

Timber from all areas owned by the Crown or areas under timber lease or licence shall be subject to payment of applicable royalty and/or stumpage rates by the Contractor, and he shall allow for all such costs in his tender. The applicable rates may be obtained from the local Manager, Ministry of Forests.

The Contractor is advised that he can be charged by the Ministry of Forests for any merchantable timber willfully damaged or destroyed during the construction operations.

The Contractor shall make all necessary arrangements for areas he may require for cold decking merchantable timber. No compensation will be allowed for clearing any areas required for such cold decking.

. Roadway and Drainage Excavation

Roadway and Drainage Excavation shall be carried out according to Section 201 of the General Specifications and all clauses of that Section shall apply unless otherwise specified in these Special Provisions.

!NOTE: Use the following if special excavation is required:-

( ) Rock Types

The Contractor shall note that the Type "A" (Solid Rock) material has been separated into two groups, namely, Type "A-1" and Type A-2". Type "A-2 represents the quantity in the rock cut between Stations .... and .... (Drawing ....) which is to be bid separately because of its proximity to .... pipe line. Type "A-1" represents all remaining solid rock excavation on the project.!

!NOTE: Reduce Spacing if known to be required by using the following paragraph.

( ) Rock Cuts

Reference is made to the 750 mm spacing referred to under Drilling for Smooth Blasting in Clause 201.5 (Page 201-6). For this Contract the figure is hereby reduced to ..... mm (..... inches).!

( ) Rock Protection and Dykes

Construction of rock protection fills and creek channel dykes shall be considered ordinary embankments and the price bid under Schedule Item ..... for excavation of the material required shall be accepted as full compensation for everything done in connection therewith. Overhaul, if applicable, will be paid for under Item .....

In constructing the rock fills, the larger rock shall be placed on the outer or channel side.

. Roadway and Drainage Excavation (continued)

( ) Organic Stripping

Organic material shall be removed from the roadway cut and fill areas, as indicated on the Drawings (and cross sections) or where directed by the Engineer. Upon completion of grading of the roadways this material shall be regraded onto roadway slopes and trimmed to generally blend in with the surrounding ground, or disposed of as directed by the Engineer. Care shall be taken that proper drainage is maintained.

The price bid for Schedule Item ..... shall be accepted as full compensation for excavation and placing of stripped material as described above, except that Overhaul, if applicable, will be paid for under Item .....

A quantity of ..... cubic metres (cubic yards) has been included in Schedule Item ..... for stripping in the designated gravel (and borrow) pits.

!NOTE: *As an alternative paragraph to that immediately above use the following paragraph if stripping quantity is small and included with Type "D".*

The quantity of ..... cubic metres (cubic yards) has been included in Schedule Item ..... for stripping organic materials from the roadway prism and a further quantity of ..... cubic metres (cubic yards) included for stripping in the designated gravel (and borrow) pits.!

Where the Engineer directs that stripped organic material is to be stockpiled for further use in specific areas after completion of the roadways, the Contractor will be paid the price bid for Schedule Item ..... to remove from stockpile and place where directed by the Engineer, and Overhaul, if applicable, will be paid for under Item .....

Any stripping remaining in stockpile after the project requirements are fulfilled shall be levelled and trimmed and no additional payment will be made.

. Roadway and Drainage Excavation (continued)

!NOTE: Use the Clause following for depths greater than 0.6 m (2 feet)!

( ) Organic Excavation

Organic material shall be removed from the roadway areas as indicated on the Drawings (and cross sections) or where directed by the Engineer. Proposed disposal areas are shown on Drawings ...., ... and .... The excavated material shall be placed to generally blend in with the surrounding ground or as directed by the Engineer.

!NOTE: Typical Section or Contour Detail may be required!

Care shall be taken that proper drainage is maintained.

The price bid for Schedule Item ..... shall be accepted as full compensation to excavate, place and trim this material. Overhaul, if applicable, will be paid for under Item ......

A quantity of ..... cubic metres (cubic yards) has been included in Schedule Item ..... for stripping the designated gravel (and borrow) pits.

Where the Engineer directs that excavated organic material is to be stockpiled for further use in specific areas after completion of the roadways, the Contractor will be paid the price bid for Schedule Item ..... to remove from stockpile and place where directed by the Engineer, and Overhaul, if applicable, will be paid for under Item ......

Any material remaining in stockpile after the project requirements are fulfilled shall be levelled and trimmed and no additional payment will be made.

. Roadway and Drainage Excavation (continued)

!NOTE: Consider combining with Organic Excavation!

( ) Waste Material

The soil survey has indicated that (.....% all or part) of the excavated material between the following stations is unuseable for embankment construction.

				% Unuseable
Sta.	-	Sta.	-	
Sta.	-	Sta.	-	
Sta.	-	Sta.	-	

Since conditions at the time of construction may vary, designation of the above stationing does not restrict the Engineer from requesting the use of all or a portion of the material or extending the stationing. Proposed disposal areas are shown on Drawings ...., ..., and .... The excavated material shall be placed to generally blend in with the surrounding ground or as directed by the Engineer. Care shall be taken that proper drainage is maintained.

The price bid for Schedule Item ..... shall be accepted as full compensation to excavate, place and trim this material. Overhaul, if applicable, will be paid for under Item ......

( ) Landscaping

Organic stripping or excavation shall be removed from the roadway between Stations .... and .... or where ordered by the Engineer and placed in stockpile for further use for landscaping after completion of the roadways. Location of the stockpile sites shall be the responsibility of the Contractor, subject to approval by the Engineer.

Upon completion of the roadways the organic material shall be placed as indicated on Drawings .... and ...., or on any other area designated by the Engineer.

The price bid for Item ..... shall be accepted as full compensation for excavation, stockpiling, removal from stockpile and placing as described above. Overhaul, if applicable, will be paid for under Item ......

Any organic material remaining in stockpile after the project requirements are fulfilled shall be levelled and trimmed and no additional payment will be made.

( ) Surcharging

In accordance with the Drawings .... and Clause 201.25 or as directed by the Engineer, pre-consolidation by surcharging shall be carried out over the following sections:

Sta.	-	Sta.
Sta.	-	Sta.
Sta.	-	Sta.
Sta.	-	Sta.
Sta.	-	Sta.
Sta.	-	Sta.
Sta.	-	Sta.

Because of its height, the embankment and surcharge between the following stations must be constructed in stages:

Sta.	-	Sta.
Sta.	-	Sta.
Sta.	-	Sta.
Sta.	-	Sta.
Sta.	-	Sta.

There will be a waiting period as directed by the Engineer, (estimated to be between .... and .... weeks), between the stages of construction and the Contractor shall not proceed with the next stage until advised by the Engineer. The height of embankment in the first stage must not exceed .... metre (feet) but may be less if directed by the Engineer.

The roadway embankment and surcharge shall be constructed as shown on Drawing ....

The following embankment sections shall be constructed below grade as indicated on the Drawings and the excess surcharge material, when removed, shall be utilized to bring these sections to design grade:

Sta.	-	Sta.
Sta.	-	Sta.
Sta.	-	Sta.
Sta.	-	Sta.

Removal of surcharge material will be paid for under Schedule Item ..... and Overhaul, if applicable, under Item ..... A quantity of ..... cubic metre (cubic yards) has been included in Item ..... for surcharge removal.

. Removal and Stockpiling of Existing Asphaltic Pavement

Existing asphaltic pavement within the right-of-way shown on the drawings, which is undercut or not required for base strength for the proposed roadway, and all temporary paved detours not incorporated into the final paving, shall be excavated and removed to stockpile as directed by the Engineer at ....

Pavement materials which are significantly different shall be stockpiled separately.

Care shall be exercised to prevent contamination of pavement materials in both the excavation and stockpiling operations. If required, 150 mm of acceptable granular material shall be placed for the stockpile base.

The existing pavement adjoining that to be removed shall be cut and the salvable pavement removed in a manner that leaves the remaining pavement with a neat uniform line.

Payment for the ripping, removal and stockpiling asphaltic pavement for the areas and thickness authorized by the Engineer will be paid for by the cubic metre, in place, at the price bid under Schedule Item ...... Overhaul, if applicable, will be paid for under Item ...... Payment for the stockpile base if applicable, will be at the unit price bid for similar material in the Schedule. If no unit price exists, pavement will be by Order for Extra Work.

The area outside the roadway prism where pavement is removed shall be trimmed and graded to ensure proper drainage, and then covered with a minimum 150 mm of stripped material. Any required trimming and placement of the stripped material will be paid for under Schedule Item ....., and Overhaul, if applicable, under Item ......

. Increased Compaction (Item of the Schedule)

The Contractor's attention is drawn to Clause 201.22 of the General Specifications. The Contactor may also be requested to carry out compaction of excavated areas.

. Construction and Compaction of Bridge End Fills

A portion of the approach fills back of each abutment of the proposed bridge(s) over the ...., and .... as shown on Drawings .... and ...., shall be constructed of granular material in accordance with the requirements of Clause 201.14 of the General Specifications.

. Granular Materials

( ) Sources

The designated gravel sources and their use are as follows:

Pit Name	Location	Designated Use
1.		
2.		

The Ministry reserves the right to change the source of supply if other suitable material can be obtained more economically.

!NOTE: *Any pits that have been tested in area and rejected are to be listed by the following paragraph!*

(Name of Pits) ....

Located ....

is/are not approved for the supply of ....

( ) Select Granular Sub-Base

!NOTE: *Consider if reject (over 75 mm (3")) exceeds 10% of material in pit!*

The Contractor is advised that the Select Granular Sub-base designated as being obtained from the .... Gravel Pit is to be crushed to the gradation of 75 mm (3") Crushed Granular Base and will be paid for under Schedule Item ...... Haul will be paid for under Item ...... It will not be necessary to stockpile this material - the Contractor will be allowed to place it directly on the road from the crusher belt.

. Granular Materials (continued)

( ) Gravel Blankets

Gravel Blankets shall be placed with minimum compaction as shown on Drawings .... and ...., or as ordered by the Engineer.

The gradation of the material shall be as follows:

Sieve Size	% Passing
75 mm - 3"	100
4.75 mm - #4	20 - 60
0.075 mm - #200	0 - 5

In addition the Ministry will conduct tests to ensure the material is acceptable for filter suitability in comparison with the contact soils. In the event the material is not suitable in this regard, the Contractor will be paid by an Order for Extra Work as compensation for the additional work to reduce the fines content.

Except as outlined in the above paragraph, the price bid for Schedule Item ..... shall be full compensation to produce and place this material. Haul will be paid for under Item .....

!NOTE: *Consider if reject (over 75 mm (3")) exceeds 10% of material in pit!*

The Contractor is advised that the material to be used for Gravel Blankets designated as being obtained from the .... Gravel Pit is to be crushed to the above gradation and will be paid for under Schedule Item ..... Haul will be paid for under Item .....

( ) Gravel Filter Layers

Gravel Filter Layers shall be placed in embankments as shown on Drawing(s) ...., or as ordered by the Engineer.

The gradation of the material shall be the same as for Select Granular Sub-base (Clause 202.7), and placement shall be with minimum compaction.

Payment for the filter layers shall be at the price bid for Select Granular Sub-Base. A quantity of .... tonnes (tons) has been included in Schedule Item ..... for gravel filter layers.

!NOTE: *Consider if reject (over 75 mm (3")) exceeds 10% of material in pit!*

The Contractor is advised that the material to be used for gravel filter layers, obtained from the designated source above is to be crushed to the gradation of .... and will be paid for under Schedule Item ..... Haul will be paid for under Item .....

. Granular Materials (continued)

( ) Gravel Facing

This item shall be for producing the gravel and placing a gravel facing on cut slopes as directed by the Engineer where seepage and sloughing is a problem. Placement shall be as shown on Drawing ....

!NOTE: Optional Paragraph!

The stationing on the typical sections are meant as a guide only, and are tentative areas which were indicated during the soils survey. This stationing does not restrict the Engineer to eliminating these facings or adding others.

The gradation for Gravel Facing material shall be as follows:

Sieve Size	% Passing
75 mm - 3"	100
4.75 mm - #4	20 - 60
0.075 mm - #200	0 - 5

In addition the Ministry will conduct tests to ensure the material is acceptable for filter suitability in comparison with the contact soils. In the event the material is not suitable in this regard, the Contractor will be paid by an Order for Extra Work as compensation for the additional work to reduce the fines content.

Except as outlined in the above paragraph, the price bid for Schedule Item ..... shall be full compensation to produce and place this material. Haul will be paid for under Item .....

!NOTE: Consider if reject (over 75 mm (3")) exceeds 10% of material in pit!

The Contractor is advised that the material to be used for Gravel Facing, obtained from the designated source above is to be crushed to the above gradation and will be paid for under Schedule Item ...... Haul will be paid for under Item .....

. Standard Wire Fences and Gates

Standard wire Type "A" and (or) "B" and (or) "C" Fences with wood and steel posts shall generally be in accordance with Section 203 and Standard Drawing 1-SP203 but with material, spacing and installation modifications and additional requirements as follows:-

!NOTE: *The following clauses shall be used or may be detailed on the Drawings until the new Standard Drawings for standard wire fences subsequent to 1-SP203 and a revised Section 203 are finalized!*

Wood posts and round braces shall be Lodge Pole Pine or pre-approved alternative, clean peeled, trimmed, cut to length and with line posts pointed before preservative treatment. Pressure treatment of posts, drop post and braces shall be with 95/5 hydrocarbon-borne preservative with a minimum retention of 4.0 kg m^3 of pentachlorophenol preservative.

Line posts for Type ..... fences shall be ..... long with ..... depth of bury and spaced ..... apart, and for Type ..... fences.....

!NOTE: *See details on 1-SP203 for post lengths, etc., depending on soil conditions!*

!NOTE: *Property owner agreements or local regulations may permit the specification of variations in height and/or spacing of wire and line posts of Type "C" fences but 9 m is the maximum spacing permitted for line posts next highways and the height and spacing of barbed wire shown is approved by the Provincial Wildlife Branch and the Cattlemen's Association!*

Line posts may be driven provided no damage is caused to the posts.

Fence posts generally shall be set plumb and firm but posts for fencing on curves shall be set 50 mm off plumb away from the curve centre. Fence posts on rock or with minimum overburden depth shall be steel as specified in Section 203.2 and 203.3.

Fence stabilization panels shall be provided at each end of fencing runs including gates, corners and intersections to restrain the tensioning applied to the fence fabric and/or barbed wire.

Straining post panels are required between end, corner, intersection and gate posts every 200 m (two fabric roll lengths) for Type "A" and "B" fences and every 400 m (one spool length of barbed wire) for Type "C" fences. (See also Brace Panels below).

Panels normally shall consist of an end, corner, intersection, gate or straining post and adjoining pair(s) of brace posts, connecting wood braces and tensioning diagonal wire braces.

Vertical posts, other than line posts and gates posts, shall be 120 mm minimum diameter and 400 mm longer than the specified line post lengths for the required extra buried depth.

Wood braces shall be 80 mm diameter and 2.4 m long or 100 mm diameter and 3.0 m long for horizontal braces (or 100 mm diameter and 3.0 m long for diagonal braces where required (see note below)). Connections shall be made with a 9.5 mm diameter mild steel dowel 100 mm long bored 60 mm into each end of the brace and 40 mm into the side of posts 200 mm from top (and from ground level on adjoining post for diagonal braces).

!NOTE: *Soft, marsh and/or peat soil conditions may warrant diagonal wood braces (included in brackets above), in place of horizontal braces in addition to longer posts for increased depth of bury!*

Diagonal wire braces to resist the stretch of the fencing fabric or barbed wire shall each consist of two double strands of 3.5 mm nominal diameter (9 gauge) galvanized wire looped one and one half times around and securely stapled to posts and the four wires twisted until taut and the panel is rigid. Wire braces shall generally be installed one way from 100 mm below the top of each panel posts to 100 mm above ground level of the preceeding posts. Diagonal wire braces are required both ways on each side of straining posts between panel posts.

Brace panels shall be installed at abrupt changes in vertical alignment and where the change of horizontal alignment is between 10 deg. and 30 deg: corner post panel is required for a change over 30 deg. in horizontal alignment. Brace panels shall each consist of two regular line posts connected with an 80 mm horizontal wood brace and diagonal wire braces both ways.

!NOTE: *Brace panels may be included as an optional or mandatory substitution for the straining post panel requirements included above, as follows:- Brace panels -- may be substituted for straining post panels above but -- shall be at 100 m spacing for Type "A" and "B" fences and 200 m spacing for Type "C"!*

Fabric and/or barbed wire normally required on the side of posts away from the highway shall be so installed on curved fences that the fencing pulls against the posts and not on the staples. Where livestock adjoins, the top line wire of fabric or barbed wire shall be securely wire tied in addition to stapling.

!NOTE: *Where the property owner's agreement requires fencing to be on the property side throughout, such curves with the fencing not bearing on the posts shall have every line wire of fabric or barbed wire securely wire tied to the posts!*

. Standard Wire Fences and Gates (continued)

Gates shall be of the type(s) and width(s) stated in the Schedule of Quantities, generally to the stock sizes, hinged, single or double as shown on the Drawings or directed by the Engineer.

Gates shall be hung on 180 mm diameter treated wood gate posts with steel or malleable iron hinges securely clamped and/or bolted to gate and posts, and with approved locking device, drop bolt and centre rest as necessary, all hardware with galvanized finish. Any necessary welds shall be sound, smooth and coated with a heavy application of zinc rich paint.

Payment

The price bid for the Schedule Item(s) ..... shall be full compensation for the supply of all fence materials and complete erection.

!NOTE: Two optional paragraphs following:-

The Contractor should note from the Drawings that clearing and grubbing is not always for the total right-of-way, and thus it may be necessary to carry out additional clearing for fence construction.

The price bid for Schedule Item ..... shall be full compensation for the supply of all materials, clearing of any necessary additional right-of-way and erection of the fencing where indicated on the Drawings or as ordered by the Engineer.!

The price bid for gates of the various types, widths and heights indicated shall be full compensation for the supply and installation complete with required hardware.

!NOTE: Vary wording of paragraph above where gates are supplied by the Ministry.!

. Chain Link Fencing and Gate(s)

Chain Link Type "D" Fencing shall be constructed with material in accordance with Section 316 of the General Specifications but with modifications to same and additional material, spacing and installation requirements as follows:

Chain link fabric shall be according to the requirements of CGSB Specification 138-GP-1 for 50 mm square mesh (medium) nominal 3.5 mm diameter (9 gauge) galvanized wire fabric but with a zinc coating of not less that 365 g/m^2 (1.2 oz/sq.ft.). Residential height fabric shall be (light) nominal 3.0 mm diameter (11 gauge) galvanized wire fabric.

!NOTE: *Plastic coated mesh (also covered by CGSB 138-GP-1) and matching painted pipe posts and rails may be used only with special permission!*

Security fences shall have 1.8 m, 2.1 m (or) 2.4 m (as required) high fabric with 3 lines of 2-strand barbed wire over on extension arms and to brace bands around 300 mm extra height end, gate and straining posts.

Pipe sizes in Clause 316.6 shall be modified to the following:

	Residential Fence 1.0 m & 1.2 m high	Standard Height Fence 1.5 m & 1.8 m and Security Fence 1.8 m high	Security Fence 2.1 m & 2.4 m
	mm (inch) OD	mm (inch) OD	mm (inch) OD
Line Posts	41 (1 5/8)	47 (1 7/8)	60 (2 3/8)
End, Gate, corner and straining posts	47 (1 7/8)	73 (2 7/8)	89 (3 1/2)
- for gate over 1.2 m to 3.0 m single width	60 (2 3/8)	73 (2 7/8)	89 (3 1/2)
- for gate over 3.0 m	------	--consider sliding gate---	
Top rail	35 (1 3/8)	35 (1 3/8)	41 (1 5/8)
Brace rail	------	35 (1 3/8)	41 (1 5/8)

!NOTE: *The following may be listed here or detailed on Drawings until Standard SP203 series Drawings and a revised Section 203 are finalized.!*

Additional requirements are as follows:

Tension wire: nominal 5.0 mm diameter (6 gauge) galvanized wire: nominal 3.5 mm diameter (9 gauge) for Residential height fences.

Tie wire: nominal 3.5 mm diameter (9 gauge) aluminum wire to maximum spacing of 300 mm on line posts and 450 mm along top rails.

Hog ring clips: nominal 3.5 mm diameter (9 gauge) galvanized wire clips to 450 mm maximum spacing along tension wire.

Additional requirements (continued)

Tension bars: minimum 5 mm x 16 mm galvanized mild steel flat bars.

Tension and brace bands: minimum 3 mm x 16 mm galvanized formed mild steel flat with bolts, etc. for all rail end caps and to maximum spacing of 380 mm for tension bars.

Line posts shall be regularly spaced not more than 3 m apart between end, gate and corner posts with all posts set plumb to the required height and depth of bury in footings of minimum 18 MPa standard mix concrete to the sizes specified (or detailed) as follows:-

	Pipe bury Depth mm	Concrete footing size Diameter mm	Depth mm
Residential height posts	600	200	750
Standard, line posts	600	250	750
Standard, other posts	900	300	1050
Security, line posts	750	300	900
Security, other posts	900	350	1050
Double gate drop-bolt & centre-rest		200	600

!NOTE: The following optional clause for residential height fences depending on soil conditions:

Line posts of Residential height fences may be driven-in to a minimum 840 mm provided all are firm and damage free at completion.!

Minor ground undulations between posts shall be trimmed to obtain a uniform grade 25 mm to 75 mm below bottom wire but with appreciable grade depressions backfilled only where directed by the Engineer.

End, gate and corner posts, except for Residential height fences, shall be braced to the adjoining line post(s) and with the ends of toprails, all shall be rigidly fixed with end caps bolted to brace bands around the posts. Toprails which pass continuous through the line post tops, shall be sleeve joined in the lengths.

Horizontally brace all end, gate and corner posts less than 100 m apart, and where more than 100 m, intersperce straining panel(s) at not exceeding 100 m spacing composed of straining post and horizontal brace rails to both adjoining line posts.

Alternatively, diagonally brace all end, gate and corner posts less than 150 m apart, and where more than 150 m, intersperce straining panel(s) at not exceeding 150 m spacing composed of straining post and diagonal brace rails to the adjoining line posts.

Tension wire at bottom (and where required) -- and top in place of normal top rails -- shall be looped around end, gate, corner and straining posts and, with adequate tension, twisted securely back on itself.

. Chain Link Fencing and Gate(s) (continued)

Additional requirements (continued)

Fence fabric shall be stretched with proper equipment, fastened to end, gate, corner and straining posts with tension bars and tension bands and tied or clipped at top and bottom and to every line post with the indicated wire or clip at the required spacings. Barbed wire strands shall engage the extension arms of security fences and shall be stretched and securely fastened to posts.

Gates shall be of the type(s) and width(s) stated in the Schedule of Quantities, generally to the stock sizes, hinged, single or double as shown on the Drawings or directed by the Engineer.

Unless indicated as sliding, the gates shall be hung on steel or malleable iron hinges securely clamped and/or bolted to gate and posts, and with approved locking device, drop bolt and centre rest as necessary, all with galvanized finish. Welds shall be sound, smooth and coated with a heavy application of zinc rich paint.

Payment

The price bid for the Schedule Item(s) ..... shall be full compensation for the supply of all fence materials and complete erection.

!NOTE: Two optional paragraphs following:-

The Contractor should note from the Drawings that clearing and grubbing is not always for the total right-of-way, and thus it may be necessary to carry out additional clearing for fence construction.

The price bid for Schedule Item ..... shall be full compensation for the supply of all materials, clearing of any necessary additional right-of-way and erection of the fencing where indicated on the Drawings or as ordered by the Engineer.!

The price bid for gates of the various types, widths and heights indicated shall be full compensation for the supply and installation complete with required hardware.

. Mechanical Tampers

The Contractor's attention is drawn to Section 210.6 of the General Specifications "Culvert Backfilling". The use of Mechanical Tampers will be mandatory. The type and size of tampers shall be included in the list of equipment submitted with the tender.

. Structural Plate Corrugated Steel Pipe (Field Assembled)

!NOTE: *Use all the following under this heading in accordance with Design Manual Instruction No. E.3-3.6.!*

Clause 210.10 of the General Specifications is cancelled and replaced with the following:-

(a) General

Special care shall be taken in the installation of all structural steel plate pipes.

No equipment shall be allowed to operate over the pipe structure until backfilling operations have been completed to a minimum depth of cover of 600 mm.

(b) Assembly

The assembly of the pipe structure shall be done in accordance with the drawings and instructions provided. All bolts placed shall be tightened to a torque of not less than 200 N.m (150 ft/lbs.) nor more than 340 N.m (250 ft/lbs.).

No distortion of the true shape of the pipe structure greater than 5% of the diameter for round pipes, or 2% of the span or rise for other shapes, shall be allowed during assembly and backfilling.

(c) Bedding

!NOTE: *Edit the following to suit and/or show on Drawings!*

Undesirable materials shall be removed from below the bottom elevation of the pipe and replaced with select granular material. The depth of the excavation may vary and shall amount to 300 mm for bedrock or dry hardpan, 450 mm for loose rock, and up to 1 m for soft plastic or organic material.

!NOTE: *A depth of organic material greater than 1 m constitutes a special design which will be detailed on the drawings!*

The bedding width shall extend a minimum distance of half a diameter or span beyond the outer edges of each side of the structure, with the exception that where dense material already exists outside the structure limits, then the bedding width may be reduced to the width of the structure plus 600 mm.

The top 150 mm of the bedding backfill within one quarter of the diameter or span each side of the longitudinal centreline of the pipe shall be loosely placed. Outside these limits compaction shall be to at least 95% of the laboratory density as determined by the applicable method of current ASTM Standard D698.

In the case of multiple installations bedding shall be continuous across the site and shall extend to a distance of one half of the diameter or span beyond the outside vertical spring line of the outside pipe on each side of the installation. Pipes shall not be spaced closer than 1 m apart.

(d) Structure Backfill

!NOTE: *Edit the following to suit and/or show on Drawings.!*

The backfill and compaction zone around the pipe structure shall extend to a width of 3 m each side and to a minimum depth of 1 m (if grade allows) of cover over the pipe structure. If existing creek banks of solid rock or dense material are closer than 3 m to the pipe structure, then the outer limits of the zone may reduce to a minimum 1 m on each side . This same zone reduction also applies for a trench condition in solid rock or dense material.

Placing of backfill and compaction shall be done in horizontal layers not exceeding 200 mm in loose thickness by equipment operating parallel to the longitudinal dimension of the pipe structure.

Backfilling shall be carried out so that the difference in elevation between both sides of the pipe structure is not more than 450 mm.

(d) Structure Backfill (continued)

Compaction of backfill within the compaction zone shall be to at least 95% of the laboratory density as determined by the applicable method of the current ASTM Standard D698. Haunch areas shall be compacted to the specified density using hand tamping equipment, jetting, or any other means acceptable to the Engineer, and in such a manner as to ensure firm contact with the bottom surface of the pipe structure.

Cobbles and/or boulders of a size greater than 75 mm shall not be placed within the compaction zone.

(e) Bedding and Structure Backfill Material

Material for bedding and structure backfill shall be well graded granular with a maximum size of 75 mm and not more than 8% passing a 0.075 mm (#200) Sieve.

(f) Quantities and Payment

The price bid shall be full compensation for installation as shown on the Drawings, and shall include taking delivery of the material, hauling to the sites, and complete assembly and installation of the pipe structure.

Foundation excavation will be paid for under the Item "Foundation Excavation", with measurement being to vertical lines at the outer limits of the bedding width as defined in (c) above or as shown on the Drawings. All materials excavated for inlet and outlet ditches and for channel work will be paid for under the Item "Roadway and Drainage Excavation".

Bedding and backfill will be paid for under the Item "Structure Backfill". The price bid shall be full compensation for producing placing and compacting in accordance with (c) and (d) above. Haul will be paid separately under the prices bid for Gravel Haul.

. Riprap

Loose riprap, (hand laid riprap) (grouted riprap) of the rock classification(s) indicated on the Drawings shall be placed as embankment and channel protection at the following locations:-

Name or Stationing	Type	Drawing No.

Placing and payment for this item shall be in accordance with Section 205 of the General Specifications.

!*NOTE: Add where applicable the following additional phrase(s):-*

except that in addition to placing, the price bid shall include the supply and haul of the rock for riprap.

and (or) except that the price bid shall be for measurement in cubic yards (for Imperial projects).!

. Metal Bin Wall

Metal Bin Wall shall be installed to the line and grade as shown on Drawings Nos. .... and ...., and in accordance with Section 232 of the General Specifications.

The backfill material shall be placed as wall foundation, backfill inside the bins, and for 0.6 m behind the wall unless otherwise shown on the Drawings. It shall be spread in layers not exceeding 150 mm thickness and compacted to a minimum of 95% of the laboratory density as determined by the applicable method of the ASTM Standard D698.

. Concrete Retaining Wall

( ) Concrete Retaining Walls shall be constructed to the line and grade as shown on Drawings Nos. .... and .... all generally in accordance with Section 218 (or 211).

( ) The Contractor shall provide an approved air entraining agent and shall incorporate such agent in the mix in accordance with the manufacturer's instructions in order to produce the degree of air entrainment required.

( ) Concrete shall be Class "....." (with M.O.H. Class "....." Finish).

!NOTE: Consider Ministry supply of cement if quantity is large!

( ) Payment shall be in accordance with Sub-Clause 218.13. Foundation Excavation will be paid for under Schedule Item ......

. Concrete Sandbags

Concrete filled sandbags shall be constructed as head walls and (or) end walls at culvert inlet, outlets, storm drain outlets, ditch blocks, at the locations shown on Drawing .... or as directed by the Engineer.

Heavy quality jute standard sandbag sacks of 700 mm minimum length shall contain not less than 30 kg of dry cement and sand (minimum Class "C", 10 MPa) concrete premix. The top of each sack shall be folded over at its three quarter capacity length before setting in place, except where proprietry stitch closed jute bags 550 mm long are used.

The sacks shall be set in place around the pipe and to the slopes detailed, with joints staggered in succeeding courses. The walls shall be constructed in close contact with the trimmed excavation and/or with succeeding layers of backfill well consolidated as the work proceeds. Dirt and debris shall be removed from the top of sacks before the next course is laid thereon. Each course of sacks shall be lightly sprinkled with water before placement of next course. Not more than 4 vertical courses of sacks, unless otherwise permitted by the Engineer, shall be placed in a tier until initial set has taken place in the first course of that tier. Walls shall be protected from heavy rainfall and from contacting water for a period of at least 24 hours after placing.

Alternatively, low slump Class "C" or better concrete may be used but spraying with water is not required.

!NOTE: When Class "C" or better, concrete is available on site for other purposes, dry mix sandbags should not be specified.!

Payment will be made at the price bid per bag which shall include incidental excavation, slope shaping and backfill.

!NOTE: *Concrete Generally: For Imperial projects the measurement and payment of concrete and reinforcement, except for curbs and the like in linear measure, should be in the Metric measure but may remain in cubic yards for concrete but kg per foot for reinforcement!*

. Patching and Pavement Cuts

In areas not scheduled for common excavation where cutting of the existing pavement or concrete sidewalk is required for trenching, the surface shall be cut by hand or mechanical means to provide an even uniform line. The limits of the cut surface shall be the minimum necessary to accommodate the work.

The cut areas shall be repaired using the same thickness of gravels and asphalt as the existing roadway unless otherwise directed by the Engineer.

Cutting of the asphalt pavement or concrete sidewalk will be paid from the Provisional Sum set aside under Item ...... Payment for imported gravels will be at the rate bid for the type of material used. Payment for the asphalt mix shall be at the rate bid for Asphalt Pavement in Place with an additional payment for Extra Handwork (refer to Section 223 - Appendix "C"). Payment for concrete repair will be at the unit price bid for Miscellaneous Concrete.

__. Foundation Excavation (For Urban Projects)

Foundation excavation shall be in accordance with Section 207 of the General Specifications.

The unit price bid for Item ..... of the Schedule of Approximate Quantities shall include the excavation, trench shoring as required, and disposal of unsuitable or excess material, as directed, including haul and provision of disposal site if required.

The quantity of foundation excavation will be based on measurements taken from the subgrade elevation or existing ground line, whichever is lower.

__. Storm Drain Installation

All pipe shall utilize watertight gaskets. Installation shall be in accordance with Section 219 of the General Specifications.

The laying length of fittings (tees, bends, connections, etc.) is included in the lineal measure of Schedule Items ..... and ...... No other payment will be made.

Cutting existing and new pipes to amend the lengths shall be incidental to the installation of storm drains. No additional payment will be made.

!NOTE: For CSP include the following:!

All cut ends and exposed metal shall be repaired by the application of two coats of zinc rich paint supplied by the Contractor.

__. Breaking and Entering

When breaking and entering existing structures or pipes, care must be taken to prevent excessive damage due to over breaking and weakening the structure. All rough edges are to be grouted and steel troweled to a smooth surface.

Payment for each "Break and Enter" will be made at the unit price bid for this item in the Schedule of Approximate Quantities and Unit Prices. The price shall include everything furnished and done as described including the supply of grout.

. Storm Drain Bedding and Backfilling

The following shall replace Clause 219.13 of the General Specification.

( ) Bedding

Bedding shall be defined as that material surrounding the pipe.

The material shall consist of 19 mm crushed granular surfacing aggregate and shall extend 150 mm under and 150 mm over the pipe, to a width no greater than that detailed for payment of foundation excavation in General Specification 207.4.

!*NOTE:* *For Corrugated Steel Pipe include the following clause:-*

The material shall consist of 75 mm minus Select Granular sub-base aggregate extending from 150 mm under (250 mm in solid rock) and 300 mm over the pipe, to a width no greater than that detailed for payment of Foundation Excavation in General Specification 207.4.!

Trenches shall be dry when the bedding is placed.

The bedding shall be spread in layers not exceeding 150 mm thickness and compacted to a minimum of 95% of the laboratory density as determined by the applicable method of the ASTM Standard D698.

Bedding will be paid for at the unit price bid in the Schedule of Approximate Quantities and shall be for supply and construction in place.

( ) Backfill

Backfill shall be placed on top of the bedding and extend to the existing ground line or to the sub-grade level, as applicable. It shall be placed in layers not exceeding 200 mm and compacted to a minimum of 95% of the laboratory density as determined by the applicable method of the ASTM Standard D698.

Puddling or flooding for compaction of backfill material will not be permitted.

__. Storm Drain Bedding and Backfilling__ (continued)

( ) Backfill (continued)

Backfill shall normally be with approved materials obtained from project excavation and shall be considered incidental to the foundation excavation work. When repair of existing pavement structure is required, the backfill shall match the existing materials and thicknesses.

Soil with high void content, frozen material, soils with high water absorption, debris and any other objectionable material shall not be used for backfill, and shall be replaced with material as directed by the Engineer.

Payment for imported materials will be made from the applicable items in the Schedule of Approximate Quantities.

__. Curb and Gutter Work Generally__

!NOTE 1: Consider the new details of Standard SP Drawings 2-SP219, 8, 12, 14, 21, 22, 23 and especially 26-SP219 (Sidewalks)!

!NOTE 2: Until revisions are made to Specification Section 219 include the following!

Section 219 of the General Specifications shall be modified as to Miscellaneous Drawings listed now replaced with Standard (SP) Drawings as follows:-

Clause	Misc. Drawing #	SP Drawing #
219.3	275-1A	-----
	275-1B	1 and 2-SP219
219.4	275-3	6-SP219
	275-5	7-SP219
219.5	354	19-SP219
	354-1	20-SP219

. Precast Concrete Catch Basins, Catch Basin-Manholes and Manholes

( ) Precast concrete catch basins shall be installed where shown on the Drawings or as the Engineer may direct in accordance with the intent of Standard Drawing ....

( ) Precast concrete manholes and catch basin-manholes shall be installed at the locations and to invert levels as shown on the Drawings or as the Engineer may direct in accordance with the intent of Standard Drawings ....

Contrary to Clause 219.5, there will be no depth adjustment allowance for construction of manholes.

The installation of precast concrete manholes will be grouped into depth ranges for payment, viz. up to 2 m and then increasing depths of 1 m intervals as applicable thereafter. The unit price(s) bid for the pertinent Schedule Item(s) shall be full compensation for the installation of each entire manhole structure and shall include everything furnished and done.

Installing the tee section of tee riser manholes will be included in the unit price bid for laying and joining pipe. Subsequent sections of the riser will be paid for at the unit price bid for Item ...... The price bid shall include installation of lids, frames and covers.

. Prefabricated Corrugated Steel Catch Basins and Manholes

( ) Prefabricated corrugated steel catch basins shall be installed where shown on Drawings or as the Engineer may direct in accordance with the intent of Standard Drawing ....

( ) Prefabricated steel manholes shall be installed at the locations and to the invert levels as shown on the Drawings or as the Engineer may direct in accordance with the intent of Standard Drawings ....

The unit price(s) bid for the Schedule Item(s) ..... and ..... shall be full compensation for everything supplied and the erection of the entire manhole structure.

. Concrete Curb and Gutter

Extruded or cast-in-place concrete combined curb and gutter shall be constructed in the locations designated on the Drawings and shall conform to the shape(s) shown on Standard Drawing(s) ....

The unit price(s) bid for Schedule Item(s) ..... and ..... shall be full payment for curb and gutter work in accordance with Section 219.

PAVING

__. Materials

For materials supplied by the Ministry refer to General Special Provision Clause above. *!See SP.4!*

__. Spray Primer (and Tack Coat)

All properly prepared crushed granular surfaces shall be primed with RM20 liquid asphalt to a width 0.3 m wider than the proposed asphalt concrete pavement, at such rates of application as the Engineer shall direct.

!NOTE: Where applicable add the following:-

Existing paved surfaces shall be primed with a light tack coat with RM20 liquid asphalt.!

__. Asphalt Levelling Course

Levelling Course shall be Class ....., ... Mix placed at locations and at rates of application as directed by the Engineer.

__. Asphalt Concrete Pavement

( ) Asphalt Concrete Pavement shall be Class ....., ... Mix.

!NOTE: Refer to Section 223.3 for Class 1, 2 or 3. Use Medium Mix for standard lifts, fine for thin lifts, coarse for thick lifts!

( ) The pavement shall be constructed generally in two lifts at a total average application of 180 kg per square metre or ....
Shoulder paving shall be as shown on Drawing .... with ..... kg/m^2 application rate.

!NOTE: Two optional paragraphs following:-

( ) The Contractor is advised that not more than 800 m of completed gravel grade is to be left without paving of the first lift, unless otherwise directed by the Engineer.

( ) No top lift paving will be permitted after .... without the written approval of the Engineer.!

!NOTE: Asphalt Paving Generally: For Imperial projects the measurement and payment of asphalt paving work shall be in the Metric measure: 223 - Appendix "C" will therefore maintain when applicable!

. Traffic Islands

(a) Extruded Curb

Extruded concrete curb for traffic islands shall be constructed in the locations designated on the Drawing and shall be in accordance with Standard Drawing ....

The unit price bid for Schedule Item No. ..... shall be full payment for the supply of and placing of the air entrained concrete, the cutting of contraction joints, finishing and curing.

(b) Crushed Granular Aggregate

Crushed Granular Shouldering Aggregate shall be placed and compacted behind curbs in traffic islands to within 50 mm of the top of the curb and crowned at 2% or as directed by the Engineer.

Payment will be made at the price bid under Item ....., Shouldering Aggregate.

(c) Asphalt Concrete Pavement

Asphalt Concrete Pavement for capping traffic islands shall be the normal class and mix specified above, placed at an average application rate of 120 kg per square metre, shaped and compacted as directed by the Engineer. Payment will be made at the price bid under Item ....., Asphalt Concrete Pavement, plus the cost adjustment per square metre for "Extra Handwork" contained in Section 223 - Appendix "C".

. Asphaltic Curb

(a) Extruded machine laid asphaltic curb shall be constructed to the shape as shown on Standard Drawing 4-SP226 (or) Intergal Asphaltic curb shall be constructed to the shape shown on Standard Drawing 3-SP226 at the locations as shown on Drawing(s) .... and at any other locations directed by the Engineer.

(b) The construction of asphaltic curb shall be paid for at the rate bid under Item ..... for the actual length of curb constructed.

(c) All asphaltic mix used in the construction of the curbs shall be paid for under Item ....., Asphalt Concrete Pavement.

. Drainage Outlets

Drainage outlets shall be constructed as and where shown on Drawing(s) ...., or as directed by the Engineer. Installation shall be in accordance with Section 226 and/or Standard SP Drawings 1-SP226 (or Rural only 5-SP226) and 2-SP226.

. Drainage Outlets (continued)

!NOTE 1: *Until revisions are made to Specification Section 226 include the following!*

Section 226 of the General Specifications shall be modified as to Miscellaneous Drawings listed now replaced with Standard (SP) Drawings as follows:-

226.1	226-1A	1-SP226
	226-2	2-SP226
226.2a(i)	289	10 & 11-SP219
226.2b(ii))		
226.6)	226-2	2-SP226
226.7)		

!NOTE 2: *Where metric version of Section 226 is used, use only the following!*

226.2(a)(i)	8-SP219	10 & 11-SP219

. Gravel Shoulders

Shouldering aggregate shall be placed in accordance with Section 223.25 of the General Specifications to the widths as shown on the drawings.

!NOTE: *Review separate bid item for Shouldering Work!*

. Concrete Barriers

Precast reinforced traffic barriers shall be installed where shown on the Drawings or as the Engineer may direct as supplied in accordance with Standard SP323 Series Drawings.

!NOTE: *Options permitted for grouting holes, weephole slots and antiglare screen fixing by Standard Drawings Section 323 to be noted where required especially on material lists for supply by the Ministry.!*

!NOTE: *Grouting option paragraph following:-*

Where barriers are required to resist lateral movement, form a depression in paving under barrier, fill completely with cement mortar and finish grouting holes of units where provided neatly flush and smooth.!

The unit price(s) bid shall include all equipment and labour for accurately setting the barrier units in place without damage to surfaces and edges.

!NOTE: *For Urban projects with general paving work only, include below Clause(s) 1 and/or 2 of the "Surfacing Paving Addendum" - see the page following - but the full Addendum as such is for inclusion only with Paving Branch Project #S-XXXX surfacing requirements. See also "Mobilization" alternative included on SP.9.!*

!*NOTE:* *This Addendum is for inclusion only with Paving Branch Project #S-XXXX surfacing requirements.*!

SURFACING

PAVING ADDENDUM

1 . Change of Pit

Further to the provision of Section 202.23, should the Contractor be instructed to move out from a gravel pit of his choosing due to reasons other than the ones mentioned in said clause, he will be paid, on completion of the move, a lump sum of $2,500.00 for a normal crushing complex and a further sum of $500.00 if any additional primary unit is involved, which will be deemed to be full compensation for all costs and expenses incurred by the Contractor as a result of the authorized move.

If the Contractor moves his crushing plant without first securing a written order to do so from the Engineer, it will be considered sufficient proff that the move was unnecessary, and no allowance of compensation will be made to cover such a move.

2. Advance Payment for Crushed Aggregates in Stockpile

Contrary to Section 202.45, the advanced payment for crushed aggregates placed in stockpile will be at the rate of $2.00 per cubic metre. The quantity in stockpile is to be determined by cross sectioning, end area volume calculations, and deducting 10% for stockpile loss.

3. Mobilization

Payment in the amount of 25% of the lump sum bid for Mobilization will be authorized on the first progress estimate after the Contractor's crushing plant is set up and producing crushed aggregate in stockpile. An additional 50% will be authorized when the asphalt mixing plant is set up and producing asphalt mix for the project. The remaining 25% will be authorized when the work on the project has been completed and clean-up is finished to the satisfaction of the Engineer.

The lump sum bid under this item may not exceed 5% of the total tender.

4. Hours of Work

Contractors are advised that the hours of work on the project will be limited to a maximum of 10 hours per day.

Any extension in hours beyond the 10 hours per day will require the written approval of the Engineer's representative at least 15 days in advance.

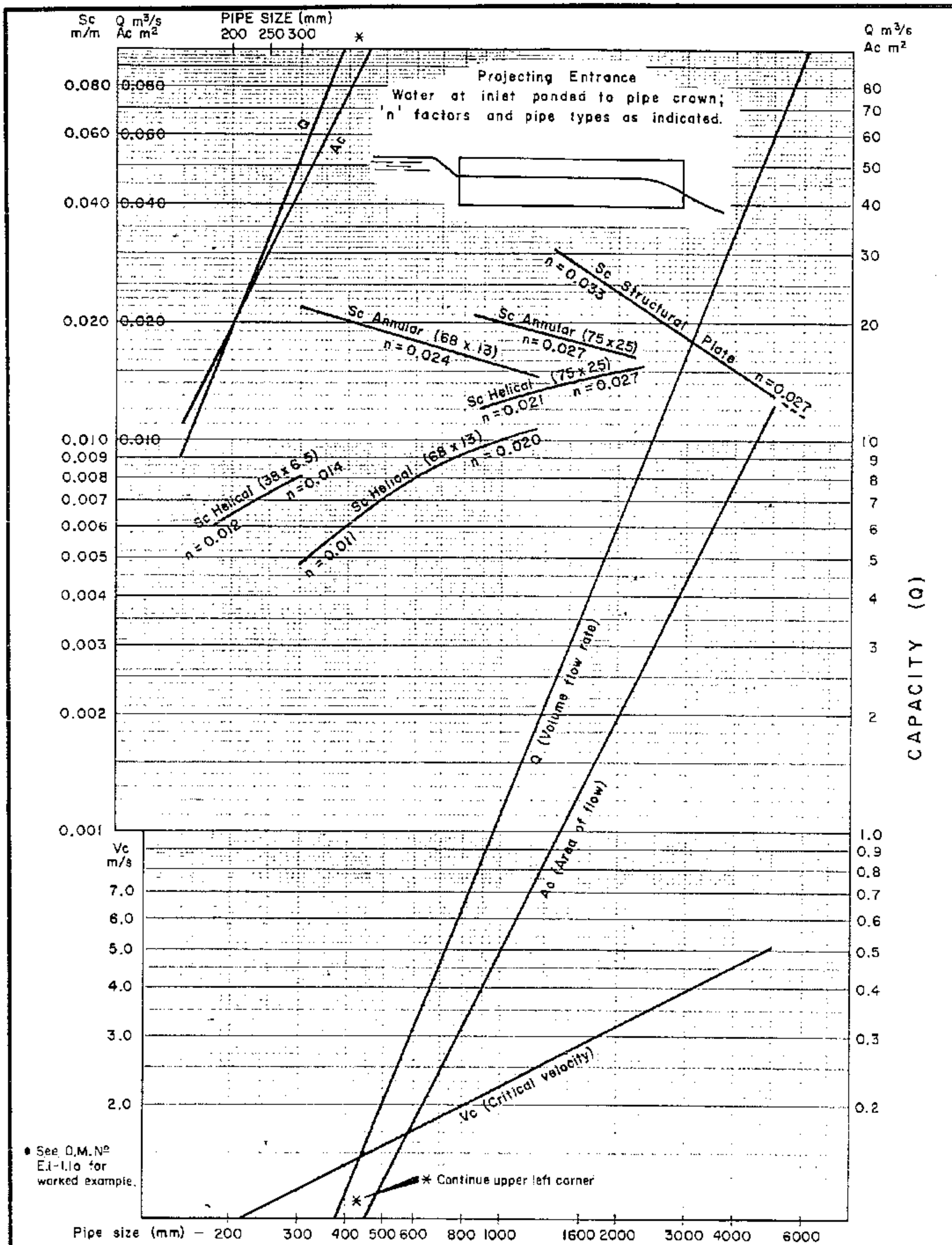
5. Engineer's Instructions

Where in accordance with Section 190.6, the Contractor has an objection to an "Engineer's Instruction" and intends to prepare a claim for the work he must submit Form H-203 "Contractors Declaration" within 10 days from the date of the Engineer's Instructions. The actual claim must be presented within 30 days following completion of the work in questions.

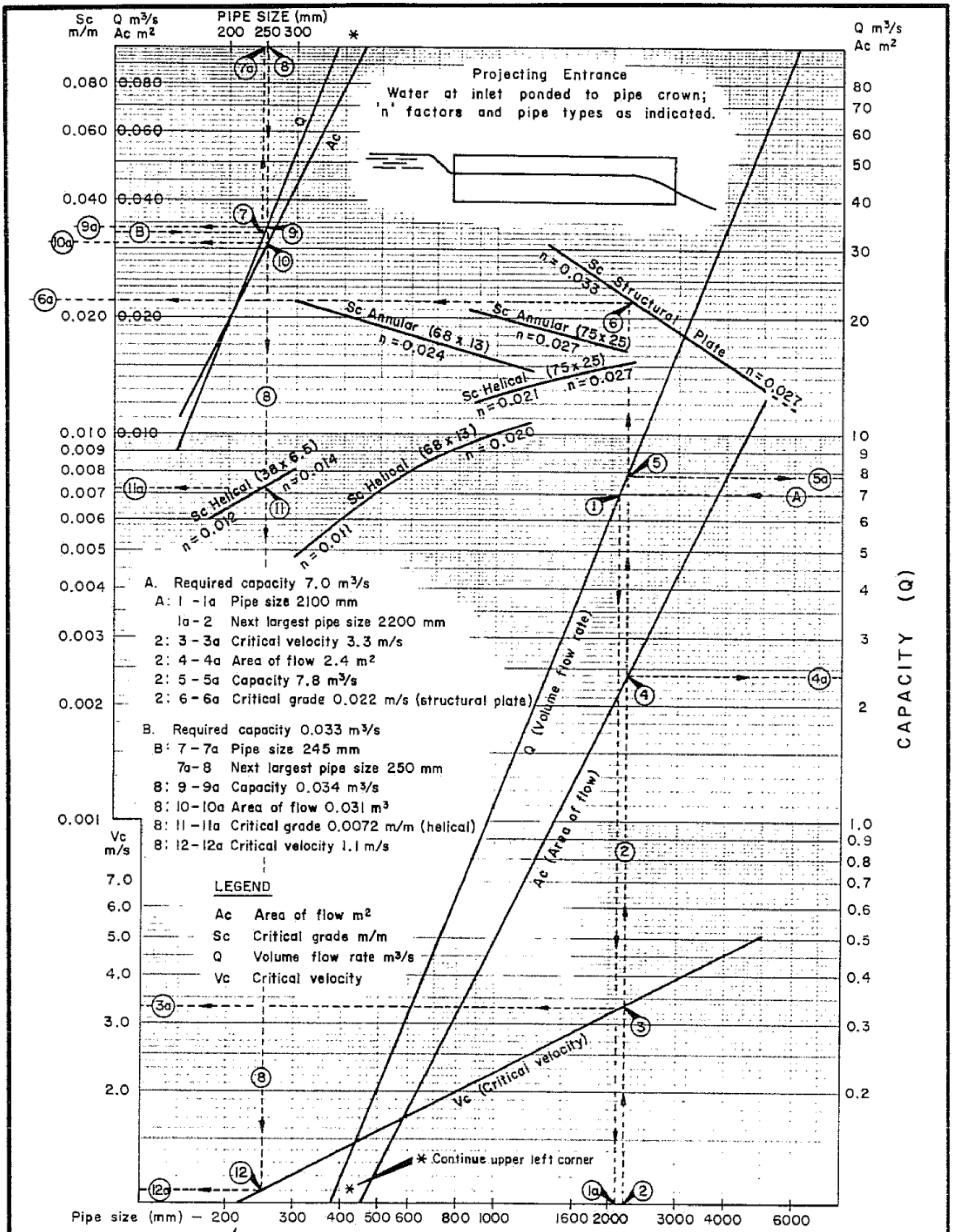
SECTION E

DRAINAGE

E.1	HYDRAULICS
E.2	HYDROLOGY
E.3	DRAINAGE STRUCTURES



APPROVED DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No
DATE 90-04-29 REVISED 91-12-10	HYDRAULIC DESIGN CHART FOR CIRCULAR CORRUGATED STEEL PIPE	E.1-1.1



APPROVED

DIRECTOR DESIGN AND SURVEYS

DATE 80-04-29

REVISED 81-12-10

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS

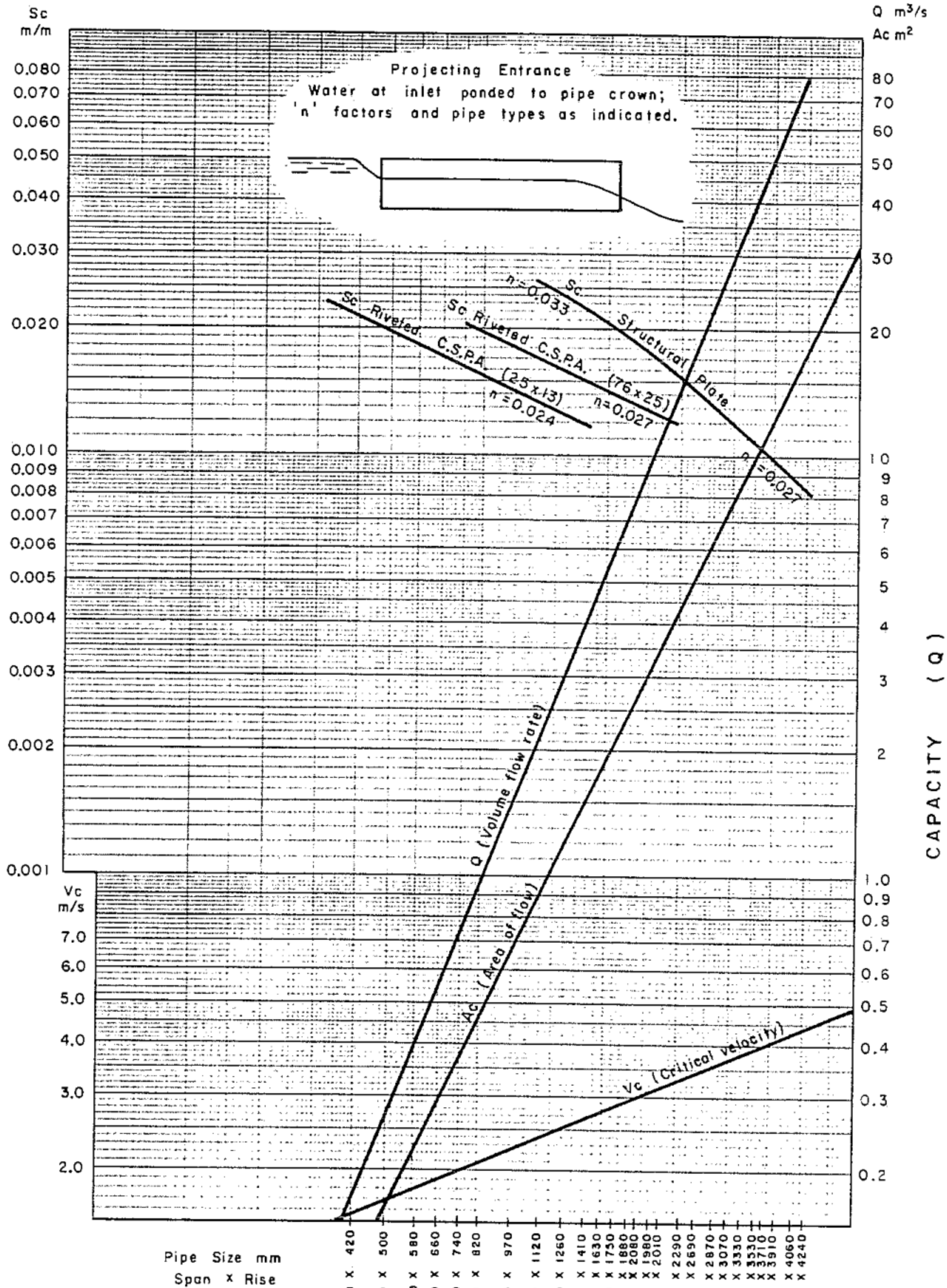
DESIGN AND SURVEYS BRANCH

HYDRAULIC DESIGN CHART FOR CIRCULAR CORRUGATED STEEL PIPE

EXAMPLE

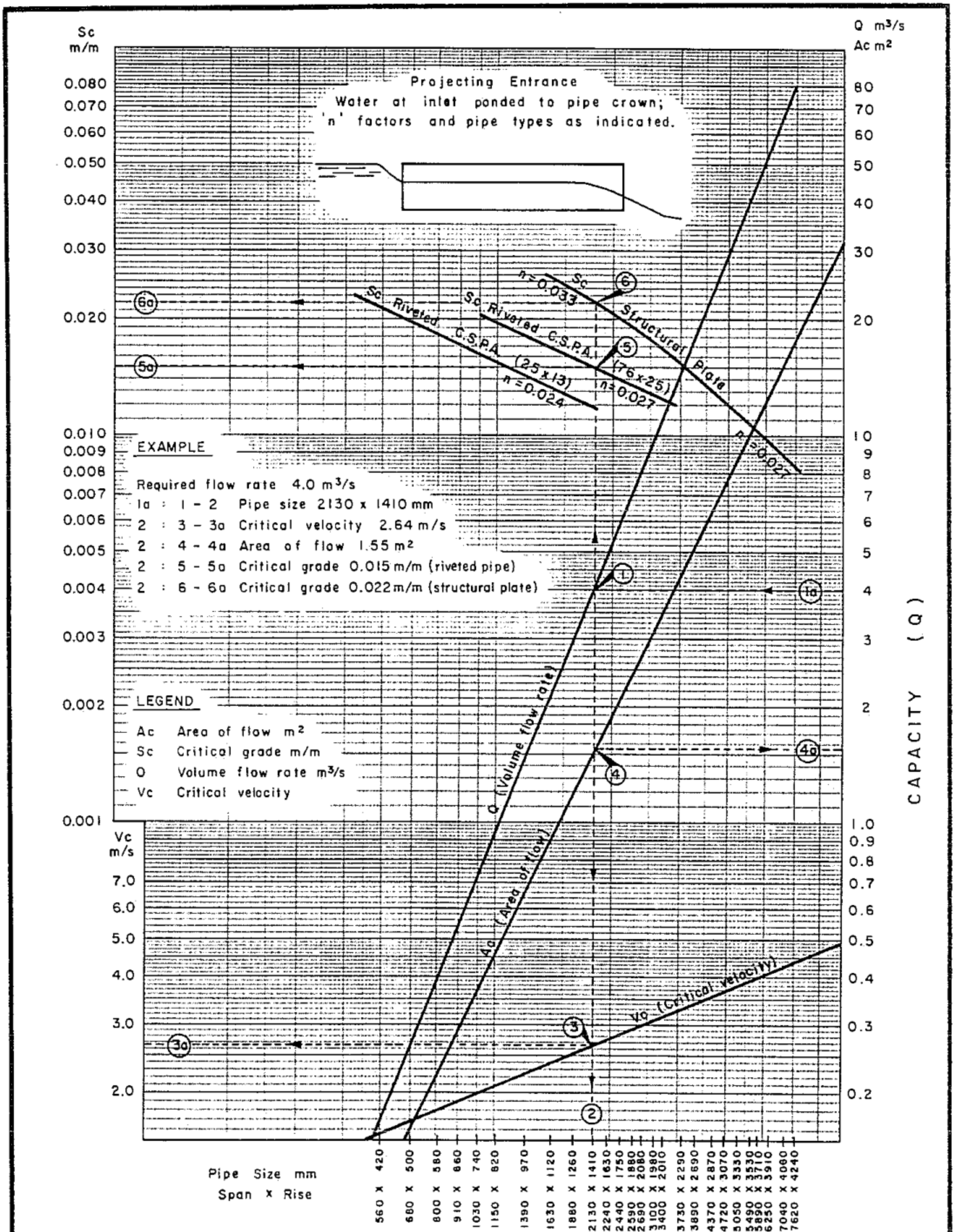
DESIGN MANUAL No.

E.1-1.1a



• FOR EXAMPLE SEE DM.Nº E.1-1.2a

APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DIRECTOR DESIGN AND SURVEYS	HYDRAULIC DESIGN CHART FOR CORRUGATED STEEL PIPE-ARCH	E.1-1.2
DATE 80-04-29 REVISED 81-10-01		



APPROVED E E Readshaw DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH HYDRAULIC DESIGN CHART FOR CORRUGATED STEEL PIPE-ARCH EXAMPLE		DESIGN MANUAL No. E.1-1.2a
DATE	80-04-29		
REVISED	81-10-01		

1. Ensure that fish are resident in the stream or that anadromous fish use stream area upstream of the culvert site,

2. Enquire if bridging is a practical alternative, if not,

3. Recommend that the following criteria be acknowledged prior to and during all phases of culvert installation:-

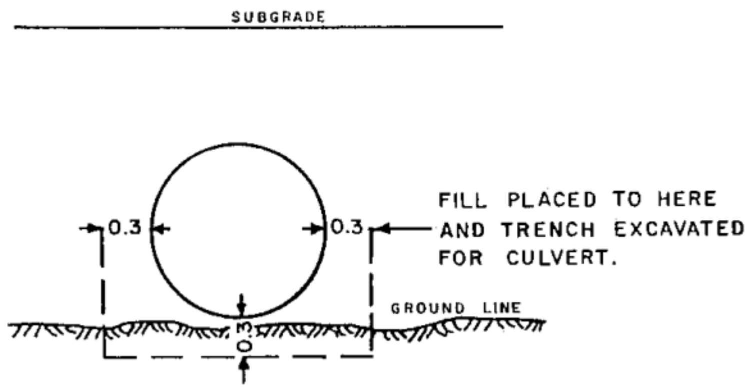
   (a) Minimum water depth of 0.2 m be maintained in the culvert during critical fish migration periods;

   (b) Water velocity not greater than 1.2 m/s in culverts under 24 m in length, and not to exceed 0.9 m/s in culverts over 24 m in length;

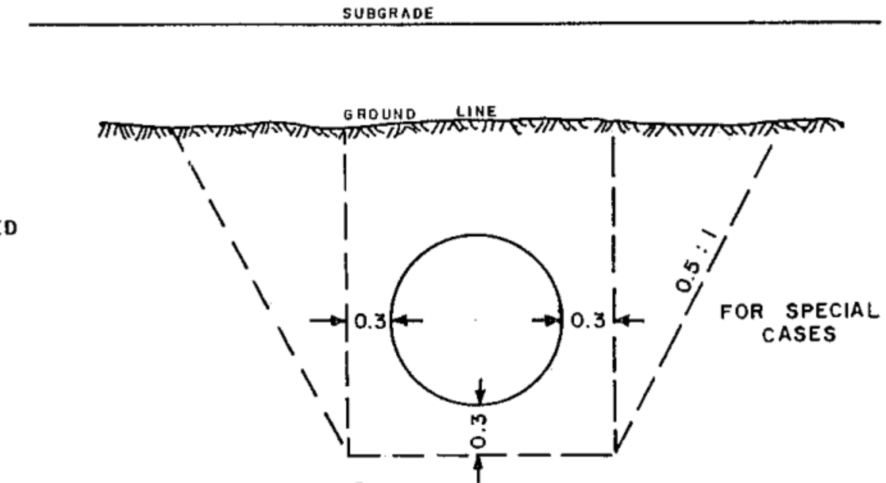
   (c) Gradient of 2 percent or less (i.e. 2 m rise in 100 m of culverting);

   (d) Water surface drop of not more than 0.3 m at the culvert's outlet. The approach to the culvert intake should be gradual, not a direct drop.

Advocated by Environment Canada - Fisheries and Marine Service.

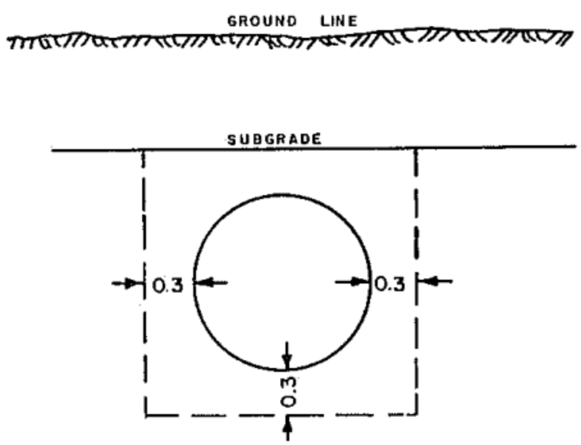


EXAMPLE 1.
CULVERT PLACED IN EMBANKMENT.



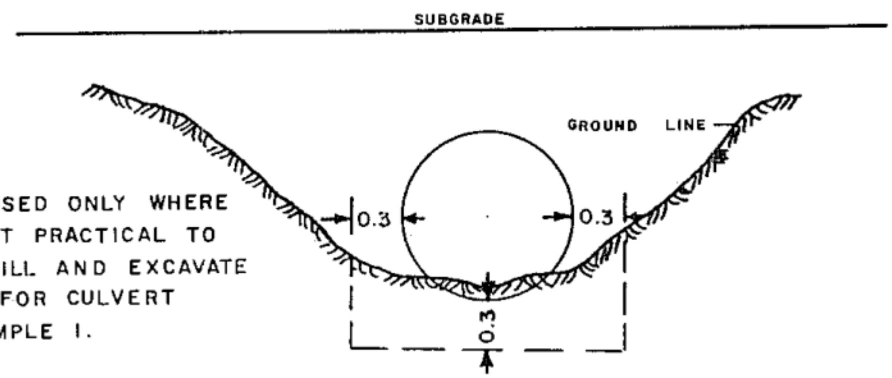
EXAMPLE 2.
CULVERT PLACED BELOW ORIGINAL
GROUND LINE.

GENERAL NOTE:
SPECIAL CONDITIONS APPLY FOR STRUCTURAL STEEL PLATE CULVERTS OVER 3.6 DIAMETER.



EXAMPLE 3.
CULVERT PLACED IN PROPOSED CUT.

NOTE:
TO BE USED ONLY WHERE IT IS NOT PRACTICAL TO PLACE FILL AND EXCAVATE TRENCH FOR CULVERT AS EXAMPLE 1.



EXAMPLE 4.
CULVERT PLACED IN NATURAL STREAM BED

Approved

Date: 77-09-29
Revised: 87-01

B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

FOUNDATION EXCAVATION FOR CULVERTS

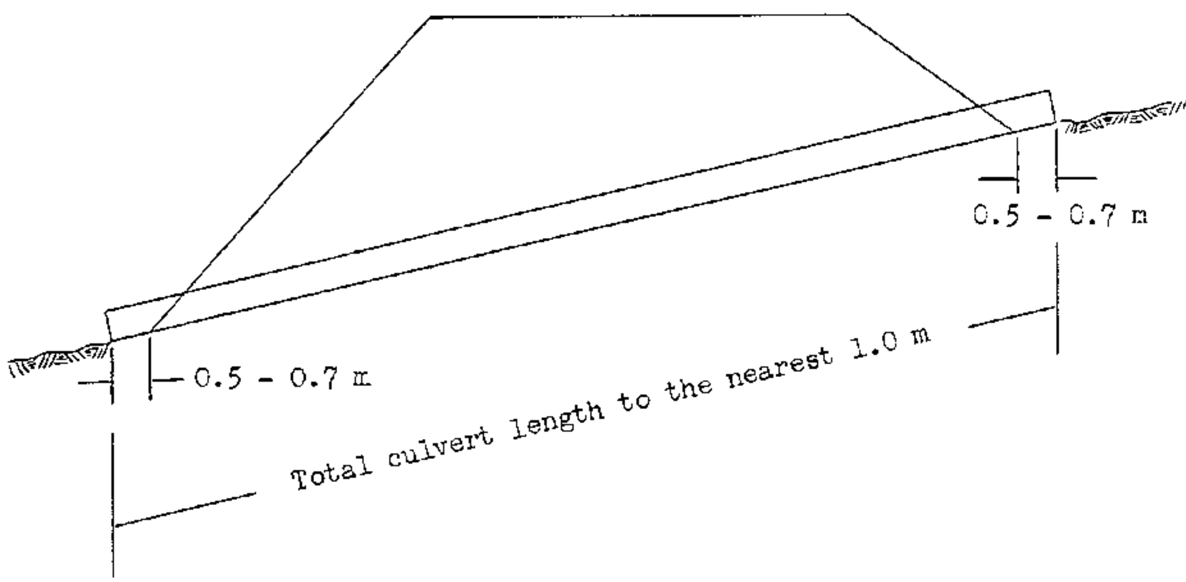
DESIGN MANUAL No.
E.3-3.0

1. Designate recorrugated culvert ends with annular couplers for helical C.S.P. culverts where the installation will be on a gradient greater than 15%.

2. Annular couplers to be indicated on the drawings, the additional materials list, and the H 741 and H 742 forms.

3. Culvert to extend approximately 0.5 m - 0.7 m beyond toe of slope.

4. Total culvert length to be to nearest 1.0 m.



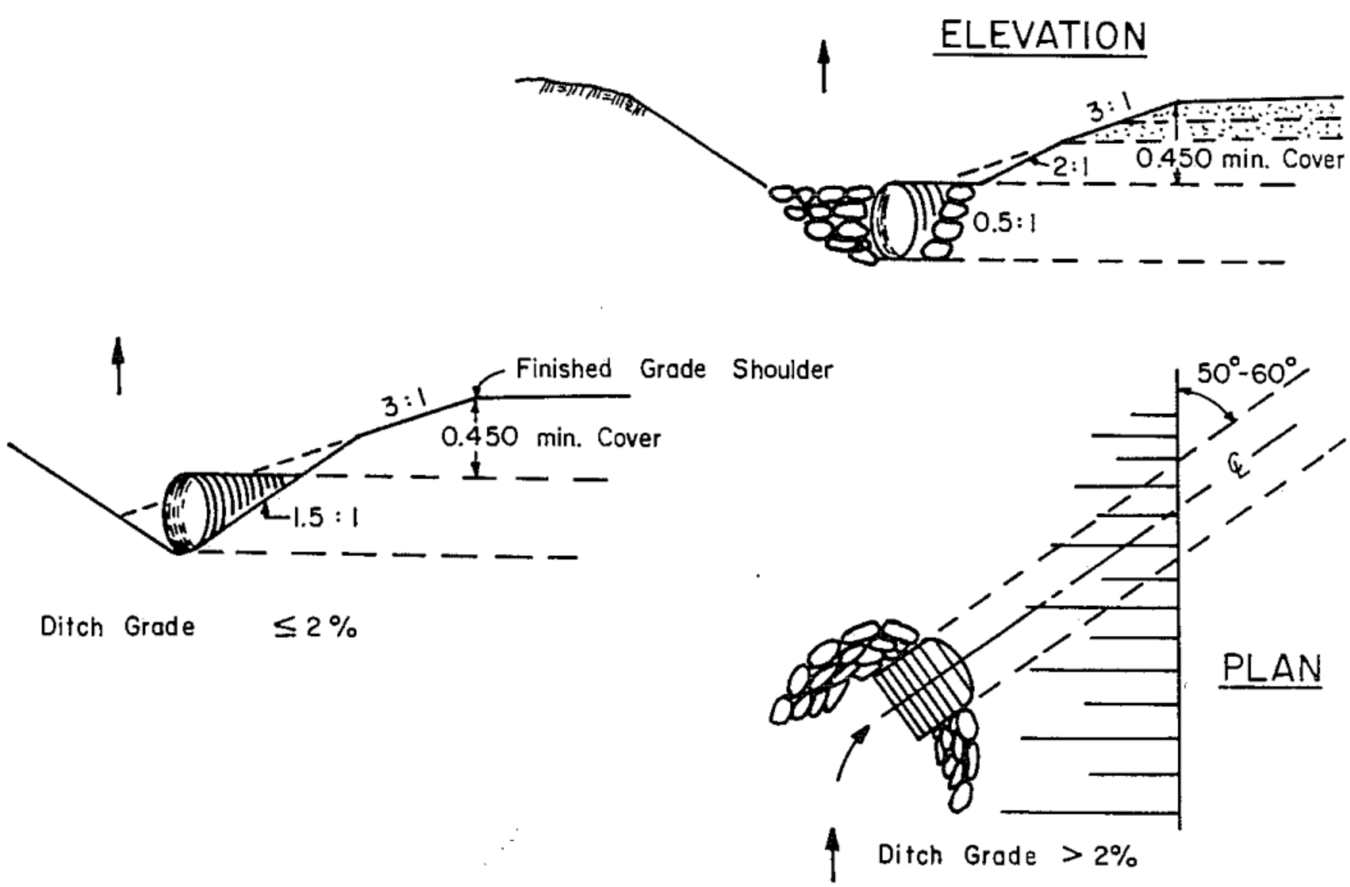
APPROVED DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No
DATE 78-10-11 REVISED 82-11-01	CULVERT INSTALLATION (C.S.P.)	E.3-3.1

1. Culverts should ideally be placed slightly steeper than the critical grade for the size and type of pipe used. This will usually be between 1.0 and 2.2 percent. The desirable minimum gradient is 0.5% to prevent sedimentation.

2. A skew number shall be designated for any installation not normal to the highway centreline. The skew number is the angle measured from the centreline of the highway ahead to the centre-line of the culvert, measured in a clockwise direction. The normal range is from 45 to 135 degrees.

3. A cross culvert from a highway ditch in cut shall be installed on a skew. The minimum cover requirement will provide a sump at the inlet (see sketch).

   When the ditch gradient is greater than 2%, more positive inlet control is required. In this case include a ditch block on the lower side of the culvert inlet. Concrete filled sandbags are effective for this purpose.



APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DIRECTOR DESIGN AND SURVEYS	CULVERT INSTALLATIONS	E.3-3.2
DATE 78-09-27 REVISED 87-07		

DESIGN DATA :

1. H25 S20 Loading
2. Live Load 9.07 tonnes on Assumed Area of 915 mm x 1015 mm
3. Impact 25 % of Live Load
4. Dead Load 1.92 tonnes / m^3
5. Young's Modulus Es = 200 kN / mm^2
6. Max. Flexibility Factor 0.245 mm / N
7. Compaction 85% Standard Density
8. Load Factor = 0.86 when h > d
9. Buckling Stress F.O.S = 2

Diameter mm	Minimum Cover	MAXIMUM COVER IN METRES — Wall Thickness 1.6 mm	2.0 mm	2.8 mm	3.5 mm
300	0.450 m to Finished Grade	70	91		
400		53	68		
500		42	54		
600		35	45		
700		30	39		
800		26	34	50	
900			30	44	
1000			27	40	50
1200				33	42
1400				27	35
1600				22	28
1800				17	22
2000					17
2200					13

NOTE : Recommended Wall Thickness Above Solid Line. Those below the line for use when durability is not a factor.

APPROVED

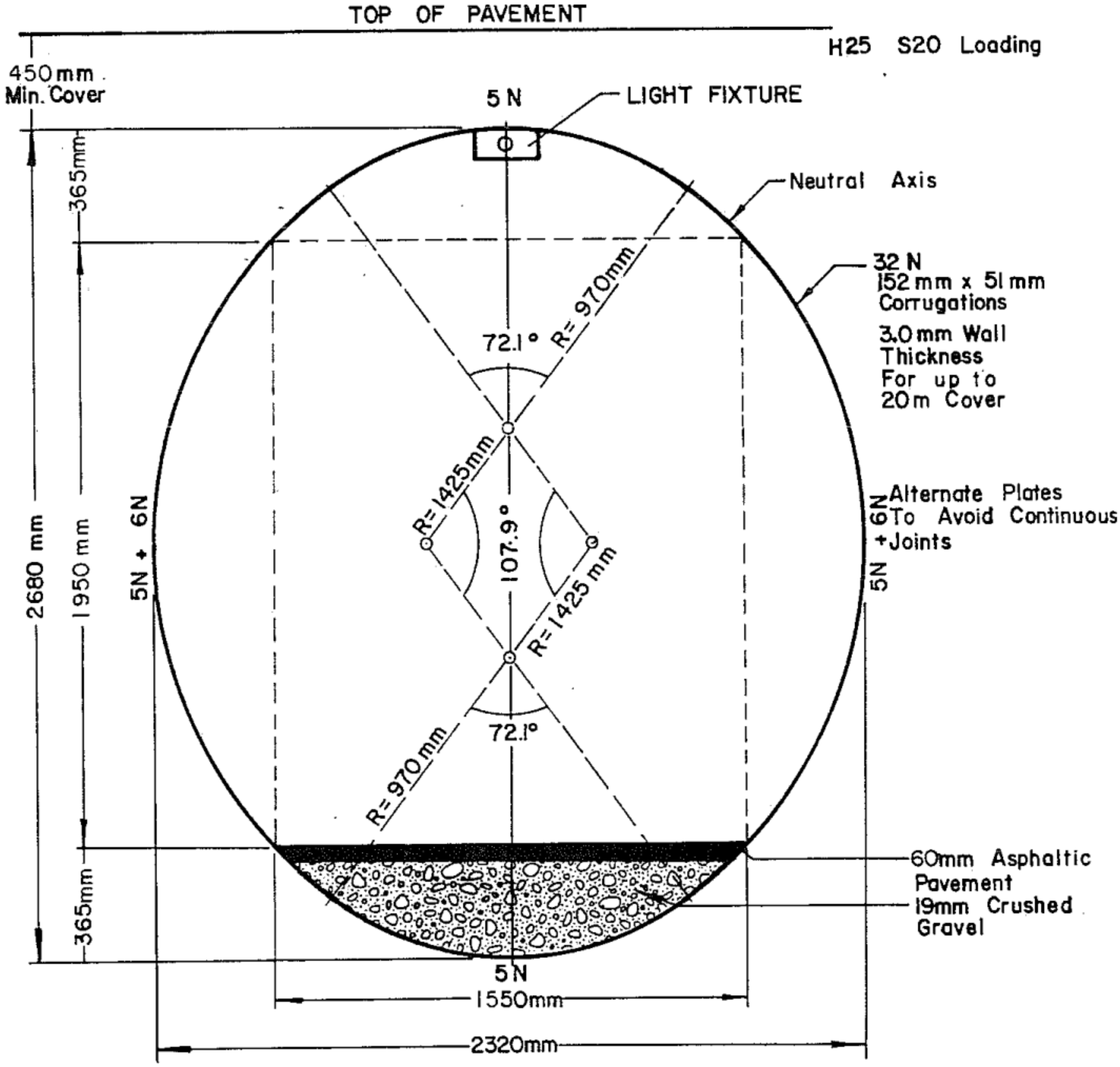
DIRECTOR DESIGN AND SURVEYS

DATE 79-08-10
REVISED 87-07

B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

HELICAL CORRUGATED STEEL PIPE
68 mm x 13 mm Corrugations

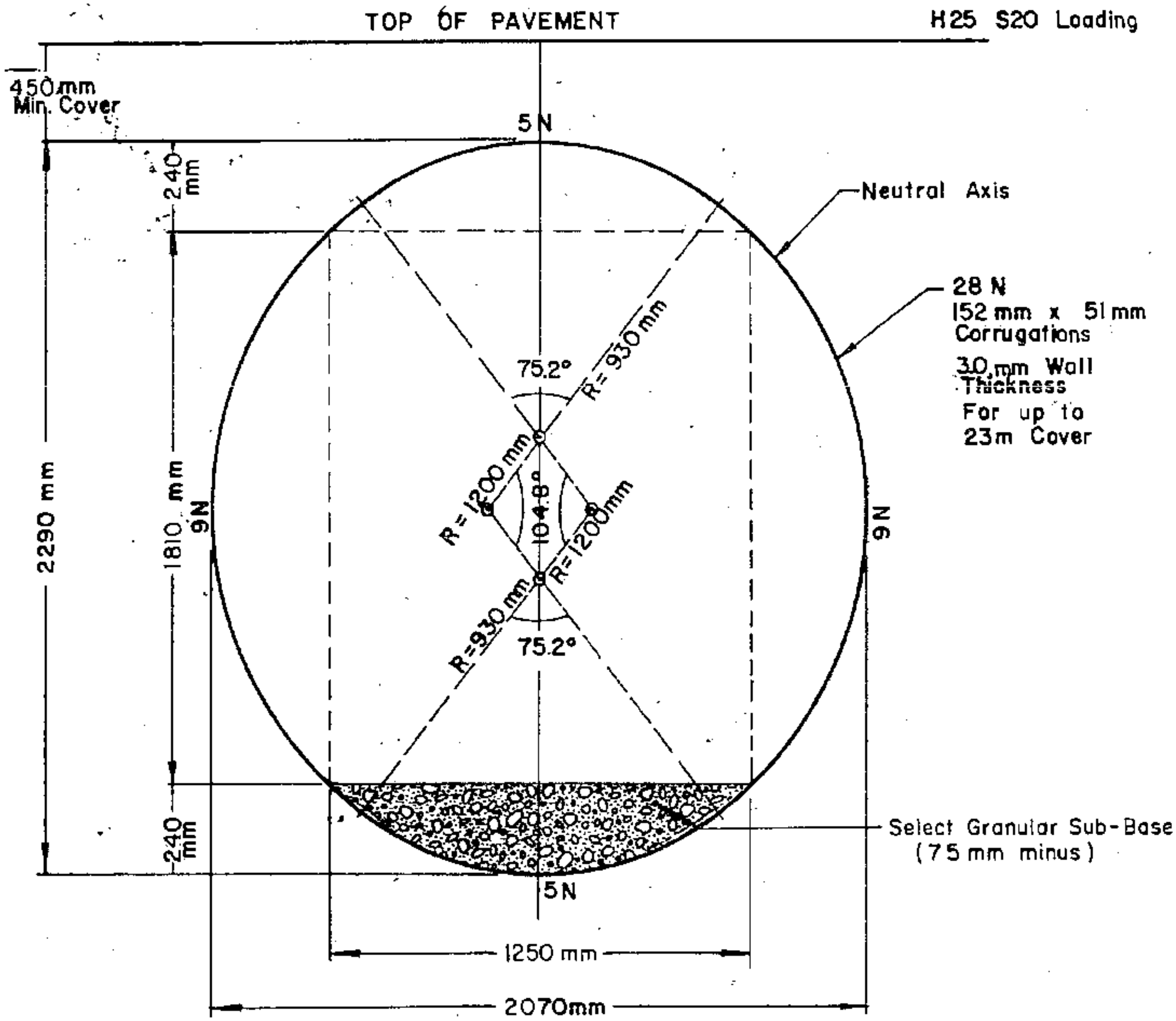
DESIGN MANUAL No. E.3-3.3



NOTE:

Use Two (2) 19mm Ø A.S.T.M. A-449 Bolts
With A.S.T.M. A-563 Grade "C" Nuts Per Corrugation

APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	MANUAL Nº
DIRECTOR DESIGN AND SURVEYS	2320mm x 2680mm STRUCTURAL STEEL PLATE PEDESTRIAN UNDERPASS	E.3 — 3.4
DATE 80-03-19		
REVISED 87 - 01		



NOTE:

Use Two (2) 19mm Ø A.S.T.M. A-449 Bolts
With A.S.T.M. A-563 Grade "C" Nuts Per Corrugation.

APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	MANUAL Nº.
DIRECTOR DESIGN AND SURVEYS	2070mm x 2290mm STRUCTURAL STEEL PLATE CATTLE UNDERPASS	E.3 – 3.5
DATE 80-03-19		
REVISED 87-01		

1. Structural Plate pipes over 3650 mm in diameter or span require installation and the use of Structural Backfill as outlined in the Special Provisions (D2).

2. Structural Plate pipes 3650 mm and under in diameter or span shall be installed in accordance with General Specification Clause 210.10.

3. If there are both over and under 3650 mm diameter or span culverts on the same project, No. 1 above shall apply for all sizes of Structural Plate pipe.

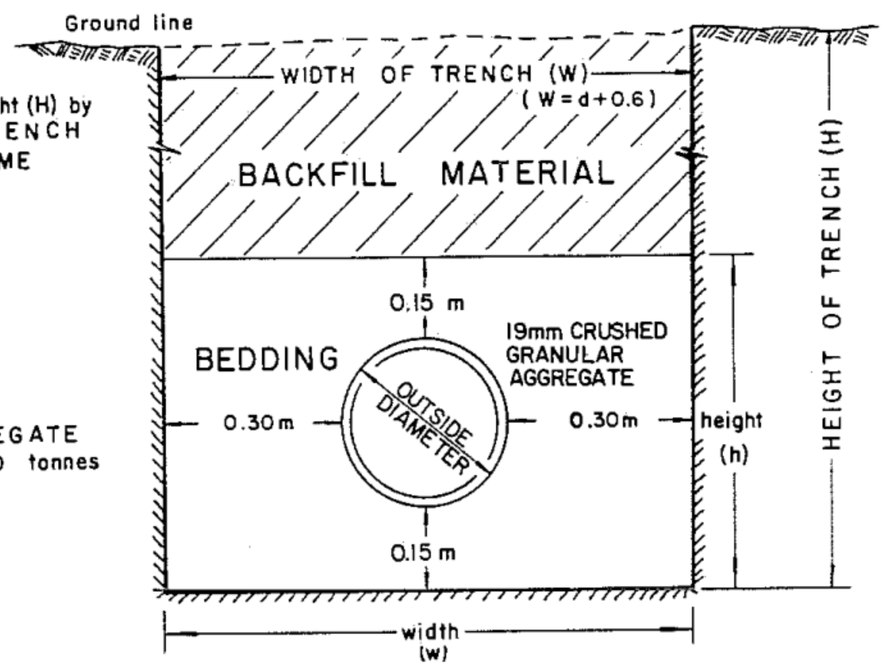
4. When depth of cover is considerable - bedding and backfill may have to be as outlined in No. 1 above even if the diameter or span of the pipe is less than 3650 mm.

CONCRETE PIPE			BEDDING							TRENCH EXCAVATION
PIPE SIZE Ø mm	WALL THICKNESS mm	OUTSIDE DIAM. mm	Height (h) m	Width (w) m	Area m^2	Pipe Area m^2	Bedding Area m^2	19 mm Crush Volume m^3	19 mm Crush Mass tonnes	Volume m^3 per m depth per lin. metre
			A	B	C (A x B)	D	E (C-D)	per linear metre		F
200	32	264	0.564	0.864	0.487	0.055	0.433	0.433	0.908	0.864
250	37	324	0.624	0.924	0.577	0.082	0.494	0.494	1.038	0.924
300	51	402	0.702	1.002	0.703	0.127	0.576	0.576	1.211	1.002
375	57	489	0.789	1.089	0.859	0.188	0.671	0.671	1.410	1.089
450	64	578	0.878	1.178	1.034	0.262	0.772	0.772	1.621	1.178
525	70	665	0.965	1.265	1.221	0.347	0.873	0.873	1.834	1.265
600	95	790	1.090	1.390	1.515	0.490	1.025	1.025	2.152	1.390
675	102	879	1.179	1.479	1.744	0.607	1.137	1.137	2.388	1.479
750	108	966	1.266	1.566	1.983	0.733	1.250	1.250	2.624	1.566
900	121	1142	1.442	1.742	2.512	1.024	1.488	1.488	3.124	1.742
1050	133	1316	1.616	1.916	3.096	1.360	1.736	1.736	3.646	1.916
1200	146	1492	1.792	2.092	3.749	1.748	2.001	2.001	4.201	2.092

*Multiply Trench Height (H) by Column 'F' to get TRENCH EXCAVATION VOLUME per linear metre

BEDDING AREA $= (h \times w) - (\frac{\pi}{4} D^2)$

COMP. GRAN. AGGREGATE
Mass per m^3 = 2.1000 tonnes



APPROVED DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 81-10-05 REVISED 84-06	CONCRETE PIPE STORM SEWER QUANTITY CHART BEDDING — FOUNDATION EXCAVATION	E.3-3.7

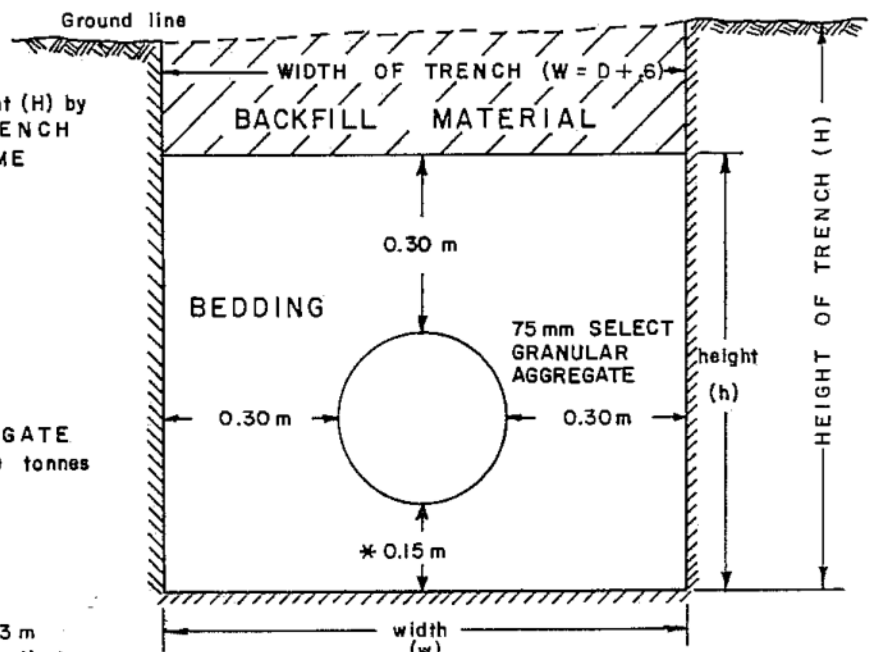
CORR. STEEL PIPE			BEDDING								FOUNDATION EXCAVATION
PIPE SIZE Ø mm	WALL THICKNESS mm	OUTSIDE DIAM. mm	Height (h) m	Width (w) m	Area m^2	Pipe Area m^2	Bedding Area m^2	75 mm Agg. Volume m^3	75 mm Agg. Mass tonnes		Volume m^3 per m depth per lin. metre
			A	B	C (A x B)	D	E (C−D)	per linear metre			F
200	—	200	0.650	0.800	0.520	0.031	0.489	0.489	1.026		0.800
250	—	250	0.700	0.850	0.595	0.049	0.546	0.546	1.146		0.850
300	—	300	0.750	0.900	0.675	0.071	0.604	0.604	1.269		0.900
400	—	400	0.850	1.000	0.850	0.126	0.724	0.724	1.521		1.000
500	—	500	0.950	1.100	1.045	0.196	0.849	0.849	1.782		1.100
600	—	600	1.050	1.200	1.260	0.283	0.977	0.977	2.052		1.200
700	—	700	1.150	1.300	1.495	0.385	1.110	1.110	2.331		1.300
800	—	800	1.250	1.400	1.750	0.503	1.247	1.247	2.619		1.400
900	—	900	1.350	1.500	2.025	0.636	1.389	1.389	2.917		1.500
1000	—	1000	1.450	1.600	2.320	0.785	1.535	1.535	3.223		1.600
1200	—	1200	1.650	1.800	2.970	1.131	1.839	1.839	3.862		1.800

* Multiply Trench Height (H) by Column 'F' to get TRENCH EXCAVATION VOLUME per linear metre

BEDDING AREA
$= (h \times w) - (\frac{\pi}{4} D^2)$

COMP. GRAN. AGGREGATE
Mass per m^3 = 2.1000 tonnes

* In Solid Rock use 0.3 m
– Increase bedding accordingly.



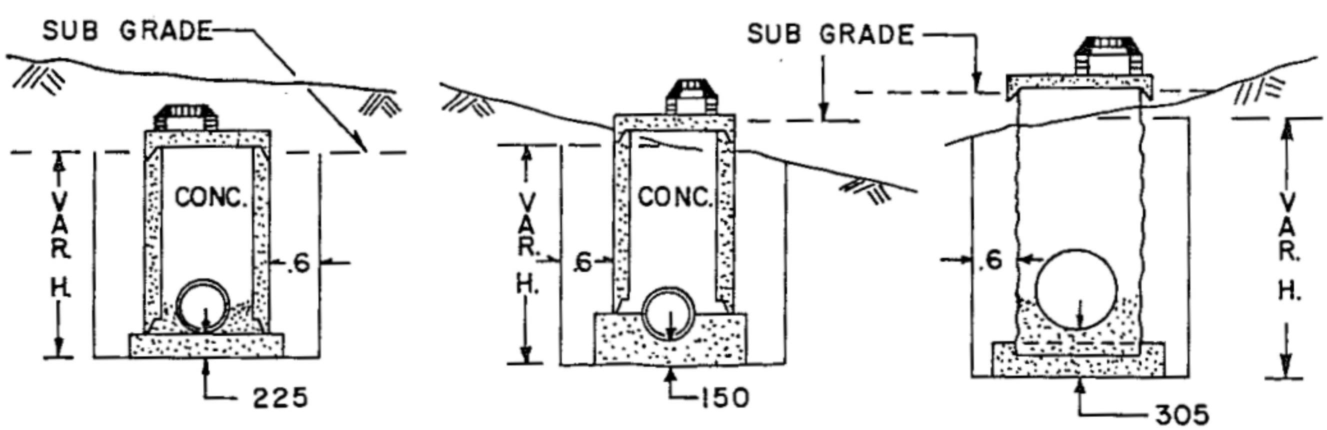
APPROVED
DIRECTOR DESIGN AND SURVEYS
DATE 84-06
REVISED

B.C MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

C.S. PIPE STORM SEWER QUANTITY CHART
PIPE BEDDING – FOUNDATION EXCAVATION

DESIGN MANUAL No.
E.3-3.7 A

DIAMETER mm	WALL TH. mm	OUTSIDE DIAMETER METRES	EXCAVATION DIAMETER METRES	AREA EXCAVATION SQ. METRES	VOLUME per m of depth CUBIC METRES	TYPE OF MATERIALS
900	2.8	0.930	2.130	3.563	3.563	Corr. Steel
	100	1.100	2.300	4.155	4.155	Concrete
1000	2.8	1.030	2.230	3.906	3.906	Corr. Steel
1050	115	1.280	2.480	4.831	4.831	Concrete
1200	2.8	1.230	2.430	4.638	4.638	Corr. Steel
	125	1.450	2.650	5.515	5.515	Concrete
	—·—	—·—	—·—	—·—	—·—	—·—
1350	165	1.680	2.880	6.514	6.514	Concrete
1400	2.8	1.430	2.630	5.433	5.433	Corr. Steel
1500	170	1.840	3.040	7.258	7.258	Concrete
1600	2.8	1.630	2.830	6.290	6.290	Corr. Steel
1650	185	2.020	3.220	8.143	8.143	Concrete
1800	2.8	1.830	3.030	7.211	7.211	Corr. Steel
	195	2.190	3.390	9.026	9.026	Concrete



CONCRETE
A BASE

CONCRETE
B BASE

CORRUGATED
STEEL

20 – SP 219

22 – SP 219

NOTES:

— TOP LIMIT FOR FOUNDATION EXCAVATION CALCULATION IS SUB GRADE OR GROUND LINE, WHICHEVER IS LOWER.
— NO FOUNDATION EXCAVATION WHEN RISER IS SMALLER THAN SEWER.

APPROVED DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS • DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 84-06 REVISED	FOUNDATION EXCAVATION VOLUMES PER METRE DEPTH OF MANHOLE	E.3-3.7B

1. The minimum size open culvert installation under a highway or main road shall be 600 mm diameter.

2. The minimum size frontage road culvert shall be 500 mm diameter.

3. The minimum size driveway culvert shall be 400 mm diameter.

4. Culverts shall be designed to be of a size to carry flow in the 50 to 200 year return period range ponded to the crown.

   Examples of when the various return periods should be used are as follows:-

   50 year For low volume roads with shallow fill in undeveloped areas.

   100 year Normal design except when the conditions stated for the 50 or 200 year return period are applicable.

   200 year (a) For highways in developed areas where flood damage is a possibility. (In some instances where the upstream flood levels are critical, it may be necessary to design the culvert so as not to increase the upstream water levels).

   (b) When requested by Ministry of Environment.

5. A culvert list and summary shall be made on forms H 741 and H 742 for each project.

   When submitting a project for Contract, a copy of the list and summary shall be forwarded to the Contract Documents Officer.

   For helical pipe the length breakdown in multiples of 4, 5 or 7 m must be listed.

1. The inlets of corrugated steel culverts are susceptable to hydrostatic uplift and may collapse due to this effect. To prevent uplift, a concrete (or sheet metal) cut off wall shall be constructed at the inlet of culverts equal or greater than 3050 mm diameter or 2590 mm span.

DESIGN DATA:

CLASS "B" BEDDING
WIDTH OF TRENCH AT PIPE CROWN = TRANSITION WIDTH
BACKFILL - SAND AND GRAVEL AT 1.92 tonnes / m^3
PIPE STRENGTH - A.S.T.M. - C 14 AND C 76
LOADING H.25
LOAD FACTORS (LIVE LOAD = 1.5 ; EARTH LOAD = 1.9)
SAFETY FACTOR = 1.5

COVER IN METRES									
DIAM. IN mm	NON - REINF. C 14-3		REINF. C 76-III		REINF. C 76-IV		REINF. C 76-V		DIAM. IN m.m.
	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	
200	6.4	0.3	-	-	-	-	-	-	200
250	5.2	0.4	-	-	-	-	-	-	250
300	4.2	0.4	-	-	4.8	0.4	6.1	0.3	300
375	3.8	0.4	-	-	5.0	0.4	6.2	0.3	375
450	3.7	0.4	-	-	5.1	0.4	6.3	0.3	450
525	3.7	0.4	3.4	0.5	5.1	0.3	6.3	0.2	525
600	3.8	0.4	3.5	0.5	5.2	0.3	6.4	0.2	600
675	3.6	0.4	3.5	0.5	5.2	0.2	6.5	0.2	675
750	3.4	0.4	3.5	0.4	5.3	0.2	6.6	0.2	750
900	3.0	0.4	3.6	0.3	5.3	0.2	6.6	0.2	900
1050	-	-	3.6	0.2	5.4	0.2	6.7	0.2	1050
1200	-	-	3.6	0.2	5.4	0.2	6.7	0.2	1200
1350	-	-	3.7	0.2	5.4	0.2	6.7	0.2	1350
1500	-	-	3.7	0.2	5.5	0.2	6.7	0.2	1500
1650	-	-	3.5	0.2	5.5	0.2	6.7	0.2	1650
1800	-	-	3.8	0.2	5.5	0.2	6.7	0.2	1800

REFERENCE:

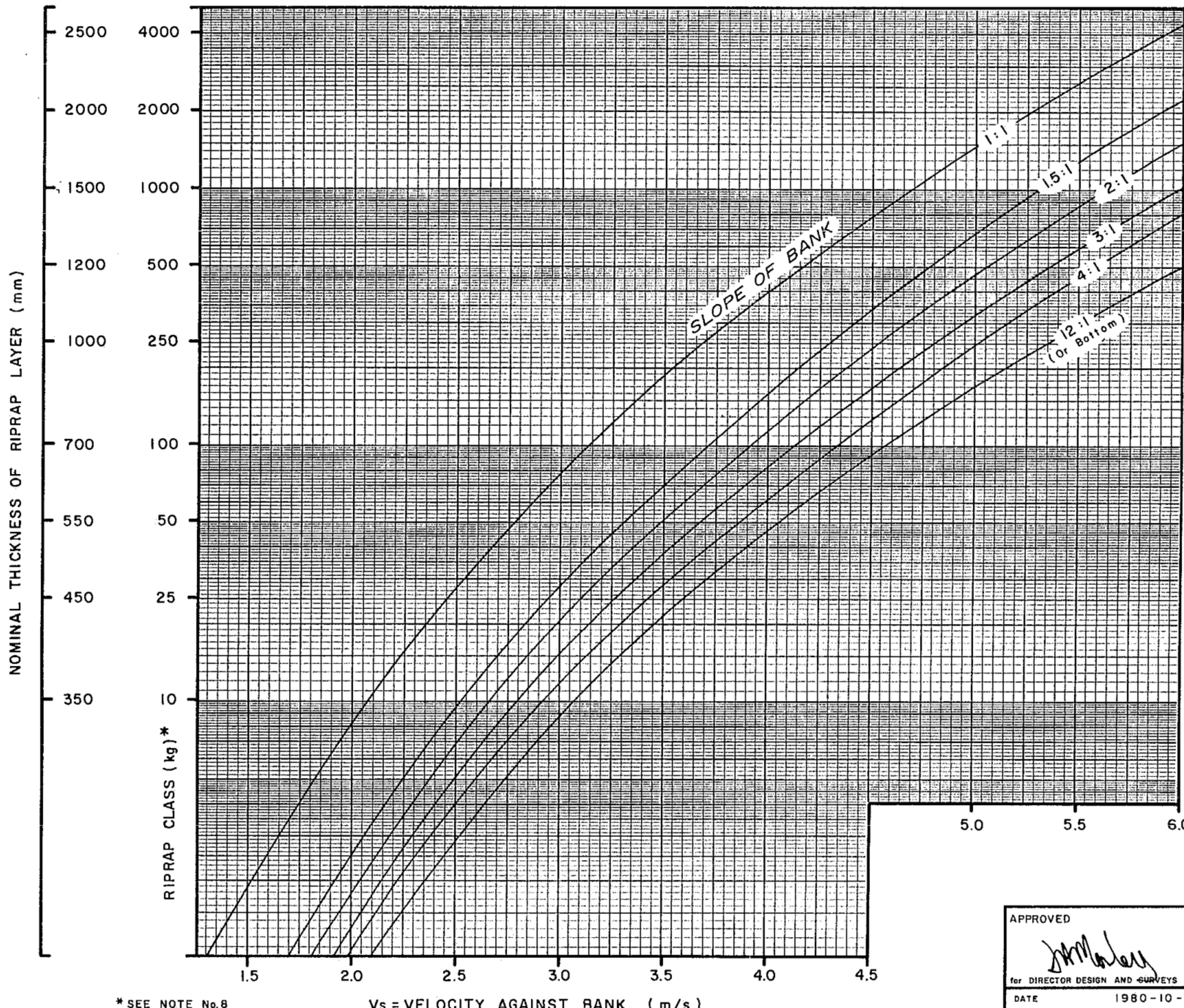
CONCRETE PIPE DESIGN MANUAL - by the Am. Conc. Pipe Ass'n '70

APPROVED
DIRECTOR DESIGN AND SURVEYS
DATE 81-06-30
REVISED 82-11-01

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

CONCRETE PIPE
TRENCH INSTALLATION

DESIGN MANUAL No.
E.3 - 3.10



*SEE NOTE No.8

SIZE OF ROCK AND THICKNESS OF PROTECTION BLANKET THAT WILL RESIST DISPLACEMENT FOR VARIOUS VELOCITIES AND BANKSIDE SLOPES.

NOTES:

1. ADAPTED FROM REPORT OF SUB-COMMITEE ON SLOPE PROTECTION, AM. SOC. CIVIL ENGINEERS PROC. JUNE 1948.
2. DENSITY OF STONE ASSUMED AT 2640 kg/m³.
3. ENTER GRAPH AT KNOWN VELOCITY TO INTERSECTION WITH DESIRED SLOPE CURVE. MOVE HORIZONTALLY TO REQUIRED RIPRAP CLASS AND THICKNESS.
4. V_M = MEAN STREAM VELOCITY.
5. FOR PARALLEL FLOW ALONG TANGENT BANK; $V_S = \frac{2}{3} V_M$.
6. FOR IMPINGING FLOW AGAINST CURVED BANK; $V_S = \frac{4}{3} V_M$.
7. FOR DIRECT IMPINGEMENT ON THE BANK; $V_S = 2 V_M$.
*8. THE RIPRAP CLASS No. IS THE MASS (kg) OF THE 50% ROCK SIZE (ie AT LEAST HALF OF THE RIPRAP MUST BE HEAVIER THAN ITS CLASS MASS). FOR DETAILS REGARDING THE ROCK GRADATION SEE GENERAL SPECIFICATIONS - SECTION 205.2
9. DO NOT INTERPOLATE BETWEEN RIPRAP CLASSES. USE THE NEXT HIGHEST CLASS.

APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	
for DIRECTOR DESIGN AND ~~SURVEYS~~	RIPRAP DESIGN CHART	DESIGN MANUAL
DATE 1980-10-10		E 3-3 II
REVISED 1982-11-01		

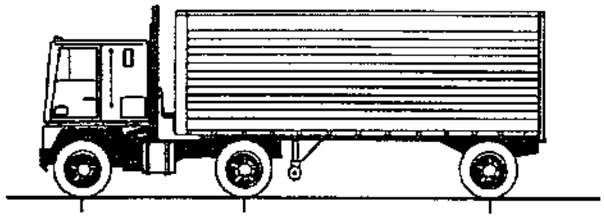
Dimensions for culverts shall be shown in the following form:

20 m - 300 Ø CSP 1.6 WT

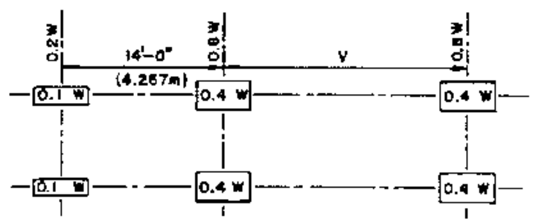
The complete information should be shown on the plan and profile, although showing of the WT on the plan is optional.

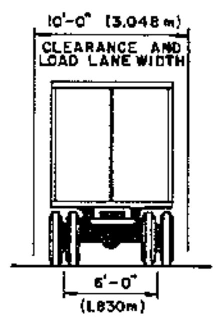
Abbreviations for steel pipe are:

CSP - Corrugated steel pipe
ACCSP - Asphalt-coated corrugated steel pipe
SPCSP - Structural plate corrugated steel pipe
WT - Wall thickness



MS 250 – 77	50 kN	200 kN	200 kN
MS 225 – 77	45 kN	180 kN	180 kN
MS 200 – 77	40 kN	160 kN	160 kN
MS 150 – 77	30 kN	120 kN	120 kN





APPROVED

DIRECTOR DESIGN AND SURVEYS

DATE 85 – 02

REVISED

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS

DESIGN AND SURVEYS BRANCH

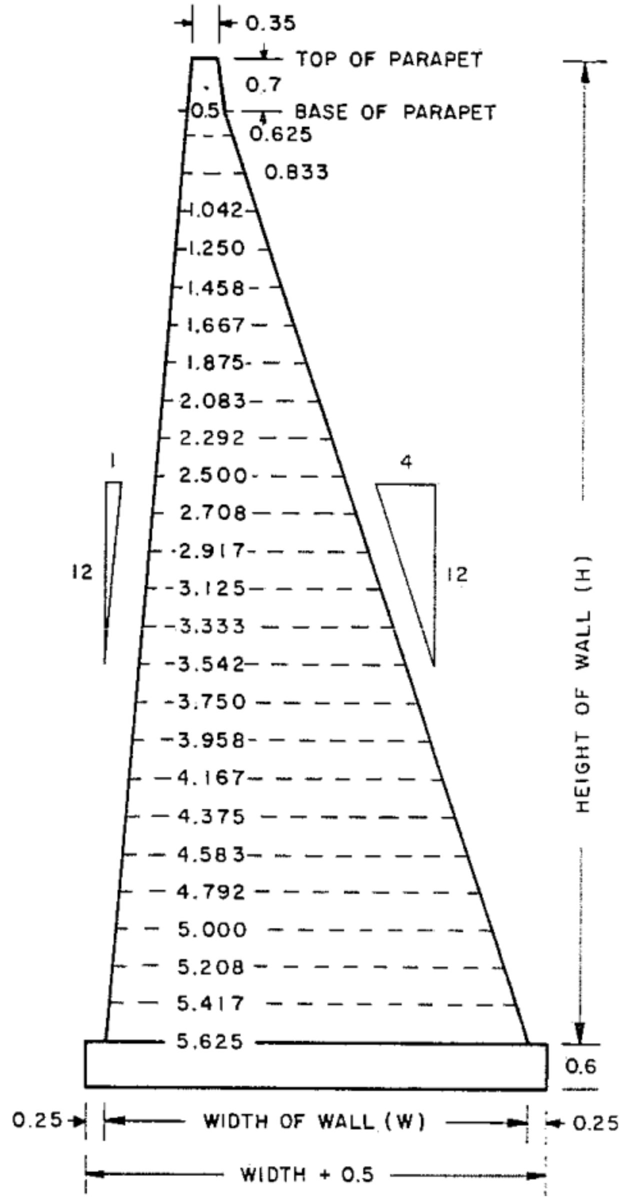
DESIGN LOADING

DESIGN MANUAL No.

E.3-3.13

H	VW/M	VB/M	VT/M
HEIGHT OF WALL INCLUDES PARAPET m	VOLUME* OF WALL per LIN.-m m^3	VOLUME* OF BASE per LIN.-m m^3	TOTAL VOLUME* PER LIN.-m m^3
0.7	0.298	0.600	0.898
1.0	0.466	0.675	1.141
1.5	0.831	0.800	1.631
2.0	1.300	0.925	2.225
2.5	1.873	1.050	2.923
3.0	2.550	1.175	3.725
3.5	3.331	1.300	4.631
4.0	4.216	1.425	5.641
4.5	5.206	1.550	6.756
5.0	6.300	1.675	7.975
5.5	7.498	1.800	9.298
6.0	8.800	1.925	10.725
6.5	10.206	2.050	12.256
7.0	11.716	2.175	13.891
7.5	13.331	2.300	15.631
8.0	15.050	2.425	17.475
8.5	16.873	2.550	19.423
9.0	18.800	2.675	21.475
9.5	20.831	2.800	23.631
10.0	22.966	2.925	25.891
10.5	25.206	3.050	28.256
11.0	27.550	3.175	30.725
11.5	29.998	3.300	33.298
12.0	32.550	3.425	35.975
12.5	35.206	3.550	38.756
13.0	37.966	3.675	41.641

* END AREA IS EQUAL TO THE VOLUME EXPRESSED IN m^2.



NOTE:

INTERMEDIATE VOLUMES CAN BE CALCULATED AS FOLLOWS:
e.g. WALL HEIGHT 5.35 m

$$W = 0.5 + \left(\frac{H - 0.7}{2.4}\right) = 0.5 + \left(\frac{5.35 - 0.7}{2.4}\right) = 2.438 \text{ m}$$

$$VW/M = 0.2975 + (H - 0.7)\left(\frac{W + 0.5}{2}\right) = 0.2975 + 4.65\left(\frac{2.438 + 0.5}{2}\right) = 7.128 \text{ m}^3/\text{m}$$

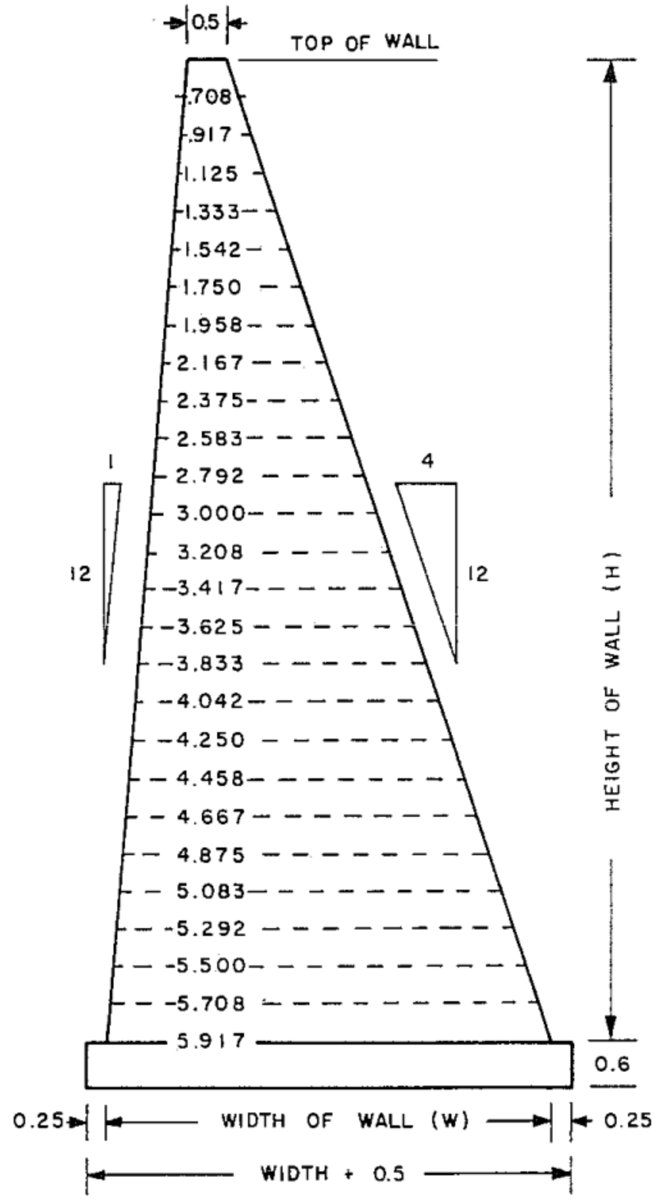
$$VB/M = 0.6\,(W + 0.5) = 0.6\,(2.938) = 1.763 \text{ m}^3/\text{m}$$

$$VT/M = VW/M + VB/M = 7.128 + 1.763 = 8.891 \text{ m}^3/\text{m}$$

APPROVED [signature] DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH **CONCRETE VOLUMES PER LINEAL METRE OF STANDARD GRAVITY RETAINING WALLS (WITH PARAPET)**	DESIGN MANUAL No. E.3-4.0
DATE 82-11-01		
REVISED 87-01		

H	VW/M	VB/M	VT/M
HEIGHT OF WALL m	VOLUME* OF WALL per LIN.-m m^3	VOLUME* OF BASE per LIN.-m m^3	TOTAL VOLUME* PER LIN.-m m^3
0.5	0.302	0.725	1.027
1.0	0.708	0.850	1.558
1.5	1.219	0.975	2.194
2.0	1.833	1.100	2.933
2.5	2.552	1.225	3.777
3.0	3.375	1.350	4.725
3.5	4.302	1.475	5.777
4.0	5.333	1.600	6.933
4.5	6.469	1.725	8.194
5.0	7.708	1.850	9.558
5.5	9.052	1.975	11.027
6.0	10.500	2.100	12.600
6.5	12.052	2.225	14.277
7.0	13.708	2.350	16.058
7.5	15.469	2.475	17.944
8.0	17.333	2.600	19.933
8.5	19.302	2.725	22.027
9.0	21.375	2.850	24.225
9.5	23.552	2.975	26.527
10.0	25.833	3.100	28.933
10.5	28.219	3.225	31.444
11.0	30.708	3.350	34.058
11.5	33.302	3.475	36.777
12.0	36.000	3.600	39.600
12.5	38.807	3.725	42.527
13.0	41.708	3.850	45.558

* END AREA IS EQUAL TO THE VOLUME EXPRESSED IN m^2.



NOTE:

INTERMEDIATE VOLUMES CAN BE CALCULATED AS FOLLOWS:
e.g. WALL HEIGHT 6.67 m

$$W = 0.5 + \left(\frac{H}{2.4}\right) = 0.5 + \frac{6.67}{2.4} = 3.279 \text{ m}$$

$$VW/M = H\left(\frac{W + 0.5}{2}\right) = 6.67\left(\frac{3.279 + 0.5}{2}\right) = 12.603 \text{ m}^3/\text{m}$$

$$VB/M = 0.6\ (W + 0.5) = 0.6\ (3.779) = 2.267 \text{ m}^3/\text{m}$$

$$VT/M = VW/M + VB/M = 12.603 + 2.267 = 14.870 \text{ m}^3/\text{m}$$

APPROVED [signature] DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS · DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.	
DATE 82-11-01	CONCRETE VOLUMES PER LINEAL METRE OF STANDARD GRAVITY RETAINING WALLS (WITHOUT PARAPET)	E.3-4.1	
REVISED 87-01			

SECTION F

RAILWAYS & UTILITIES

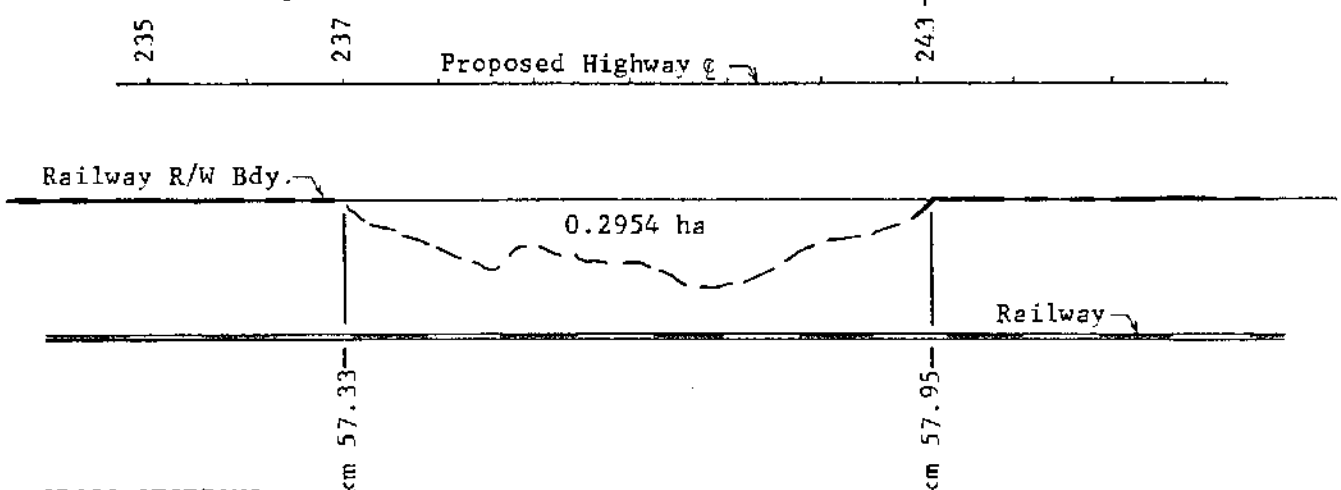
F.1 RAILWAYS

F.2 UTILITIES

Attempts should be made to avoid Railway Encroachment, but if encroachment is absolutely necessary three prints of each of the applicable project plan drawings and cross sections must be forwarded to the Railway agency for their comments or approval.

The drawing requirements are as follows:

1. The encroachment area to be represented by a plot of the toes of cut and/or fill. Shade the area in red on the prints.
2. Show the areas in hectares.
3. If the encroachment is less than 100 m long show the railway kilometre near the mid-point; if longer than 100 m show the kilometre at the beginning and end.
4. Show drainage relevant to the railway.



<u>CROSS-SECTIONS</u>

1. To be drawn on reproducible cross-section paper, preferably at a scale of 1:100.
2. Show both the highway and railway prisms, and include one section before and after the encroachment area.
3. Show position of the railway R/W boundary, the railway centre-line, and base of rail elevations on each section.
4. Show cross-section at relevant culvert locations.
5. The cross-sections to be referenced to the railway kilometre shown on the plans.

APPROVED DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 79-05-07 REVISED	RAILWAY ENCROACHMENTS	F.1-1.2

1. Approximate minimum vertical clearances for design, from construction grade to base of rail, are as follows:

   8.55 m for a highway overpass,

   6.70 m for a highway underpass.

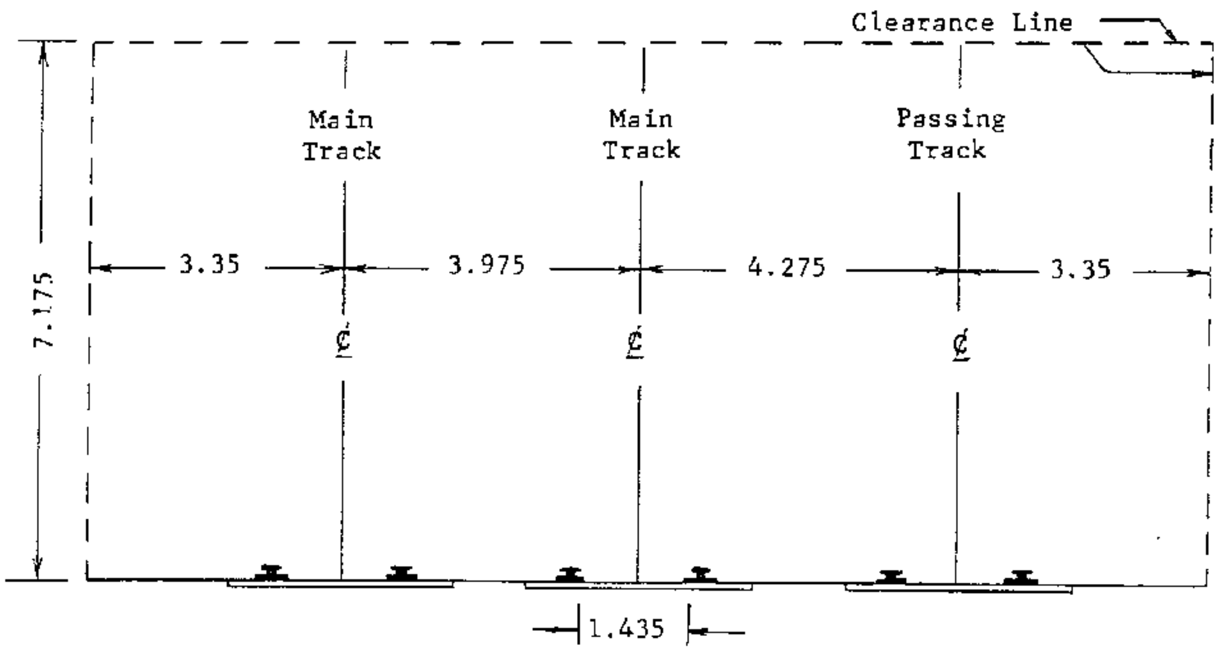
2. The finished clearances required are:

   7.175 m for a highway overpass,

   4.90 m for a highway underpass.

3. It is no longer necessary to provide increased clearance for electrification.

4. Minimum horizontal clearances are as shown below. Distances could increase if railway on curve - obtainable from Bridge Branch.



5. Site plans are to be forwarded to headquarters as soon as possible, for submittal to the Bridge Branch to enable them to check the clearance requirements and proceed with structure design.

APPROVED	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DIRECTOR DESIGN AND SURVEYS		
DATE 79-05-07 REVISED	RAILWAY CLEARANCES	F.1-2.1

A special drawing must be prepared to accompany an application for new at-grade railway crossings. This also applies for temporary crossings which may be required during highway construction, or if reconstruction is proposed at an existing crossing.

Drawing information and crossing requirements shall be in accordance with the section on Railway Crossings in Chapter 8 of the Ministry's Manual of Policy and Procedure. No. F.1-2.3 is a sample drawing.

Guide lines on sight distances are as follows:-

Where the maximum speed of a vehicle approaching the crossing is 50 km/h, there should be clear vision of approaching trains from all points on the road on both sides of the crossing for a distance of approximately 60 m back from the crossing. Where the maximum speed of vehicles may be 70 km/h, there should be clear vision for a distance of 90 m back from the crossing. The distance of clear vision along the track from all points on the road, as specified above, should be at least 150 m where the maximum speed of trains approaching the crossing does not exceed 50 km/h. Distances for higher train speeds are as follows:-

200 m for 70 km/h

310 m for 100 km/h

400 m for 130 km/h

The final drawing should be submitted to the Director of Bridge Engineering, Attention: C.T.C. Liaison Engineer, for the assignment of a number and processing of the application.

For Projects On The Active List:

1. It is desirable to contact each Utility Authority during the design stage, advising that highway improvements are proposed, and discuss the affects of the design on the utility.

2. As soon as plans showing location of proposed streets, limits of cuts and fills, and proposed right-of-way are available, supply a set of prints to each Utility Authority, indicating the poles to be relocated.

3. A copy of the following legend shall be affixed to the first sheet (key plan) of each set of prints showing the poles to be relocated.

	Blue Circle	Transformer Pole
	Blue Circle	Power Pole
	Blue Circle	Power Guy Pole
	Red Circle & Blue Circle	Combination Power and Telephone Pole
	Red Circle	Telephone Pole
	Red Circle	Telephone Guy Pole
	Black Circle	Telegraph or Telecommunications Pole
	Black Circle	Telegraph or Telecomm. Guy Pole
LS	Green Circle	Lamp Standard
HT	Blue Circle	High Tension Power Tower

4. Correspondence to the Utility Authority should:-

   (a) Give a general project description.

   (b) Query the accuracy of the utility locations as shown and ask to be advised of any errors or omissions.

   (c) Indicate minimum acceptable distance from face of curb to face of pole on curb and gutter projects.

   (d) For telephone pole relocations, request an estimate of the number of spliced sheath metres involved (F.2-1.3).

   (e) State construction scheduling if known - check with Design and Surveys Headquarters.

5. If the project is to be a Contract, send a copy of each Utility Authority's accompanying letter with a copy of the Pole Relocation List (H-96) to the Contract Documents Officer.

Recommended Guidelines For Pole Relocation:-

1. Desirable minimum offsets for utility poles are as follows:-

   (a) Curb and Gutter Projects — behind the sidewalk or 1.7 m from face of curb to face of pole, whichever is greatest.

   (b) Open Shoulder Projects — beyond limits of the roadway prism; usually 1.8 m from edge of right-of-way. Preferably minimum 9 m from outer lane edge.

2. Under no circumstance shall poles be installed within traffic islands.

3. As street lighting is a possibility on all arterial highways through urban areas, electrical wires must be high enough to safely clear luminaires by 3.3 m. Therefore, where proposed electrical lines are above potential luminaire locations, the minimum vertical clearances from the roadway shall be:

   12.5 m for 2-lane highways
   14 m for 4-lane highways
   17 m for highways wider than 4-lanes

   For standard clearances, see Design Manual No. F.2-1.2

4. There shall be no diagonal crossing of Hydro lines and telephone lines at intersections.

1. Minimum clearances between a high voltage transmission line and any part of the travelled roadway are as follows:

Voltage	Minimum Clearance (secondary road)	Minimum Clearance (main road)
138 kV	7.3 m	13 m
230 kV	7.9	13.6
345 kV	9.5	14.6
500 kV	14.5	15.2

2. The minimum clearances for a lower voltage distribution line are as follows:

Voltage	Minimum Clearance
0 to 750 V	4.9 m
750 to 38 000 V	4.9
38 000 to 86 000 V	5.5

3. The minimum clearance for communication wires and guy wires is 4.9 m.

The following cancels all previous agreements:-

Where the Ministry requests relocation of B.C. Hydro or B.C. Telephone pole lines, the Ministry contribution regardless of line detail is:-

Power - $400. per pole

Telephone - $400. per pole plus $350. per 100 sheath metres.

Reimbursement of $350. per 100 sheath metres will apply only when at least one splice of a line is involved.

100 sheath metres is an enclosed telephone cable 100 metres long regardless of the number of pairs in the cable. Where there is more than one cable, they will be paid for separately. Where telephone circuits are open wire, any number of open wires is considered the equivalent of one cable.

Where there are power poles with joint ownership, $400. plus $350. per 100 sheath metres will apply. There will be no Ministry contribution to remove guy poles.

Note the above costs relate only to aerial relocations.

APPROVED DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 81-10-15 REVISED	POLE LINE RELOCATION COSTS	F.2-1.3

SECTION G

MISCELLANEOUS

G.1	SURVEY NOTES
G.2	ENVIRONMENTAL AGENCIES
G.3	AIRPORT CLEARANCES
G.4	MANUAL OF POLICY & PROCEDURE. Chpt. 10
G.T.	TABLES

1. Measure P-Line and L-Line angles to the nearest 10 seconds.

2. Standard staking and cross section interval to be 20 m, and 10 m for Curb and Gutter surveys. Curves of 135 m radius and less to be staked at 10 m intervals.

3. Cross Section elevations and distances to be measured to the nearest 0.01 m (1 cm).

4. Benchmarks to be established to the nearest 0.001 m (1 mm).

SAMPLE FIELD NOTES FOR DOUBLE TURN LEVELS

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

APPROVED
DIRECTOR DESIGN AND SURVEYS
DATE 78-02-14
REVISED 84-06

DESIGN MANUAL No G.1-1

STA.	B.S.	H.I.	F.S.	I.S.	ELEV.
G.B.M. #693-P	2.189	539.968			537.779
	2.189	539.968			
		539.968			
T.P. #1	2.070	540.693	1.345		538.623
	2.405	540.695	1.678		538.290
		540.694			
T.P. #2	2.012	541.611	1.095		539.599
	2.226	541.609	1.311		539.383
		541.610			
P. 0+30				1.372	540.238
P. 0+60				1.921	539.689
P. 0+75				2.073	539.537
P. 1+00				2.346	539.264
P.B.M. #1			1.089		540.521
			1.089		540.521
					540.521
	13.091		7.607		540.520
					0.001

82-09-26
Cloudy-Showers 18°C

π J.W. MacKay
Rod R.T. Brown

(65)

Tablet on S.E. abutment of R.R. bridge
across Stony Creek Elev. 537.779

Check: 537.779 Starting elevation
540.521 final elevation
2.742 x 2 = 5.484

Total B.S. 13.091
Total F.S. 7.607
5.484

Spike in 0.20 ϕ fir stump 23 m Lt of
P. 1+05 Elev. 540.520

Difference

APPROVED

DIRECTOR DESIGN AND SURVEYS

DATE 78-02-14

REVISED 84-06

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

SAMPLE FIELD NOTES FOR L - LEVELS

DESIGN MANUAL No G.1-2

82-09-22
Cloudy-Cool 17°C

π J.W. McKay
Rod R.T. Brown

(57)

STA.	B.S.	H.I.	F.S.	I.S.	ELEV.		
L.B.M.#37	3.470	573.868			570.398	Spike in 0.15 ø fir stump 67m Rt of	
230+60				0.244	573.624	Sta. 230+48 Elev. 570.398	
230+80				1.280	572.588		
231+00				1.853	572.015		
231+19				3.279	570.589	H.W.M.	
231+24				3.706	570.162	Present water level Williams Lake Creek	
231+89				3.675	570.193	Present water level	
231+95				3.248	570.620	H.W.M.	
G.B.M. #396-J			0.422		573.446	Bolt set horizontally in east face of west abutment	
					573.447	of bridge over Williams Lake Creek Elev 573.447	
					+0.001	Difference	
G.B.M. #396-J	1.009	574.456			573.447		
P.O.T. 232+00				0.610	573.846		
232+20				0.514	573.942		
232+40				3.780	570.676	Page Check	570.398
T.P.	1.296	572.006	3.746		570.710		−4.830
232+60				2.713	569.293		565.568
L.B.M.#38			0.662		571.344	Spike in telepone pole 38m Lt of	+5.775
					571.342	Sta. 232+54 Elev. 571.342	571.343
	+5.775		−4.830		−0.002	Difference	+0.001
							571.344
							−0.002
							571.342

APPROVED

DIRECTOR DESIGN AND SURVEYS

DATE 78-02-14

REVISED 84-06

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS

DESIGN AND SURVEYS BRANCH

SAMPLE FIELD NOTES FOR P-LINE TRAVERSE

DESIGN MANUAL No G.1-3

STA.	DIST.	DEFL LT	DEFL RT	VERT.	
1210	286.371		44°57'00"		nail in 2"×2"
	.371		89°54'10"	89°54'15"	
	.370		179°48'20"	270°05'55"	
	286.371		44°57'05"	89°54'10"	
1209	279.055	22°54'20"			spike in tie on ℄ of track
	.056	45°48'20"		91°36'40"	
	.054	91°36'40"		268°23'30"	
	279.055	22°54'10"		91°36'35"	
1208	176.518	03°02'30"			nail in 2"×2"
	.519	06°05'20"		90°02'30"	
	.523	12°10'40"		269°57'20"	
	176.520	03°02'40"		90°02'35"	
1207	198.692		12°04'30"		spike in paved road
	.695		24°09'10"	89°10'10"	21 m ahead of 600mm CSP
	.695		48°18'20"	270°49'50"	
	198.694		12°04'35"	89°10'10"	
1206					spike in bottle cap on paved road.

82-09-21

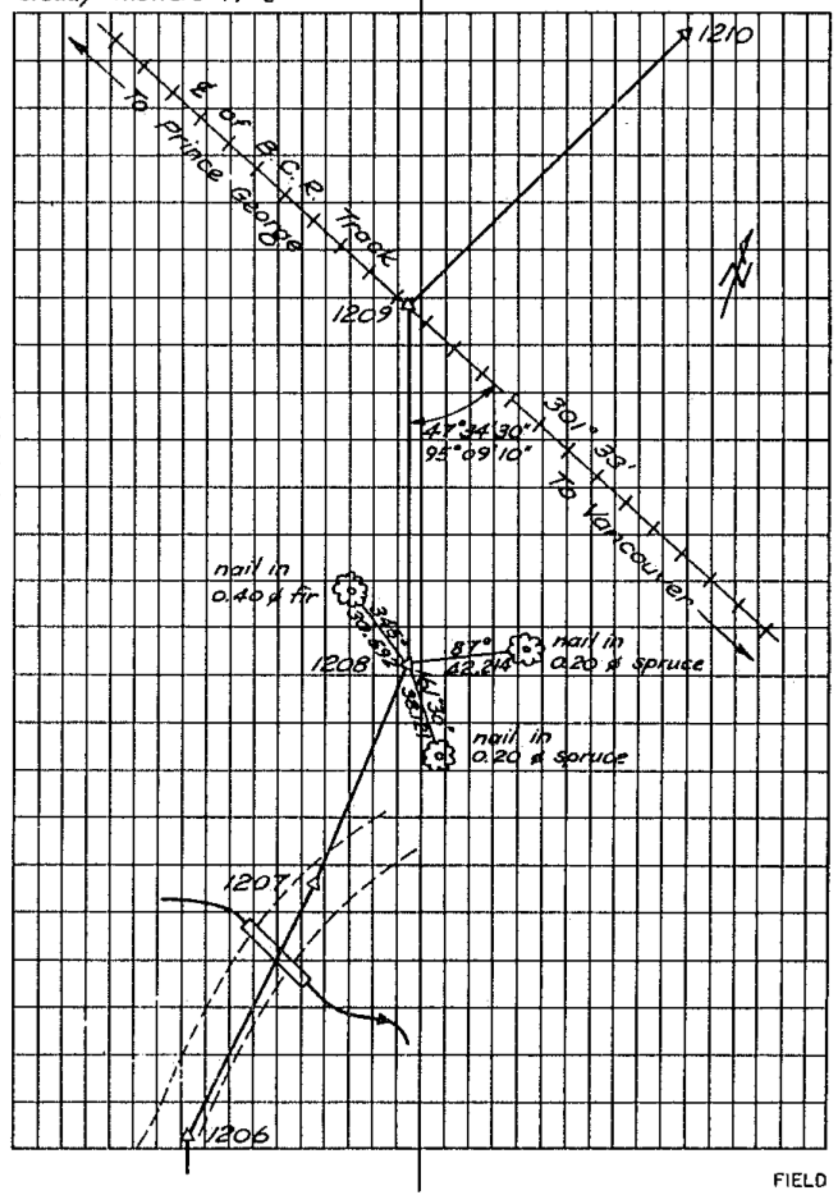
Cloudy-Showers 17°C

π · J. H. Davidson

R. R. Fisher

N. P. Williams

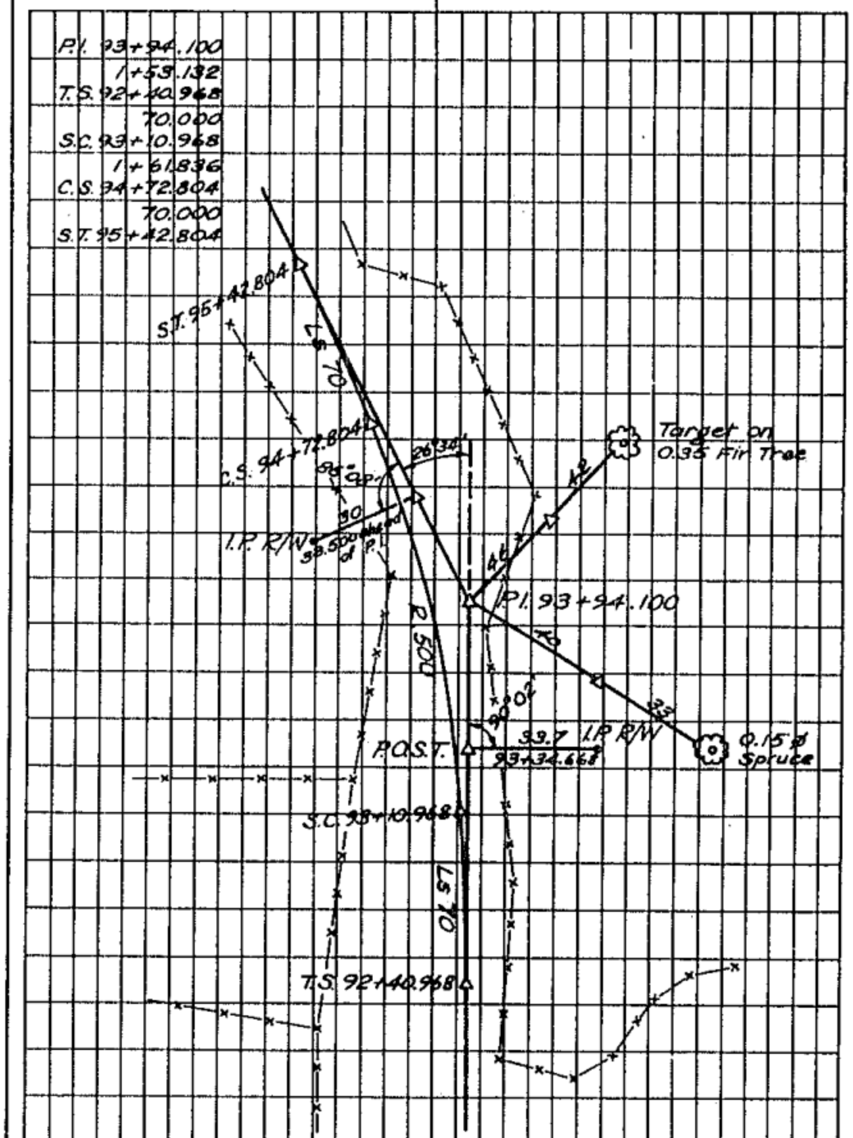
(23)



FIELD

POINT	STA.	FWD DEFL. LT	BACK DEFL. RT	DATA	
S.T.	95+42.804		–		
	95+40		0°00'08"		
	95+20		0°08'31"		
	95+00		0°30'00"		
	94+80		1°04'34"		
C.S.	94+72.804		1°20'13"		
	94+60		0°44'01"	Δ	26°34'
	94+40	7°23'35"	1°52'46"	A.D.	153.132
	94+20	6°14'50"		E_s	14.164
	94+00	5°06'04"			
	93+80	3°57'19"		R	500
	93+60	2°48'33"		Δ_c	18°32'42"
	93+40	1°39'48"		Arc	161.836
	93+20	0°31'03"			
S.C.	93+10.968	1°20'13"		L_s	70
	93+00	0°57'03"		θ_s	4°00'39"
	92+80	0°24'57"		ϕ_s	1°20'13"
	92+60	0°05'56"		L.T.	46.679
T.S.	92+40.968	–		S.T.	23.344
				L.C.	69.985

82-09-11 ⊼ C.G. Johanson J.H. Dobbs (46)
R.S. Sprig E.D. Williams
Overcast - Cool 16°C



FIELD

APPROVED
DIRECTOR DESIGN AND SURVEYS
DATE 78-02-14
REVISED 84-06

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

SAMPLE FIELD NOTES FOR CIRCULAR CURVE WITH TWO END TRANSITIONS

DESIGN MANUAL No
G.I-4

APPROVED

DIRECTOR DESIGN AND SURVEYS

DATE 78-02-14

REVISED 84-06

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS

DESIGN AND SURVEYS BRANCH

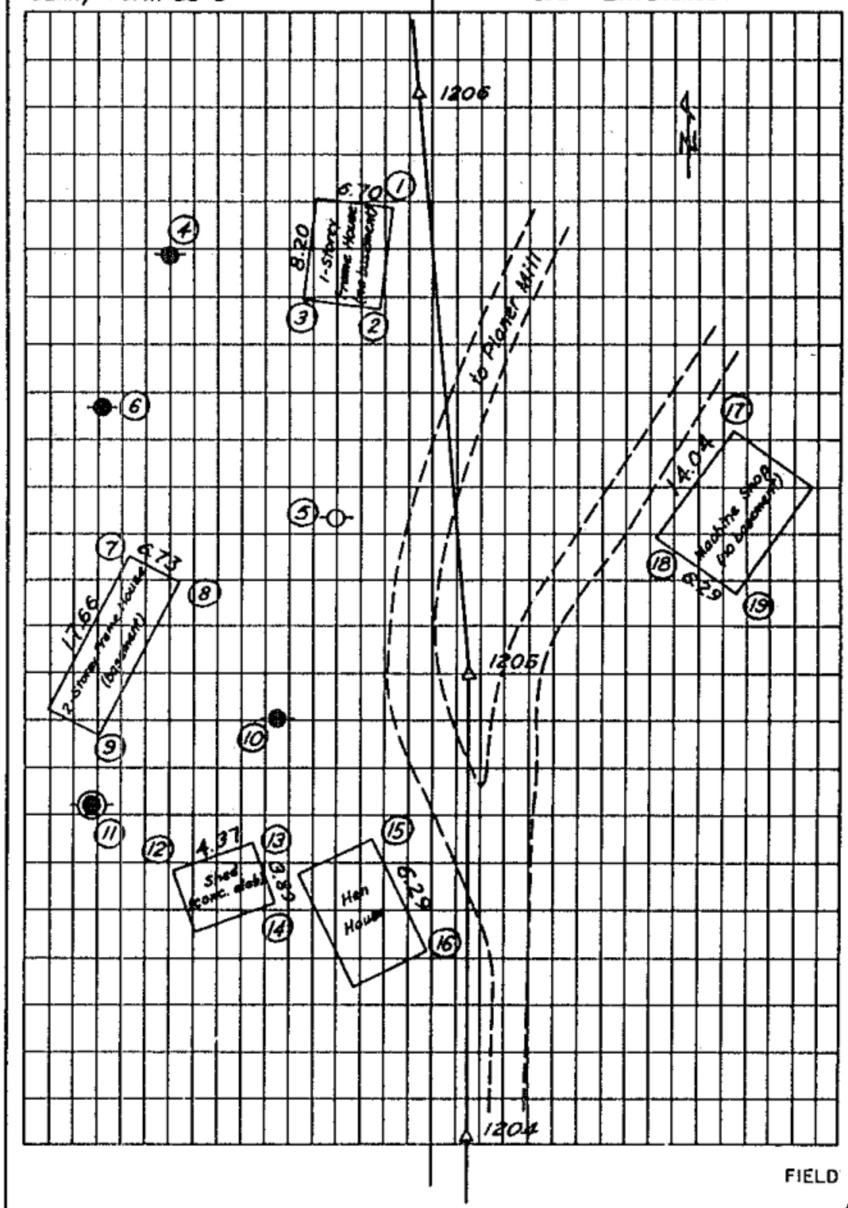
SAMPLE FIELD NOTES FOR TOPOGRAPHIC TIES BY STADIA

DESIGN MANUAL No G. 1-5

STA.	DEFL.	VERT.	STADIA INT.	DIST.	
1204					B.S.
1205					π
1	−35°34′		0.634	63.4	House
2	−40°05′		0.567	56.7	"
3	−45°33′		0.604	60.4	"
4	−56°31′	−5°30′	0.818	81.0	Power Pole
5	−70°00′		0.204	20.4	Telephone Pole
6	−82°25′	−4°50′	0.559	55.5	Power Pole
7	−107°31′	−5°11′	0.729	72.3	House
8	−111°55′	−5°29′	0.676	67.0	"
9	−119°30′	−5°16′	0.815	80.8	"
10	−125°05′		0.500	50.0	Power Pole
11	−125°24′		1.064	106.4	Power & Transf. Pole
12	−127°30′		0.433	43.3	Shed
13	−128°39′		0.390	39.0	"
14	−134°00′		0.402	40.2	"
15	−135°02′		0.341	34.1	Hen House
16	−144°52′		0.360	36.0	"
17	+65°28′		0.747	74.7	Machine Shop
18	+69°44′		0.616	61.6	"
19	+79°12′		0.677	67.7	"

82-09-13 | π W.R. Brown | 25

Sunny-Warm 23°C | Rod B.J. Dickson



FIELD

METRES - FEET			
M	FT	M	FT
0.1	0.3281	5.1	16.7323
0.2	0.6562	5.2	17.0604
0.3	0.9843	5.3	17.3885
0.4	1.3123	5.4	17.7165
0.5	1.6404	5.5	18.0446
0.6	1.9685	5.6	18.3727
0.7	2.2966	5.7	18.7008
0.8	2.6247	5.8	19.0289
0.9	2.9528	5.9	19.3570
1.0	3.2808	6.0	19.6850
1.1	3.6089	6.1	20.0131
1.2	3.9370	6.2	20.3412
1.3	4.2651	6.3	20.6693
1.4	4.5932	6.4	20.9974
1.5	4.9213	6.5	21.3255
1.6	5.2493	6.6	21.6535
1.7	5.5774	6.7	21.9816
1.8	5.9055	6.8	22.3097
1.9	6.2336	6.9	22.6378
2.0	6.5617	7.0	22.9659
2.1	6.8898	7.1	23.2940
2.2	7.2178	7.2	23.6220
2.3	7.5459	7.3	23.9501
2.4	7.8740	7.4	24.2782
2.5	8.2021	7.5	24.6063
2.6	8.5302	7.6	24.9344
2.7	8.8583	7.7	25.2625
2.8	9.1864	7.8	25.5906
2.9	9.5144	7.9	25.9186
3.0	9.8425	8.0	26.2467
3.1	10.1706	8.1	26.5748
3.2	10.4987	8.2	26.9029
3.3	10.8268	8.3	27.2310
3.4	11.1549	8.4	27.5591
3.5	11.4829	8.5	27.8871
3.6	11.8110	8.6	28.2152
3.7	12.1391	8.7	28.5433
3.8	12.4672	8.8	28.8714
3.9	12.7953	8.9	29.1995
4.0	13.1234	9.0	29.5276
4.1	13.4514	9.1	29.8556
4.2	13.7795	9.2	30.1837
4.3	14.1076	9.3	30.5118
4.4	14.4357	9.4	30.8399
4.5	14.7638	9.5	31.1680
4.6	15.0919	9.6	31.4961
4.7	15.4199	9.7	31.8241
4.8	15.7480	9.8	32.1522
4.9	16.0761	9.9	32.4803
5.0	16.4042	10.0	32.8084

FEET - METRES			
FT	M	FT	M
0.1	0.0305	5.1	1.5545
0.2	0.0610	5.2	1.5850
0.3	0.0914	5.3	1.6154
0.4	0.1219	5.4	1.6459
0.5	0.1524	5.5	1.6764
0.6	0.1829	5.6	1.7069
0.7	0.2134	5.7	1.7374
0.8	0.2438	5.8	1.7678
0.9	0.2743	5.9	1.7983
1.0	0.3048	6.0	1.8288
1.1	0.3353	6.1	1.8593
1.2	0.3658	6.2	1.8898
1.3	0.3962	6.3	1.9202
1.4	0.4267	6.4	1.9507
1.5	0.4572	6.5	1.9812
1.6	0.4877	6.6	2.0117
1.7	0.5182	6.7	2.0422
1.8	0.5486	6.8	2.0726
1.9	0.5791	6.9	2.1031
2.0	0.6096	7.0	2.1336
2.1	0.6401	7.1	2.1641
2.2	0.6706	7.2	2.1946
2.3	0.7010	7.3	2.2250
2.4	0.7315	7.4	2.2555
2.5	0.7620	7.5	2.2860
2.6	0.7925	7.6	2.3165
2.7	0.8230	7.7	2.3470
2.8	0.8534	7.8	2.3774
2.9	0.8839	7.9	2.4079
3.0	0.9144	8.0	2.4384
3.1	0.9449	8.1	2.4689
3.2	0.9754	8.2	2.4994
3.3	1.0058	8.3	2.5298
3.4	1.0363	8.4	2.5603
3.5	1.0668	8.5	2.5908
3.6	1.0973	8.6	2.6213
3.7	1.1278	8.7	2.6518
3.8	1.1582	8.8	2.6822
3.9	1.1887	8.9	2.7127
4.0	1.2192	9.0	2.7432
4.1	1.2497	9.1	2.7737
4.2	1.2802	9.2	2.8042
4.3	1.3106	9.3	2.8346
4.4	1.3411	9.4	2.8651
4.5	1.3716	9.5	2.8956
4.6	1.4021	9.6	2.9261
4.7	1.4326	9.7	2.9566
4.8	1.4630	9.8	2.9870
4.9	1.4935	9.9	3.0175
5.0	1.5240	10.0	3.0480

APPROVED: DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No
DATE 78-01-01 REVISED	METRIC CONVERSION TABLE	G.T. 2

SQUARE INCHES TO HECTARES (ha)

Multiply planimeter reading (square inches) by the relevant factor below to obtain hectares.

Plan Scale	Factor
1 : 100	0.000 645 16
1 : 200	0.002 580 64
1 : 250	0.004 032 25
1 : 400	0.010 322 56
1 : 500	0.016 129
1 : 1 000	0.064 516
1 : 10 000	6.451 6

To obtain ha: factor = $(\text{scale})^2 \times (6.451\ 6 \times 10^{-8})$

To obtain m^2: factor = $(\text{scale})^2 \times (6.451\ 6 \times 10^{-4})$

SQUARE INCHES TO SQUARE METRES (m^2) FOR CROSS SECTIONS

Multiply planimeter reading (square inches) by the relevant factor below to obtain m^2.

Cross Section Scale	Factor
Horiz. 1 : 250 Vert. 1 : 250	40.322 5
Horiz. 1 : 100 Vert. 1 : 100	6.451 6
Horiz. 1 : 100 Vert. 1 : 50	3.225 8
Horiz. 1 : 100 Vert. 1 : 20	1.290 32

To obtain m^2: factor = (horiz. x vert.) $\times (6.451\ 6 \times 10^{-4})$

VOLUME OVERHAUL DIAGRAM

Multiply planimeter reading (square inches) by 6.451 6 to obtain cm^2. (1 square inch = 6.451 6 cm^2)

For Volume Overhaul see Design Manual No. H.5-1.0

Environmental agency contact shall be as stated on the 'Agency Listing'. Copy of the current list is available from:

Environmental Co-ordinator
Ministry of Transportation & Highways
Design & Surveys Branch
940 Blanshard Street
Victoria, B.C.
V8W 3E6

Telephone: 387-3754

CHAPTER 10

FIELD SURVEYS AND PLANS

10.01 HIGHWAY FUNCTIONAL STUDIES

1. Functional studies are carried out to determine the feasibility and/or approximate costs of alternates in order that survey and design time and costs can be kept to a minimum.

   These investigations are carried out with the aid of aerial photography and aerial mapping of varying scales and accuracy.

2. Photography

   Aerial photo coverage over our Province is very extensive and all areas of interest can usually be viewed with either 20 or 40 chain photography (Metric equivalent is 1:15 000 to 1:20 000 and 1:25 000 to 1:45 000, respectively). The 20 chain photography is normally taken with a 12 inch (metric equivalent is 3095 mm) focal length camera. Air photos are no longer available for loan. A quick print photo "Iteck" is available for viewing from the air photo library but they will only supply a maximum of 10 prints at one time. They are available from Air Photo Sales, Mapping Section, Surveys and Mapping Branch, Ministry of Environment, Parliament Buildings, Victoria. Another source worthy of consideration is the office of the District Forester, who has photo coverage of his district; these photos cannot be removed from his office but could be viewed to confirm photo orders to ensure proper coverage.

   Indexes of coverage are available and are ordered by the standard geographic grid reference, e.g. 92 m (E) or (W) for 20 chain and 92 m for 40 chain.

   Many areas of the Province are covered by Special Projects which are usually covered with low level photography. Specific enquiry regarding coverage should be made directly to the Air Photo Sales Office.

   For certain Functional Studies new photography is obtained from either the Ministry of the Environment, or Aerial Mapping Consultants who have aircraft equipped to obtain the desired photos. Scale of the photography is set depending on its required usage.

** Generally, 1:5 000 photo scale will be used to produce 1:500 mapping and 2 metre contours; 1:10 000 will produce 1:1 000 mapping and 2 metre contours; photo scales greater than this are usually used to produce recce type uncontrolled mapping, at a scale of 1:50 000 with 5 metre contours.

** Amendment

3. Mapping

Mapping at various scales can be obtained photogrammetrically. Particular care should be taken to select a scale which is suitable for the required use as costs vary terrifically for the different types, ranging from $2.00/ha to as much as $90.

Caution should also be exercised in expecting accuracy under dense tree cover. The machine operator drawing the contours cannot plot what he cannot see. In such cases, average tree heights are deducted from the instrument readings and the results are at most approximations. Areas of greatest concern are those of undulating terrain and varying soil types. In the first instance drainage in the depressions causes greater growth than the drier areas on the heights of land; and in the second, growth could be more vigorous in soil than on adjacent rock out-croppings.

Mapping is available in manuscript or fairdrawn format. Manuscript mapping is prepared at the machine, usually on mylar with a minimal amount of drafting. Fairdrawn mapping is traced by draftsmen from the manuscript sheets and presented in a finished form. Fairdrawing doubles production time and cost.

4. Mapping Usage

Large areas of terrain can be mapped cheaply at 1:5 000 scale with 5 m contours and this base serves as an ideal aid for route comparisons and analysis. No prior survey is required to establish control. Generally, it is best to investigate alternates on stereo pairs of photos indicating all possible alternates; then eliminate the obvious, and outline a mapping area which covers the remainder, for closer study.

Mapping of 1:2 000 to 1:500 is known as "high order" mapping and must be controlled mathematically to ensure accuracy. This requires the establishment of a survey control line and fixing predetermined controls prior to commencement of the mapping.

The 1:1 000 scale would serve as plan base in rural undeveloped areas, the 1:500 being selected for areas of greater planimetric detail. The same applies for urban or semi-urban areas. If the amount of detail to be added to the sheets is excessive, a larger scale map is required to provide space for the detail, e.g. an urban street with gas, power, telephone, water, storm and sanitary utilities plotted would show very cluttered on a 1:1 000 plan but not so cluttered on a 1:500 plan. There must be room to show new design detail.

5. Economic Evaluation

In order to determine the preferred route considerable work is involved. Sometimes the obvious route can be selected by simply comparing projected alignments and plotted profiles. Other times sophisticated cost comparisons are required - extracting necessary data can be tedious and time-consuming. A digital terrain program has been developed as an aid for the computer. This enables the engineer to select an infinite number of routes and by supplying the required parameters will provide profiles and quantities for each alignment.

To augment this program, we have also developed a cost analysis program which utilizes the alignment and grades to simulate vehicle operating costs.

By combining these two outputs the choice of routing is simplified.

Left to be considered by the engineer is the social, ecological, economic and environmental impact on the adjacent environment.

6. Environmental Agencies

Work on all alignment and grade changes, must be coordinated with numerous Provincial and Federal Agencies to ensure that a minimum impact occurs on the agencies' field of interest.

Direct contact should be made to the parties listed on Appendix "H" as early as possible in the planning stage in order that the agency may assign a person to your particular project.

Your initial submittal should be as simple as possible, such as a line on an aerial photo, mosaic, or key map.

10.02 HIGHWAY LOCATION SURVEYS

1. Need

A location survey is required when a new highway is to be constructed, or when an existing highway is to be reconstructed to new horizontal or vertical alignment, requiring excavation and embankment of earthworks, special construction to correct stability problems, control of surface or sub-surface water, changes to utilities, services or traffic patterns, or to the purchase of additional right-of-way. Significant changes to the highway system require the measurement and evaluation of material quantities, costs and alternatives. A location survey provides the information that makes proper estimating and economy of design possible.

2. Preliminary

The first requirement of a successful location survey is the development of accurate mapping on which to project the highway centreline. There are two commonly used methods. The first is the old original transit and chain survey where a preliminary base line is set out as a series of tangents, with the angles between turned with a transit and stakes set on even stations each hundred metres. All elevations, contours, and detail are tied in manually to this base line and the information is compiled on a vellum plan at an appropriate scale. This method is used both for surveys in rural bush areas, and for urban street work.

The second, and usually the more economical method is by photogrammetric survey. These surveys are carried out utilizing the services of private mapping contractors. The procedures for a photogrammetric mapping survey are as follows:

> A control base line is run on the ground along the general area of the route. The traverse line is similar to that established for a transit and chain survey except that the line is staked only at intersection points of the tangents (P.I.'s). Because only the P.I.'s are recorded this method is most adaptable to the use of electronic measuring instruments which preclude manual chaining and its multitude of errors. A line of bench marks for vertical control is also established along the route.

One major advantage of the aerial mapping survey is that the base line can be laid out along existing roads and streets and the detail and topographic information obtained without alarming property owners.

When the base line and the line of bench marks have been established and checked, co-ordinates of the survey points (P.I.'s) are calculated on traverse sheets and sent along with a list of the bench marks to the mapping contractor. The mapping contractor in turn, after receiving the mapping boundaries for the project, sends the surveyor a set of control air photos on which horizontal and vertical control points have been pin-pricked. He also sends a list with a description of each horizontal and vertical control point. The surveyor then manually ties in the control points to the base line and bench marks. He ties the horizontal control points both horizontally and vertically, the vertical control points vertically only. He then calculates co-ordinates for the horizontal points and sends them to the contractor with the elevations for each horizontal and vertical point.

The contractor uses this information to compile the mapping sheets at the desired scale. By use of highly technical plotting machines he plots direct from models of the stereo air photo pairs, all contour and spot elevations as well as all detail such as roads, streets, ditches, poles, streams, buildings, etc. When plotting is complete the sheets are returned to the surveyor for checking and plotting of cadastral. The sheets are then ready for the projection of the location centreline.

3. <u>Location Line</u>

After completion of preliminary line survey or photogrammetric mapping, the final designed location centre line, the L line, is run in the field. All points of intersection of tangents beginnings and ends of curves, and the curves themselves, both spiral and circular, are located; accurate chainage is marked out and detailed cross sections taken at suitable intervals so that accurate earthwork quantities can be calculated. On simple projects the L line can be run as soon as P line data is plotted; on more complex ones, a great deal of office analysis must be carried out using the P line topography to estimate preliminary quantities on several trial centre lines. Computer programs are available for this purpose.

4. Miscellaneous Surveys

Elements of the location survey are applied to minor projects involving bridge or culvert replacements, intersection improvements, passing lanes, railway and pipeline crossings, grade separations, retaining wall installations, property acquisition, gazette requirements, and preventative maintenance operations of various kinds.

5. Field Books

The use of proper form and order in entering survey information in the field books is important because the information is used by the field draftsmen preparing the topographic detail plan, by the highway designer preparing contract drawings and estimates, and by the construction supervisor directing the work of the contractor.

The notes must be neat and legible and in a form clearly understood by all concerned. Examples of standard field notes are contained in the Design and Surveys Manual.

10.03 HIGHWAY DESIGN

1. Earthwork Program

After the L line is run in the field, the second group of programs is used. This group, the Earthwork System, is based on cross sections taken on the ground, as previously described. These sections are punched on cards, checked for error, and then stored on magnetic tape, from which they can be recalled in whole or in part for processing. Roadway widths, slopes and ditches, superelevation, berms, stripping, shrinkage and swell factors and vertical geometry can all be varied as the designer wishes, but once the initial earthwork run has been processed, it is usually the vertical geometry which is modified to obtain satisfactory balances and haul distances.

The printed output includes excavation and fill volumes, a volume overhaul diagram, toe-to-toe roadway templates, plus various options - gravel and stripping quantities, plan and profile plots, and cross sections and template plots - any or all of which may be asked for. Where necessary, rock and Type "C" stratum sections may be added to the ground cross sections; line shifts are also allowed for.

** 2. Standards

The main design reference is the "Design and Surveys Manual of Standards and Instructions" which includes design standards, detail drawings and charts to assist the designer. This Manual also contains a number of Design Instructions to familiarize the designer with the policy and procedure in preparing a project.

Additional references used are the Roads and Transportation Association of Canada, "Manual of Geometric Design Standards for Canadian Roads 1986" and the American Association of State Highway and Transportation Officials, "A Policy on Geometric Design of Highways and Streets 1984".

3. Drawings

** A. Preliminary Plan

Whenever aerial mapping is not available or is difficult to obtain, the results of field surveys are drawn on vellum paper. If possible, the grid shall be orientated to azimuths derived from Legal Survey Plans.

A preliminary traverse (P-line) of the approximate proposed highway route is plotted, and existing roads, fences, railways, water courses, existing culverts, manholes, telephone and hydro poles, houses, structures, underground services, etc., are shown. Recommended symbols to be used are shown on three sheets under Appendix "A".

Contours are drawn at 1 or 2 metre intervals.

All cadastral information (Township, Section or District Lot Lines, Subdivision plans, Rights-of-way, etc.) is shown from the field tie information.

** B. Location Plan

After the final location has been chosen and all plotting checked, the information from the preliminary plan (excluding the P-line) is traced onto standard A1 size sheets. The scales to be used are 1:1000 or 1:500. For urban street designs a scale of 1:250 is to be used.

All the horizontal alignment information shall be shown, i.e. P.I.'s, stationing, curve and spiral data, and azimuths in the direction of the stationing. Also to be shown are proposed right-of-way boundaries, clearing and grubbing lines and areas in hectares.

Other design information, such as laning, proposed culverts, minor structures and creek diversions should be shown.

** Amendment

** C. Key Plan

This plan shows the relationship of the Project to the nearest town, and should also show the major Land Subdivisions. If available, the Landmark Inventory reference with Segment should be given.

** D. Profiles

These drawings show centreline ground line, design (finished) grades with vertical curves, bench marks, culvert elevations and structures. Preferred scales are Horizontal 1:2000, Vertical 1:200 for Rural Designs and Horizontal 1:250, Vertical 1:50 for Urban Design.

A typical sections drawing must accompany the profile showing lanes and shoulder widths, crossfall, curbing and sidewalk (where applicable). Also shown are the various depths of gravel, asphalt binder and pavement, side slopes, and ditch slopes.

** E. Volume Overhaul Diagram

This drawing is a plot from the mass ordinate sheets and shows freehaul limits, overhaul and balance points. Preferred scales are Horizontal 1:5000 and Vertical 1cm = $5{,}000m^3$.

F. Gravel Haul Charts

This chart shows the amount and haul distance for the various types of gravel on a Project.

** G. Cross Sections

These drawings show the required cut and fill. The cross sections with roadway template can be plotted manually or by computer. Preferred scales are Horizontal and Vertical 1:250 (or 1:100) for Rural Design and Horizontal 1:100, Vertical 1:50 (or 1:25) for Urban Design.

** H. Detail Drawings

Additional drawings are required when there is not room to show details on the Location Plan, e.g., Intersection layout, laning, underground drainage, large culvert site plan, curbing, roadside barrier, retaining wall details, etc.

A number of special drawings are required for interchanges and these show geometric layout, landscaping, curbing, drainage, spot elevations and profiles.

** Amendment

I. Drafting Guidelines

** As most drawings will be reduced to half size and/or put on microfilm, it is preferable to use Ink to ensure clarity. Also the use of lettering templates provides uniformity in lettering style. The minimum letter height should be 1.8mm (18 template with 0.18mm pen) or 2.5mm (25 template with 0.25mm pen) if half sizing is proposed. "Rub On" symbols may be obtained for greater efficiency.

4 Quantity Schedule and Estimate

Appendix "B" list the basic items required for a highway project. Depending on the type of project, there are many other items such as Manholes, Catch Basins, Curbing, Roadside Barrier, etc., which may be added.

If the work is to be by Contract, Special Provisions must be written for any of the items where the work or method of payment deviates from that described in the General Specifications.

To complete an estimate it is necessary to prepare an additional sheet listing all materials to be purchased by the Ministry. This sheet should also include any work item not included in the Schedule and to be done by Others.

10.04 SURVEYS AND PLANS FOR BRIDGE SITES

The survey of a bridge site, being one of the fundamental operations in bridge construction, should be given close attention and consideration. Complete and accurate field data should be obtained so that a complete and accurate site plan may be prepared.

** Site plans shall be drawn on standard A1 size tracing sheets to a natural scale of 1:250. Each sheet shall have a title at the lower right corner together with a date, name of surveyor and name of draftsperson. Datum used should be noted and location and elevation of the nearest construction bench mark given.

1. General Requirements for Site Plans

(a) 0.5m contours of site extending at least 35m either side of the centreline and 35m along the highway centreline beyond the probable limits of the structure.

(b) Profile at centreline showing ground line and proposed grade line and stating finished grade (i.e. bridge deck grade).

(c) Nature of terrain, i.e. swamp, solid rock, other material, boulders, etc., and locale of each.

(d) Description of vegetation.

** Amendment

(e) Location of power, telephone, and telegraph poles, the number of wires on each line and names of owners.

(f) Location and general description of existing structure including all available foundation data.

(g) Width of finished roadway, number and width of lanes.

(h) Vertical and horizontal clearances required.

(i) Number and location of sidewalks required.

** (j) Alignment showing azimuths, curve and spiral data with rate of superelevation.

(k) Property lines, buildings, municipal or village sidewalks, etc.

(l) Highway right-of-way.

(m) Location of probable detour, if required.

(n) Location and depth of underground services and names of owners.

2. Rivers and Streams Requirements

The following additional data should be shown in connection with site plans for river or stream crossings:

(a) Profile of stream bed for 60m upstream and downstream of the highway centreline.

(b) Key map at 1:1000 showing stream alignment 150m upstream and downstream of the highway centreline.

(c) Velocity of the stream in metres per second.

(d) Elevation of extreme high water and the date.

(e) Elevation of normal high water.

(f) Elevation of water on the date of survey.

(g) Elevation of low water.

(h) Description of drift, logs, debris or log jams.

(i) Description of scouring and silting.

(j) Description of shift in channel.

(k) Description of ice flow.

** Amendment

(l) Description of river bed, i.e. silt, sand, boulders, etc.

(m) Location of flood plains.

(n) Effect of tides.

(o) Location and general description of any bridge owned by others within 150m upstream or downstream of highway centreline; plus minimum vertical clearance at extreme high water with elevation on structure of point of minimum clearance, evidence of scour, drift or ice.

(p) Centreline profile to be carried across river bottom, where possible.

(q) Location spawning grounds, whether fish-producing river or stream.

(r) A ground survey tie between the proposed bridge centreline at one high water line and an established point on a registered land subdivision.

(s) The Land Registry Office Property description of the parcel of land used for the reference point in (r) above.

** (t) Any evidence of occupancy of water lots or booming ground leases within 35m either side of the centreline.

3. Railway Crossings

The following additional data shall be shown in connection with site plans for railway crossings:

(a) Complete alignment of all railroad tracks showing degree of curvature, location of points on spirals and circular curves, distance centre to centre of tracks and superelevation of tracks.

(b) Angle between centreline of highway and centreline of each track; if railway on curve, angles shall be measured between highway centreline and 30m chords to centreline on each track on both sides of highway centreline.

(c) Elevation of base of rails on highway centreline.

(d) Chainages of rails on highway centreline.

(e) Profile base of rail along railway for 60m either side of highway centreline.

(f) Location of railroad right-of-way.

(g) Location of railroad culverts, ditches, etc.

** Amendment

(h) Location of sidings.

(i) Location of switches or railway installations.

(j) Distance along track to nearest mile or km post.

10.05 LAYOUT PLANS FOR RAILWAY CROSSINGS

Please refer to the following appropriate Appendix for data required covering site plans at railway crossings:

Construction of Overpass	- Appendix "C"
Reconstruction of Overpass	- Appendix "D"
Construction of Subway	- Appendix "E"
Reconstruction of Subway	- Appendix "F"
Construction of At Grade Crossing	- Appendix "G"
Environmental Agencies	- Appendix "H"

10.06 SOIL SURVEYS

1. General (See also related sections 12.16, 12.17, 13.45 to 13.53 and 14.37 to 14.43)

Adequate soils and rock information is a prerequisite for the accurate and safe design of new highways and their attendance structures. Ideally, a soil survey will identify the type and condition of all materials along the proposed route; establish to location, quality and quantity of borrow and gravel materials; and give design information affecting the estimating, construction and future performance of the proposed highway and structures.

Because of the variable conditions usually prevailing in British Columbia, complete soil and rock information can rarely be obtained without excessive costs. Soil survey practice therefore concentrates on the recognition and investigation of specific elements, such as large cuts, poor foundation areas, existing or potential slide areas, gravel and borrow pit prospecting and pavement design conditions.

The recognition of areas to be investigated not only requires knowledge of the proposed design and a general familiarity with the soil types and their relevant behaviour characteristics, but also an appreciation of the consequences of errors or omissions in the investigation. For example, bridge foundation areas are always checked intensively because of the large cost and hazard of failure; wrong assumptions for large rocks or soil cuts can drastically change the design; marginal fill foundations, though frequently used in undeveloped areas, must be thoroughly investigated if there are houses located in the possible slide path.

The Geotechnical and Materials Branch use different methods to carry out soil surveys. The methods vary greatly in cost, effectiveness, and in the kind of information they yield.

2. Soil Survey Methods and Characteristics

Name	Kind of Information	Relative Cost & Effectiveness
Visual Field Identification	Preliminary recognition of surface soil types and condition. In bedrock areas this may take the form of rock mapping for cut slope design.	Very cheap, fairly effective only in open terrain.
Airphoto Interpretation	Broad identification of soil types and conditions through recognition of landforms.	Large area coverage at low cost; used to identify major problem areas and as a preliminary to gravel prospecting.
Seismic Refraction Survey	Gives approximate solid rock profiles under overburden and may identify other strata.	Moderate cost for large possible coverage. Accuracy of information variable, correlation drilling required.
**Electro-magnetic Conductivity Survey	Identifies electro-magnetic conductivity without direct ground contact; used to delineate soil deposits.	Very fast and cheap. Results used to optimize drilling program.
Electrical Resistivity Survey	Identifies anomalies in electri- resistivity. Mostly used for prospecting and the delineation of large gravel deposits.	Moderate cost for broad possible coverage. Aids in setting up of test pitting and drilling program.
Sounding with Rods	Determination of depth to firm material.	Very cheap and rapid. No identification of soil types but very effective in conjunction with HPA or other drilling.
Swedish Vane Shear Field Testing	Measurements of the in situ undrained shear strength of soft soils.	Moderate cost, rapid production, semiportable into poorly accessible areas. No identification of soil types. Very effective with HPA or other drilling.

Name	Kind of Information	Relative Cost & Effectiveness
Static Cone and Pressure Meter testing	Measurement of in-situ density, strength and pressure; mostly in sandy soils.	Moderate to fairly high cost because of specialized testing. Mostly for problem areas and detailed foundation testing.
Hand Power Auger (H.P.A.) Drilling	Identification of type and moisture condition of soft and loose soils.	Moderate cost, rapid production, limited to soft or loose soil. Mostly disturbed samples only.
Truck-mounted Machine Auger (A.R.) Drilling	Identification of type and condition of all but dense and bouldery soils.	Fairly expensive but rapid Mostly disturbed but can be fitted for undisturbed sampling. Effective for general soil survey and most gravel pit investigations but requires good access
Rotary (Diamond) Drilling (D.D.)	Identification of type and condition of all soils and rock.	Relatively expensive. Most versatile for disturbed and undisturbed sampling and field tests. Requires good access for a large truck.

In addition, backhoes are frequently used for test pitting, especially in gravel prospecting work. It may be noted that the listing above is ranked from methods that are relatively inexpensive, giving broad general coverage to those that are expensive but producing specific and detailed information for a small area.

3. Reporting

Soil survey reports are usually requested by and submitted to the Survey and Design Branch. A preliminary visual field soil identification along the proposed route is done by the Design and Surveys Branch on Form H.740. Subsequent reporting by the Geotechnical and Materials Branch is by letter reports if the investigations are few and far between; when a more thorough soil survey is done, a soils profile is prepared on standard sized sheets showing all drill logs, test results, probes, etc., as well as typed notes on material suitability, slope design, gravel pits, pavement structure design, etc. Such soil profiles are for use only within the Ministry; another copy without the typed notes is made part of the contract documents for information to the Contractors.

10.07 LEGAL SURVEYS

Legal Survey plans are required to define lands acquired for the following:

(a) Statutory Right-of-Way for Highways
(b) Statutory Right-of-Way for Easements
(c) Yard Sites
(d) Gravel and Borrow Pits
(e) Foreshore Lots

These surveys must be carried out by a commissioned British Columbia Land Surveyor.

Legal Surveys are administered from Headquarters by the Lands Survey Officer and paid under the Legal Survey and Construction Project Votes. The Construction Project Vote covers the cost of defining the right-of-way and other works within the limits of the construction project, and the Legal Survey Vote covers the cost of undertaking all surveys of other highways and any legal survey requirements of the Ministry.

District offices may submit request for surveys to the Lands Survey Officer, providing the area to be surveyed has been acquired by the Property Services Branch or is established under the Highways Act.

The surveys will be undertaken providing sufficient funds are available. Requests should be accompanied by two paper prints of the plan showing the area to be surveyed in a red outline.

Upon completion of the survey, plans are forwarded to the Property Services Branch for deposit. The District Official is advised by means of a form letter that the plan has been prepared for deposit in the Land Registry Office.

10.08 PRESERVATION OF MONUMENTS

Monuments refer to highway right-of-way, pipe posts, concrete monuments, rock posts, iron pins, monuments for triangulation stations, control surveys, district lot section corners, geodetic bench marks, tidal surveys, etc.

Prior referencing should be carried out in order to avoid future unnecessary work and expense to the Ministry. When it is apparent that a monument is to be disturbed, arrangements can be made to have it referenced by providing the Lands Survey Officer at Headquarters with a complete detailed description.

Proper care must be taken during road construction to prevent the loss or removal of valuable survey evidence. The destruction or unauthorized removal of monuments is an offence and bears a penalty.

	METRIC PEN SIZES
International Boundary	1.00
Section Lines & District Lot Bdy.	1.00
Quarter Section Line	0.70
Subdivision Boundary	0.35
Old Road R/W (surveyed)	0.35
Proposed Highway R/W	1.00
Easement (state type)	0.35
Control Lines	0.25 P-Line 23 / 0.50 L-Line 78
℄ Plan & Grade Line	1.00
Clearing & Grubbing	0.50

	PEN SIZE	EXISTING	PEN SIZE	PROPOSED
Road (paved)	0.35	GRAVEL SHOULDER, PAVEMENT EDGE	0.5	
Road (gravel)	0.35	GRAVEL EDGE	0.5	
Guard Rail	0.35	Timber, Steel	0.5	Timber, Steel
No Post Guard Rail	0.35	Conc., Asphalt	0.5	Conc.
Drainage Ditches	0.35	EL 24.1 → 23.8 → 23.5	0.5	→ 7.35 → 7.25
Storm Drains & Sewers	0.35	S S S	0.5	S S S
Sanitary Sewer	0.35	SAN SAN	0.5	SAN SAN
Retaining Wall	0.35	Timber, Metal Bin, Conc.	1.00	Metal Bin, Conc.

Approved by Director of D & S.	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
E. E. Readshaw	PLAN AND SURVEY SYMBOLS	H.I - I
Date 77-08-19 Revised		

Water Main — W 200 mm A.C. W 100 mm Plastic W

pen 0.25

Gas Main — G 150 mm L.P., I.P., H.P. G G

Oil Line — OIL 600 mm T. M. P. L. OIL OIL

Underground Electric Cable — U.E. U.E. U.E.

Underground Telephone Cable — U.T. U.T. U.T.

PROPOSED RELOCATIONS TO BE NOTED AS SUCH

Fence with Gate — x show type e.g.: 4 St. B. W. x x C. L. x

Fence along Lot lines — Type

Railway — C. P. R. C. N. R.

20 mm 20 mm

Telephone Poles — show Nº of wires on Plans

Power Poles — Hydro

Power Pole with Transformer

Power Pole & Tel. Pole combined

High Tension Power Poles

High Tension Power Tower — HT

Telephone Booth — T

Telephone Guy Poles

Dead man

Power Guy Pole

Lamp Standard — LS

Road Sign

Fire Hydrant — F.H.

Gas Valve — G.V.

Water Valve — W.V.

Water Meter — W.M.

Catch Basin existing — C.B.

" " proposed — C.B.

Manhole existing — M.H.

" " proposed — M.H.

Combined Catch Basin and Manhole — C.B-M.H

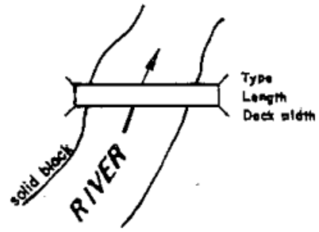
Traffic Signal

Traffic Signal Control Box

Appoved by Director of D. & S.	B. C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
Date 77-08-19 Revised 83-07	PLAN AND SURVEY SYMBOLS	H.I-2

Culverts existing	12 m — 300 ø C.S.P.
Culverts proposed	37 m — 900 ø C.S.P.

Bridge



Curb	Conc. Asphalt
Island Curbing	
Sidewalk	Wood Asphalt
Sidewalk	Concrete
Rock wall	
Hedge	
Wooded area	
Trees	

Buildings

ABBREVIATIONS

House	H.
Shed	SH.
Garage	G.
Chicken H.	Ch.H.
Barn	B.

Show Business Names on Commercial Bldgs.

Swamp

SURVEY SYMBOLS

Witness Post	o Wt.P.
Hub	Δ
Wooden Post	o W.P.
Iron Post	● I.P.
Monument	⊙ Mon. Conc.

Sketch showing Land description i.e. Tps., D.L., Sec's.

Land ties — Δ- - - - - $\frac{34°06'}{120.344}$ - - - -● I.P.
Shown on Hardshell only

Approved by Director of D. & S.	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
Date 77-08-19 Revised 82-11-01	PLAN AND SURVEY SYMBOLS	H.1-3

Province of British Columbia
Ministry of Transportation and Highways

ELECTORAL DISTRICT
PROJECT NO.
HIGHWAY NO.
(RE)CONSTRUCTION: TO
STATION TO STATION BK.=
STATION AH. TO STATION
km
LANDMARK INVENTORY - SEGMENT
km TO km

SCHEDULE OF APPROXIMATE QUANTITIES AND UNIT PRICES

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
1.	Mobilization (See Special Provisions, Clause_____) Move in and Move out	L.S.				
	PART I - GRADING					
2.	Clearing and Grubbing (See Special Provisions, Clause_____)					
	(a) Clearing	ha				
	(b) Grubbing.	ha				
3.	Roadway Drainage Excavation 300 m Freehaul (See Special Provisions, Clause_____)					
	(a) Type "A"	m^3				
	(b) Type "B"	m^3				
	(c) Type "C"	m^3				
	(d) Type "D"	m^3				
	(e) Type "D", Borrow	m^3				
	(f) Organic Stripping (and Waste Material)	m^3				
	(g) Topsoil	m^3				
4.	Overhaul on Excavation (See Special Provisions, Clause_____)	1000 Sta. m				
5.	Pavement Ripping (See Special Provisions, Clause_____)	m^3				

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	AMOUNT ¢
6.	<u>Increasing Compaction and Watering</u> (See Special Provisions, Clause____)					
	(a) Increasing Compaction of Top 0.3 m of Subgrade, Section 201.22	m^2				
	(b) Watering in Accordance With Section 201.23	kL				
7.	<u>Base Course & Sub-Base Aggregates</u> Section 202 (See Special Provisions, Clause____)					
	(a) Select Granular Sub-Base 100% to Pass 75mm Square Mesh Screen	t				
	(b) [Well Graded,] [Intermediate Graded,] Crushed Base [or Open Graded] Course 100% to Pass 75mm Square Mesh Screen	t				
	(c) [Well Graded,] Crushed Base [Intermediate Graded,] Course, From [or Open Graded] Stockpile 100% to Pass 75mm Square Mesh Screen	t				
	(d) [Well Graded,] [Intermediate Graded,] Crushed Base [or Open Graded] Course 100% to Pass 25mm Square Mesh Screen	t				
	(e) [Well Graded,] Crushed Base [Intermediate Graded,] Course, From [or Open Graded] Stockpile 100% to Pass 25mm Square Mesh Screen	t				
	(f) Crushed Granular Surfacing 100% to Pass 19mm Square Mesh Screen	t				
	(g) Crushed Granular Surfacing, From Stockpile, 100% to Pass 19mm Square Mesh Screen	t				
8.	<u>Gravel Blanket</u> (See Special Provisions, Clause____)					
9.	<u>Rock Blanket</u> (See Special Provisions, Clause____)					
10.	<u>Gravel Facing</u> (See Special Provisions, Clause____)					

ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
11.	Bridge End Fill (See Special Provisions, Clause____)	t				
12.	Haul on Granular Base, Gravel Blankets, Facing and Bridge End Fills (See Special Provisions, Clause____)	t				
	(a) First Kilometre	t				
	(b) Second Kilometre	t				
	. . .	t				
	. . .	t				
	(l) Twelfth Kilometre	t				
13.	Fencing and Farm Gates (See Special Provisions, Clause____)	t				
	(a) Fencing, Type "__", (Dwg. No.__-SP203)	m				
	(b) Gates,__m Opening (Dwg. No.__-SP203)	Each				
14.	Foundation Excavation					
	(a) Type "A"	m^3				
	(b) Type "B"	m^3				
	(c) Type "C"	m^3				
	(d) Type "D"	m^3				
15.	Culverts (See Special Provisions, Clause____)	t				
	(a)	m				
	(b)	m				
	(c)	m				
	(d)	m				
	(e)	m				

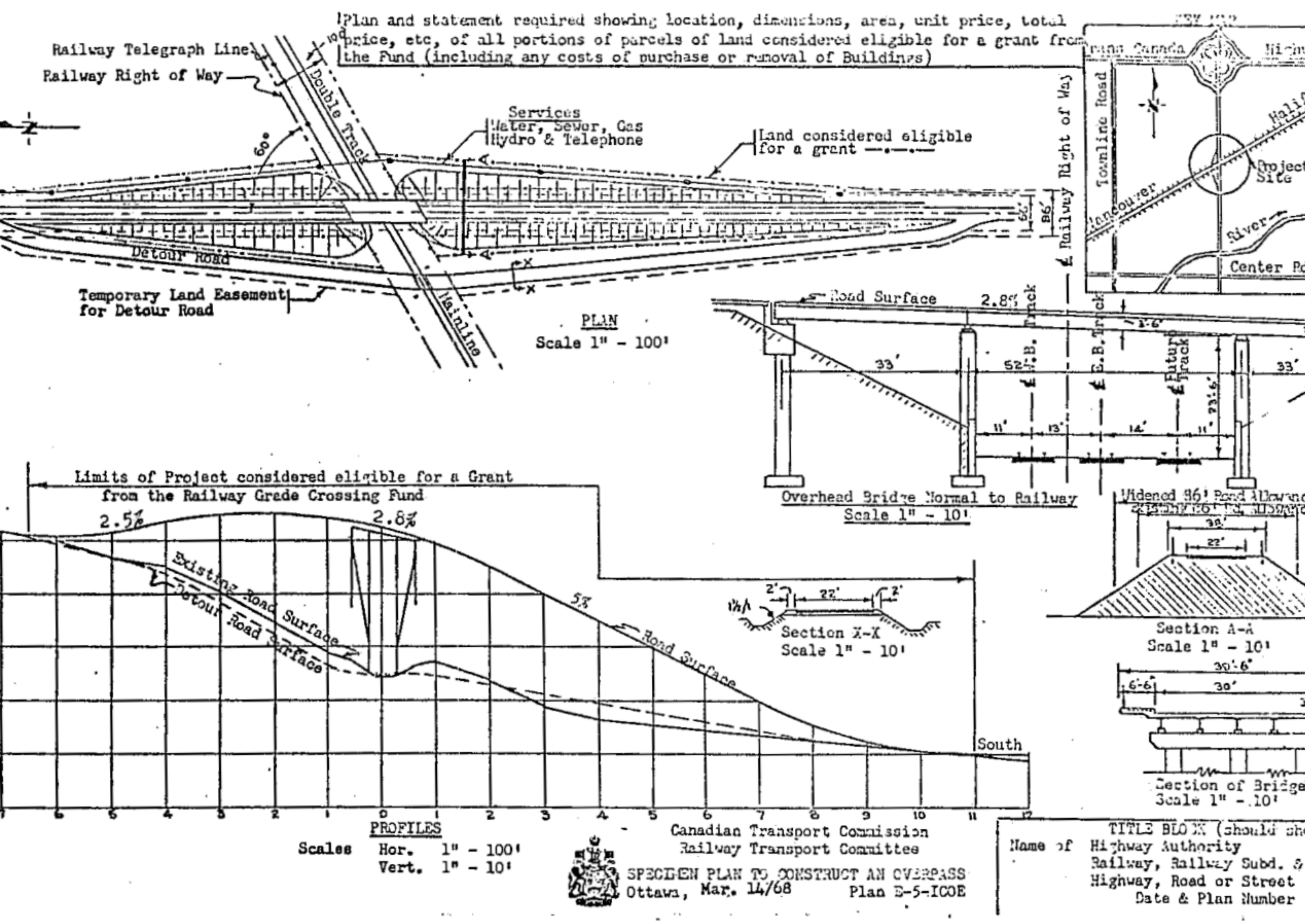
ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
15.	Culverts (continued)					
	(f)	m				
	(g)	m				
	(h)	Each*				
	Each* is used for Elbows, etc.					
	(i)	Each*				
	(Delivery to site and installation in accordance with Section 210. Foundation Excavation to be paid under Item ___. All pipe to be supplied to Contractor, f.o.b. ______________________, B.C.					
16.	Structural Steel Plate Pipe (See Special Provisions, Clause____)					
	(a)	m				
	(b)	m				
	(c)	m				
	(d)	m				
	(Delivery to site and installation in accordance with Section 210. Foundation Excavation to be paid under Item ___. All pipe to be supplied to Contractor, f.o.b. ______________________, B.C.					
17.	Precast Concrete Catch Basins, Manholes and Catch Basin Manholes (See Special Provisions, Clause____)					
	(a) Catch Basins (Dwg. No.__-SP219)	Each				
	(b) ___Manholes (Dwg. No.__-SP219)	Each				
	(i) 0 - 2 m	Each				
	(ii) 2 - 3 m	Each				
	(iii) 3 - 4 m	Each				
	(c) ___Catch Basin Manholes (Dwg. No.__-SP219)	Each				

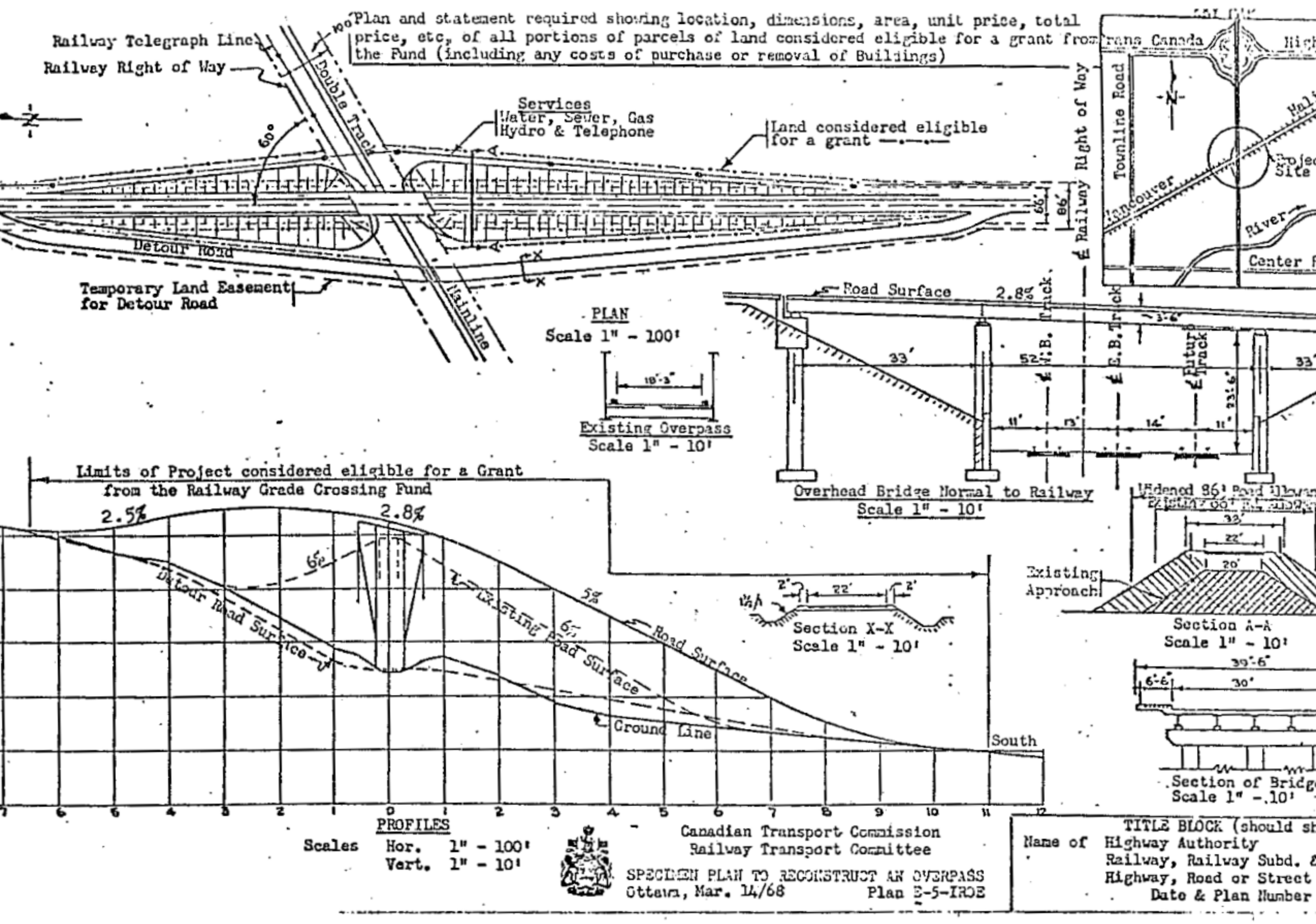
ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	AMOUNT ¢
18.	<u>Storm Drains</u>					
	(a)	m				
	(b)	m				
	(c)	m				
	(d)	m				
	(e)	m				
	(f)	m				
	(g)	Each*				
	Each* is used for Tees, Wyes, etc.					
	(h)	Each*				
	(i) Bedding and Backfill	m^3				
	(Delivery to site and installation in accordance with Section 219. Foundation Excavation to be paid under Item ___. All pipe to be supplied to Contractor, f.o.b. ____________________, B.C.					
19.	<u>Metal Bin Wall</u> (See Special Provisions, Clause___)					
	(a) Delivery to Site and Erection. All Materials to be Supplied to the Contractor, f.o.b.____________, B.C.	m^2				
	(b) Structural Backfill	t				
20.	<u>Concrete Crib Retaining Wall</u> (See Special Provisions, Clause___)					
	(a) Delivery to Site and Erection. All Materials to be Supplied to the Contractor, f.o.b.____________, B.C.	m^2				
	(b) Structural Backfill	t				

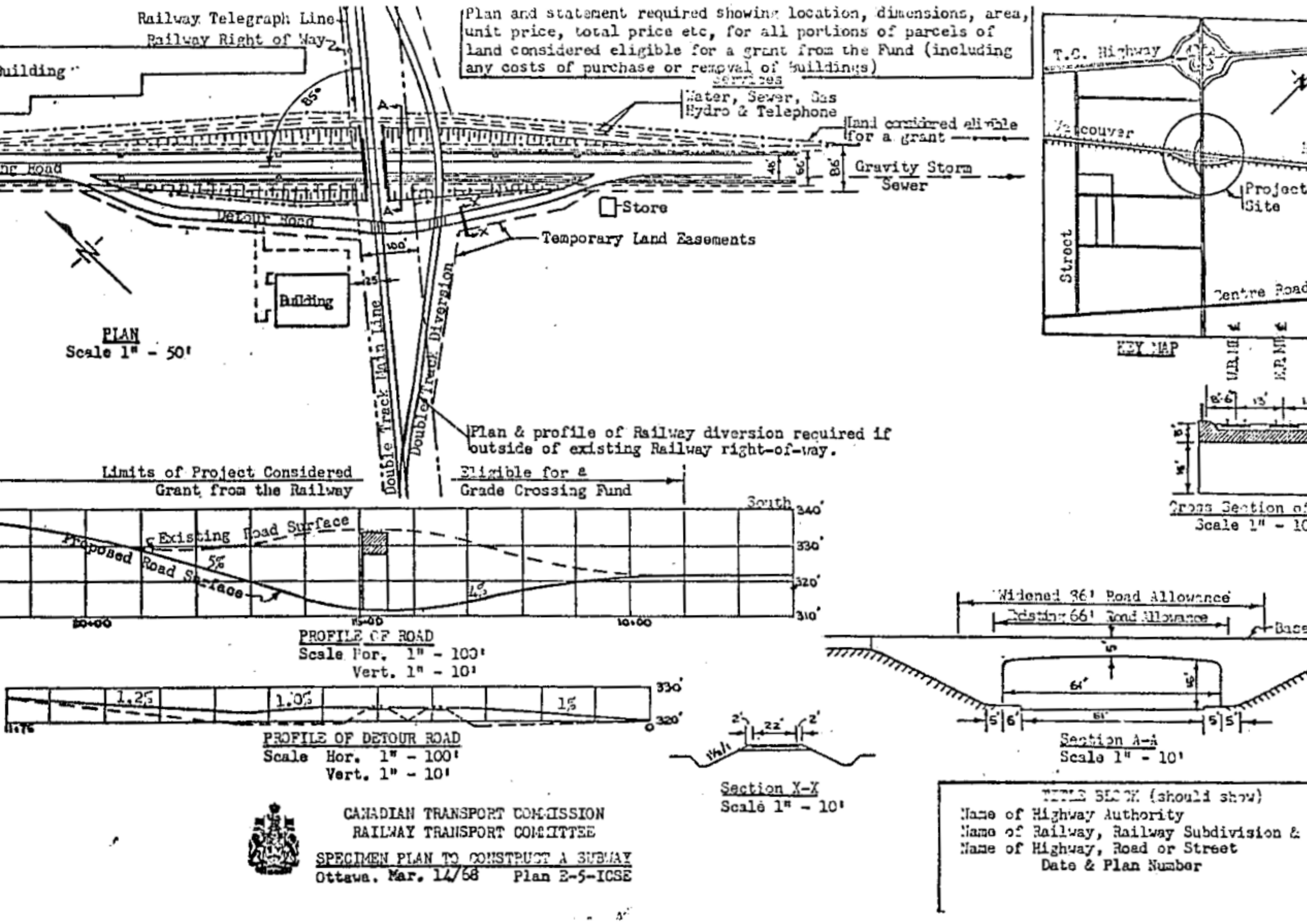
ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
*21.	Concrete Retaining Wall (See Special Provisions, Clause___)					
	(a) Class"__" Concrete, Supplied in Place	m^3				
	(b) Supply and Place Reinforcing Steel	kg				
*When a "CONCRETE CONSTRUCTION" section is included in the Schedule, include this item in that section.						
22.	Riprap (See Special Provisions, Clause___)					
	(a) Hand Laid	m^3				
	(b) Loose	m^3				
23.	Sandbags, Supplied in Place (See Special Provisions, Clause___)	Each				
24.	Chain Link Mesh, Supply and Install (See Special Provisions, Clause___)	m^2				
25.	Shotcreting, Supplied in Place (See Special Provisions, Clause___)	m^3				
26.	Rock Bolts, Supply and Install (See Special Provisions, Clause___)	m				
27.	Accommodation of Government Employees (See Special Provisions, Clause___)	Month				

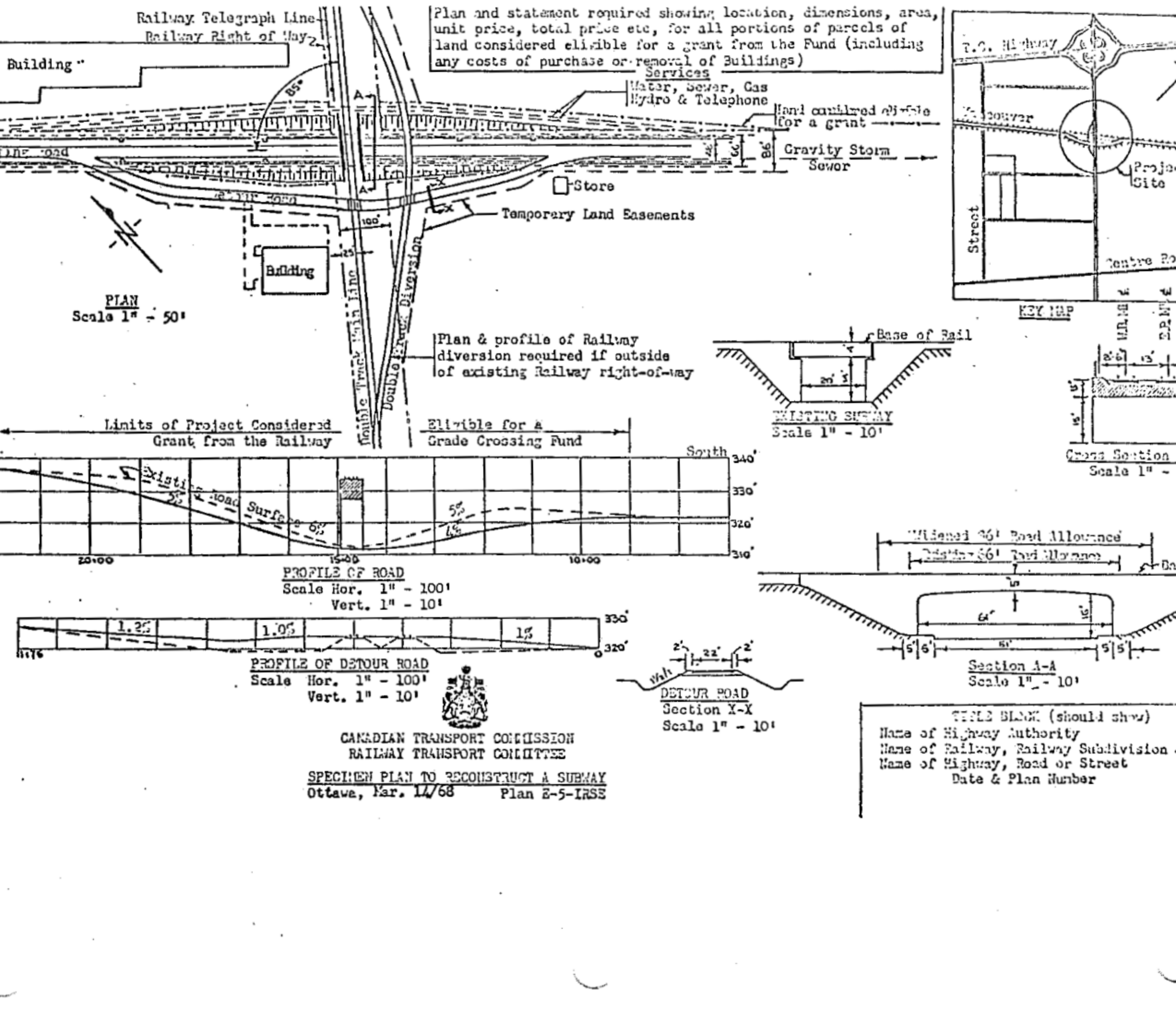
ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
28.	Plant Mixed Portland Cement Treated Base Course (See Special Provisions, Clause____)					
	(a) Cement Treated Base Course, Supplied in Place	t				
	(b) Spray Bituminous Seal	L				
	(c) Sand Cover	t				
29.	Asphaltic Plant Mixed Stabilized Base (See Special Provisions, Clause____)					
	(a) Class"__", Medium Mix, Supplied in Place	t				
	(b) Integral Curb (Dwg.No. 5-SP223)	m				
30.	Spray Primer (See Special Provisions, Clause____)	L				
31.	Asphalt Levelling Course					
	Class"___", Medium Mix, Supplied in Place	t				
32.	Asphalt Concrete Pavement (See Special Provisions, Clause____)	L				
	(a) Class"__", Medium Mix, Supplied in Place	t				
	(b) Class"__", Medium Mix, f.o.b. Plant	t				
33.	Extruded Asphalt Curb (See Special Provisions, Clause____)					
	Type"___" (Dwg.No. 6-SP223)	m				
34.	Extruded Concrete Curb (See Special Provisions, Clause____)					
	(a) Drawing No. 17-SP219	m				
	(b) Type"___" (Dwg.No. 6-SP223)	m				

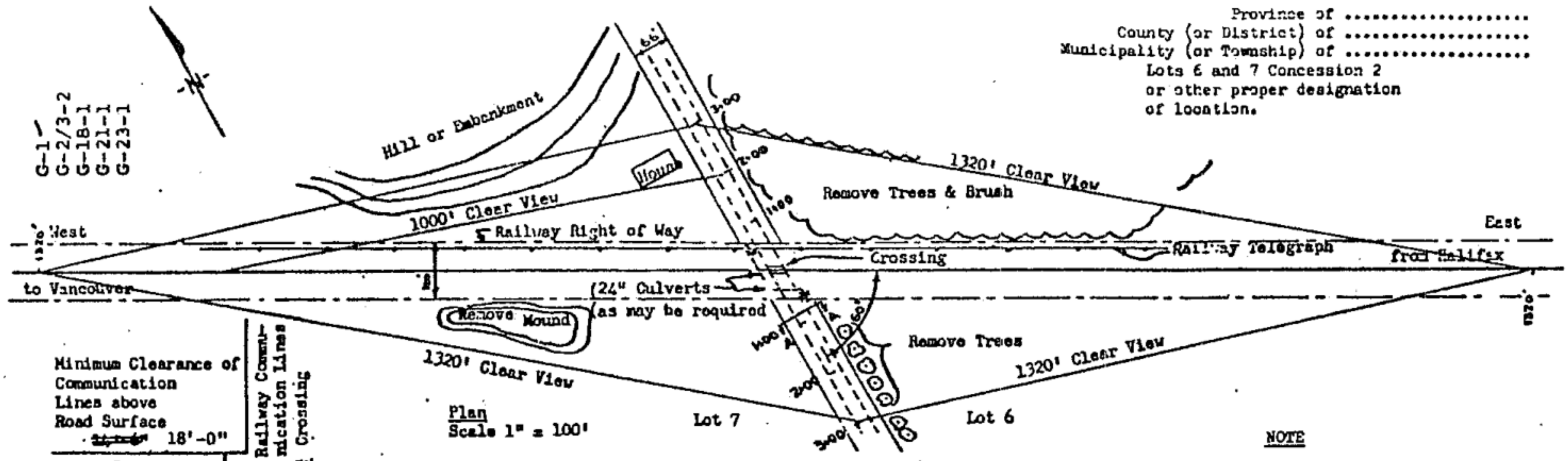
ITEM NO.	DESCRIPTION OF WORK	UNIT	QUANTITY	RATE IN DOLLARS	AMOUNT $	¢
35.	Drainage Outlets (In Accordance with Section 226)					
	(a) 200mm Diameter Corrugated Metal Pipe	m				
	(b) Cast Iron Catch Basin (Dwg.No. 1-SP226)	Each				
36.	Shouldering Aggregate, Supplied in Place	t				
37.	Shoulder Work	km				
38.	Precast Reinforced Concrete No Post Barrier					
	(a) 18" Type "B" (Dwg.No.1-SP323)	m				
	(b) 27" Type "A" (Dwg.No.2-SP323)	m				
	(c) CTB-3 (Dwg.No.8-SP323)	m				
	(d) CTB-1 (Dwg.No.9-SP323)	m				
	(e) CRB-M&F (Dwg.Nos.10&11-SP323)	m				
	(f) CTB-2 (Dwg.No.12-SP323)	m				
	(g) CMB-M&F (Dwg.Nos.13&14-SP323)	m				
	(h) CPB-M&F (Dwg.No.15-SP323)	m				
	(i) CDB-1 (Dwg.No.16-SP323)	m				
	Taking delivery, hauling to the site and installation. All barrier to be supplied to Contractor, f.o.b.____________, B.C.					
39.	Allowance for Adjustment of Haul (See Special Provisions, Clause____)	Prov. Sum				
40.	Allowance for Payments Under Specifications Section 223.43 (See Special Provisions, Clause____)	Prov. Sum				
41.	Allowance for Handwork (See Special Provisions, Clause____)	Prov. Sum				
42.	Preparatory Work at Railway (and Bridge) Crossings (See Special Provisions, Clause____)	Prov. Sum				

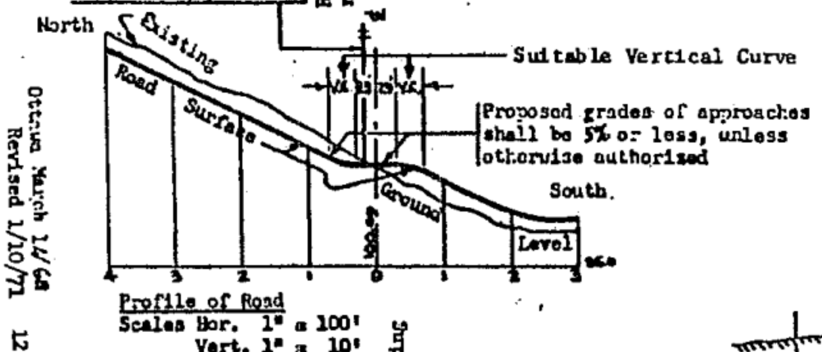

Plan and statement required showing location, dimensions, area, unit price, total price, etc, of all portions of parcels of land considered eligible for a grant from the Fund (including any costs of purchase or removal of Buildings)
Railway Telegraph Line
Railway Right of Way
Double Track
60°
Services
Water, Sewer, Gas
Hydro & Telephone
Land considered eligible for a grant
Detour Road
Temporary Land Easement for Detour Road
Mainline
PLAN
Scale 1" - 100'
86'
66'
Railway Right of Way
Townline Road
Vancouver
Halifax
Project Site
River
Center Rd
Road Surface
2.8%
W.B. Track
E.B. Track
Future Track
33'
52'
23'6"
11'
13'
14'
Overhead Bridge Normal to Railway
Scale 1" - 10'
Limits of Project considered eligible for a Grant from the Railway Grade Crossing Fund
2.5%
2.8%
5%
Existing Road Surface
Detour Road Surface
Road Surface
2'
22'
Section X-X
Scale 1" - 10'
Widened 86' Road Allowance
22'
Section A-A
Scale 1" - 10'
30'6"
30'
6'6"
Section of Bridge
Scale 1" - 10'
South
PROFILES
Scales Hor. 1" - 100'
Vert. 1" - 10'
Canadian Transport Commission
Railway Transport Committee
SPECIMEN PLAN TO CONSTRUCT AN OVERPASS
Ottawa, Mar. 14/68
Plan E-5-ICOE
TITLE BLOCK
Name of Highway Authority
Railway, Railway Subd. &
Highway, Road or Street
Date & Plan Number

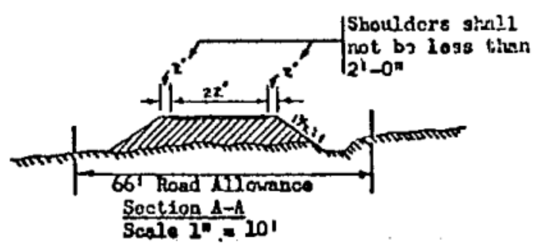

Plan and statement required showing location, dimensions, area, unit price, total price, etc, of all portions of parcels of land considered eligible for a grant from the Fund (including any costs of purchase or removal of Buildings)
Railway Telegraph Line
Railway Right of Way
Double Track
Services
Water, Sewer, Gas
Hydro & Telephone
Land considered eligible for a grant
60°
Detour Road
Temporary Land Easement for Detour Road
Mainline
PLAN
Scale 1" - 100'
Existing Overpass
Scale 1" - 10'
Railway Right of Way
Townline Road
Trans Canada
Vancouver
River
Center
Road Surface
2.8%
W.B. Track
E.B. Track
Future Track
33'
52'
11'
13'
14'
23'6"
Overhead Bridge Normal to Railway
Scale 1" - 10'
Limits of Project considered eligible for a Grant from the Railway Grade Crossing Fund
2.5%
2.8%
6%
5%
Detour Road Surface
Existing Road Surface
Road Surface
Ground Line
South
Section X-X
Scale 1" - 10'
22'
2'
Existing Approach
Section A-A
Scale 1" - 10'
20'
39'6"
30'
6'6"
Section of Bridge
Scale 1" - 10'
PROFILES
Scales Hor. 1" - 100'
Vert. 1" - 10'
Canadian Transport Commission
Railway Transport Committee
SPECIMEN PLAN TO RECONSTRUCT AN OVERPASS
Ottawa, Mar. 14/68
Plan E-5-IRDE
TITLE BLOCK (should sh
Name of Highway Authority
Railway, Railway Subd. &
Highway, Road or Street
Date & Plan Number

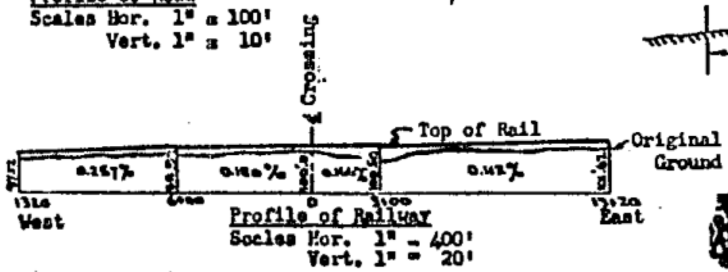

Railway Telegraph Line
Railway Right of Way
Building
Plan and statement required showing location, dimensions, area, unit price, total price etc, for all portions of parcels of land considered eligible for a grant from the Fund (including any costs of purchase or removal of buildings)
Services
Water, Sewer, Gas Hydro & Telephone
Land considered eligible for a grant
Gravity Storm Sewer
Detour Road
Store
Temporary Land Easements
Building
PLAN
Scale 1" - 50'
Double Track Main Line
Double Track Diversion
Plan & profile of Railway diversion required if outside of existing Railway right-of-way.
Limits of Project Considered
Grant from the Railway
Eligible for a
Grade Crossing Fund
South
Existing Road Surface
Proposed Road Surface
5%
4%
PROFILE OF ROAD
Scale Hor. 1" - 100'
Vert. 1" - 10'
1.25
1.0%
1%
PROFILE OF DETOUR ROAD
Scale Hor. 1" - 100'
Vert. 1" - 10'
Section X-X
Scale 1" - 10'
CANADIAN TRANSPORT COMMISSION
RAILWAY TRANSPORT COMMITTEE
SPECIMEN PLAN TO CONSTRUCT A SUBWAY
Ottawa. Mar. 14/68 Plan E-5-ICSE
T.C. Highway
Vancouver
Project Site
Street
Centre Road
KEY MAP
Cross Section of
Scale 1" - 10'
Widened 86' Road Allowance
Existing 66' Road Allowance
Base
Section A-A
Scale 1" - 10'
TITLE BLOCK (should show)
Name of Highway Authority
Name of Railway, Railway Subdivision & M
Name of Highway, Road or Street
Date & Plan Number


Railway Telegraph Line
Railway Right of Way
Building
Plan and statement required showing location, dimensions, area, unit price, total price etc, for all portions of parcels of land considered eligible for a grant from the Fund (including any costs of purchase or removal of Buildings)
Services
Water, Sewer, Gas
Hydro & Telephone
Gravity Storm
Sewer
Store
Temporary Land Easements
Building
PLAN
Scale 1" - 50'
Double Track Main Line
Double Track Diversion
Plan & profile of Railway diversion required if outside of existing Railway right-of-way
Base of Rail
Scale 1" - 10'
Limits of Project Considered
Grant from the Railway
Eligible for a
Grade Crossing Fund
South
Existing Road Surface
PROFILE OF ROAD
Scale Hor. 1" - 100'
Vert. 1" - 10'
PROFILE OF DETOUR ROAD
Scale Hor. 1" - 100'
Vert. 1" - 10'
DETOUR ROAD
Section X-X
Scale 1" - 10'
Section A-A
Scale 1" - 10'
Name of Highway Authority
Name of Railway, Railway Subdivision
Name of Highway, Road or Street
Date & Plan Number
KEY MAP
Street
CANADIAN TRANSPORT COMMISSION
RAILWAY TRANSPORT COMMITTEE
SPECIMEN PLAN TO RECONSTRUCT A SUBWAY
Ottawa, Mar. 14/68
Plan E-5-IRSE









Canadian Transport Commission
Railway Transport Committee
Rail Systems Development Branch

CANADA

NOTE

Plan indicates road allowance "junior" to the railway right of way and extent of clear vision which may be required.
If automatic protection is to be installed at the crossing, improvement of vision may not be required.
Planking or other road surface at the crossing shall comply with the requirements of Section 5(2) of Part II of General Order No. E-4

Forward three copies of plan to the Commission and three copies of plan to General Counsel of Railway concerned.

SPECIMEN PLAN TO CONSTRUCT CROSSING AT GRADE

TITLE BLOCK (should show)
Name of Highway Authority
Name of Railway, Railway Subdivision & Mileage
Name of Highway, Road or Street
Date and Plan Number

Ottawa March 14/68
Revised 1/10/71 12/4/76
Plan E-4-2

HIGHWAYS - REGION 1 - 1967-84	Person Contacted	Function of Agency	Reason for Contact	Method of Contact
PROVINCIAL AGENCIES				
MINISTRY OF ENVIRONMENT & PARKS 10334 - 152A Street Surrey, B.C., V3R 7P8	Don Hehn Regional Director (584-8822)			Letter
Water Management Branch	Jim McCracken Regional Manager (584-8822)	Hydraulic Studies Control and Licencing of all Flowing Water	Major effect on rivers or streams. Disruption of private works. Hwys through irrigation and Fire Protection Dists., minor stream diversion and bank protection	Letter, Application Form for Permit Plan (in triplicate)
Fish & Wildlife Branch	Tom Wood Regional Manager (584-8822)	Wildlife Protection (fencing) and Fish Protection (Fresh Water)	Construction of bridges, installation of culverts, diversion of all spawning streams, riprap bank protection	Letter with Plan
Waste Management Branch	Mike Wong Regional Manager (584-8822)	Control of all Waste Discharge to Land, Air and Water	Compliance with Pollution Control Act, 1976, Requires that all waste discharges to environment must be covered by Permit or Approval from Director	Letter showing proposal with emphasis on the environmental impact and subsequent application for permit or approval if it is determined that such is required by the Act.
Parks & Outdoor Rec. Div. 1610 Indian River Dr. North Vancouver, B.C., V7G 1L3	George Trachuk Regional Director (929-1291)	Jurisdiction Over Provincial Parks, Campgrounds, etc.	Highways through and servicing parks, camp sites, etc. Lookout sites	Letter with Plans
Parks & Outdoor Rec. Div. Park Programs Branch 3rd Floor, 4000 Seymour Pl. Victoria, B.C., V8V 1X5	Derek Thompson Manager Planning & Ecological Reserves (387-4594)	Jurisdiction on Ecological Reserves	Conflicts of highway alignments on Ecological Reserves	Letter with Plans
MINISTRY OF FORESTS AND LANDS				
Regional Div. 4595 Canada Way Burnaby, B.C., V5G 4L9	Rich Scarrow Regional Director (660-7626)	General Environmental Coordination (Prov. Gov't.)	Information for Provincial Government Coordination purposes	Letter with Plans. List of Agencies contacted
MINISTRY OF TOURISM, RECREATION AND CULTURE				
Impact Assessment Section Heritage Conservation Branch 333 Quebec Street Victoria, B.C., V8V 1X4	Brian Apland Head (356-1438)	Preservation and Excavation of Archaeology and Heritage Sites	Conflicts of Highway Alignments on Archaeological and Historic Sites	Letter and Key Maps
MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES				
Mineral Resources Div. Geological Branch 617 Government Street Victoria, B.C., V8V 1X4	Ann Ratel Land Use Coordinator (387-5975)	Engineering & Inspection	Location of Mine Shafts, Areas of Active Mining Activity, Mineral Status, Reserves	Letter and Mosaic

HIGHWAYS - REGION 1 - 1987-04 (continued)	Person Contacted	Function of Agency	Reason for Contact	Method of Contact
MINISTRY OF AGRICULTURE AND FISHERIES				
South Coastal Region 205 - 33780 Laurel Street Abbotsford, B.C., V2S 1X4	Wayne Wickens Regional Director (852-5211)	Jurisdiction Over Farmland Resources	Affects on Agricultural Operations	Letter with Plans
Commercial Fisheries Branch Marine Resources Section 808 Douglas Street Victoria, B.C., V8W 2Z7	Gordon Halsey Manager (387-9687)	Protection of Marine Resources (Oysters, Clams, etc.)	Effect on oyster beds, Aquaculture	Letter with Plans
B. C. AGRICULTURAL LAND COMMISSION				
4940 Canada Way Burnaby, B.C., V5G 4K6	Ian Paton Chairman (660-7000)	Enforcement of the Land Commission Act (Agricultural Land)	Check on ALR to be alienated. If none, do not submit plans. Compliance with the Act	Letter with Plans
FEDERAL AGENCIES				
FISHERIES & OCEANS CANADA Habitat Management Unit Fraser Ri, Northern BC, Yukon Div 80 - 6th Street New Westminster, B.C., V3L 5B3	Otto Langer Senior Habitat Biologist (666-0315)	Salmon Protection and any Marine Life for coastal areas and river systems	Construction of bridges, installation of culverts and diversion of salmon spawning streams and riprap bank protection	Letter with Plans (Refer to LI 56 - (1975-04-09))
-- OR --				
South Coast Division Habitat Management Unit 3225 Stephenson Pt. Road Nanaimo, B.C., V9T 1K3	Rick Higgins Senior Habitat Biologist (756-7284)			
ENVIRONMENT CANADA Canadian Wildlife Service Habitat & Ecological Assessment 5421 Robertson Road P. O. Box 340 Delta, B.C., V4K 3Y3	Laszlo Retfalvi Head (946-8546)	Canadian Wildlife Protection in Northern Regions and Migratory Bird Sanctuaries	Affect on Wildlife and Migratory Birds	Letter with Plans
TRANSPORT CANADA Canadian Coast Guard 224 W Esplanade Street North Vancouver, B.C., V7M 3H7	John Ouduman Senior Officer (984-3731)	Navigable Waters Protection Act	Compliance with Act	Letter with Plans

HIGHWAYS - REGION 2 - 1987-04	Person Contacted	Function of Agency	Reason for Contact	Method of Contact
PROVINCIAL AGENCIES				
MINISTRY OF ENVIRONMENT & PARKS 1259 Dalhousie Dr. Kamloops, B.C., V2C 5Z5	Bill Kastelen Regional Director (374-9717)			Letter
(FOR THOMPSON-NICOLA REGION)				
Water Management Branch 1259 Dalhousie Dr. Kamloops, B.C., V2C 5Z5	Al Zackodnik Regional Manager (374-9717)	Hydraulic Studies Control and Licencing of all Flowing Water	Major effect on rivers or streams. Disruption of private works. Hwys through irrigation and fire Protection Dists., minor stream diversion and bank protection	Letter, Application Form for Permit Plan (in triplicate)
Fish and Wildlife Branch 1259 Dalhousie Dr. Kamloops, B.C., V2C 5Z5	Zeke Withler Regional Manager (374-9717)	Wildlife Protection (fencing) and Fish Protection (Fresh Water)	Construction of bridges, installation of culverts, diversion of all spawning streams, riprap bank protection	Letter with Plan
Waste Management Branch 1259 Dalhousie Dr. Kamloops, B.C., V2C 5Z5	Howard Henderson Regional Manager (374-9717)	Control of all Waste Discharge to Land, Air and Water	Compliance with Pollution Control Act, 1976, Requires that all waste discharges to environment must be covered by Permit or Approval from Director	Letter outlining proposal with emphasis on the environmental impact and subsequent application for permit or approval if it is determined that such is required by the Act.
-- OR --		-- OR --		

(FOR SOUTH INTERIOR)			(FOR CARIBOO REGION)		
Sub-Regional Office: 3547 Skaha Lake Road Penticton, B.C., V2A 7K2			Sub-Regional Office: 540 Borland Street Williams Lake, B.C., V2G 1R8		
Water Management Branch	Neil Banera (493-8261)	Head, Water Allocation	Water Management Branch	Brain Symonds (398-4576)	Head, Water Allocation
Fish & Wildlife Branch	Chris Bull (493-8261)	Regional Fisheries Biologist	Fish & Wildlife Branch	Marty Beets (398-4552)	Habitat Protection Biologist
Fish & Wildlife Branch	Bob Lincoln (493-8261)	Regional Wildlife Biologist	Waste Management Branch	Al Stephens (398-4543)	Assistant Regional Manager
Waste Management	Bill Hamilton (493-8261)	Assistant Regional Manager			

Parks & Outdoor Rec. Div. 101 - 1050 W. Columbia St. Kamloops, B.C., V2C 1L4	Milt Goddard Regional Director (828-4501)	Jurisdiction Over Provincial Parks, Campgrounds, etc.	Highways through and servicing parks, camp sites, etc. Lookout sites	Letter with Plans
Parks & Outdoor Rec. Div. Park Programs Branch 3rd Floor, 4000 Seymour Pl. Victoria, B.C., V8V 1X5	Derek Thompson Manager (387-4594)	Jurisdiction on Planning & Ecological Reserves	Conflicts of highway alignments on Ecological Reserves	Letter with Plans Ecological Reserves

HIGHWAYS - REGION 2 - 1987-04 (continued)	Person Contacted	Function of Agency	Reason for Contact	Method of Contact
MINISTRY OF FORESTS AND LANDS				
Regional Div. 515 Columbia Street Kamloops, B.C., V2C 2T7	Peter Levy Regional Director (828-4121)	General Environmental Coordination (Prov. Gov't.)	Information for Provincial Government Coordination purposes	Letter with Plans. List of Agencies contacted
MINISTRY OF TOURISM, RECREATION AND CULTURE				
Impact Assessment Section Heritage Conservation Branch 333 Quebec Street Victoria, B.C., V8V 1X4	Brian Apland Head (356-1438)	Preservation and Excavation of Archaeology and Heritage Sites	Conflicts of Highway Alignments on Archaeological and Historic Sites	Letter and Key Maps
MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES				
Mineral Resources Div. Geological Branch 617 Government Street Victoria, B.C., V8V 1X4	Ron Ratel Land Use Coordinator (387-5975)	Engineering & Inspection	Location of Mine Shafts, Mining Activity and Mineral Status, Reserves	Letter and Mosaic
MINISTRY OF AGRICULTURE AND FISHERIES				
Thompson-Cariboo Region 162 Oriole Road Kamloops, B.C., V2C 4N7	Albert Isfeld Regional Director (828-4552)	Jurisdiction Over Farmland Resources	Affect on Agricultural Operations	Letter with Plans
	-- OR --			
Okanagan-Kootenay Region 1873 Spall Road Kelowna, B.C., V1Y 4R2	Brian Baehr Regional Director (861-7211)			
B. C. AGRICULTURAL LAND COMMISSION				
4940 Canada Way Burnaby, B.C., V5G 4K6	Ian Paton Chairman (660-7000)	Enforcement of the Land Commission Act (Agricultural Land)	Check on ALR to be alienated. If none, do not submit plans. Compliance with the Act	Letter with Plans
FEDERAL AGENCIES				
FISHERIES & OCEANS CANADA Fraser Ri, Northern BC, Yukon Div Habitat Management Unit 80 - 6th Street New Westminster, B.C., V3L 5B3	Otto Langer Senior Habitat Biologist (666-0315)	Salmon Protection and any Marine Life for coastal areas and river systems	Construction of bridges, installation of culverts and diversion of salmon spawning streams and riprap bank protection	Letter with Plans (Refer to LT 56 - (1975-04-09))
ENVIRONMENT CANADA Canadian Wildlife Service Habitat & Ecological Assessment 5421 Robertson Road P. O. Box 340 Delta, B.C., V4K 3Y3	Laszlo Retfalvi Head (946-8546)	Canadian Wildlife Protection in Northern Regions and Migratory Bird Sanctuaries	Affect on Wildlife and Migratory Birds	Letter with Plans

HIGHWAYS - REGION 3 - 1937-94	Person Contacted	Function of Agency	Reason for Contact	Method of Contact
PROVINCIAL AGENCIES				
MINISTRY OF ENVIRONMENT & PARKS 310 Ward Street Nelson, B.C., V1L 5S4	Dennis McDonald Regional Director (354-6347)			Letter
Water Management Branch	John Dyck Regional Manager (354-6372)	Hydraulic Studies Control and Licencing of all Flowing Water	Major effect on rivers or streams. Disruption of private works. Hwys through irrigation and Fire Protection Dists., minor stream diversion and bank protection	Letter, Application Form for Permit Plan (in triplicate)
Fish & Wildlife Branch	Ian Robertson Regional Manager (354-6344)	Wildlife Protection (fencing) and Fish Protection (Fresh Water)	Construction of bridges, installation of culverts, diversion of all spawning streams, riprap bank	Letter with Plan
Waste Management Branch	Maurice Baillargeon Regional Manager (354-6355)	Control of all Waste Discharge to Land, Air and Water	Compliance with Pollution Control Act, 1976, Requires that all waste discharges to environment must be covered by Permit or Approval from Director	Letter outlining proposal with emphasis on environmental impact and subsequent application for permit or approval if it is determined that such is required by the Act.
-- OR --				
(FOR SW PORTION OF REGION 3)				
Sub-Regional Office: 3547 Skaha Lake Road Penticton, B.C., V2A 7K2				
Water Management Branch	Neil Banera (493-8261)	Head, Water Allocation		
Fish & Wildlife Branch	Chris Bull (493-8261)	Regional Fisheries Biologist		
Fish & Wildlife Branch	Bob Lincoln (493-8261)	Regional Wildlife Biologist		
Waste Management	Bill Hamilton (493-8261)	Assistant Regional Manager		
Parks & Outdoor Rec. Div. 101 - 1050 W. Columbia Street Kamloops, B.C., V2C 1L4	Milt Goddard Regional Director (828-4501)	Jurisdiction Over Provincial Parks, Campgrounds, etc.	Highways through and servicing parks, camp sites, etc. Lookout sites	Letter with Plans
Parks & Outdoor Rec. Div. Park Programs Branch 3rd Floor, 4000 Seymour Pl. Victoria, B.C., V8V 1X5	Derek Thompson Manager (387-4594)	Jurisdiction on Planning & Ecological Reserves	Conflict of highway alignments on Ecological Reserves	Letter with Plans Ecological Reserves

HIGHWAYS - REGION 3 - 1987-04 (continued)	Person Contacted	Function of Agency	Reason for Contact	Method of Contact
MINISTRY OF FORESTS AND LANDS				
Regional Div. 518 Lake Street Nelson, B.C., V1L 4C6	Ross Tozer Regional Director (354-6203)	General Environmental Coordination (Prov. Gov't.)	Information for Provincial Government Coordination purposes	Letter with Plans, List of Agencies contacted
MINISTRY OF TOURISM, RECREATION AND CULTURE				
Impact Assessment Section Heritage Conservation Branch 333 Quebec Street Victoria, B.C., V8V 1X4	Brian Apland Head (356-1438)	Preservation and Excavation of Archaeology and Heritage Sites	Conflicts of Highway Alignments on Archaeological and Historic Sites	Letter and Key Maps
MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES				
Mineral Resources Div. Geological Branch 617 Government Street Victoria, B.C., V8V 1X4	Ann Ratel Land Use Coordinator (387-5975)	Engineering & Inspection	Location of Mine Shafts, Mineral Status, Mining Activity	Letter and Mosaic
MINISTRY OF AGRICULTURE AND FISHERIES				
Okanagan-Kootenay Region 1873 Spall Road Kelowna, B.C., V1Y 4R2	Brian Baehr Regional Director (861-7211)	Jurisdiction Over Farmland Resources	Affect on Agricultural Operations	Letter with Plans
B. C. AGRICULTURAL LAND COMMISSION				
4940 Canada Way Burnaby, B.C., V5G 4K6	Ian Paton Chairman (660-7000)	Enforcement of the Land Commission Act (Agricultural Land)	Check on ALR to be alienated. If none, do not submit plans. Compliance with the Act	Letter with Plans
FEDERAL AGENCIES				
ENVIRONMENT CANADA Canadian Wildlife Service Habitat & Ecological Assessment 5421 Robertson Road P. O. Box 340 Delta, B.C., V4K 3Y3	Laszlo Retfalvi Head (946-8546)	Canadian Wildlife Protection in Northern Regions and Migratory Bird Sanctuaries	Affect on Wildlife and Migratory Birds	Letter with Plans

HIGHWAYS - REGION 4 - 1987-89	Person Contacted	Function of Agency	Reason for Contact	Method of Contact
PROVINCIAL AGENCIES				
MINISTRY OF ENVIRONMENT & PARKS 1011 Fourth Avenue Prince George, B.C., V2L 3H9	Earl Warnock Regional Director (565-6400)			Letter
Water Management Branch	Dennis Roberts Regional Manager (565-6432)	Hydraulic Studies Control and Licencing of all Flowing Water	Major effect on rivers or streams. Disruption of private works. Hwys through irrigation and Fire Protection Dists., minor stream diversion and bank protection	Letter, Application Form for Permit Plan (in triplicate)
Fish and Wildlife Branch	Steve Willett Regional Manager (565-6421)	Wildlife Protection (fencing) and Fish Protection (Fresh Water)	Construction of bridges, installation of culverts, diversion of all spawning streams, riprap bank	Letter with Plan
Waste Management Branch -- OR -- (FOR CARIBOO REGION) Sub-Regional Office: 540 Borland Street Williams Lake, B.C., V2G 1R8	Ron Driedger Regional Manager (565-6443)	Control of all Waste Discharge to Land, Air and Water	Compliance with Pollution Control Act, 1976, Requires that all waste discharges to environment must be covered by Permit or Approval from Director	Letter outlining proposal with emphasis on environmental impact and subsequent application for permit or approval if it is determined that such is required by the Act.
Water Management Branch	Brian Symonds (398-4576)	Head, Water Allocation		
Fish & Wildlife Branch	Marty Beets (398-4552)	Habitat Protection Biologist		
Waste Management Branch	Al Stephens (398-4543)	Assistant Regional Manager		
Parks & Outdoor Rec. Div. 1011 - 4th Avenue Prince George, B.C., V2L 3H9	Tom Moore Regional Director (565-6270)	Jurisdiction Over Provincial Parks, Campgrounds, etc.	Highways through and servicing parks, camp sites, etc. Lookout sites	Letter with Plans
Parks & Outdoor Rec. Div. Park Programs Branch 3rd Floor, 4000 Seymour Pl. Victoria, B.C., V8V 1X5	Derek Thompson Mgr. Planning & Ecological Reserves (387-4594)	Jurisdiction on Ecological Reserves	Conflict of highway alignments on Ecological Reserves	Letter with Plans
MINISTRY OF FORESTS AND LANDS				
Regional Div. 1011 - Fourth Avenue Prince George, B.C., V2L 3H9 -- OR --	Fred Baxter Regional Director (565-6102)	General Environmental Coordination (Prov. Gov't.)	Information for Provincial Government Coordination purposes	Letter with Plans. List of Agencies contacted
Regional Div. Cariboo Region 540 Borland Street Williams Lake, B.C., V2G 1R8	John Szauer Regional Director (398-4389)	General Environmental Coordination (Prov. Gov't)	Information for Provincial Government Coordination purposes	Letter with Plans. List of Agencies contacted
MINISTRY OF TOURISM, RECREATION AND CULTURE				
Impact Assessment Section Heritage Conservation Branch 333 Quebec Street Victoria, B.C., V8V 1X4	Brian Apland Head (356-1438)	Preservation and Excavation of Archaeology and Heritage Sites	Conflicts of Highway Alignments on Archaeological and Historic Sites	Letter and Key Maps

HIGHWAYS - REGION 4 - 1987-04 (continued)	Person Contacted	Function of Agency	Reason for Contact	Method of Contact
MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES				
Mineral Resources Div. Geological Branch 617 Government Street Victoria, B.C., V8V 1X4	Ron Ratel Land Use Coordinator (387-5975)	Engineering & Inspection	Location of Mine Shafts, Mineral Status, Mining Activity	Letter and Mosaic
MINISTRY OF AGRICULTURE AND FISHERIES				
Experimental Farm Site R.R. #8, RMD 7 Prince George, B.C., V2N 4M6	Robert Kohlert Regional Director (565-6466)	Jurisdiction Over Farmland Resources	Affect on Agricultural Operations	Letter with Plans
-- OR --				
(FOR CARIBOO REGION) 162 Oriole Road Kamloops, B.C., V2C 4N7	Albert Isfeld Regional Director (828-4552)			
Commercial Fisheries Branch Marine Resources Section 808 Douglas Street Victoria, B.C., V8W 2Z7	Gordon Halsey Manager (387-9687)	Protection of Marine Resources (Oysters, Clams, etc.)	Effect on oyster beds, etc.	Letter with Plans
B. C. AGRICULTURAL LAND COMMISSION				
4940 Canada Way Burnaby, B.C., V5G 4K6	Ian Paton Chairman (660-7000)	Enforcement of the Land Commission Act (Agricultural Land)	Check on ALR to be alienated. If none, do not submit plans Compliance with the Act	Letter with Plans
FEDERAL AGENCIES				
FISHERIES & OCEANS CANADA Fraser R1, Northern BC, Yukon Div Habitat Management Unit 80 - 6th Street New Westminster, B.C., V3L 5B3	Otto Langer Senior Habitat Biologist (666-0315)	Salmon Protection and any Marine Life For coastal areas and river systems	Construction of bridges, installation of culverts and diversion of salmon spawning streams and riprap bank protection	Letter with Plans (Refer to LT 56 - (1975-04-09))
-- OR --				
North Coast Division Habitat Management Unit 109 - 417 2nd Ave., West Prince Rupert, B.C., V8J 1G8	Denis Rowse Senior Habitat Biologist (624-9385)			
ENVIRONMENT CANADA Canadian Wildlife Service Habitat & Ecological Assessment 5421 Robertson Road P. O. Box 340 Delta, B.C., V4K 3Y3	Laszlo Retfalvi Head (946-8546)	Canadian Wildlife Protection in Northern Regions and Migatory Bird Sanctuaries	Affect on Wildlife and Migratory Birds	Letter with Plans
TRANSPORT CANADA Canadian Coast Guard 224 W Esplanade Street North Vancouver, B.C., V7M 3H7	John Duduman Senior Officer (984-3731)	Navigable Waters Protection Act	Compliance with Act	Letter with Plans

HIGHWAYS - REGION 5 - 1987-04	Person Contacted	Function of Agency	Reason for Contact	Method of Contact
PROVINCIAL AGENCIES				
MINISTRY OF ENVIRONMENT & PARKS 1011 - 4th Avenue Prince George, B.C., V2L 3H9	Earl Warnock Regional Director (565-6400)			Letter
Water Management Branch 3726 Alfred Street Bag 5000 Smithers, B.C., V0J 2N0	Wilfred Dreher Head, Engineering Section (847-7275)	Hydraulic Studies Control and Licencing of all Flowing Water	Major effect on rivers or streams. Disruption of private works. Hwys through irrigation and Fire Protection Dists., minor stream diversion and bank protection	Letter, Application Form for Permit Plan (in triplicate)
Fish & Wildlife Branch 3726 Alfred Street Bag 5000 Smithers, B.C., V0J 2N0	Allan Edie Head, Habitat (847-7288) Ben Van Drimmelen Head, Wildlife (847-7298)	Fish Protection (Fresh Water) Wildlife Protection (fencing)	Construction of bridges, installation of culverts, diversion of all spawning streams, riprap bank	Letter with Plan
Waste Management Branch 3726 Alfred Street Bag 5000 Smithers, B.C., V0J 2N0	Brian Wilkes Head, Environment Section (847-7251)	Control of all Waste Discharge to Land, Air and Water	Compliance with Pollution Control Act, 1976, Requires that all waste discharges to environment must be covered by Permit or Approval from Director	Letter outlining proposal with emphasis on the environmental impact and subsequent application for permit or approval if it is determined that such is required by the Act.
Parks & Outdoor Rec. Div. 1011 - Fourth Avenue Prince George, B.C., V2L 3H9	Tom Moore Regional Director (565-6270)	Jurisdiction Over Provincial Parks, Campgrounds, etc.	Highways through and servicing parks, camp sites, etc. Lookout sites	Letter with Plans
Parks & Outdoor Rec. Div. Park Programs Branch 3rd Floor, 4000 Seymour Pl. Victoria, B.C., V8V 1X5	Derek Thompson Manager (387-4591)	Jurisdiction on Ecological Reserves	Conflicts of highway alignments on Ecological Reserves	Letter with Plans
MINISTRY OF FORESTS AND LANDS				
Regional Div. Bag 5000 3726 Alfred Avenue Smithers, B.C., V0J 2N0	Ken Ingram Acting Reg'l Dir. (847-7545)	General Environmental Coordination (Prov. Gov't.)	Information for Provincial Government Coordination purposes	Letter with Plans, List of Agencies contacted
MINISTRY OF TOURISM, RECREATION AND CULTURE				
Impact Assessment Section Heritage Conservation Branch 333 Quebec Street Victoria, B.C., V8V 1X4	Brian Apland Head (356-1438)	Preservation and Excavation of Archaeology and Heritage Sites	Conflicts of Highway Alignments on Archaeological and Historic Sites	Letter and Key Maps
MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES				
Mineral Resources Div. Geological Branch 617 Government Street Victoria, B.C., V8V 1X4	Ann Ratel Land Use Coordinator (387-5975)	Engineering & Inspection	Location of Mine Shafts	Letter and Mosaic

HIGHWAYS - REGION 5 - 1987-04 (continued)	Person Contacted	Function of Agency	Reason for Contact	Method of Contact
MINISTRY OF AGRICULTURE AND FISHERIES				
Experimental Farm Site R.R. #8, RMD 7 Prince George, B.C., V2N 4M6	Robert Kohlert Regional Director (565-6466)	Jurisdiction Over Farmland Resources	Affect on Agricultural Operations	Letter with Plans
Commercial Fisheries Branch Marine Resources Section 808 Douglas Street Victoria, B.C., V8W 2Z7	Gordon Halsey Manager (387-9687)	Protection of Marine Resources (Oysters, Clams, etc.)	Effect on oyster beds, Aquaculture	Letter with Plans
B. C. AGRICULTURAL LAND COMMISSION				
4940 Canada Way Burnaby, B.C., V5G 4K6	Ian Paton Chairman (660-7000)	Enforcement of the Land Commission Act (Agricultural Land)	Check on ALR to be alienated. If none, do not submit plans. Compliance with the Act	Letter with Plans
FEDERAL AGENCIES				
FISHERIES & OCEANS CANADA North Coast Division Habitat Management Unit 109-417 2nd Ave., West Prince Rupert, B.C., V8J 1G8	Denis Rowse Senior Habitat Biologist (624-9385)	Salmon Protection and any Marine Life for coastal areas and river systems	Construction of bridges, installation of culverts and diversion of salmon spawning streams and riprap bank protection	Letter with Plans (Refer to LI 56 - (1975-04-09))
-- OR --				
Fraser Ri, Northern BC, Yukon Div Habitat Management Unit 80 - 6th Street New Westminster, B.C., V3L 5B3	Otto Langer Senior Habitat Biologist (666-0315)			
ENVIRONMENT CANADA Canadian Wildlife Service Habitat & Ecological Assessment 5421 Robertson Road P. O. Box 340 Delta, B.C., V4K 3Y3	Laszlo Retfalvi Head (946-8546)	Canadian Wildlife Protection in Northern Regions and Migratory Bird Sanctuaries	Affect on Wildlife and Migratory Birds	Letter with Plans
TRANSPORT CANADA Canadian Coast Guard 224 W Esplanade Street North Vancouver, B.C., V7M 3N7	John Duduman Senior Officer (984-3731)	Navigable Waters Protection Act	Compliance with Act	Letter with Plans

HIGHWAYS - REGION 6 - 1987-04	Person Contacted	Function of Agency	Reason for Contact	Method of Contact
PROVINCIAL AGENCIES				
MINISTRY OF ENVIRONMENT & PARKS 2569 Kenworth Road Nanaimo, B.C., V9T 4P7	Tom Oxland Regional Director (758-3951)			Letter
Water Management Branch	Bill Hollingshead Regional Manager (758-3951)	Hydraulic Studies Control and Licencing of all Flowing Water	Major effect on rivers or streams. Disruption of private works. Ways through irrigation and Fire Protection Dists., minor stream diversion and bank protection	Letter, Application Form for Permit Plan (in triplicate)
Fish & Wildlife Branch	Mike Whately Regional Manager (758-3951)	Wildlife Protection (fencing) and Fish Protection (Fresh Water)	Construction of bridges, installation of culverts, diversion of all spawning streams, riprap bank	Letter with Plan
Waste Management Branch	Ted Oldham Regional Manager (758-3951)	Control of all Waste Discharge to Land, Air and Water	Compliance with Pollution Control Act, 1976, Requires that all waste discharges to environment must be covered by Permit or Approval from Director	Letter outlining proposal with emphasis on environmental impact and subsequent application for permit or approval if it is determined that such is required by the Act.
Parks & Outdoor Rec. Div. 1610 Indian River Drive North Vancouver, B.C., V7G 1L3	George Trachuk Regional Director (929-1291)	Jurisdiction Over Provincial Parks, Campgrounds, etc.	Highways through and servicing parks, camp sites, etc. Lookout sites	Letter with Plans
Parks & Outdoor Rec. Div. Park Programs Branch 3rd Floor, 4000 Seymour Pl. Victoria, B.C., V8V 1X5	Derek Thompson Manager, Planning Ecological Reserves (387-4599)	Jurisdiction on Ecological Reserves	Conflict of highway alignments on Ecological Reserves	Letter with Plans
MINISTRY OF FORESTS AND LANDS				
Regional Div. 4595 Canada Way Burnaby, B.C., V5G 4L9	Rich Scarrow Acting Reg'l Dir. (660-7626)	General Environmental Coordination (Prov. Gov't.)	Information for Provincial Government Coordination purposes	Letter with Plans. List of Agencies contacted
MINISTRY OF TOURISM, RECREATION AND CULTURE				
Impact Assessment Section Heritage Conservation Branch 333 Quebec Street Victoria, B.C., V8V 1X4	Brian Apland Head (356-1438)	Preservation and Excavation of Archaeology and Heritage Sites	Conflicts of Highway Alignments and Archaeological and Historic Sites	Letter and Key Maps
MINISTRY OF ENERGY, MINES & PETROLEUM RESOURCES				
Mineral Resources Div. Geological Branch 617 Government Street Victoria, B.C., V8V 1X4	Ann Ratel Land Use Coordinator (387-5975)	Engineering & Inspection	Location of Mine Shafts, Mining Activity, Mineral Claims, Reserves	Letter and Mosaic

HIGHWAYS - REGION 6 - 1987-04 (continued)	Person Contacted	Function of Agency	Reason for Contact	Method of Contact
MINISTRY OF AGRICULTURE AND FISHERIES				
South Coastal Region 205 - 33780 Laurel Street Abbotsford, B.C., V2S 1X4	Wayne Wickens Regional Director (852-5211)	Jurisdiction Over Farmland Resources	Affect on Agricultural Operations	Letter with Plans
Commercial Fisheries Branch Marine Resources Section 808 Douglas Street Victoria, B.C., V8W 2Z7	Gordon Halsey Manager (387-9687)	Protection of Marine Resources (Oysters, Clams, etc.)	Effect on oyster beds, Aquaculture	Letter with Plans
B. C. AGRICULTURAL LAND COMMISSION				
4940 Canada Way Burnaby, B.C., V5G 4K6	Ian Paton Chairman (660-7000)	Enforcement of the Land Commission Act (Agricultural Land)	Check on ALR to be alienated. If none, do not submit plans. Compliance with the Act	Letter with Plans
FEDERAL AGENCIES				
FISHERIES & OCEANS CANADA South Coast Division Habitat Management Unit 3225 Stephenson Pt. Road Nanaimo, B.C., V9T 1K3	Rick Higgins Senior Habitat Biologist (756-7284)	Salmon Protection and any Marine Life for coastal areas and river systems	Construction of bridges, installation of culverts and diversion of salmon spawning streams and riprap bank protection	Letter with Plans (Refer to LT 56 - (1975-04-09))
ENVIRONMENT CANADA Canadian Wildlife Service Habitat & Ecological Assessment 5421 Robertson Road P. O. Box 340 Delta, B.C., V4K 3Y3	Laszlo Retfalvi Head (946-8546)	Canadian Wildlife Protection in Northern Regions and Migratory Bird Sanctuaries	Affect on Wildlife and Migratory Birds	Letter with Plans
TRANSPORT CANADA Canadian Coast Guard 224 W Esplanade Street North Vancouver, B.C., V7M 3H7	John Duduman Senior Officer (984-3731)	Navigable Waters Protection Act	Compliance with Act	Letter with Plans

SECTION H

DRAWINGS

	METRIC PEN SIZES	
International Boundary	1.00	
Section Lines & District Lot Bdy.	1.00	
Quarter Section Line	0.70	
Subdivision Boundary	0.35	
Old Road R/W (surveyed)	0.35	
Proposed Highway R/W	1.00	
Easement (state type)	0.35	
Control Lines		0.25 P-Line 23 0.50 L-Line 78
℄ Plan & Grade Line	1.00	
Clearing & Grubbing	0.50	

	PEN SIZE	EXISTING	PEN SIZE	PROPOSED
Road (paved)	0.35	GRAVEL SHOULDER, PAVEMENT EDGE	0.5	
Road (gravel)	0.35	GRAVEL EDGE	0.5	
Guard Rail	0.35	Timber, Steel	0.5	Timber, Steel
No Post Guard Rail	0.35	Conc., Asphalt	0.5	Conc.
Drainage Ditches	0.35	EL 24.1 → 23.8 → 23.5	0.5	→ 7.35 → 7.25
Storm Drains & Sewers	0.35	— s — — s — — s —	0.5	— s — — s — — s
Sanitary Sewer	0.35	— SAN — — SAN —	0.5	— SAN — — SAN —
Retaining Wall	0.35	Timber, Metal Bin, Conc.	1.00	Metal Bin, Conc.

Approved by Director of D & S. [signature] Date 77-08-19 Revised	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH PLAN AND SURVEY SYMBOLS	DESIGN MANUAL No. H.1-1

Water Main — W 200 mm A.C. W 100 mm Plastic W

pen 0.25

Gas Main — G 150 mm L.P., I.P. & H.P. G G

Oil Line — OIL 600 mm T. M. P. L. OIL OIL

Underground Electric Cable — U.E. U.E. U.E.

Underground Telephone Cable — U.T. U.T. U.T.

PROPOSED RELOCATIONS TO BE NOTED AS SUCH

Fence with Gate — show type e.g.: 4 St. B. W. ; C. L.

Fence along Lot lines — Type

Railway — C. P. R. C. N. R.

20 mm 20 mm

- Telephone Poles (show Nº of wires on PTans)
- Power Poles (Hydro)
- Power Pole with Transformer
- Power Pole & Tel. Pole combined
- High Tension Power Poles
- High Tension Power Tower — HT
- Telephone Booth — T
- Telephone Guy Poles
- Dead man
- Power Guy Pole
- Lamp Standard — L S.
- Road Sign

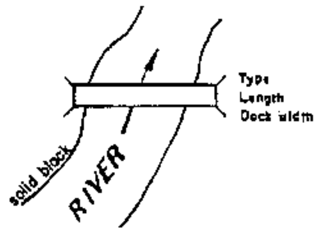
- Fire Hydrant — F.H.
- Gas Valve — G.V.
- Water Valve — W.V.
- Water Meter — W.M.
- Catch Basin existing — C.B.
- " " proposed — C.B.
- Manhole existing — M.H.
- " " proposed — M.H.
- Combined Catch Basin and Manhole — C.B.-M.H.
- Traffic Signal
- Traffic Signal Control Box

Appoved by Director of D. & S. E. E. Readshaw	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS • DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
Date 77-08-19 Revised 83-07	PLAN AND SURVEY SYMBOLS	H.I-2

Culverts existing — 12 m — 300 ø C.S.P.

Culverts proposed — 37 m — 900 ø C.S.P.

Bridge



Curb — Conc. Asphalt

Island Curbing

Sidewalk — Wood Asphalt

Sidewalk — Concrete

Rock wall

Hedge

Wooded area

Trees

Buildings — H

ABBREVIATIONS

House	H.
Shed	SH.
Garage	G.
Chicken H.	Ch.H.
Barn	B.

Show Business Names on Commercial Bldgs.

Swamp

SURVEY SYMBOLS

Witness Post — o Wt.P.

Hub — Δ

Wooden Post — o W.P.

Iron Post — ● I.P.

Monument — ⊙ Mon. Conc.

Sketch showing Land description i.e. Tps., D.L., Secs.

Land ties Δ- - - - - $\frac{34°06'}{120.344}$ - - -● I.P.
Shown on Hardshell only

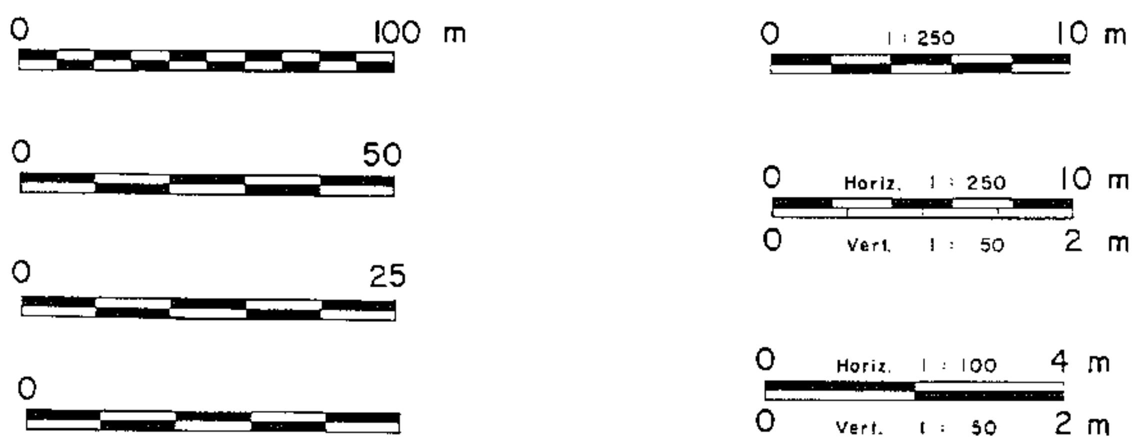
Approved by Director of D. & S.	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS . DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
Date 77–06–19 Revised 82–11–01	PLAN AND SURVEY SYMBOLS	H.1–3

PLAN:		1:500	
		or 1:1000	
RECCE MAPPING:		1:5000	
PROFILE:	Horiz.	1:2000	
	Vert.	1:200	
CROSS SECTION:		1:250	
		or 1:100	
MASS DIAGRAM:	Horiz.	1:5000	
	Vert.	Variable, usually 1cm = 5000m^3	
BRIDGE SITE PLAN:		1:250	

<u>FOR URBAN DESIGN:</u>

PLAN:		1:250
PROFILE:	Horiz.	1:250
	Vert.	1:50
CROSS SECTION:	Horiz.	1:100
	Vert.	1:50
		or 1:25 (optional)

The following Metric Bar Scales are available on Letratape:



Wheelbase Templates are available at scales of 1:250, 1:500 and 1:1000 for:

SU9, WB12, WB15 and WB18 Design Vehicles

ACTUAL SIZE

Leroy Template No.		Pen Width
13	METRIC Standard Leroy Pens 1978–1979–1980–1981	0.13 mm
18	METRIC Standard Leroy Pens 1978–1979–19	0.18
25	METRIC Standard Leroy Pens 1978	0.25
35	METRIC Standard Leroy Pens	0.35
50	METRIC Standard Ler	0.50
70	METRIC Standar	0.70
100	METR Stand	1.00

HALF SIZE REDUCTION

13	METRIC Standard Leroy Pens 1978–1979–1980–1981	0.13 mm
18	METRIC Standard Leroy Pens 1978–1979–19	0.18
25	METRIC Standard Leroy Pens 1978	0.25
35	METRIC Standard Leroy Pens	0.35
50	METRIC Standard Ler	0.50
70	METRIC Standar	0.70
100	METR Stand	1.00

Approved DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
Date: 77-09-19 Revised:	LINE AND TEMPLATE SIZES	H.I-5

RTAC T. No.	(T.R.) Radius mm	1:200	1:250	1:500	1:1000	1:2000	1:5000
		Radius (m) Represented at Scales:					
* 1	90	18	22.5	45	90	180	450
* 2	95	19	23.75	47.5	95	190	475
* 3	100	20	25	50	100	200	500
* 4	105	21	26.25	52.5	105	210	525
* 5	110	22	27.5	55	110	220	550
* 6	115	23	28.75	57.5	115	230	575
* 7	120	24	30	60	120	240	600
* 8	125	25	31.25	62.5	125	250	625
* 9	130	26	32.5	65	130	260	650
*	135	27	33.75	67.5	135	270	675
* 10	140	28	35	70	140	280	700
*	145	29	36.25	72.5	145	290	725
* 11	150	30	37.5	75	150	300	750
* 12	160	32	40	80	160	320	800
* 13	170	34	42.5	85	170	340	850
14	175	35	43.75	87.5	175	350	875
* 15	180	36	45	90	180	360	900
* 16	190	38	47.5	95	190	380	950
* 17	200	40	50	100	200	400	1 000
* 18	210	42	52.5	105	210	420	1 050
* 19	220	44	55	110	220	440	1 100
20	225	45	56.25	112.5	225	450	1 125
* 21	230	46	57.5	115	230	460	1 150
22	237.5	47.5	59.375	118.75	237.5	475	1 187.5
* 23	240	48	60	120	240	480	1 200
* 24	250	50	62.5	125	250	500	1 250
* 25	260	52	65	130	260	520	1 300
26	262.5	52.5	65.625	131.25	262.5	525	1 312.5
*	270	54	67.5	135	270	540	1 350
27	275	55	68.75	137.5	275	550	1 375
* 28	280	56	70	140	280	560	1 400
29	287.5	57.5	71.875	143.75	287.5	575	1 437.5
*	290	58	72.5	145	290	580	1 450
* 30	300	60	75	150	300	600	1 500
* 31	320	64	80	160	320	640	1 600
32	325	65	81.25	162.5	325	650	1 625
* 33	340	68	85	170	340	680	1 700
34	350	70	87.5	175	350	700	1 750
* 35	360	72	90	180	360	720	1 800
36	375	75	93.75	187.5	375	750	1 875
* 37	380	76	95	190	380	760	1 900
* 38	400	80	100	200	400	800	2 000
39	420	84	105	210	420	840	2 100
* 40	425	85	106.25	212.5	425	850	2 125
41	440	88	110	220	440	880	2 200
* 42	450	90	112.5	225	450	900	2 250
43	460	92	115	230	460	920	2 300
* 44	475	95	118.75	237.5	475	950	2 375
45	480	96	120	240	480	960	2 400
* 46	500	100	125	250	500	1 000	2 500
47	525	105	131.25	262.5	525	1 050	2 625
* 48	550	110	137.5	275	550	1 100	2 750
49	560	112	140	280	560	1 120	2 800

RTAC T. No.	(T.R.) Radius mm	1:200	1:250	1:500	1:1000	1:2000	1:5000
		Radius (m) Represented at Scales:					
50	575	115	143.75	287.5	575	1 150	2 875
* 51	600	120	150	300	600	1 200	3 000
52	625	125	156.25	312.5	625	1 250	3 125
53	640	128	160	320	640	1 280	3 200
* 54	650	130	162.5	325	650	1 300	3 250
55	680	136	170	340	680	1 360	3 400
* 56	700	140	175	350	700	1 400	3 500
57	750	150	187.5	375	750	1 500	3 750
58	760	152	190	380	760	1 520	3 800
* 59	800	160	200	400	800	1 600	4 000
60	840	168	210	420	840	1 680	4 200
61	850	170	212.5	425	850	1 700	4 250
* 62	900	180	225	450	900	1 800	4 500
63	950	190	237.5	475	950	1 900	4 750
* 64	1 000	200	250	500	1 000	2 000	5 000
65	1 050	210	262.5	525	1 050	2 100	5 250
66	1 100	220	275	550	1 100	2 200	5 500
67	1 150	230	287.5	575	1 150	2 300	5 750
* 68	1 200	240	300	600	1 200	2 400	6 000
69	1 250	250	312.5	625	1 250	2 500	6 250
70	1 300	260	325	650	1 300	2 600	6 500
71	1 400	280	350	700	1 400	2 800	7 000
* 72	1 500	300	375	750	1 500	3 000	7 500
73	1 600	320	400	800	1 600	3 200	8 000
74	1 700	340	425	850	1 700	3 400	8 500
75	1 750	350	437.5	875	1 750	3 500	8 750
76	1 800	360	450	900	1 800	3 600	9 000
77	1 900	380	475	950	1 900	3 800	9 500
* 78	2 000	400	500	1 000	2 000	4 000	10 000
79	2 100	420	525	1 050	2 100	4 200	10 500
80	2 200	440	550	1 100	2 200	4 400	11 000
81	2 250	450	562.5	1 125	2 250	4 500	11 250
82	2 300	460	575	1 150	2 300	4 600	11 500
83	2 400	480	600	1 200	2 400	4 800	12 000
84	2 500	500	625	1 250	2 500	5 000	12 500
85	2 600	520	650	1 300	2 600	5 200	13 000
86	2 800	560	700	1 400	2 800	5 600	14 000
* 87	3 000	600	750	1 500	3 000	6 000	15 000
88	3 200	640	800	1 600	3 200	6 400	16 000
89	3 400	680	850	1 700	3 400	6 800	17 000
90	3 500	700	875	1 750	3 500	7 000	17 500
91	3 600	720	900	1 800	3 600	7 200	18 000
92	4 000	800	1 000	2 000	4 000	8 000	20 000
93	4 400	880	1 100	2 200	4 400	8 800	22 000
94	4 500	900	1 125	2 250	4 500	9 000	22 500
* 95	5 000	1 000	1 250	2 500	5 000	10 000	25 000
96	6 000	1 200	1 500	3 000	6 000	12 000	30 000
97	7 000	1 400	1 750	3 500	7 000	14 000	35 000
* 98	8 000	1 600	2 000	4 000	8 000	16 000	40 000
99	9 000	1 800	2 250	4 500	9 000	18 000	45 000
100	10 000	2 000	2 500	5 000	10 000	20 000	50 000
101	12 000	2 400	3 000	6 000	12 000	24 000	60 000
102	14 000	2 800	3 500	7 000	14 000	28 000	70 000

This table gives template radii for various scale ratios. If the radius in the field (m) is entered under the represented plan ratio, the Template Radius (mm) and the Template Number (T.No.) can be read off to the left of the table.

1) $\text{T.R.} = \dfrac{\text{R.f. x 1000}}{\text{scale ratio}}$

2) $\text{R.f.} = \dfrac{\text{T.R. x scale ratio}}{1000}$

T.R. = Template Radius in mm
R.f. = Radius in the field (m)
T.No. = Template Number

Example 1

Given: R.f. = 200 m
Plan ratio 1:500

Find: T.R. and T.No.

Sol'n: from (1) $\text{T.R.} = \dfrac{200 \text{ x } 1000}{500}$

$\underline{\text{T.R.}}$ = 400 mm

$\underline{\text{T.No.}}$ = 38

Example 2

Given: R.f. = 400 m
Plan ratio 1:1000

Find: T.R. and T.No.

Sol'n: from (1) $\text{T.R.} = \dfrac{400 \text{ x } 1000}{1000}$

$\underline{\text{T.R.}}$ = 400 mm

$\underline{\text{T.No.}}$ = 38

Example 3

Given: T.No. 59
T.R. = 800 mm
Plan ratio 1:250

Find: R.f.

Sol'n: from (2) $\text{R.f.} = \dfrac{800 \text{ x } 250}{1000}$

$\underline{\text{R.f.}}$ = 200 m

APPROVED

DIRECTOR DESIGN AND SURVEYS

DATE 83 - 07

REVISED

B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

METRIC CIRCULAR CURVE TEMPLATES

DESIGN MANUAL No.

H.I-6

1. Symbols are printed in roman (upright) type:

   m g °C s L ha

2. Symbols are printed in lower-case letters:

   g for gram m for metre

   Exception: When the unit is derived from a proper name:
   N for newton A for ampere

   Note: When proper name units are written out in full, only Celsius takes a capital.

3. For prefix symbols use roman (upright) type without spacing between the prefix symbol and the unit symbol:

   kg for kilogram mL for millilitre

4. Symbols are never pluralized:

   1 g, 45 g (not 45 gs) 1 km, 123 km (not 123 kms)

5. Never use a period after a symbol, except when the symbol occurs at the end of a sentence:

   The length of the room is 12 m.

6. Use a full space between the quantity and the symbol:

   35 g (not 35g) 50 m 1.59 ha

   Exception: When the first character of a symbol is not a letter, no space is left -
   37°C 78°14'30"

7 Use symbols instead of writing out unit names:

   12 t (not 12 tonnes) 16.7 m² (not 16.7 sq. metres)

   Exception: When quantity is also written out -
   The train travelled sixty kilometres in one hour.

APPROVED: DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No
DATE 79-05-07 REVISED	BASIC RULES FOR SI SYMBOL USE	H.1-6.1

8. Use decimals, not common fractions:
   0.25 g (not 1/4 g)   4.75 m (not 4 3/4 m)

9. Use a zero in front of a decimal point:
   0.433 ha (not .433 ha)

10. For division, use a solidus (/):
    km/h (not kmph or km per h) m/s^2 kg/m^3

11. Use spaces to separate groups of three digits with respect to the decimal point:
    32 495.446 075   2 450 600.374 12

    Exceptions: i) A space is unnecessary if there are only four digits to the left or right of the decimal, unless such numerals are listed in a column with other numerals of five digits or more.

    ii) A comma is used for monetary values
    $10,000 $39,406.24

12. The product of two or more units in symbolic form is indicated by a dot: N·m   Pa·s   J/(kg·°C) $kg \cdot m/s^2$

OPTIONAL ADOPTIONS

All Numeric Dates:

Instead of July 1, 1979, write 1979-07-01
or 1979 07 01

All Numeric Times:

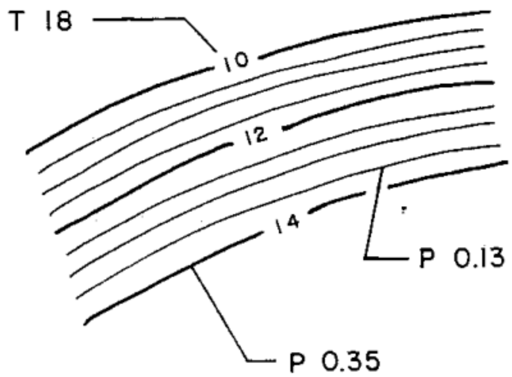
Instead of	12:30 a.m., write	00:30	zero thirty
	7:15 a.m.	07:15	seven fifteen
	12:20 p.m.	12:20	twelve twenty
	4:00 p.m.	16:00	sixteen (hours)
	10:30 p.m.	22:30	twenty-two thirty

APPROVED for DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 79-05-07 REVISED 81-07-16	BASIC RULES FOR SI SYMBOL USE	H.1-6.2

SITE PLAN

1:250

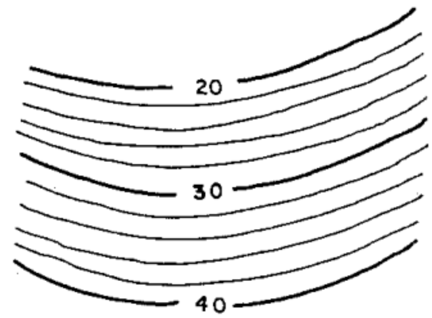
Use 0.5m contour intervals.



PLAN

1:500

Use 2m contour intervals, accentuate 10m contours.



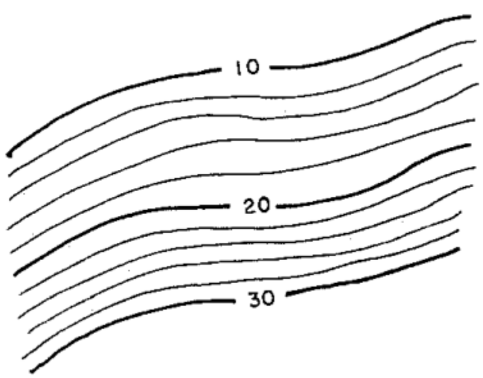
NOTE: Metric Leroy Lettering Templates used.

T = Template number
P = Pen size

PLAN

1:1000

Use 2m contour intervals, accentuate 10m contours.



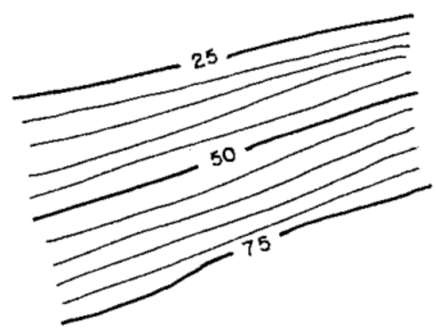
KEY PLANS: Variable Scales

Use 2m, 5m, or 10m contours.

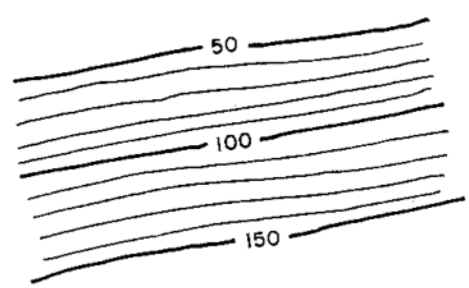
MAPPING RECCE TYPE

1:5000

For 5m contour intervals, accentuate 25m contours.



For 10m contour intervals, accentuate 50m contours.



APPROVED	B.C. MINISTRY OF TRANSPORTATION AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DIRECTOR DESIGN AND SURVEYS	CONTOUR INTERVALS	H.1-7
DATE 79-09-24		
REVISED 83-07		

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS
DESIGN AND SURVEYS BRANCH

PROJECT NAME

(to be on all drawings and part of all correspondence)

PREPARED UNDER THE DIRECTION OF			RECOMMENDED		ACCEPTED FOR CONSTRUCTION
DATE			DIRECTOR OF HIGHWAY DESIGN AND SURVEYS DATE		EXECUTIVE DIRECTOR ENGINEERING DATE
INDEX	NEG. No.	FILE No.	PROJECT No.	REGION	DRAWING No.
		Note 1.	Note 2.		Note 3.

NOTES:

1. This is the Design and Surveys Headquarters correspondence file number. Quote this number and the project name on all correspondence with the Branch.

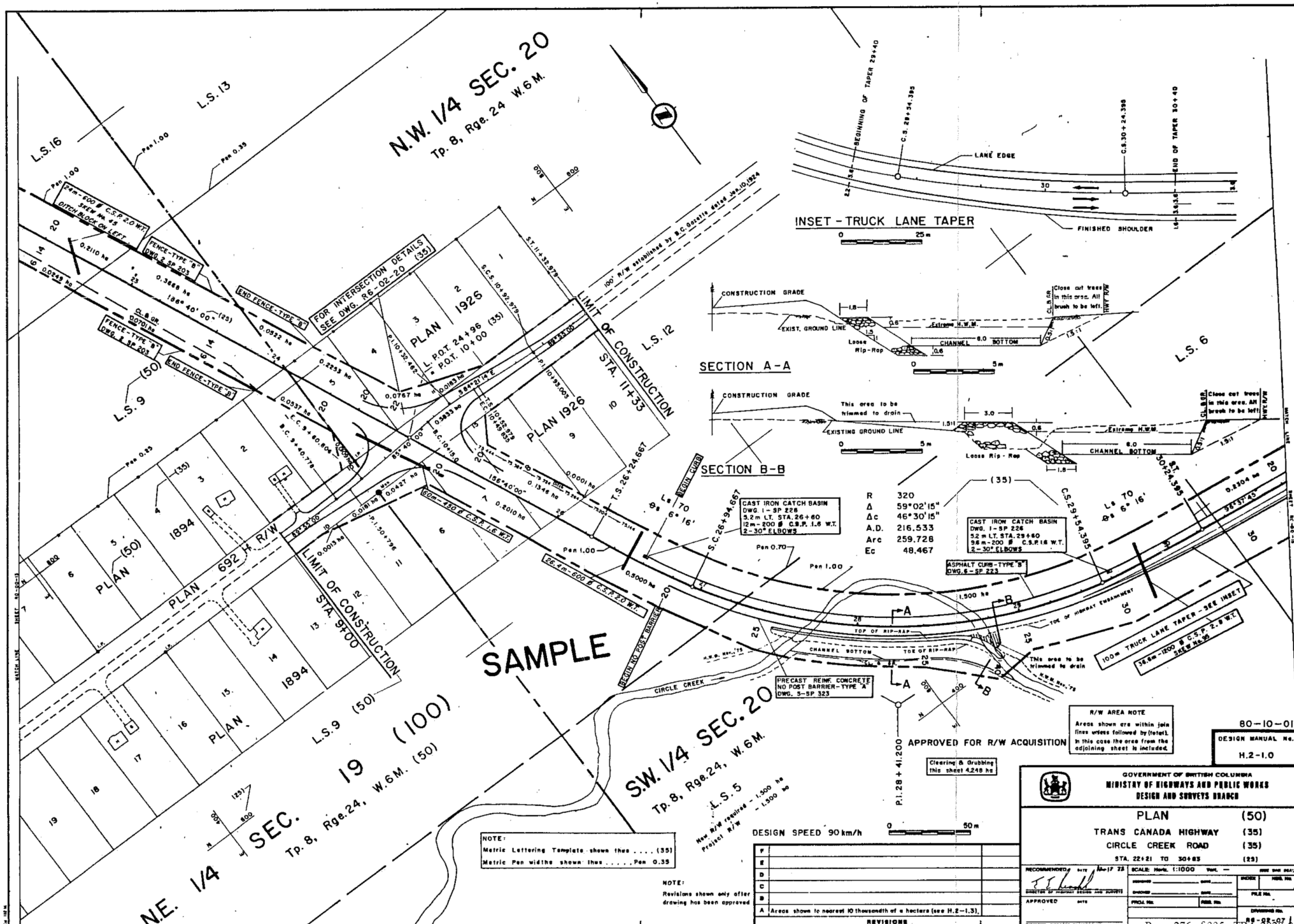
2. This number is issued only after funds have been allocated for the construction of the project. This is an identification and book-keeping number. After issue, quote this number, the correspondence number and the project name for all correspondence with this Branch.

3. This is the Project Drawings designation number for each project. This number indicates the Region encompassing all or most of the project, the drawing series, and the sheet number within that series.

EXAMPLE: 'R6-16-01'

'R6-16' -indicates Region 6, drawing series 16 and is unique to this project.

'01' -indicates that this is drawing number on in the series. This is usually the Key Map Title Page.


N.W. 1/4 SEC. 20
Tp. 8, Rge. 24 W.6 M.
L.S. 16
L.S. 13
L.S. 12
L.S. 9
L.S. 6
L.S. 5
24m-600 Ø C.S.P. 2.0 W.T. SKEW No. 45 DITCH BLOCK ON LEFT
FENCE-TYPE "B" DWG. 2 SP 203
END FENCE-TYPE "B"
FOR INTERSECTION DETAILS SEE DWG. R6-02-20 (35)
PLAN 1926
L. P.O.T. 24+96 (35)
P.O.T. 10+00
LIMIT OF CONSTRUCTION STA. 11+33
LIMIT OF CONSTRUCTION STA. 9+00
100' R/W established by B.C. Gazette dated Jan. 10, 1924
PLAN 692 H R/W
PLAN 1894
60m-450 Ø C.S.P. 1.6 W.T.
26.4m-600 Ø C.S.P. 2.0 W.T.
BEGIN CURB
BEGIN NO POST BARRIER
T.S. 26+24.667
S.C. 26+94.667
C.S. 29+54.395
S.T. 30+24.395
CIRCLE CREEK
SAMPLE
INSET - TRUCK LANE TAPER
BEGINNING OF TAPER 29+40
C.S. 29+34.395
C.S. 30+24.395
END OF TAPER 30+40
LANE EDGE
FINISHED SHOULDER
SECTION A-A
SECTION B-B
CONSTRUCTION GRADE
EXIST. GROUND LINE
Loose Rip-Rap
CHANNEL BOTTOM
Extreme H.W.M.
Close cut trees in this area. All brush to be left.
This area to be trimmed to drain
R 320
Δ 59°02'15"
Δc 46°30'15"
A.D. 216.533
Arc 259.728
Ec 48.467
CAST IRON CATCH BASIN DWG. 1-SP 226 5.2m LT. STA. 26+60 12m-200 Ø C.S.P. 1.6 W.T. 2-30° ELBOWS
CAST IRON CATCH BASIN DWG. 1-SP 226 52 m LT. STA. 29+60 96 m-200 Ø C.S.P. 1.6 W.T. 2-30° ELBOWS
ASPHALT CURB-TYPE "B" DWG. 6-SP 223
PRECAST REINF. CONCRETE NO POST BARRIER-TYPE "A" DWG. 5-SP 323
100m TRUCK LANE TAPER - SEE INSET
36.6m-1200 Ø C.S.P. 2.8 W.T. SKEW No. 35
TOP OF RIP-RAP
TOE OF HIGHWAY EMBANKMENT
SW. 1/4 SEC. 20
Tp. 8, Rge. 24, W.6 M.
New R/W required - 1.500 ha
Project R/W - 1.300 ha
NE. 1/4 SEC. 19 (100)
Tp. 8, Rge. 24, W.6 M. (50)
P.I. 28+41.200
APPROVED FOR R/W ACQUISITION
Clearing & Grubbing this sheet 4.248 ha
R/W AREA NOTE
Areas shown are within join lines unless followed by (total). In this case the area from the adjoining sheet is included.
80-10-01
DESIGN MANUAL No. H.2-1.0
DESIGN SPEED 90 km/h
NOTE: Metric Lettering Template shown thus ....(35) Metric Pen widths shown thus .....Pen 0.35
NOTE: Revisions shown only after drawing has been approved
A Areas shown to nearest 10 thousandth of a hectare (see H.2-1.3).
REVISIONS
GOVERNMENT OF BRITISH COLUMBIA
MINISTRY OF HIGHWAYS AND PUBLIC WORKS
DESIGN AND SURVEYS BRANCH
PLAN (50)
TRANS CANADA HIGHWAY (35)
CIRCLE CREEK ROAD (35)
STA. 22+21 TO 30+83 (25)
SCALE: Horiz. 1:1000
RECOMMENDED
APPROVED

On all existing highway design projects, the Landmark Inventory reference must be shown on the Title - Key Plan Drawing and on the title of the Schedule of Approximate Quantities and Unit Prices as follows:

LANDMARK INVENTORY - SEGMENT__________

KM__________TO KM__________

NOTE: This is the distance along the existing road and is likely to be longer than the length of project defined by the re-survey.

1. Prior to the finalization of a design project, a set of preliminary plans shall be submitted to the Regional Approving Officer with a copy of the memo to the Regional Director requesting assessment of access. The plans shall show all cadastral and existing entrances, together with the proposed treatment of access.

2. A summary listing of all accesses and their proposed treatment shall accompany the above plans. State whether each individual entrance is retained, relocated, or closed and connected to an existing or proposed access road.

3. A copy of the final summary shall be sent to the Director of Property Services at the time the plans are submitted to the Executive Director, Engineering Division for approval.

1. Any area less than 1 hectare to be shown to the nearest 0.0001 ha.

2. All areas larger than 1 hectare to be shown to the nearest 0.001 ha.

3. On plans, hectares to be shown between the join lines.

4. Hectares to be shown as required in subdivided areas, but not summarized except for clearing and grubbing.

5. Hectares to be shown as required in all other areas, and summarized using the following format if applicable:

New R/W required	-	1.211	ha
Old R/W inside	-	0.8232	ha
Project R/W	-	2.034	ha
Old R/W outside	-	2.113	ha
Clearing and Grubbing	-	2.034	ha

6. Areas to be shown when the remainder of a severed large parcel is less than 1 hectare.

7. For Urban Street Design Projects, all right-of-way areas to be shown to the nearest 0.1 of a square metre. Areas are to be calculated using applicable geometry. Do NOT use planimeter.

For planimeter conversion factors see G.T. 4

There has been some confusion regarding the method of handling old road areas on our plans in the cases where the old road does not have a surveyed right of way, or its boundary has not been established by adjacent subdivision.

The following procedure shall be followed:

1. All old roads are to be checked with the Regional Office for possible "Gazette notice". If a Gazette notice is in existence, then the Gazetted width shall be indicated on the plans with a symbol similar to that used for "Clearing and Grubbing" and labelled as "R/W established by B.C. Gazette dated __________".

2. If a Gazette notice is not in existence, then the area of existing roads shall be that of the "travelled way". The travelled way is defined as the width between the outer edges of the road shoulders. It is necessary, therefore, to show on the plans the plotted position of the edge of shoulders obtained by occasional measurement. The area shall be calculated by estimating the average width within each lot.

APPROVED BY 77-11-29 DATE	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No
REVISED	OLD ROAD AREAS	H.2-1.4

1. All project drawings are to be traced with the chainage running from left to right.

2. It is preferable to have the north arrow up, and thus when a survey is assigned the direction of chainage shall be set accordingly. (e.g. west to east)

3. All bearings shown on plans should be set out in the full-circle system, clockwise from North.

4. Property Services must have the approved project plan for right-of-way purchase, but if the design details are not complete, then the following should be added to the project plan as an interim step.

APPROVED FOR R/W ACQUISITION

DIRECTOR OF DESIGN AND SURVEYS

EXECUTIVE DIRECTOR ENGINEERING

DATE______________________

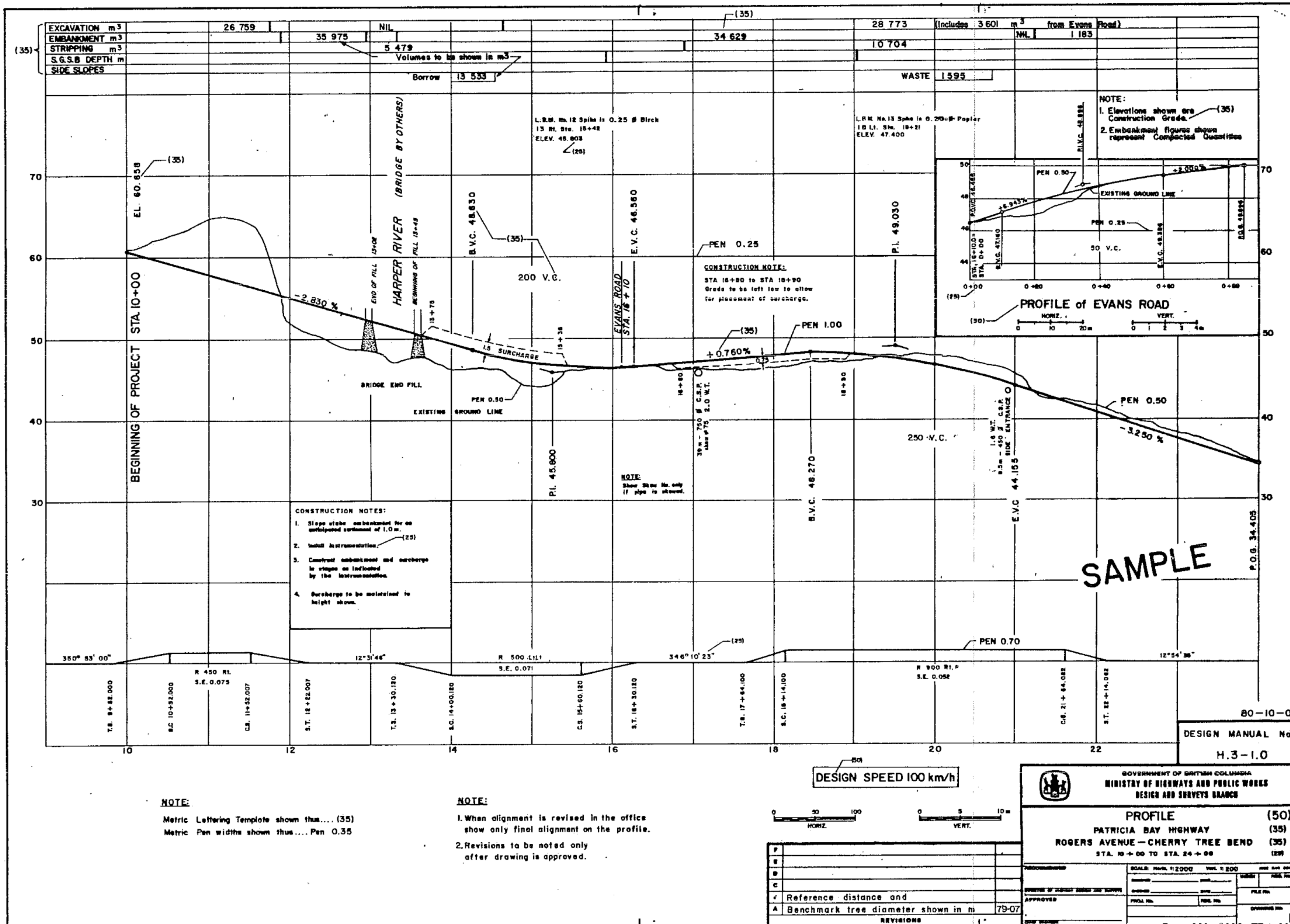
APPROVED DIRECTOR DESIGN AND SURVEYS	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DATE 1979-12-07 REVISED	PROJECT DRAWINGS	H.2-1.7

1. Once a project drawing has been approved by the Executive Director Engineering any further alterations or amendments must be recorded in the space provided.

2. If an approved project plan is amended, either the original or seven prints are to be submitted to the Director of Property Services.

3. A major revision which completely alters the intent of the original approved drawing must be reapproved.

4. When a project plan drawing is amended to show right-of-way as purchased, do not remove the original boundary or area. Show the amended right-of-way boundary with a slightly heavier line and note the increase or decrease in area.



EXCAVATION m3
EMBANKMENT m3
STRIPPING m3
S.G.S.B DEPTH m
SIDE SLOPES
26 759
NIL
35 975
5 479
Volumes to be shown in m3
Borrow 13 533
34 629
28 773 (Includes 3 601 m3 from Evans Road)
NIL 1 183
10 704
WASTE 1 595
NOTE:
1. Elevations shown are Construction Grade.
2. Embankment figures shown represent Compacted Quantities
BEGINNING OF PROJECT STA. 10+00
EL. 60.658
HARPER RIVER (BRIDGE BY OTHERS)
END OF FILL 13+02
BEGINNING OF FILL 13+45
B.V.C. 48.630
200 V.C.
E.V.C. 46.560
EVANS ROAD STA. 16+10
-2.830 %
1.5 SURCHARGE
BRIDGE END FILL
EXISTING GROUND LINE
PEN 0.50
PEN 0.25
PEN 1.00
P.I. 45.800
L.B.M. No. 12 Spike in 0.25 Ø Birch 13 Rt. Sta. 15+42 ELEV. 45.603
L.B.M. No. 13 Spike in 0.20 Ø Poplar 10 Lt. Sta. 19+21 ELEV. 47.400
CONSTRUCTION NOTE: STA 16+80 to STA 18+90 Grade to be left low to allow for placement of surcharge.
+0.760%
P.I. 49.030
B.V.C. 46.270
250 V.C.
E.V.C. 44.155
-3.250 %
PEN 0.50
P.O.G. 34.405
NOTE: Show Skew No. only if pipe is skewed.
PROFILE of EVANS ROAD
CONSTRUCTION NOTES:
1. Slope stake embankment for an anticipated settlement of 1.0 m.
2. Install instrumentation.
3. Construct embankment and surcharge in stages as indicated by the instrumentation.
4. Surcharge to be maintained to height shown.
SAMPLE
PEN 0.70
350° 53' 00"
R 450 Rt. S.E. 0.075
12°31'46"
R 500 Lt. S.E. 0.071
346°10'23"
R 900 Rt. S.E. 0.052
12°54'38"
80-10-01
DESIGN MANUAL No. H.3-1.0
DESIGN SPEED 100 km/h
NOTE:
Metric Lettering Template shown thus.... (35)
Metric Pen widths shown thus.... Pen 0.35
NOTE:
1. When alignment is revised in the office show only final alignment on the profile.
2. Revisions to be noted only after drawing is approved.
GOVERNMENT OF BRITISH COLUMBIA
MINISTRY OF HIGHWAYS AND PUBLIC WORKS
DESIGN AND SURVEYS BRANCH
PROFILE (50)
PATRICIA BAY HIGHWAY (35)
ROGERS AVENUE—CHERRY TREE BEND (35)
STA. 10+00 TO STA. 24+00
Reference distance and Benchmark tree diameter shown in m 79-07
REVISIONS

Form H 759

OVERHAUL

MINISTRY OF HIGHWAYS AND PUBLIC WORKS
DESIGN AND SURVEYS BRANCH

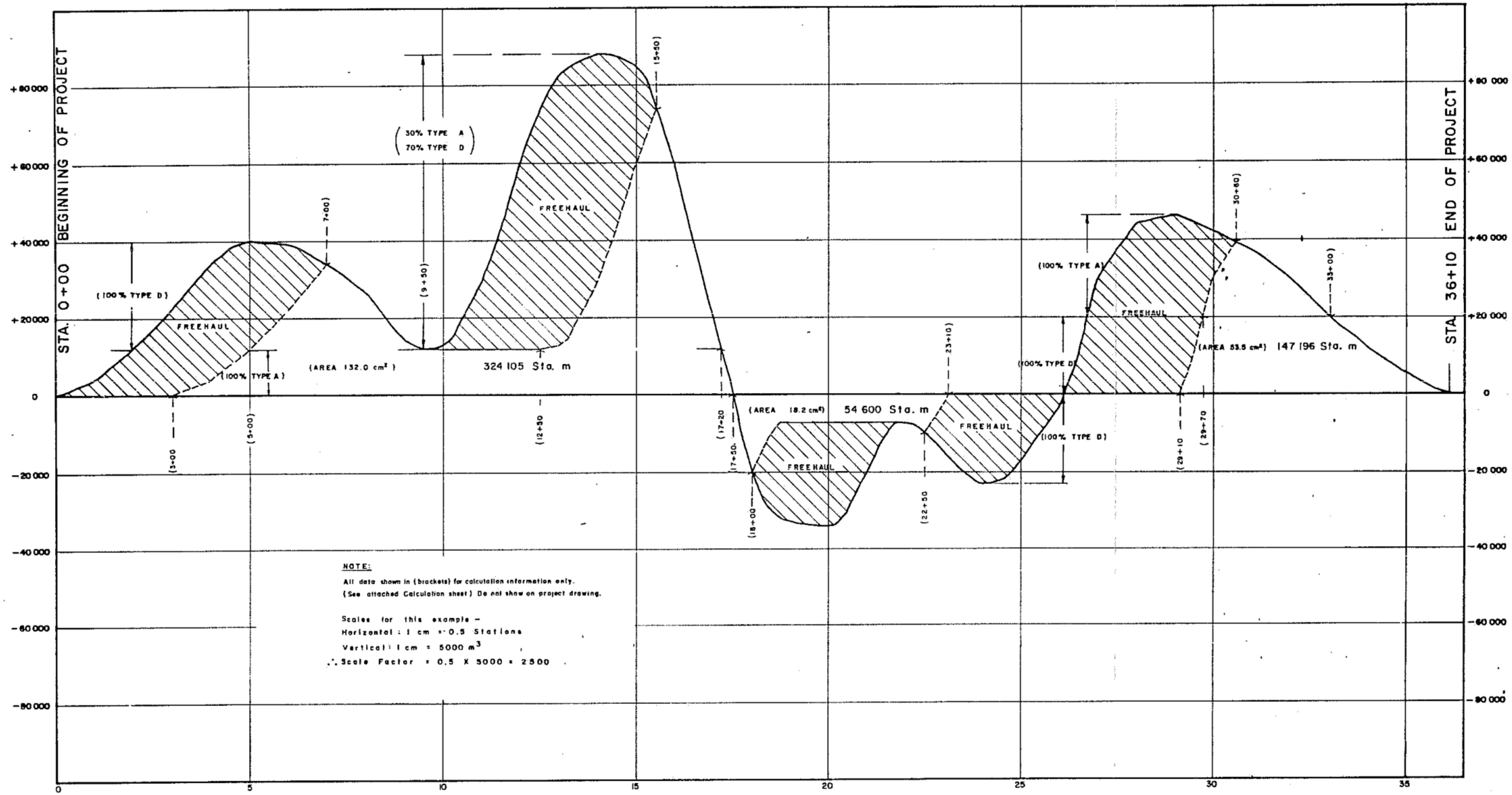
Made by: M. E. Date: 77-06-30
Checked by: J.A.C. Sheet 1 of 1

A		B	C	D	E	F
STATIONS	STATIONS	AREA (cm^2)	SCALE FACTOR (see note)	MATERIAL TYPE	FACTOR	OVERHAUL Sta.m (BxCxDxE)
3+00 5+00	17+20 17+50	63.6	2500	100%A	0.833	132 447
5+00 7+00	9+50	19.2	2500	100%D	1.20	57 600
12+50 15+50	17+20	49.2	2500	30%A	0.833	30 738
12+50 15+50	17+20	49.2	2500	70%D	1.20	103 320
						324 105
17+50 18+00	22+50 23+10	18.2	2500	100%D	1.20	54 600
29+10 29+70	33+00 36+10	39.0	2500	100%D	1.20	117 000
29+70 30+60	33+00	14.5	2500	100%A	0.833	30 196
						147 196
					TOTAL	525 901

NOTE: Scales for this example
Horiz.: 1 cm = 0.5 Sta.
Vert. : 1 cm = 5000 m^3
∴ Scale Factor = 0.5 x 5000
= 2500

NOTE: To be used in conjunction with Design Manual No. H.5-1.1
On SCHEDULE we show overhaul quantities in 1000 Sta.m
therefore, divide above Sta.m by 1000 and show: 526

APPROVED	B.C. MINISTRY OF TRANSPORTATION, COMMUNICATIONS AND HIGHWAYS DESIGN AND SURVEYS BRANCH	DESIGN MANUAL No.
DIRECTOR DESIGN AND SURVEYS	OVERHAUL	H.5-1.0
DATE 77-06-30 REVISED 82-04-26		



82–02–27

DESIGN MANUAL No.
H.5–1.1

VOLUME OVERHAUL SUMMARY

525 901 Station m

Definition:
Sta. m is 1 m³ hauled one station (100 m).

NOTE:

This VOLUME OVERHAUL DIAGRAM is a plot on which shrinkage and swell adjustment factors have been applied to the excavation quantities. The vertical scale should therefore not be used to scale in situ excavation quantities to be overhauled.
The haul figures shown represent the actual estimated unadjusted excavation quantites.

F	
E	
D	
C	
B	
A	
REVISIONS	

GOVERNMENT OF BRITISH COLUMBIA
MINISTRY OF HIGHWAYS AND PUBLIC WORKS
DESIGN AND SURVEYS BRANCH

VOLUME OVERHAUL DIAGRAM

PATRICIA BAY HIGHWAY
ROGERS ROAD – ROYAL OAK AVE.
STA. 0+00 TO STA. 36+10

RECOMMENDED Nov-17 '78
DIRECTOR OF HIGHWAY DESIGN AND SURVEYS
APPROVED
CHIEF ENGINEER

SCALE: Horiz. 1cm = 50m Vert. 1 cm = 5000 m³
DESIGNED ____ DATE ____
CHECKED ____ DATE ____
PROJ. No.
REG. No.
INDEX
NEG. No.
FILE No.
DRAWING No. 1

The following materials are to have their own quantity and haul* charts:-

1. High Fines 25 mm Surfacing Aggregate
2. Crushed Base Course Aggregates;
   -Nominal maximum sizes can be 25, 50 or 75 mm.
   -Specified as Well, Intermediate or Open Graded.
3. Select Granular Sub-Base
4. Gravel Facing
5. Gravel Blankets
6. Gravel Filter Layers
7. Bridge End Fills
8. Structural Backfill for Bin Walls and Structural Steel Plate Culverts over 3650 mm diameter

*Haul not applicable if the material(s) to be supplied in place.

CHAPTER C

CROSS SECTION ELEMENTS

CHAPTER C

CROSS SECTION ELEMENTS

CHAPTER C

CROSS SECTION ELEMENTS
(Continued)

CHAPTER C

Tables

CHAPTER C

Figures

CHAPTER C

Figures
(Continued)

CHAPTER C

CROSS SECTION ELEMENTS

C.1 INTRODUCTION

C.1.1 General considerations

For driver safety and convenience, wide traffic lanes, shoulders and gently sloping unobstructed border areas are desirable as they add forgiving qualities for minor errors of driver judgement and promote ease of operation. Ideally, for two-lane highways, 3.7 m lanes and 3.0 m shoulders are desirable. The cross section of a street or highway provides accommodation for moving and parked vehicles, pedestrians, drainage and public utilities. The factors that determine the cross section follow:

- Type, volume and mode of operation of the vehicles using the road
- Volume of pedestrians
- Topography traversed by the route
- Materials used in construction and the native materials of the site
- Local climatological conditions, in particular, exposed roads susceptible to drifting snow
- Adjacent sections of road (including sight distances, proximity of intersections, bridges and connecting roadways)
- Safety
- Aesthetic considerations
- Maintenance procedures
- Construction practice.

A set of cross section standards is presented in Figures C13.1 to C13.13. Alternatives to the standards might be appropriate to accommodate particular conditions, and variations should tend to improve the quality of the road. For this reason, careful consideration should be given to the function of the cross section element before lowering the standard.

Where economically feasible, as in flat terrain, or where large truck combinations are prevalent, the 7.4-m width of surface for two-lane roads is desirable. Alternatively, on local roads with design speeds of 80 km/h or less, on severe terrain and where the volume of trucks is low, the lower surface widths, as shown on the standards, are appropriate.

Overall right-of-way dimensions are not shown in the Manual. In addition to providing sufficient right-of-way to accommodate the road elements, consideration should be given to allowing right-of-way for future road expansion, utilities, landscaping and provision of environmental features such as noise barriers. Right-of-way width is, therefore, a planning dimension rather than a design dimension.

C.1.2 Dimensions*

All cross section dimensions are stated in metres or millimetres. In general, horizontal dimensions are stated in metres and vertical dimensions are stated in metres where they are greater than one metre and in millimetres where they are less than one metre. Cross slope and superelevation are normally stated in terms of vertical rise in metres over a horizontal distance of one metre, for example, 0.02 m/m. However, it is the practice of some road authorities to state cross slope and superelevation as a percentage to simplify plans and to minimize drafting time.

It is advantageous to maintain the dimensions of horizontal cross section elements as a multiple of a standard increment, to facilitate design practice and construction layout. In this Manual the dimensions of horizontal cross section elements are multiples of 0.1 m, and all standards are given on this basis. An increment of 0.25 m is used by some road authorities.

There might be occasions where a standard design element has a cross section element dimension other than a multiple of 0.1 m, for example a gutter width or median barrier width. In such cases it is useful to select an adjacent element dimension of increment other than 0.1 m so that the overall dimensions are maintained at multiples of 0.1 m. For example, if a standard concrete median barrier had a width of 0.65 m the adjacent shoulder width may be selected so that the median width made up of two shoulders and the barrier is a multiple of 0.1 m.

Subsurface dimensions are not shown, as they are beyond the scope of this Manual.

C.1.3 Stage construction

It is good design practice to consider the need for future expansion of a road facility to provide additional capacity or, perhaps, to convert a road to a different classification. This is particularly important in the design of a cross section and selection of cross section elements and their dimensions.

Change in land use of the area during the foreseeable life of the road, that might affect its classification, is recognized; for example, a road may be classified as rural initially but may become urban several years later.

In selecting cross section elements it is prudent to approach the design in two ways:

a) Determine the ultimate requirements of the road in terms of classification, design speed, level of service and service volumes, and design a suitable cross section. For the first and any intermediate stages, the cross section consists only of those elements of the cross section that are required to meet immediate needs. Additional elements can then be added in the future as required without wasting capital expenditures made initially.

b) Determine initial requirements and adjust the dimensions so as to allow for future expansion should it be required.

Approach (a) is the better approach, but depends on knowing what the ultimate requirements will be at the outset. This is often not known or might be known in general terms only, in which case Approach (b) might be appropriate. Often in practice, knowledge of future requirements is limited and the designer may consider both approaches in selecting cross section elements.

To illustrate the above by an example, the design of a 4-lane rural freeway is considered. If the road is to be built in an area that is rural and could never conceivably become urban, the appropriate design is a 4-lane rural freeway cross section. Alternatively, if the area is presently rural but is on the fringe of a major metropolitan area, a different planning approach is appropriate. If sufficient right-of-way is being protected for a future urban freeway the ultimate design is that of an urban freeway, providing the appropriate number of lanes for the ultimate requirement. For the first stage all but four lanes are omitted and the cross section may well be similar to that of a rural freeway. Cross section considerations for the first and subsequent stages of a facility are dependent on the expected growth of traffic demands in each time frame.

In some cases it may be economical to provide the earth grading for the ultimate cross section at the first stage of construction.

Most urban freeways will ultimately require 6 or more lanes and 4-lane urban freeways are rare.

Widening of 2-lane rural arterial roads to multi-lane undivided or divided highways usually takes place on the outside and culverts are extended at the time of the widening. Bridges at underpasses may be built to the ultimate design in the initial stage. Sometimes a 2-lane rural arterial is converted to a 4-lane divided arterial or rural freeway by twinning the existing 2-lane roadway. In this case the dimensions of the future cross section are determined so that the initial roadway can be properly located within the right-of-way to accommodate future expansion.

Freeways are usually widened in the median so that ramps and bridge structures are unaffected at later stages. In this way the critical dimensions in the cross section to allow for future expansion are lane width, shoulder width, and median width.

In the case of urban arterial roads, provision for future lanes is usually made in the median. Existing arterial roads for which provision was not made are normally widened on the outsides.

C.1.4 Chapter format

In the following sections of the chapter, each cross section element is discussed and standard dimensions are presented, in many cases using tables and figures interspersed with the text. At the end of the chapter, Figures C.13.1 to C.13.13 present a composite of typical cross section dimensions for each road classification.

C.1.5 Safety

Safety is a fundamental consideration in cross section design and influences the selection of dimensions of most cross section elements. The safety aspect is discussed in the following sections, and reference may also be made to Chapter F, Traffic Barriers in cross section design.

C.2 LANE WIDTH

C.2.1 Introduction

Lane width and condition of the road surface have a significant influence on the safety and comfort of the travelling public.

Studies on 2-lane two-way highways have shown that inadequate vehicle lateral clearance and edge-of-pavement clearance occur on lanes less than 3.5 m wide when carrying even moderate volumes of mixed traffic. To provide desirable clearance between trucks, lane widths of 3.7 m might be required. It is generally desirable to maintain this width on higher speed 2-lane roads. Traffic volumes and composition are also considerations.

The capacity of a road is markedly affected by lane width. For example, the capacity of a 2-lane rural road is reduced by 23% if the lane width is 3.0 m instead of 3.7 m; and for a 4-lane undivided highway the capacity is similarly reduced by 12%. In terms of capacity the effective width is further reduced by lateral obstructions less than 2.0 m from the edge of pavement or narrow shoulders.

In general, safety increases with wider lanes up to a width of 3.7 m. Lane width greater than 3.7 m does not offer further increased safety.

C.2.2 Through lanes

Standard through lane widths shown in this Manual increase in increments of 0.2 m, with one exception, as follows:3.0 m, 3.1 m, 3.3 m, 3.5 m, 3.7 m. Values for lane widths for various classifications of roads are set out in the following paragraphs and are also shown together with other cross section elements in Figures C.13.1 to C.13.13. Variations of the desirable design standards might be appropriate as outlined below:

Higher design speeds warrant wider lanes. In addition wider lanes are normally appropriate:

- for major highways which typically carry high volumes over long distances between important regional centres
- where warranted by type, size and volume of commercial traffic
- in rugged terrain narrower lanes may be appropriate by reason of cost and this consideration is reflected in the selection of design speed.

Lane widths for 2-lane rural roads are shown in Table C.2.2a by classification for a range of design speeds and design hour volumes.

Lane widths for undivided rural multi-lane roads; and for all divided rural roads are related to design speed as in Table C.2.2b.

Lane widths for undivided urban roads vary with design speed and classification, and are shown in Table C.2.2c.

Lane widths for divided urban roads having two or more lanes in each direction are related to design speed and are shown in Table C.2.2d. For divided urban roads such as a collector in a residential suburban area, roads having one lane in each direction, lane width is 4.6 m.

Table C.2.2a
Lane width for 2-lane rural roads

design speed km/h	RLU	RCU design hour volume <250	RCU 250-450	RCU >450	RAU design hour volume <450	RAU >450
50	3.0					
60	3.0	3.0	3.3	3.5		
70	3.0	3.0	3.3	3.5		
80	3.0	3.3	3.5	3.7	3.5	3.7
90	3.3	3.5	3.5	3.7	3.5	3.7
100	3.3	3.5	3.5	3.7	3.5	3.7
110					3.7	3.7
120					3.7	3.7
130					3.7	3.7

(classification and design hour volume)

Table C.2.2b
Lane width for multi-lane and divided rural roads

design speed	lane width
less than 100 km/h	3.5 m
100 km/h and greater	3.7 m

Table C.2.2c
Lane width for undivided urban roads

design speed km/h	classification ULU	UCU	UAU
30	3.0		
40	3.0		
50	3.0	3.3	3.5
60		3.5	3.5
70		3.5	3.7
80		3.7	3.7

Table C.2.2d
Lane width for divided urban roads

design speed	lane width
less than 80 km/h	3.5 m
80 km/h and greater	3.7 m

C.2.3 Auxiliary lanes

Auxiliary lanes are traffic lanes provided in addition to those which are intended for normal through travel. They are usually relatively short, and each auxiliary lane is introduced for a specific function. Auxiliary lanes may be divided into the following groups:

- right-turn lanes
- left-turn lanes
- continuous left-turn lanes
- acceleration and deceleration lanes
- weaving lanes
- truck-climbing lanes
- passing lanes
- left-turn slip-around lanes

Standard widths for auxiliary lanes are the same for all classifications of road and are summarized in Table C.2.3.

C.2.3.1 Turning lanes

Right-turn lanes added to the right of through lanes ahead of intersections allow right-turning traffic to slow down before making the turn, without interfering with following through traffic, and provide additional capacity at intersections. The lane may or may not lead directly into a right-turning roadway. The standard widths are either the same as the adjacent lane width or 0.2 m less, but not less than 3.3 m.

Left-turn lanes added to the left of through traffic lanes provide a refuge for left- turning traffic waiting to make the turn and limit interference with following through traffic. Left-turning traffic typically moves into the left-turning lane, slows down and wait for a suitable gap in oncoming traffic to make the turn. Left-turn lanes are used with and without medians.

The standard widths of left-turn lanes not adjacent to a median are either the same as the adjacent lane width or 0.2 m less, but not less than 3.3 m. Left-turn lanes adjacent to a raised median without a gutter normally have the curb offset by 500 mm. Left-turn lanes adjacent to a raised or painted median are either the same width as the adjacent lane or 0.2 m less, but not less than 3.0 m wide.

Continuous left-turn lanes are introduced between through lanes in opposite directions to provide storage for left-turning vehicles arriving from either direction and are usually designated for left turns only throughout their length. This form of operation is well suited to multi-lane urban arterial roads where operating speeds are relatively low, in the range of 40 km/h to 70 km/h.

Standard width for continuous left-turn lanes is 4.0 m. The additional width over the adjacent through lane recognizes that vehicles are making turning manoeuvres from both directions simultaneously, and adds a measure of safety. Lesser widths are acceptable where operating speeds are less than 60 km/h.

Left-turn slip-around lanes may be used on 2-lane highways at "T" intersections, where the left-turning traffic volumes do not warrant the standard left-turning treatment, but may pose a threat to the safety of through traffic, and where by-passing vehicles throw gravel from the shoulder onto the highway. Standard widths are the same as the adjacent lane width or 0.2 m less, but not less than 3.3 m.

C.2.3.2 Speed-change lanes

Acceleration and deceleration lanes are auxiliary lanes adjacent to through lanes on arterial roads and freeways at intersections and interchanges for vehicles changing speed. Standard widths of these auxiliary lanes are the same as the adjacent lane width or 0.2 m less, but not less than 3.3 m.

Table C.2.3
Auxiliary lane width

auxiliary lane	standard width
right-turn lane	– same as adjacent lane or 0.2 m less but not less than 3.3 m
left-turn lane not adjacent to a median	– same as adjacent lane or 0.2 m less but not less than 3.3 m
left-turn lane adjacent to a median	– same as adjacent lane or 0.2 m less but not less than 3.0 m
continuous two-way left-turn lane	– 4.0 m where design speed is greater than 60 km/h – 3.5 m to 4.0 m where design speed is equal to or less than 60 km/h
left-turn slip-around lane	– same as adjacent lane or 0.2 m less but not less than 3.3 m
acceleration and deceleration lanes	– same as adjacent lane or 0.2 m less but not less than 3.3 m
weaving lane	– same as adjacent lane or 0.2 m less but not less than 3.5 m
truck-climbing lane	– same as adjacent lane or 0.2 m less but not less than 3.3 m
passing lane	– same as adjacent lane or 0.2 m less but not less than 3.3 m

C.2.3.3 Weaving lanes

Weaving lanes are auxiliary lanes introduced between an entrance followed by an exit in close succession, usually less than 1000 m, to minimize turbulence in the traffic stream and to maintain adequate capacity. Standard widths are the same as the adjacent lane width or 0.2 m less, but not less than 3.5 m.

C.2.3.4 Truck-climbing lanes

Truck-climbing lanes are introduced on steep upgrades to provide a lane for trucks and other slow-moving vehicles whose speed drops because of the grade. The through uphill lanes are kept free for faster traffic. Truck-climbing lanes increase capacity, improve travel times, and reduce accident rates. Standard widths are the same as the adjacent lane width or 0.2 m less, but not less than 3.3 m.

C.2.3.5 Passing lanes

Passing lanes are similar to truck-climbing lanes, but are not necessarily located on upgrades. Passing lanes are applied to 2-lane roads carrying large volumes of slow-moving vehicles (for example, recreational routes). A slow moving vehicle will cause a queue to form because of lack of passing opportunity, sight distance restrictions or large volumes of opposing traffic. Passing lanes are introduced at intervals to allow following vehicles to overtake. Standard widths are the same as the adjacent lane width or 0.2 m less but not less than 3.3 m.

C.2.4 Ramp and transfer lanes

An interchange is an intersection of two (or more) roadways separated vertically, with at least one roadway for travel between them. These interconnecting roadways are called ramps. Transfer lanes are roadways to provide for travel between freeway express lanes and collector roadways or service roads.

The lane width for single-lane ramps and transfer lanes is 4.8 m. This is based on the premise that interchanges carry sufficient single unit and semi-trailer vehicles to govern design requirements. It also provides for widening on curves of radius greater than 50 m. For smaller radii the width should be increased according to Table D.8.4. Lane widths for ramps of two or more lanes should be 3.7 m and adjusted for curvature according to the above-noted table.

C.2.5 Parking lanes

Cross section design may include provision for parking, normally only on urban roads. Parking facilities should offer safe and convenient access for parking users and at the same time maintain safe and convenient operation for other traffic.

Parking dimensions depend on the vehicle dimensions and steering geometry of vehicles to be parked, and on the form of parking provided. Although there is a marked trend toward smaller cars in recent years which would suggest smaller parking dimensions, parking facilities should be able to accommodate most cars, with adequate dimensions for all but the larger passenger vehicles.

On-street parking is normally parallel or angled to the alignment of the roadway. Parking at right angles to the alignment offers the most efficient use in terms of parking area, but is seldom considered for on-street parking since it calls for a very wide cross section and is interruptive to the flow of through traffic.

Parking lanes are used on lower design speed roads, normally local and collector urban streets, and generally are not applied to roads having design speeds of 70 km/h or over. On local streets, a parking lane width of 2.4 m is used. Parking lane width for all other streets is 2.8 m. Parking lane widths do not include gutter allowances or set-backs which in practice may be used for parking. The length of a typical parallel parking stall is 7.0 m to 8.0 m.

C.3 PAVEMENT WIDENING ON CURVES

C.3.1 Basis of design

Pavement widening on curves is carried out to provide for the off-tracking characteristics of vehicles on curves.

Vehicles travelling on a curve occupy a greater width of roadway than they do on tangent sections as a result of the rear wheels tracking inside the front wheel path. The amount of this increase in roadway occupation is dependent on the curve radius and the length and type of vehicle. For the range of radii used on open highways, this additional amount is negligible for passenger cars. However, for trucks it is significant and some road authorities provide an additional width of pavement to ensure adequate clearance between opposing trucks on curves.

Maintaining a vehicle centrally located on the lane is more difficult on a curve than on a tangent section. To compensate for this, an additional clearance is provided on curves to reduce driver apprehension, should a vehicle deviate from the centre of its lane. This amount is dependent on the vehicle speed and curve radius.

The amount of widening required is the difference between the width required when two trucks meet on the curve and the approach width. The basis of determining the amount of widening is illustrated in Figure C.3.1. Design vehicles are shown in Figure D.6.1.

Pavement widening should not be confused with partially paved shoulders which are not intended for normal travel.

C.3.2 Design values

Tables C.3.2a, C.3.2b and C.3.2c indicate values of pavement widening for single unit trucks (SU) and semi-trailer combinations (WB-15 and WB-17). The range of values for curve widening extends to curve radii corresponding to 30 km/h less than the design speed indicated. This provides widening values for conditions where the overall design speed and operating speed are known to exceed the operating speed of an isolated curve, as determined by its geometry.

C.3.3 Warrants

The need for widening the pavement on a curve is dependent upon one truck meeting another on a curve, the frequency of which is dependent on truck volumes and distribution, curve radius and design speed. Failure to provide widening on a curve will result in a higher degree of concentration required by the driver and possible reduction in speed.

On a curvilinear section of road in which the majority of the alignment is on curve, the probability that two trucks will meet on a curve is greater than the case where most of the alignment is on tangent. However, the probability that two trucks will meet on any particular curve is independent of the configuration of the alignment on either side of the curve. The need for pavement widening on a curve is not dependent on the frequency of curves.

C.3.3.1 Undivided roads

For 2-lane roads where the number of trucks in both directions is less than 15/h, pavement widening is not required. Where the number of trucks is 15/h or more pavement widening might be appropriate.

Theoretically, widening of a 4-lane undivided road should consist of the additional clearance required for the difficulty of negotiating the curve (Z) plus twice that required for the physical occupation of the roadway. Since the additional clearance is required to compensate for opposing vehicles only, this component need not be included twice for a 4-lane road where some of the vehicles are travelling in the same direction. The possibility of trucks occupying all lanes at a given location on a curve is so remote that the absence of the small amount of widening required to compensate for the physical roadway occupation of the extra vehicles is not significant.

Where there is a requirement for pavement widening on undivided roads, suggested values for widening are given in Tables C.3.2a, C.3.2b and C.3.2c for three standard design vehicles for design speeds of 50 km/h to 130 km/h. These tables are not intended for divided highways or ramps.

C.3.3.2 Divided roads

On divided roads vehicles only encounter other vehicles moving in the same direction. The relative speeds are such that the additional clearance (Z) is not required. Furthermore, due to the relatively flat curves utilized on highways of this type, the effects of vehicular off-tracking are usually sufficiently small to be insignificant. Pavement widening on divided highways therefore is not required.

C.3.3.3 Ramps

Ramp lane widths for channelized intersections and interchange ramps are based on vehicle off-tracking and clearance requirements similar to the pavement widening considerations for open highways. However, due to the relatively small radius curves associated with this type of design the width requirements are considerably larger. Lane widths of 4.8 m on single lane ramps do not require widening to accommodate off-tracking.

Design considerations include provision for passenger cars, single unit and tractor semi- trailer design vehicles, together with operating conditions which assume one-way traffic with no provision for passing, one- way traffic with provision for passing stalled vehicles and two-way traffic.

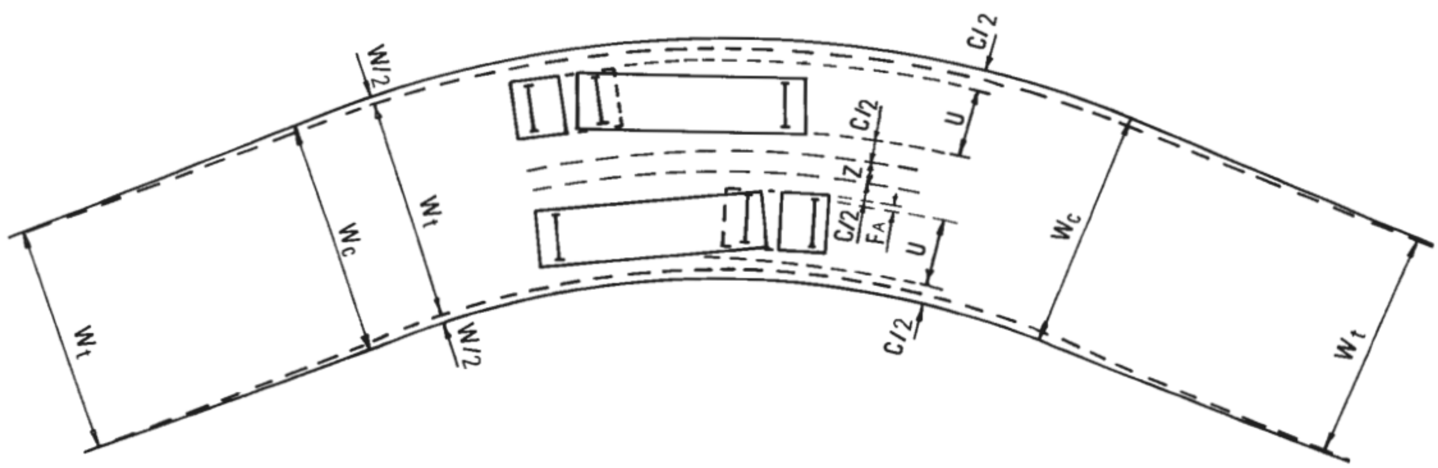
Design values for ramp lane widths are indicated in C.2.4 and values for widening are given in Chapter D.

C.3.4 Application

The pavement widening values given in Tables C.3.2a, C.3.2b, and C.3.2c represent the total amount of widening required.

For new construction and reconstruction projects, curve widening is applied by adding half of the total requirement to each side of the highway. Equal division of the widening is not practical, however, with values which are not a multiple of 0.2 m. A preferred treatment is to round the total widening value to a higher value which is a multiple of 0.2 m. The normal shoulder width is maintained over the length of curve widening.

An exception to the minimum shoulder width requirement may be considered in the application of resurfacing and curve widening to roads with low traffic volumes. Where the required curve widening closely approaches or exceeds the existing shoulder width,



$W = W_c - W_t$
where: W = amount of widening
W_c = pavement width on curve
W_t = pavement width on tangent

$W_c = 2(U + C) + F_A + Z$
where: U = vehicle track width on curve in metres
C = nominal clearance between vehicles
0.46 m for 6.0 m wide pavements
0.61 m for 6.6 m wide pavements
0.76 m for 7.0 m wide pavements
0.91 m for 7.4 m wide pavements

F_A = front overhang in metres

Z = additional clearance in metres to compensate for difficulty of driving on curves where

$$Z = \frac{0.1046V}{\sqrt{R}}$$

V = design speed of highway in kilometres per hour

R = curve radius in metres

Table C.3.2a
Pavement widening values on curves for single unit (SU) vehicles

design speed km/h															
50		60		70		80		90		100		110		120	
R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W
pavement width 7.4m															
50	1.2	50-55	1.3	55-65	1.3										
55-65	1.0	60-70	1.0	70-80	1.0										
70-85	0.8	75-95	0.8	85-110	0.7	90-125	0.8	130-140	0.7						
90-120	0.5	100-140	0.5	115-160	0.5	130-190	0.5	150-210	0.5	190-240	0.5	250-280	0.4		
125-200	0.2	150-240	0.2	170-280	0.3	200-320	0.3	220-380	0.3	250-450	0.3	300-500	0.2	340-550	0.2
pavement width 7.0m															
50	1.5	50-55	1.5	55-60	1.5										
55-60	1.3	60-70	1.3	65-75	1.2										
65-80	1.0	75-90	1.0	80-105	1.0	90-115	1.0	130	0.9						
85-110	0.7	95-130	0.8	110-150	0.8	120-170	0.8	140-190	0.7	190-220	0.7	250	0.6		
115-170	0.5	140-200	0.5	160-240	0.5	180-280	0.5	200-320	0.6	230-380	0.5	280-420	0.5		
180-350	0.3	210-450	0.3	250-500	0.3	300-650	0.2	340-750	0.2	400-900	0.3	450-1050	0.2		
pavement width 6.6m															
		50	1.7	55-60	1.7										
50-55	1.5	55-65	1.5	65-75	1.4										
60-75	1.3	70-85	1.2	80-95	1.2	90-110	1.3								
80-100	1.0	90-115	1.0	100-130	1.0	115-150	1.0	130-170	0.9	190-200	0.9				
105-150	0.8	120-180	0.8	140-210	0.8	160-250	0.7	180-280	0.7	210-320	0.7				
160-280	0.5	190-350	0.5	220-420	0.5	280-500	0.5	300-600	0.5	340-700	0.5				
300-1050	0.3	380-1300	0.2	450-1700	0.2	525-2000	0.3	650-2500	0.2	750-2500	0.2				
pavement width 6.0m															
55	1.6	55-60	1.7												
60-70	1.5	65-80	1.5	90	1.5	130									
75-95	1.2	85-110	1.2	95-125	1.2	130-140	1.2								
100-140	1.0	115-160	1.0	130-190	1.0	150-220	1.0	170-250	1.0						
150-250	0.7	170-300	0.7	200-350	0.7	230-420	0.8	280-500	0.8						
280-700	0.4	320-850	0.5	380-1100	0.5	450-1300	0.5	525-1600	0.5						
750-10000	0.2	900-10000	0.3	1150-10000	0.2	1400-10000	0.2	1700-10000	0.3						

NOTES: (1) Widening values, *W* (m) are based on SU design vehicles travelling at the design speed
(2) *R* denotes centreline radius in metres

Table C.3.2b
Pavement widening values on curves for tractor-semi-trailer (WB-15) vehicles

design speed km/h															
50		60		70		80		90		100		110		120	
R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W
pavement width 7.4m															
65-70	2.0	75	2.0	75-80	2.0										
75-80	1.8	80-85	1.8	85-90	1.8	90-95	1.8								
85-90	1.5	90-95	1.5	95-105	1.5	100-110	1.5								
95-105	1.2	100-115	1.3	110-125	1.2	115-130	1.3	130-140	1.3						
110-130	1.0	120-140	1.0	130-150	1.0	140-170	1.0	150-180	1.0	190-200	1.0				
140-170	0.8	150-180	0.8	160-200	0.8	180-220	0.8	190-240	0.8	210-250	0.8	250-280	0.8		
180-230	0.5	190-250	0.5	210-280	0.5	230-300	0.5	250-340	0.5	280-380	0.5	300-400	0.5	340-450	0.5
240-350	0.3	280-400	0.3	300-450	0.3	320-525	0.3	350-575	0.3	400-650	0.3	420-700	0.3	475-800	0.3
pavement width 7.0m															
75	2.0	75-80	2.0	75-85	2.0										
80-85	1.8	85-95	1.8	90-100	1.8	90-105	1.8								
90-105	1.5	100-110	1.5	105-120	1.5	110-130	1.5	130-140	1.5						
110-125	1.3	115-130	1.3	125-140	1.3	140-160	1.3	150-170	1.3						
130-160	1.0	140-170	1.0	150-190	1.0	170-210	1.0	180-230	1.0	190-240	1.0	250	1.0		
170-210	0.8	180-240	0.8	200-250	0.8	220-280	0.8	240-300	0.8	250-340	0.8	280-380	0.8		
220-320	0.5	250-350	0.5	280-400	0.5	300-450	0.5	320-500	0.5	350-550	0.5	400-600	0.5		
340-600	0.3	380-700	0.3	420-800	0.3	475-950	0.3	525-1050	0.3	575-1200	0.2	650-1300	0.2		
pavement width 6.6m															
80-85	2.0	85-90	2.0	90-95	2.0	90-105	2.0								
90-100	1.7	95-105	1.8	100-115	1.8	110-125	1.8	130	1.8						
105-120	1.5	110-130	1.5	120-140	1.5	130-150	1.5	140-160	1.5						
125-150	1.2	140-160	1.2	150-180	1.3	160-190	1.2	170-210	1.2	190-230	1.2				
160-200	1.0	170-220	1.0	190-240	1.0	200-250	1.0	220-280	1.0	240-320	1.0				
210-280	0.8	230-320	0.8	250-350	0.8	280-400	0.8	300-450	0.8	340-450	0.8				
300-500	0.5	340-575	0.5	380-650	0.5	420-750	0.5	475-850	0.5	475-950	0.5				
525-1600	0.2	800-1800	0.2	700-2200	0.3	800-2500	0.2	900-3000	0.3	1000-3500	0.3				

NOTES: (1) Widening values, *W* (m) are based on WB-15 design vehicles travelling at the design speed
(2) *R* denotes centreline radius in metres

Table C.3.2c
Pavement widening values on curves for tractor-semi-trailer (WB-17) vehicles

design speed km/h															
50		60		70		80		90		100		110		120	
R	W	R	W	R	W	R	W	R	W	R	W	R	W	R	W
pavement width 7.4m															
115-125	2.0	120-130	2.0	125-140	2.0	130-150	2.0	140-150	2.0	150-160	2.0	160-170	2.0	160-180	2.0
130-150	1.8	140-160	1.8	150-170	1.8	160-180	1.7	170-190	1.7	170-200	1.7	180-210	1.8	190-230	1.8
160-180	1.5	170-190	1.5	180-210	1.5	190-220	1.5	200-240	1.5	210-250	1.5	220-250	1.5	240-280	1.5
190-240	1.3	200-250	1.2	220-250	1.2	230-300	1.3	250-320	1.2	280-340	1.2	280-300	1.3	300-380	1.2
250-320	1.0	280-350	1.0	280-380	1.0	320-420	1.0	340-450	1.0	350-500	1.0	380-550	1.0	400-575	1.0
340-525	0.7	380-600	0.7	400-650	0.7	450-700	0.8	475-800	0.8	525-850	0.7	575-950	0.7	600-1050	0.8
550-250	0.5	150-1400	0.5	700-1600	0.5	750-1800	0.5	850-2000	0.5	900-2200	0.5	1000-2500	0.5	1100-2500	0.5
1300-10 000	0.2	1500-10 000	0.2	1700-10 000	0.3	4000-10 000	0.2	2200-10 000	0.3	2500-10 000	0.2	3000-10 000	0.2	3500-10 000	0.3
pavement width 7.0m															
105-120	2.0	115-125	2.0	120-130	2.0	125-140	2.0	130-140	2.0	140-150	2.0	150-160	2.0		
125-140	1.8	130-140	1.8	140-150	1.8	150-160	1.8	150-170	1.8	160-180	1.8	170-200	1.7		
150-170	1.5	160-180	1.5	160-190	1.5	170-200	1.5	180-220	1.5	190-230	1.5	210-240	1.5		
180-210	1.2	190-230	1.2	200-240	1.2	210-250	1.3	230-280	1.3	240-300	1.3	250-320	1.2		
220-280	1.0	240-300	1.0	250-340	1.0	280-350	1.0	300-380	1.0	320-420	1.0	340-450	1.0		
300-420	0.8	320-475	0.7	350-525	0.8	380-575	0.8	400-600	0.8	450-650	0.8	475-750	0.7		
450-800	0.5	500-900	0.5	550-1050	0.5	600-1150	0.5	650-1300	0.5	700-1400	0.5	800-1600	0.5		
850-3500	0.2	950-4500	0.2	1100-5000	0.3	1200-6000	0.3	1400-7000	0.3	1500-8000	0.3	1700-10 000	0.2		
pavement width 6.6m															
100-110	2.0	105-115	2.0	110-125	2.0	120-130	2.0	125-140	2.0	130-140	2.0				
115-130	1.7	120-130	1.7	130-140	1.8	140-150	1.8	150-160	1.8	150-170	1.8				
140-150	1.5	140-160	1.5	150-170	1.5	160-180	1.5	170-200	1.5	180-210	1.5				
160-190	1.2	170-200	1.2	180-220	1.3	140-230	1.3	210-250	1.3	220-250	1.3				
200-250	1.0	210-250	1.0	230-280	1.0	240-320	1.0	280-340	1.0	280-350	1.0				
280-350	0.8	280-380	0.7	300-420	0.8	340-450	0.8	350-500	0.8	380-550	0.8				
380-600	0.5	400-650	0.5	450-750	0.5	475-800	0.5	525-900	0.5	575-1000	0.5				
650-1600	0.3	700-1800	0.2	800-2200	0.3	850-2500	0.3	950-2500	0.3	1050-3000	0.3				

NOTES: (1) Widening values, *W* (m) are based on WB-17.5 design vehicles travelling at the design speed
(2) *R* denotes centreline radius in metres

an acceptable and cost-effective design alternative to road widening is to utilize the entire shoulder width to achieve the curve widening.

Since the amount of pavement widening is a function of the curve radius, the widening is applied over the length of the spiral curve in such a fashion that a smooth edge of pavement is produced. For un-spiralled curves the widening is applied over the corresponding spiral length, had the spiral been applied.

Pavement widening may be warranted on several successive horizontal curves so that a significant length of highway has a continuous variation in pavement width. In such a situation the provision of a wider pavement over the total section of highway is considered. The amount of widening is representative of the required widening on individual curves and not necessarily the widening required by the smallest radius curve. Alternatively, less widening could be applied over the total section with additional widening on the smaller radius curves.

Each application is assessed independently considering how closely the warrants are met, the length of the highway section under consideration, the frequency of curves and the amount of widening required for each curve. A uniform pavement width is desirable but may not always be economically practical.

C.4 PAVEMENT CROSS SLOPE AND SUPERELEVATION

C.4.1 Normal cross slope

Cross slopes for various classes of road are not shown on the typical cross sections because they depend on the type of surface. Generally accepted minimum cross slope values for different surface types on the travelled way are given in Table C.4.1a.

Table C.4.1a
Minimum cross slope

surface	minimum cross slope m/m
paved	
asphalt	0.02
concrete	0.015
gravel or crushed stone	0.04
earth	0.04

On tangent sections of roadway, cross slope is normally applied to drain storm water to the side of the roadway. On 2-lane roads the pavement is normally crowned at the centreline and the pavement slopes down to each edge.

On 4-lane undivided roads and 4-lane divided roads with a flush median, the crown is normally placed in the centre of the pavement or median, and cross-slope to each pavement edge is 0.02 m/m.

On a 4-lane divided road with a depressed median, a crown may be placed at the centre of each roadway with a cross-slope of 0.02 m/m to each edge or both lanes may drain away from the median. The advantages of the crown are storm water drains to either side of the roadway and it facilitates the treatment of the roadway with de-icing chemicals which are spread in a narrow strip about the crown line, allowing the action of traffic and cross- slope to further spread the chemicals across the entire pavement. If the road eventually requires expansion to six lanes by adding two lanes in the median, the additional lanes will slope toward the median. The advantages of both lanes draining away from the median is the reduction in median drainage provision.

If a 4-lane divided road is to be expanded to six lanes within a short period of time of initial construction, it is normally designed for six lanes and built without the median lanes initially. In this case both lanes of each roadway slope toward the outer edge.

For 6-lane divided roads, the crown for each roadway is applied to either edge of the centre lane, in which case one or two lanes drain toward the median. With two lanes draining toward the median, at locations where an auxiliary lane is added, two lanes are draining in each direction. This location of the crown also is convenient for an initial stage of 4 lanes divided. If the 6-lane cross section is to be a stage of an 8-lane cross section, a crown located at the common edge of the median and centre lane is preferred to avoid 3 lanes draining toward the median. The above is illustrated in Figure C.4.1.

Cross-slope on auxiliary lanes is the same as that of the adjacent through lane.

At intersections where two roads on tangent intersect, normal cross-slope is maintained on the major road, and cross-slope on the minor road is run out on the approaches to the intersection to match the profile of the major road. This treatment is typical of intersections controlled by a stop sign on the minor road. In the case of an intersection where the two roads are of equal importance, or where the intersection is signalized, the normal cross-slope is run out on all four approaches so that the cross-slope on each road matches the profile of the crossing road. Simply put, the pavements are warped to maintain smooth profiles for traffic on both roads. This topic is dealt with in more detail in Chapter D.

For roadways on structures, the cross-slope is a minimum of 0.02 m/m.

For resurfacing, design guidelines and minimum acceptable standards are provided for pavement cross-slope, related to design speed in Table C.4.1b.

C.4.2 Superelevation

C.4.2.1 Superelevation requirements

Maximum superelevation is normally 0.04 m/m, 0.06 m/m or 0.08 m/m, and is a matter of policy based on climatic and maintenance considerations. Normally, 0.04 m/m is used only in urban areas and 0.08 m/m only in rural areas. Selection of maximum superelevation is discussed more fully in B.3.1.5.

Superelevation values for design are given in Tables B.3.1.4a, B.3.1.4b and B.3.1.4c for maximum superelevation of 0.04 m/m, 0.06 m/m, 0.08 m/m a range of design speeds from 40 km/h to 130 km/h and a range of radii from 50 m to 7000 m. Transition from normal cross slope on tangent to superelevation on curve is discussed in B.3.1.6 and B.3.2.4.

Figure C.4.1
Cross slope for 6-lane divided road

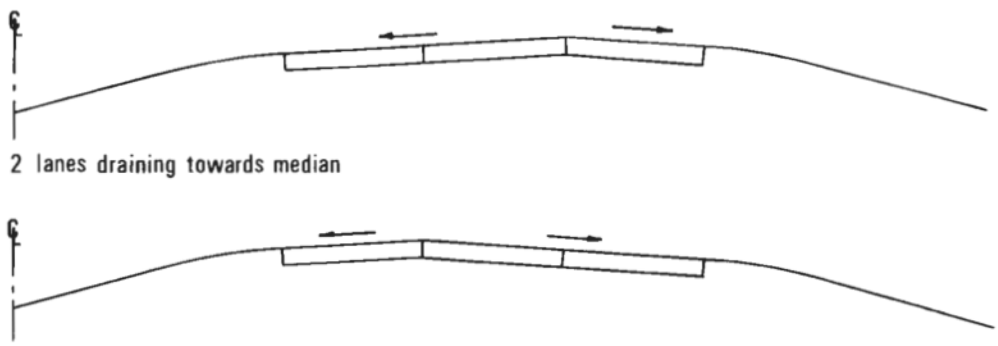


Table C.4.1b
Pavement cross slope for resurfacing

design speed	cross-slope, m/m design standard	acceptable tolerance	maximum algebraic difference (driving lanes), m/m
120 km/h	0.02	0.015-0.025	0.05
100 km/h	0.02	0.015-0.03	0.06
80 km/h	0.02	0.015-0.035	0.07

C.4.2.2 Application of superelevation

C.4.2.2.1 Rate of change:

The basis for acceptable rates of change of superelevation are comfort, safety and convenience of operation. Changes in the rate of superelevation occur on mainline design at the beginning and end of circular curves and other areas where changes in direction of vehicle travel occur; for example, on turning roadways at intersections and at interchanges on ramps and ramp terminals.

Acceptable rates of change are a function of design speed and radius of curve.

Relative slope is the slope or profile of the outer edge of the pavement in relation to the profile of the centreline. It is dependent on the rate of superelevation being developed, the length over which it is developed, and the width of the pavement. It is therefore an expression of rate of change of superelevation. The maximum relative slope normally applied varies with design speed and for 2-lane roadways, acceptable values are shown in Table C.4.2.2.1a. For 4-lane and 6-lane roadways, the maximum relative slope is 1.5 times and 2.0 times that for two-lane roadways, respectively.

The term "turning roadway" refers to separate roadways to provide for right-turning traffic at intersections and curvilinear sections of interchange ramps.

The rate of change of cross-slope on intersection curves, ramp curves and ramp terminals varies with the design speed. As the design speed is decreased the length over which the change in superelevation can be made is reduced.

Design values for rates of change of cross-slope are shown on Table C.4.2.2.1b. These values are suitable for single-lane ramps. For 2-lane ramps lower values are appropriate. Theoretically, the maximum rate of change for 2-lane roadways should be 50% of that for single lane roadways, however, this may generate transition lengths which cannot be achieved at an acceptable cost and values of 75% are acceptable.

The minimum length is given by the equation:

$$l = \frac{100\, we}{2s}$$

where w is the width of pavement in metres

- e is the superelevation developed in metres per metre
- s is the relative slope, percentage

Table C.4.2.2.1a
Maximum relative slope between outer edge of pavement and centreline for 2-lane roadways

design speed, km/h	relative slope %
40	0.70
50	0.65
60	0.60
70	0.55
80	0.51
90	0.47
100	0.44
110	0.41
120	0.38
130	0.36

Table C.4.2.2.1b
Design values for rate of change of cross slope for single-lane turning roadways

design speed km/h	change in rate of superelevation m/m/m length
25 and 30	0.0025
40	0.0023
50	0.0020
55 and more	0.0016

C.4.2.2.2 Difference in pavement cross slope:

The phenomenon of adjacent traffic lanes having different rates of cross-slope or superelevation gives rise to a ridge at the common edge, referred to as algebraic difference or roll-over.

Too great a difference in cross-slope may cause vehicles travelling between lanes to sway, giving rise to some discomfort, and possible hazard. Significant differences in cross-slope can occur in the vicinity of ramp exit terminals and ramp entrance terminals. The maximum algebraic difference in the cross-slope between adjacent lanes is given in Figure C.4.2.2.2.

Where the design of the superelevation meets speed/radius requirements and the minimum design values for rate of change of cross-slope, but exceeds the maximum algebraic differences in pavement cross slope, the alignment design should be re-examined.

Figure D.4.6 illustrates the development of superelevation at a turning roadway exit terminal for alternative alignments and auxiliary lane treatments.

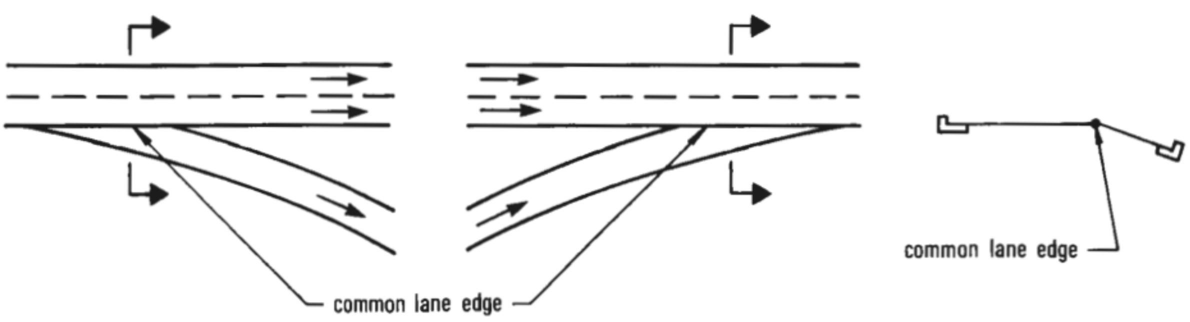
C.4.2.2.3 Undivided roads:

On 2-lane roads and 4-lane undivided roads superelevation is normally applied between a tangent section and a fully superelevated curve by revolving the pavement about either the centreline or one of the edges of the roadway. These methods are described in B.3.1.6 and B.3.2.4.

C.4.2.2.4 Divided roads:

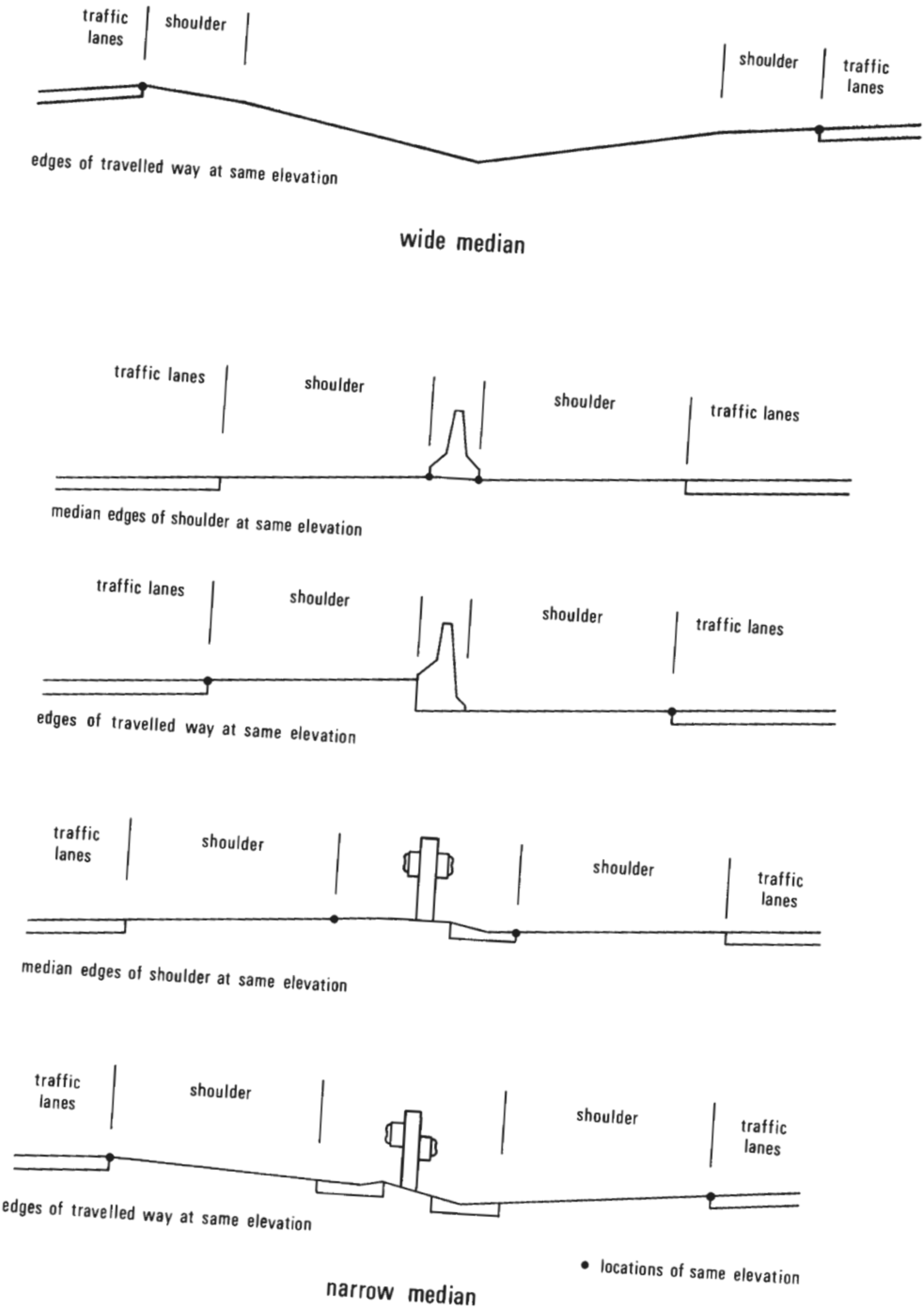
On divided roads with wide medians, the median pavement edges may be maintained at the same elevation as shown in Figure C.4.2.2.4 and each pavement is rotated about the inside (median) edge as illustrated in Figure B.3.2.4, or rotated about the roadway centreline.

Figure C.4.2.2.2
Maximum algebraic difference in pavement cross slope at turning roadway exit terminals



design speed of exit or entrance curve km/h	maximum algebraic difference in cross slope m/m
up to 30	0.06
30 to 50	0.05
50 & over	0.04

Figure C.4.2.2.4
Application of superelevation to divided roads



On divided roads with narrow medians consisting of a median barrier and paved shoulders, either the median edges of the two shoulders, or the median edges of the travelled way are normally maintained at the same elevation as shown in Figure C.4.2.2.4.

On divided roads where additional lanes are added to the median and provision for the above treatment was not made in the original design, median shoulder edges are not at the same elevation. This difference in elevation can be taken up either in a concrete median barrier or with slope paving and a staggered steel beam guide rail, as shown in Figure C.4.2.2.4.

Where superelevation is applied and shoulder edges are at the same elevation on a crest curve at or near limiting value, stopping sight distance should be checked for each lane, and if it is found to be inadequate, the vertical control line should be flattened.

Application of superelevation for divided roadways is illustrated in Figure C.4.2.2.4.

C.5 SHOULDERS

C.5.1 General

A shoulder is that part of the roadway adjacent to traffic lanes provided as refuge for stopped or disabled vehicles, for travel by emergency vehicles, and for lateral support for the roadway structure. Shoulders are normally provided on rural roads and on freeways in urban areas. On roads in urban areas, shoulders are usually omitted except on freeways since speeds are lower and it is consequently less hazardous for a stalled vehicle to be on the travelled way. Property cost in urban areas is usually too high to justify the provision of shoulders.

Shoulders provide an area that may be used to avoid a potential accident or to minimize the severity of an accident. Shoulders improve highway capacity by encouraging uniform speed, providing an area for stalled vehicles for increased safety; and promoting a sense of well-being on the part of the driver.

It is important for the operation of the road to make a clear distinction between traffic lanes and shoulders so as not to encourage the use of a shoulder as a traffic lane. This can be accomplished in a number of ways.

Most 2-lane roads have paved traffic lanes and gravel shoulders, in which case the driver recognizes the shoulder as such and is not encouraged to treat it as a traffic lane. Where shoulders are paved for reasons such as traffic volume, reduction in shoulder-related accidents, maintenance or drainage, the shoulder can be delineated by means of a contrasting colour and/or texture. The shoulder may be treated with a coarser surface than that of the traffic lane, so that if a vehicle inadvertently leaves the lane and travels onto the shoulder, the change in tone of tire noise will alert the driver.

Pavement edge striping is an important device for delineating the shoulders, particularly where the shoulder is partially paved with the same mix as the through travel lane. Shoulders sometimes have a steeper cross-slope than the adjacent travel lane and this further assists the driver in distinguishing between the two.

C.5.2 Shoulder width

It is desirable that a vehicle stopped on a shoulder for emergency reasons be clear of the pavement by at least 0.3 m and preferably 0.5 m. This has led to the adoption of 3.0 m as the normal shoulder width for high-speed roads. For roads of lower speed and/or lower volume, this width of shoulder is normally not justified and a narrower shoulder may be applied.

The minimum shoulder width for pavement support is 0.5 m if the shoulder is paved and 1.0 m if the shoulder is gravel surfaced. The minimum usable shoulder width required to accommodate a disabled vehicle is 2.0 m. Where curb and gutter is placed at the outside edge of a shoulder, the gutter pan is regarded as part of the usable shoulder width. Where a mountable curb and gutter is placed between the traffic lane and shoulder, the gutter pan is treated as part of the shoulder width.

Where guide rails, walls or other obstructive elements are introduced adjacent to a shoulder, it is desirable they be at least 0.5 m from the outer edge of the shoulder to allow for opening of a vehicle door. However, it is not always practical or economical to do so.

Shoulders desirably should be continuous so that at any location along the roadway a driver can leave the traffic lanes to use the shoulder. If the shoulder is intermittent some drivers may find it necessary to stop on the traffic lanes precipitating a hazardous condition. However, it may not always be economical to maintain shoulder width in all cases as for example in deep rock cuts. Shoulder widths on bridge decks for various conditions are given in C.12.2.

Shoulder widths are normally multiples of 0.5 m. For cross sections in which there is a curb and gutter adjacent to the shoulder, the shoulder width is measured to the face of the curb.

For undivided rural roads, shoulder widths are given in Table C.5.2.

Table C.5.2
Shoulder width for undivided rural roads

design speed	classification and design hour volume					
	RLU	RCU design hour volume			RAU design hour volume	
km/h		<250	250-450	>450	<450	>450
60	1.0	1.5	2.0	2.5		
70	1.0	1.5	2.0	2.5		
80	1.0	2.0	2.5	2.5	2.5	3.0
90	1.0	2.0	2.5	2.5	2.5	3.0
100	1.0	2.5	2.5	3.0	2.5	3.0
110					2.5	3.0
120					3.0	3.0
130					3.0	3.0

For divided rural roads shoulder widths are as follows:

- the right shoulder width for all classification and design speeds is 3.0 m
- the left shoulder width for all classifications and design speeds for 4-lane divided roads is 1.5 m
- the left shoulder width for all classifications and design speeds for divided roads having more than 4 lanes is 2.5 m

For interchange ramps and transfer roads the right shoulder width is 2.5 m and the left shoulder width is as follows:

- for one and two-lane ramps, 1.0 m
- for ramps of more than two lanes, 2.5 m

Shoulder width adjacent to climbing lanes and passing lanes preferably should be the same as for the roadway on the approach to the auxiliary lane, however, where the cost is excessive, the width may be reduced to not less than 1.0 m.

C.5.3 Shoulder cross slope and superelevation

The difference in cross slope between a shoulder and an adjacent traffic lane is an important safety consideration. When the difference is significant, a disabled vehicle moving to the shoulder will either experience serious sway causing the occupants discomfort and perhaps causing the driver to lose control; or the driver, on recognizing the difference will reduce speed before moving to the shoulder, putting himself and other road users in danger.

On a tangent section the cross slope on shoulders may be the same as or slightly steeper than that of the adjacent traffic lane.

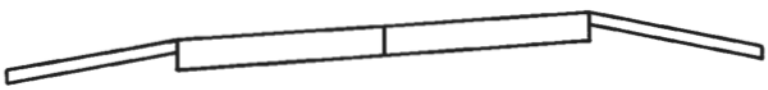
On sections in which the normal crown is removed, the shoulder cross slope is normally maintained as for the tangent section. On superelevated sections the cross slope on the low side is normally the same as that of the adjacent travelled lane. On the high side two alternative treatments are in common use. Some authorities superelevate the shoulder to match that of the travelled lanes, while others slope the shoulder away from the travelled lane to prevent run-off from the shoulder across the travelled lanes. In the latter practice, excessive difference in slope at the common edge is undesirable, to avoid sway in a vehicle moving to the shoulder and to discourage reductions in speed before leaving the travelled lanes. For this application a maximum algebraic difference of 0.08 m/m is used by some authorities. The above is illustrated in Figure C.5.3.

Some authorities form a crown in the centre of a shoulder on the high side so as to avoid excessive difference in cross slope at the lane edge and, at the same time, reduce shoulder run-off across the traffic

Figure C.5.3
Shoulder cross slope and superelevation

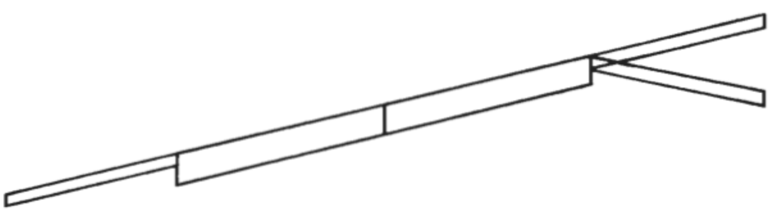
tangent section

shoulder cross slope same as travelled lanes or steeper



crown removed

shoulder cross slope same as on tangent



superelevated section

shoulder cross slope on low side, same as travelled lanes.
shoulder superelevation on high side same as travelled lanes or cross slope as on tangent

lanes. This practice has become less common because of the added complexity of construction of the shoulder surface and the limited benefit derived.

C.5.4 Shoulder rounding

Shoulder rounding is a transition between the shoulder and the constant fill slope or cut side slope and provides lateral support for the shoulder. It is formed with granular material and if the shoulder is paved, is placed after the shoulder is in place. Shoulder rounding may require treatment with stabilizing material to inhibit shoulder erosion.

Wider rounding is appropriate for higher design speed roads and the following dimensions are typical.

Design speed	Rounding
>100 km/h	1.0 m
<100 km/h	0.5 m

Where a traffic barrier is in place, rounding normally is measured from the back of the barrier, illustrated in Figure C.5.4.

C.6 MEDIANS AND OUTER SEPARATIONS

C.6.1 General

Where traffic lanes in opposite directions are separated laterally, that part of the cross section between opposing traffic lanes is referred to as the median. Where traffic lanes in the same direction are separated, it is referred to as the outer separation. The median or outer separation width includes shoulders. The width of the median or outer separation is the distance between the edges of the traffic lanes.

A median is a safety device which provides some measure of freedom from interference of opposing traffic. Medians provide a recovery area for out-of-control vehicles, storage area for emergencies, speed-change lanes for left-turn and U-turn traffic, and reduce headlight glare. Medians add to a sense of open space and freedom, particularly in urban areas.

Medians should be visible day and night and should be in definite contrast to adjacent traffic lanes. Medians may be flush with, raised above or depressed below, adjacent traffic lanes.

Median widths may be as narrow as 1 m and as wide as 30 m. Widths above 30 m are usually associated with independent alignments, in which case the roadways are designed separately, and the area between is largely left in its natural state. In general, medians should be as wide as possible, however, economic conditions may preclude wide medians. In any case, the median width should be in balance with the other elements of the cross section and the character of the area.

Median widths for rural typical sections are normally multiples of 1 m and for urban typical sections multiples of 0.2 m.

Outer separations form a physical barrier between adjacent traffic lanes to separate traffic moving in the same direction. There is little advantage in wide outer separations. They need only be wide enough to provide for elements such as shoulders, curbs, barriers, bridge piers and lighting poles.

Barrier warrants for medians and outer separations are based on traffic volume and median widths, and are presented in Chapter F.

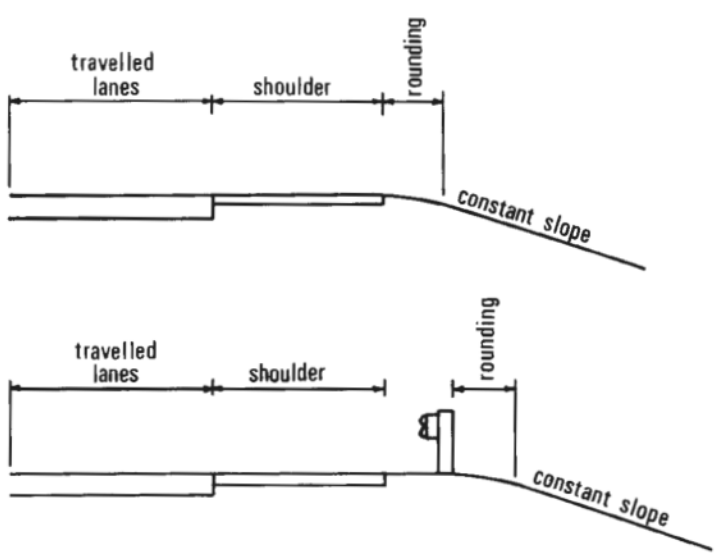
C.6.2 Freeway medians

C.6.2.1 Rural freeway medians

Rural freeways usually have depressed medians of sufficient width to allow the road bed to drain into the median and to obviate the need for median barriers. Median side slopes are kept flat so that a vehicle leaving the travelled lanes has an opportunity to recover control minimizing occupant injury and vehicle damage. Slopes of 4:1 are regarded as minimum and flatter slopes are desirable where feasible in terms of cost, drainage and property.

Wide medians promote safety by reducing the possibility of collision by vehicles travelling in opposite directions; and they promote a sense of well-being for the travelling public. Rural freeway medians in the

Figure C.5.4
Shoulder rounding



order of 20 m are common and may be as much as 30 m. Wider medians constitute separate alignment and independent design.

In metropolitan fringe areas it may be appropriate to build a rural freeway with a depressed median, recognizing that the character of the area will become urban and that future lanes will be required together with a flush or raised median. The ultimate cross section is designed and then elements removed to give the depressed median width for the first stage. The selection of median width in this case is an urban design consideration and reference should be made to C.6.2.2.

Typical rural freeway medians are shown in Figure C.6.2.

C.6.2.2 Urban freeway medians

Medians for urban freeways normally are either flush or raised with a median barrier. Median dimensions depend on shoulder widths, barrier type, and the need for provision of structure piers.

A concrete barrier, described in F.3.2, is commonly used with a flush median and the shoulders are sloped to drain toward the barrier where catch basins collect the runoff.

A box beam barrier is used with the flush median, in which case a median width of at least 3 m is required to accommodate deflection of the beam within the median.

The normal width of a left shoulder for an urban freeway is 2.5 m and therefore the median width should be at least 5.0 m plus the width of the selected barrier. Urban freeway medians are usually wider than this to allow for such factors as barrier deflection on impact, illumination poles, overhead sign footings and bridge piers. Commonly used median widths are in the order of 7.5 m to 8.0 m, in some cases with additional width for bridge piers.

Raised medians are used on urban freeways where double steel beam barriers are applied. A raised median consists of a mountable curb and gutter bordering a level area that is normally surfaced with asphalt. The width of the barrier is in the order of 0.8 m and the gutter is placed so that the gutter face is 0.6 m from the face of the barrier rail.

Where light poles or sign supports are placed in the median between the two rails, a barrier assembly with additional offset blocks is used to provide sufficient space. The overall width of this barrier is in excess of 1 m.

If the median is to accommodate a bridge pier, the median width should desirably be increased to allow the barrier to deflect on vehicle impact without contacting the pier.

Where limited space precludes offsetting the barrier from the pier, the steel beam guide rail with offset blocks may be anchored directly to the pier.

C.6.2.3 Outer separations

Outer separations separate express lanes from collector lanes in an express collector system. They usually contain a barrier or fence and may accommodate bridge piers and lighting poles. Viewed in the direction of the traffic, the outer separation consists of a right shoulder on the left and a left shoulder on the right separated by a barrier or fence.

Typical width of outer separations is 7.5 m. Additional width might be required for specific items such as bridge piers, but there is little safety benefit to be derived from wider outer separations.

C.6.3 Arterial roads

C.6.3.1 Rural arterial medians

Divided rural arterial roads usually have depressed or flush medians depending on the width. Depressed medians are preferred for reasons of safety. Design details and dimensions are essentially the same as depressed medians for rural freeways discussed in C.6.2.1.

A flush median without barrier may be appropriate for rural highways with medium to high volumes and operating speeds. This median is normally slightly crowned to effect drainage, and is normally paved, often in the same surface material as the adjacent lanes. It is advantageous, however, to surface the median in a contrasting texture and/or colour to alert the errant driver travelling in the median. The normal width is 1.0 m.

Wider flush medians with barriers normally apply to high speed rural arterial roads.

C.6.3.2 Urban arterial medians

Medians in urban areas may be either flush or raised.

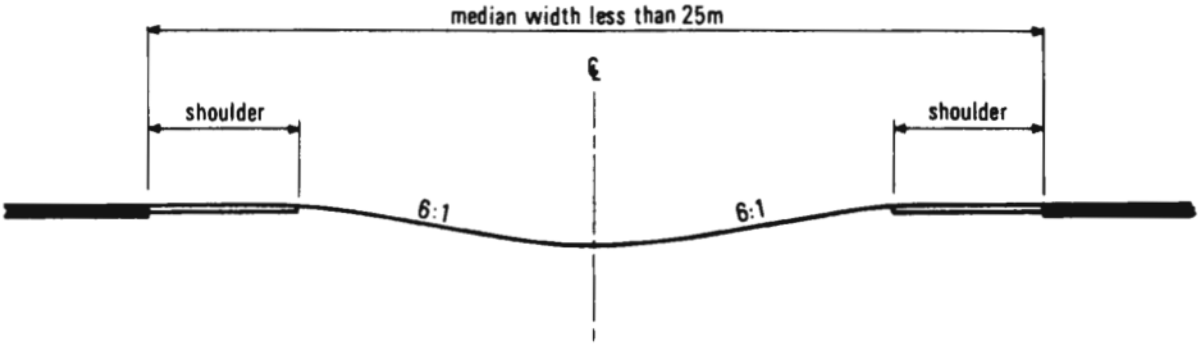
A median in an urban area normally does not have a barrier since it has to be terminated at intersections and some entrances, in which case the safety benefits are offset by the hazard of the barrier ends. Where a barrier is applied, it is usually a concrete barrier in a flush median. Shoulders are not normally justified in urban areas, in which case the concrete barrier is offset 0.5 m from the edge of travelled lane. Additional median width might be required to accommodate illumination plant, bridge piers or traffic control devices.

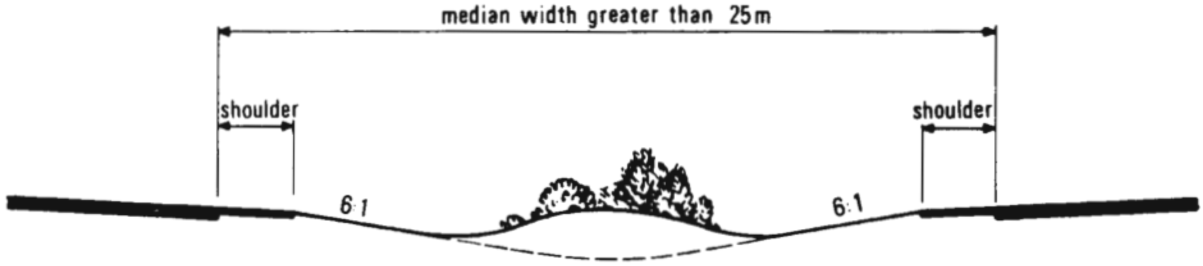
Where a median barrier is not applied, the median is normally raised, with barrier curbs. A width of 2.0 m is normally adequate to allow for gutters or offsets from the edges of the travelled lanes on each side and to allow traffic signs and other control devices to be located in the median without interrupting adjacent traffic. Where provision for a left-turn lane is required, the median is widened from 2.0 m by the appropriate lane width indicated in C.2.3, the width rounded up to a multiple of 0.2 m. Additional width may be required for bridge piers with or without barrier protection. Figure C.6.3.2 gives suitable dimensions for raised median treatment at bridge piers for urban arterial roads.

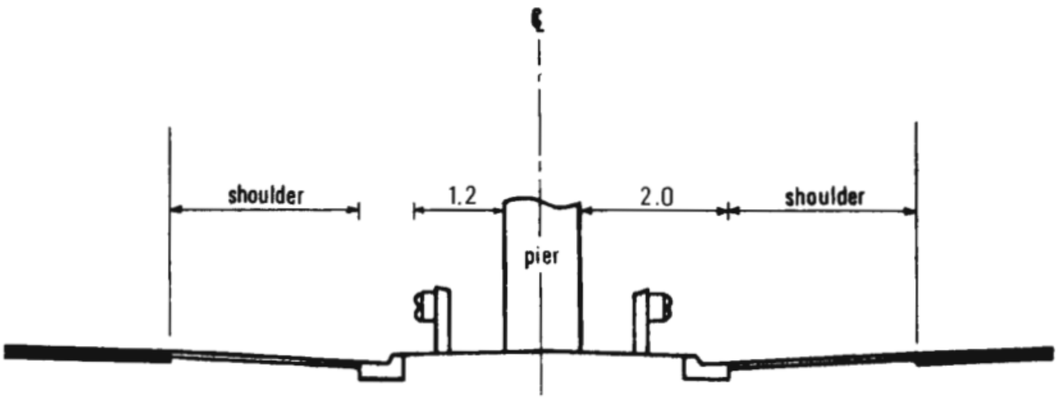
C.6.4 Median crossovers

Median crossovers are introduced on divided highways to allow police, emergency vehicles and maintenance vehicles to make U-turns to travel in the opposite direction. Their location depends on the distance between adjacent interchanges and the maintenance operation responsibilities. Median crossovers should be located where sight distance for an approaching vehicle is at least decision sight distance as noted in B.2.4; for example in the vicinity of long sag curves.

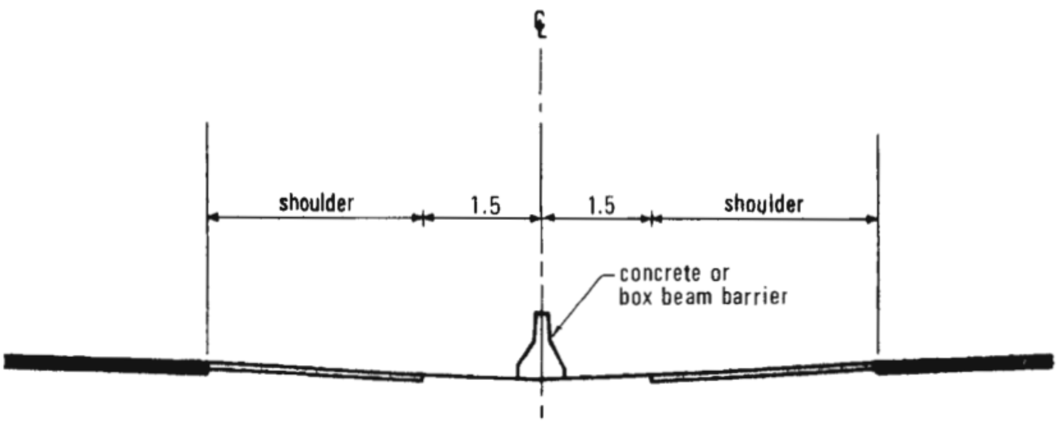
Figure C.6.2
Freeway medians





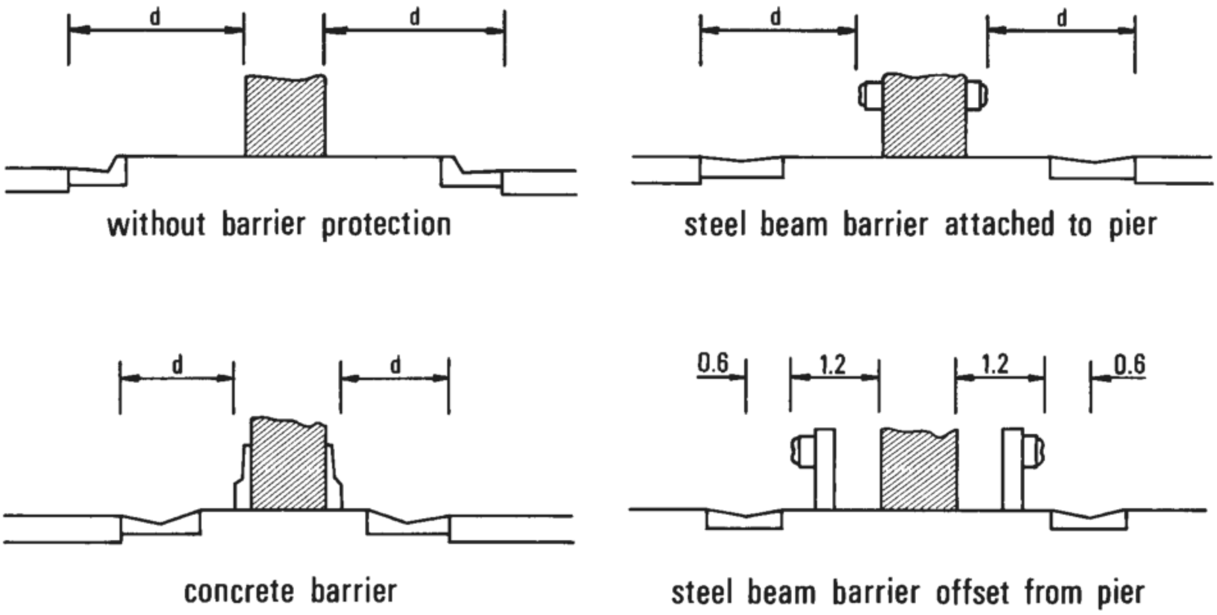


freeway
median with pier



freeway or arterial
narrow median

Figure C.6.3.2
Urban arterial raised median treatment at bridge pier



For values for d, see Table C.12.2b

C.7 CURB AND GUTTER

A curb is a raised element located adjacent to a traffic lane or shoulder. Curbs are normally introduced to control drainage and provide delineation of the pavement edge or pedestrian walkways.

The type and location of curbs can affect driver behaviour and the safety of a highway. They are extensively used on all types of urban highways, but only to a limited extent on rural highways where drainage is usually controlled by means of drainage channels.

There are three general types of curb, namely, barrier, semi-mountable and mountable, shown in Figure C.7. All three types of curb may be formed integrally with a gutter.

Barrier curbs are relatively steep faced and are intended to inhibit or at least to discourage vehicles from leaving the roadway. Typically, the height of the vertical face of the barrier curb is 150 mm and higher curbs are to be avoided. Most barrier curbs are not adequate to prevent a vehicle from leaving the roadway and, where positive action is required such as along narrow medians or adjacent to bridge substructures, suitable barrier should be provided. Barrier curbs are not used adjacent to bridge parapets. A concrete parapet having a profile similar to that of a concrete median barrier is preferred. However, on urban roads where the cross section has sidewalks on the approaches and the bridge, a barrier or curb is carried across the bridge.

Semi-mountable curbs have a sloping face and are considered to be mountable under emergency conditions.

Mountable curbs have a flat sloping face intended to allow vehicles to cross them readily. Mountable curbs can be used at median edges. Where a median guide rail is installed, the gutter line of the curbs is offset 0.6 m from the face of the barrier so that a vehicle makes contact with the curb before the barrier. Curbs should not be placed adjacent to high-speed lanes, but may be placed adjacent to shoulders.

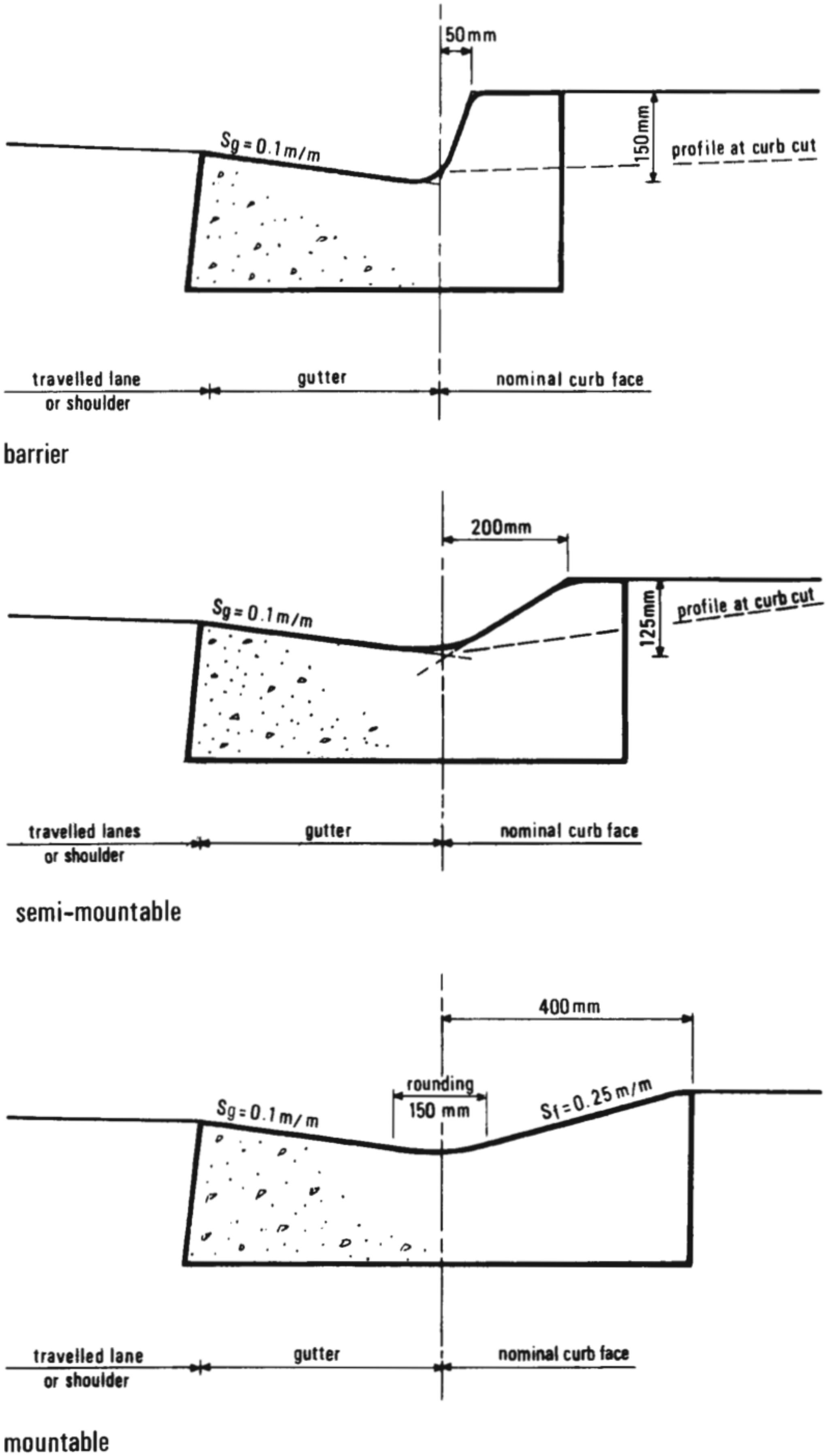
Gutters may be provided adjacent to a curb to form the principal drainage system for the roadway. Generally the gutter is not considered to be a part of the adjacent traffic lane width, since with a curb there is some lateral shying by drivers, particularly on their right, which reduces the effective lane width. For this reason, where a curb is provided without a gutter, the curb should be offset from the edge of the through traffic lane, a distance of 0.5 m.

Where curb and gutter is placed at the outside edge of a paved shoulder, the gutter width is regarded as part of the shoulder width.

Curb and gutter is usually formed with concrete, either precast or cast-in-place. Asphalt curbs are used for local drainage control, normally in rural areas, where delineation is not a requirement. Temporary curbs are usually formed of asphalt.

Typical dimensions for the more commonly used curb and gutter cross sections are shown in Figure C.7. The cross slopes may be decreased if a smaller hydraulic capacity for the gutter is satisfactory. On the high side of superelevated sections, the cross slope of the gutter, which may be carried through for delineation, normally conforms to the cross slope of the roadway surface.

Figure C.7
Curb and gutter types



C.8 SIDEWALKS

C.8.1 General

All urban roads except freeways and generally UAD 90 and 100 class roads carry some pedestrian traffic and may be provided with sidewalks. Boulevards between curb and sidewalk are desirable and, with the exception of short residential streets, sidewalks are normally provided on both sides of the roadway unless motor vehicle traffic is expected to be very light. In high-density urban areas, widening might be required to increase the pedestrian capacity. Where right-of-way is restricted, it might be necessary for the sidewalk to extend from the curb to the property line. This treatment is normally associated with low design speed roads.

On rural roads, sidewalks are usually not required, except along sections where there is intensive residential or commercial development. In these cases, sidewalks are generally located between the drainage channel and the property line. Sidewalks are provided on both sides of the roadway if motor vehicle traffic is heavy and if the development served is located on both sides of the roadway.

C.8.2 Surfaces and cross slopes

Sidewalks are normally surfaced with portland cement or bituminous concrete. The minimum cross slope for paved surface is 0.02 m/m. Steeper cross slopes may be used, but slopes in excess of 0.03 m/m are not desirable except at entrances where 0.05 m/m is acceptable. Figure C.8.2/C.9.2 indicates desirable dimensions.

C.8.3 Warrants and capacity

It is desirable in most cases to have a sidewalk on each side of a roadway where pedestrian traffic is generated on each side. Although local residential streets with single-family dwellings or a short culs-de-sac can function without a sidewalk, it is desirable even in these cases to provide sidewalks.

On roads in urban areas passing through long stretches of land that do not attract or generate pedestrian traffic, sidewalks on both sides may not be warranted.

Sidewalk widths depend on local conditions and the following guidelines may be considered in selecting appropriate widths.

- near multiple-family dwelling units, a width of 1.8 m is appropriate unless there is a possibility that the sidewalk is to be used by pedestrians from other sources
- additional width is required near schools, offices and industrial plants where large pedestrian volumes may occur for short periods
- where the adjacent land is used for shopping or entertainment, a width of at least 2.5 m is required and an additional width might be justified
- in general, people walk in pairs and in areas of heavy pedestrian traffic, sidewalk widths permitting two pairs to pass without difficulty are desirable
- a width of 1.5 m is generally regarded as minimum.

C.9 BOULEVARDS AND BORDER AREAS

C.9.1 General

The area between the roadway and the sidewalk is referred to as a boulevard. It serves as a safety separation, a location for overhead and underground utility lines and an area for snow storage. The boulevard may also be used to locate traffic signs, fire hydrants and lamp standards. However, it is generally preferred to locate utility poles, lamp standards and other objects potentially hazardous to an errant vehicle as far as possible from the travelled way, for example, at the back of the sidewalk.

The standard widths for boulevards are:

• arterial roads	3.0 m
• collector and local roads	2.0 m

The desirable minimum width for boulevards is 1.5 m.

Where property is limited or where sidewalks have to be wider than usual to accommodate pedestrian traffic, boulevards may be narrower than the standard dimension and in some cases may be omitted entirely. Examples are in downtown areas or in areas fully developed with retail stores and offices.

Boulevards are usually sloped towards the roadway to facilitate drainage.

The term "border area" refers to the area between the sidewalk and property line, or where there is no sidewalk, to the area between the curb and the property line. The functions of border areas are similar to those of boulevards.

C.9.2 Surfaces and cross slopes

Boulevards and border areas are usually surfaced with turf. In areas where vehicles or pedestrians destroy the turf, some form of surface treatment, such as portland cement or bituminous concrete, should be used. Cross slopes for turf should be at least 0.04 m/m.

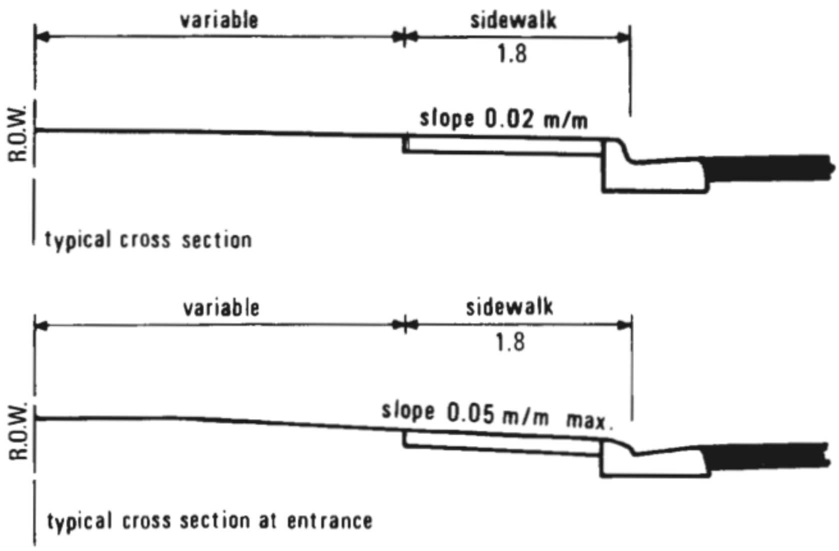
The area of the boulevard immediately adjacent to the roadway may be finished with a hard surface treatment to avoid deterioration of turf due to winter road clearing operations. This hard surface setback width is normally 1.0 m and is usually only applied to urban conditions where this problem is anticipated.

Boulevards and border areas are used to take up differences in elevation between the road elements and natural ground at the property line. Care must be taken, however, in increasing the cross slopes of boulevards where there are driveways.

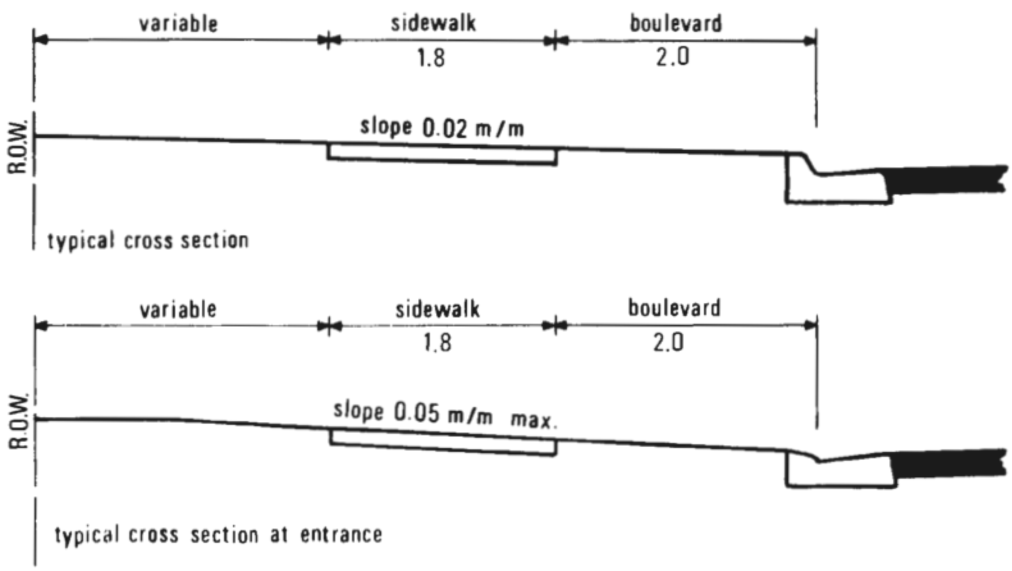
The slope of the driveway entrance across the boulevard should not exceed 0.05 m/m. In addition, the ridge in the driveway profile at the line between the sidewalk and boulevard should not be great enough to impinge on the underparts of a vehicle.

If steep sidewalk cross slopes or sidewalk depressions are used, the maximum driveway slope and boulevard slope should be determined on the basis of the geometry of the design vehicle. When reversing cross slopes, care must be taken to ensure adequate surface drainage. Figure C.8.2/C.9.2 shows typical driveway entrances.

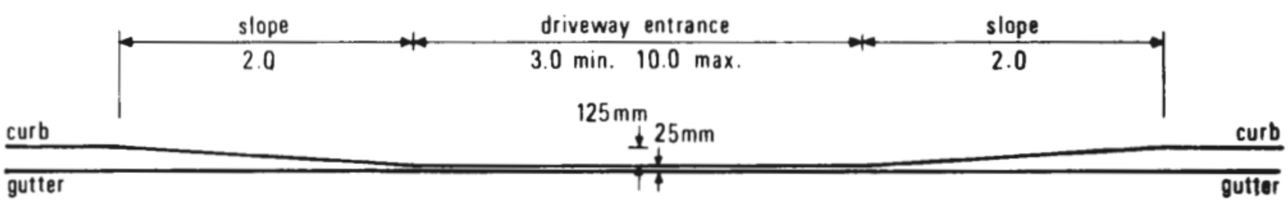
Figure C.8.2/C.9.2
Sidewalk and driveway entrances



sidewalk without boulevard



sidewalk with boulevard



driveway entrance with drop curb

C.10 GRADING AND DRAINAGE CHANNELS

C.10.1 Slopes

Earth cut and fill slopes are generally flattened and rounded to be consistent with the topography and the type of highway. Effective erosion control, maintenance costs and adequate drainage of the subgrade are largely dependent upon proper shaping of the side slopes. Overall economy depends not only on the element of first cost, but also on costs of maintenance of which slope stability is a factor. The proximity of an urban highway to the development and residents of the community calls for additional attention to slope treatment and the overall appearance.

On freeways and arterial roads with reasonably wide roadsides, side slopes on embankments and in cuts should be designed to provide a reasonable opportunity for recovery of an out-of-control vehicle. Where the roadside, at the point of departure, is reasonably flat, smooth and clear of fixed objects, many potential accidents can be avoided. Embankments at a slope of 6:1 or flatter can be negotiated by a vehicle with a reasonable chance of recovery and should therefore be provided where feasible. Steeper slopes up to 4:1 may be traversable where the height is moderate and rounding at the bottom is generous. Where the height and slope of embankment are such that an out-of-control vehicle cannot negotiate the slope with minimum hazard, the application of a barrier may be appropriate (see Chapter F).

Maximum slopes are dependent on the height of fill or depth of cut, and on the grading material.

Maximum slopes varies between jurisdiction, but typical maximum (steepest) slopes are:

- earth grading 2:1
- rock grading
  - fill side slope 1.25:1
  - cut back slope vertical

For lower heights of fill and shallower cuts, slopes should be flattened. Typical slopes are:

- earth grading:
  - fill side slope 4:1
  - cut back slope 3:1
- rock grading:
  - fill side slope 4:1
  - cut back slope 1:4

Further flattening of slopes may be considered in view of availability of material and property.

Flat and well-rounded side slopes simplify the establishment of turf and its subsequent maintenance. Usually grass can be readily established on side slopes as steep as 2:1.

In cut sections, side slopes of 6:1 or flatter can usually be negotiated by vehicles leaving the roadway if no obstruction is encountered. Back slopes flatter than 2:1 are desirable in the interest of safety and 3:1 in the interest of maintenance. In rock cut, economy generally requires steep slopes and slopes of 1:4, and vertical faces are commonly used.

C.10.2 Contour design

Contour design is usually applied to residual areas of land in interchange areas between ramps, for noise berms and disposal areas. These areas can be graded with varying slopes to give undulating and natural looking appearance. Contour design is carried out in conjunction with drainage design with consideration for safety and, where appropriate, in conjunction with landscaping. Residual pockets of land in interchange areas, particularly loop ramps, can be used to dispose of surplus material and to minimize spoil. Conversely, they may be used to generate additional excavation and to minimize borrow.

C.10.3 Drainage channels

Drainage channel cross sections must have adequate hydraulic capacity and be designed to keep water velocities below the scour limits wherever possible. Generally, additional capacity is derived by widening channels. The invert must be below the bottom of the subgrade to provide drainage of the road bed. Channels should have a streamlined cross section for safety, ease of maintenance and to minimize snow drifting. In areas of rock cut where fallen boulders can be expected, it might be desirable to provide a wider drainage channel to collect the boulders. This reduces the possibility of the boulders resting on the shoulder or roadway, and facilitates maintenance clean up. A drainage channel adjacent to the shoulder will also provide additional snow storage. The design of drainage channels is dealt with in the Drainage Manual, RTAC (Reference 33).

C.11 SNOW

C11.1 Impact on design

Snow drifts occur where snow particles have been deposited in areas of reduced wind speed. Interruptions to the smooth flow of the wind by features such as changes of grade, fences, landscaping or buildings cause the formation of localized turbulent air zones on the leeward side of the interruption. These zones are usually low velocity regions precipitating snow accumulation. Conversely, less snow is deposited where higher velocities occur. When the low velocity region causing a snow drift has been filled with snow, the snow drift does not continue to increase in size and the depth of the snow drift is not significantly affected by changes in the wind speed. However, wind speed affects the rate at which the snow drift increases.

Roadway cross sections in fill where the prevailing wind is across the roadway tend to keep reasonably clear of snow. On the other hand, roadway cross sections in cut tend to precipitate snow drifting on the roadway up to the surrounding ground elevation.

Buildings, dense tree growth sound barriers and rock faces close to roadways where the prevailing wind is across the road, tend to generate snow drifting on the leeward side of the obstruction. If these obstructions are close to the road snow drifting may obstruct the roadway itself.

C.11.2 Mitigating measures

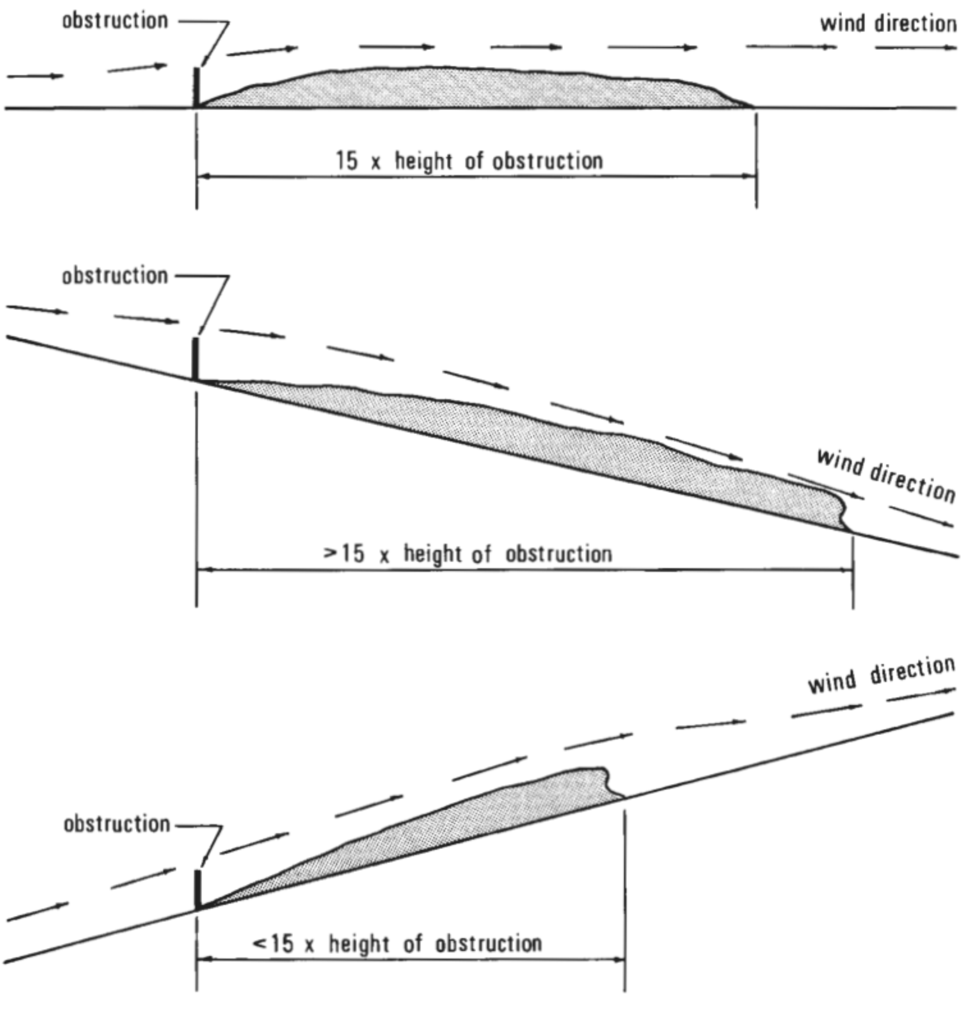
Roadways in cut sections that are likely to precipitate snow drifting may be treated in one of two ways to minimize or eliminate the impact. The more desirable treatment is to raise the profile so as to bring the roadway above natural ground elevation. If this is not possible for other reasons, the back slopes of the cut section are flattened to 7:1 and preferably flatter, so as to eliminate or minimize the area of low wind velocity where snow tends to deposit.

Where snow drifting occurs, the length of the drift depends on the height of the obstruction and the slope of the terrain as illustrated in Figure C.11.2a. Drifting on the road can be minimized by increasing the distance from the obstruction to the roadway as indicated in the Figure. For snow fencing, trees, vegetation and other semi-solid objects, a distance of 15 times the height of the obstruction on level ground is required. The distance for solid objects such as buildings and dense vegetation is 10 times the height of obstruction on level ground. Landscaping or snow fencing at an appropriate distance from the roadway can be applied to control snow drifting.

On divided highways with median barriers, snow drifting may occur at the barrier where the predominant wind direction is across the road. Figure C.11.2b illustrates the snow drifting patterns for alternative median barriers. If potential snow drifting is an important design consideration, box-beam barrier might be the most suitable type.

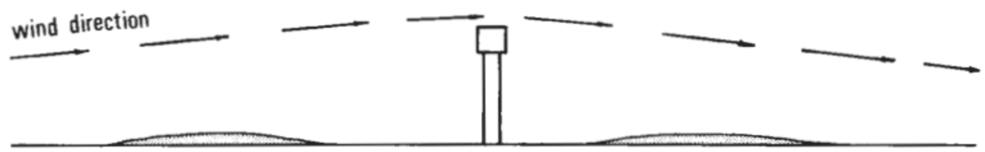
Mitigating measures described above apply to general cases and solutions to specific location may be found through scale model simulation of drifting snow.

Figure C.11.2a
Effect of slope on snow drifting



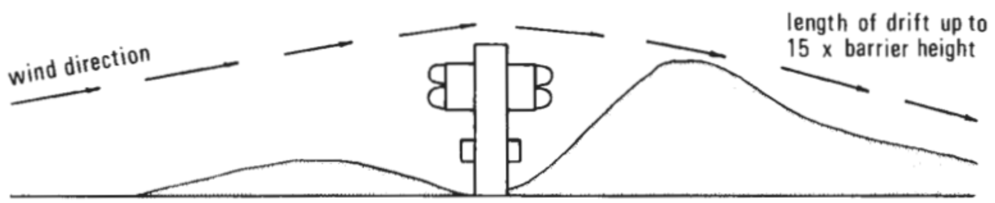
note: obstruction refers to snow fencing, trees, vegetation and other semi-solid objects

Figure C.11.2b
Snow drifting patterns for alternative median barriers



box beam

concrete barrier



steel beam barrier

C.12 CROSS SECTIONS FOR BRIDGE STRUCTURES

C.12.1 General

Bridge structure dimensions of an operational nature are geometric design features and are influenced by the geometric design elements and operational characteristics of the approach roadways.

Horizontal and vertical alignment of bridges should conform with those of the approach roadways and, in general, cross section elements of roads on and under bridges should match those of the approach.

On overpasses, it is desirable to carry the shoulder width across the bridge in order to eliminate the hazard of the offsets at the ends of the bridge and to provide a refuge for disabled vehicles. On long bridges, particularly long-span bridges, where costs are high, some width restriction might be appropriate. The effect of the restriction is compensated to some extent by the tendency of drivers to be more alert and to become accustomed to the reduced clearance. For this purpose, a long bridge is defined as 50 m or longer.

C.12.2 Cross section dimensions

C.12.2.1 Roads under bridges (underpasses)

A horizontal clearance from the edge of travelled lanes to bridge pier or abutment of 10 m is desirable to give a pleasing open appearance and to eliminate the need for barrier protection. This might not always be feasible in terms of structure cost or available property, in which case reduced clearance is required together with barrier protection, discussed in Chapter F. Clearances are given in Tables C.12.2a, C.12.2b and Figure C.12.2.

Table C.12.2a
Horizontal clearance at bridges on rural roads

		short overpass (<50 m)			long overpass (>50 m)			underpass		
		left	right		left	right		left	right	
			no sidewalk	sidewalk		no sidewalk	sidewalk		no sidewalk	sidewalk
RLU	50		1.2	0.5		1.0	1.0		2.0	1.0
	60		1.2	0.5		1.0	1.0		2.0	1.0
	70		1.2	0.5		1.0	1.0		2.0	1.0
	80		1.2	0.5		1.2	1.0		2.5	1.0
	90		1.2	0.5		1.2			2.5	1.0
	100		1.2	0.5		1.4			2.5	1.0
RCU	60		1.5	1.0		1.2	1.0		2.0	1.0
	70		1.5	1.2		1.2	1.0		2.0	1.0
	80		2.0	1.2		1.2	1.0		2.5	1.5
	90		2.0	1.5		1.2			2.5	1.5
	100		2.5	1.5		1.4			3.0	1.5
RCD	70	1.2	1.5	1.2	1.0	1.2	1.0	2.0	2.0	1.5
	80	1.2	2.0	1.2	1.0	1.2	1.0	2.0	2.5	1.5
	90	1.2	2.0	1.5	1.0	1.2		2.5	2.5	1.5
	100	1.2	2.5	1.5	1.0	1.4		2.5	3.0	1.5
RAU	80		2.5	1.5		1.5			3.5	1.5
	90		2.7	1.5		1.5			3.5	1.5
	100		3.0	2.0		1.6			3.5	1.5
	110		3.0	2.5		1.7			3.5	1.5
	120		3.0	2.5		1.8			3.5	1.5
	130		3.0	2.5		1.8			3.5	1.5
RAD	80	1.5	2.5		1.0	1.5		3.0	3.5	
	90	1.5	2.7		1.0	1.5		3.0	3.5	
	100	2.0	3.0		1.0	1.6		3.0	3.5	
	110	2.0	3.0		1.0	1.7		3.0	3.5	
	120	2.0	3.0		1.0	1.8		3.0	3.5	
	130	2.0	3.0		1.0	1.8		3.0	3.5	
RFD	100	2.5	3.0		1.5	2.0		3.0	3.5	
	110	2.5	3.0		1.5	2.0		3.0	3.5	
	120	2.5	3.0		1.5	2.0		3.0	3.5	
	130	2.5	3.0		1.5	2.0		3.0	3.5	

Notes

For short overpasses (<50 m) shoulder widths should be carried across bridge.
For measurement of clearance see Figure C.12.2.

Bridges with open abutments are preferable as they provide better visibility. Closed abutments cause greater wind speed reductions and snow accumulation on the roadway beneath the bridge.

C.12.2.2 Roads on bridges (overpasses)

It is desirable that the approach shoulder width be provided on bridge decks to allow adequate refuge for a stalled vehicle. However, this might not always be feasible, in which case some width restriction is necessary, particularly for long-span bridges where costs are high. Clearances are given in Tables C.12.2a, C.12.2b and Figure C.12.2.

C.12.3 Vertical clearances

Vertical clearance requirements vary between jurisdictions and Federal, Provincial and Municipal requirements should be confirmed before designs are finalized.

For vertical clearance dimensions reference should be made to B.4.3.7.

C.13 CROSS SECTION STANDARDS

A set of cross section standards is presented in Figures C.13.1 to C.13.13 for each of the standard classifications listed in Chapter A. Alternatives to the standards might be appropriate, depending on local or site specific conditions.

Table C.12.2b
Horizontal clearance at bridges on urban roads

		short overpass (<50 m)			long overpass (>50 m)			underpass		
		left	right		left	right		left	right	
			no sidewalk	sidewalk*		no sidewalk	sidewalk*		no sidewalk	sidewalk*
ULU	30		1.0	0.5		1.0	0.5		1.2	1.0
	40		1.0	0.5		1.0	0.5		1.2	1.0
	50		1.0	0.5		1.0	0.5		1.2	1.0
UCU	50		1.0	0.5		1.0	0.5		1.6	1.0
	60		1.0	1.0		1.0	1.0		1.6	1.0
	70		1.2	1.0		1.5	1.0		2.0	1.0
	80		1.2	1.0		1.5	1.0		2.5	1.0
UCD	50	1.2	1.2	0.5	1.0	1.0	0.5	1.4	1.6	
	60	1.2	1.5	0.5	1.0	1.0	0.5	1.4	1.6	
	70	1.5	1.8	1.0	1.0	1.5	1.0	1.4	2.0	
	80	1.5	1.8	1.0	1.0	1.5	1.0	1.5	2.0	
UAU	50		1.5	1.0		1.2	1.0		2.4	1.0
	60		1.5	1.0		1.2	1.0		2.6	1.0
	70		2.0	1.0		1.5	1.0		2.6	1.0
	80		2.0	1.5		1.5	1.5		3.0	1.0
UAD	60	1.4	1.5	1.0	1.0	1.2	1.0	1.4	2.6	1.0
	70	1.4	2.0	1.0	1.0	1.4	1.0	1.4	2.6	1.0
	80	1.6	2.0	1.5	1.2	1.5	1.5	1.5	3.0	1.0
	90	1.7	2.5		1.5	1.5		1.5	3.0	
	100	1.8	2.5		1.5	1.5		1.5	3.0	
UFD	80	2.5	3.0		1.5	1.5		2.5	3.0	
	90	2.5	3.0		1.5	1.5		2.5	3.0	
	100	2.5	3.0		1.5	1.5		3.0	3.0	
	110	2.5	3.0		1.5	1.5		3.0	3.0	
	120	2.5	3.0		1.5	1.5		3.0	3.0	

Notes

*If there is to be a rail between the sidewalk and roadway, then clearance should be the same as when there are no sidewalks.
For short overpasses (<50 m) shoulder widths should be carried across bridge.
For measurement of clearance see Figure C.12.2.

Figure C.12.2
Horizontal clearance

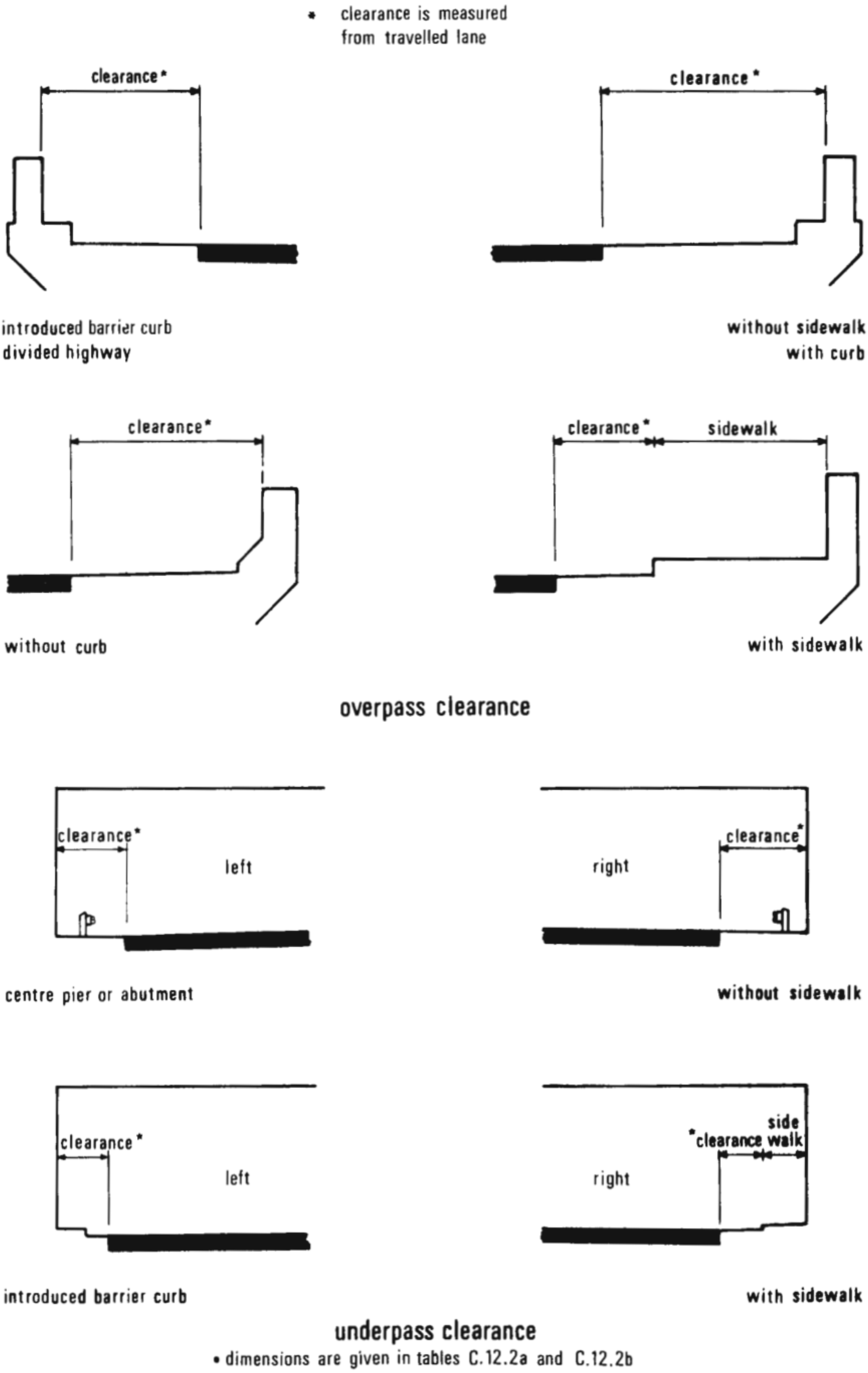
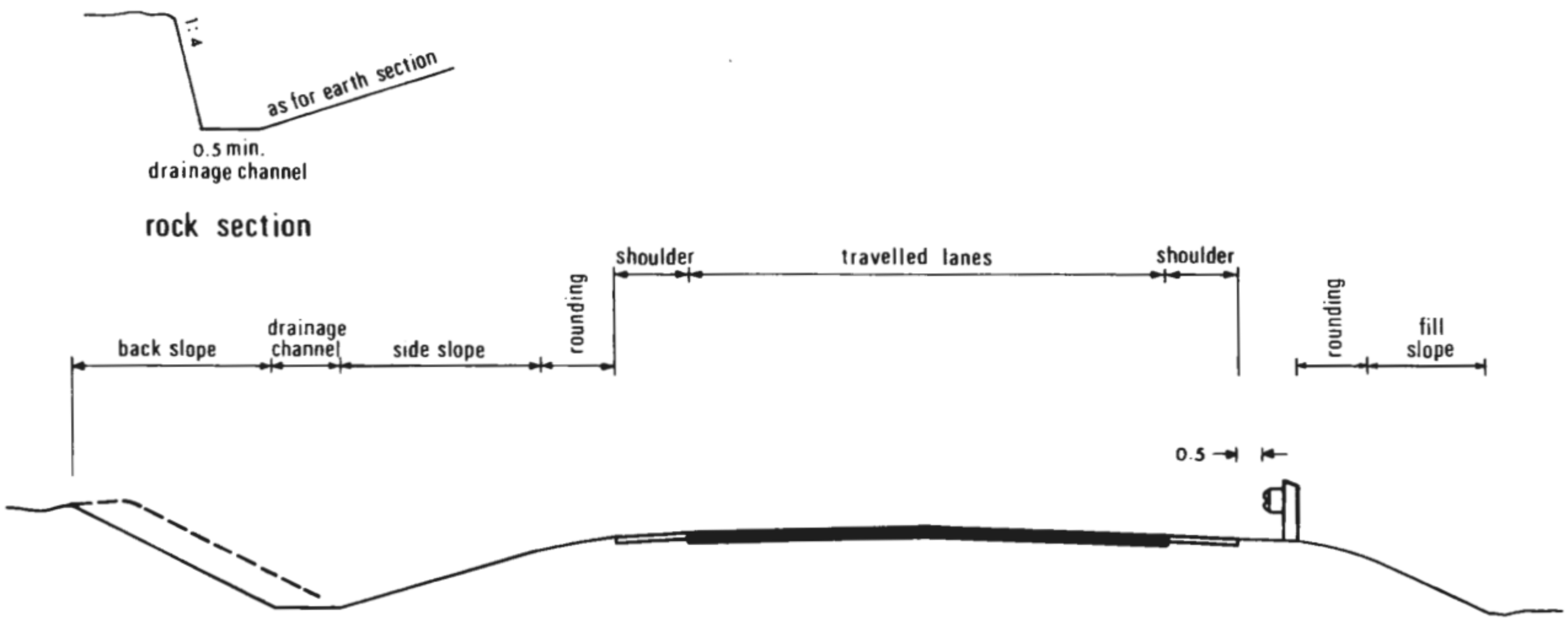
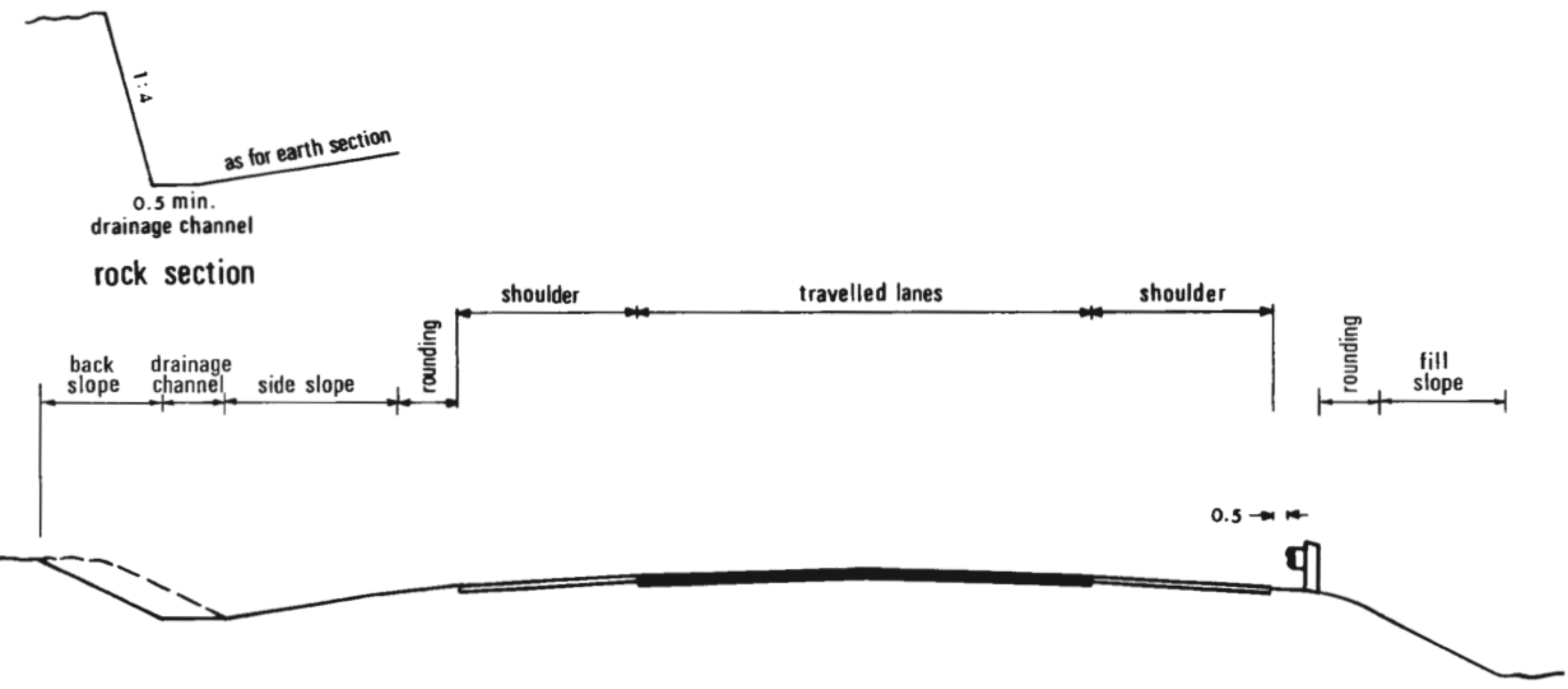


Figure C.13.1
Rural local undivided



earth section

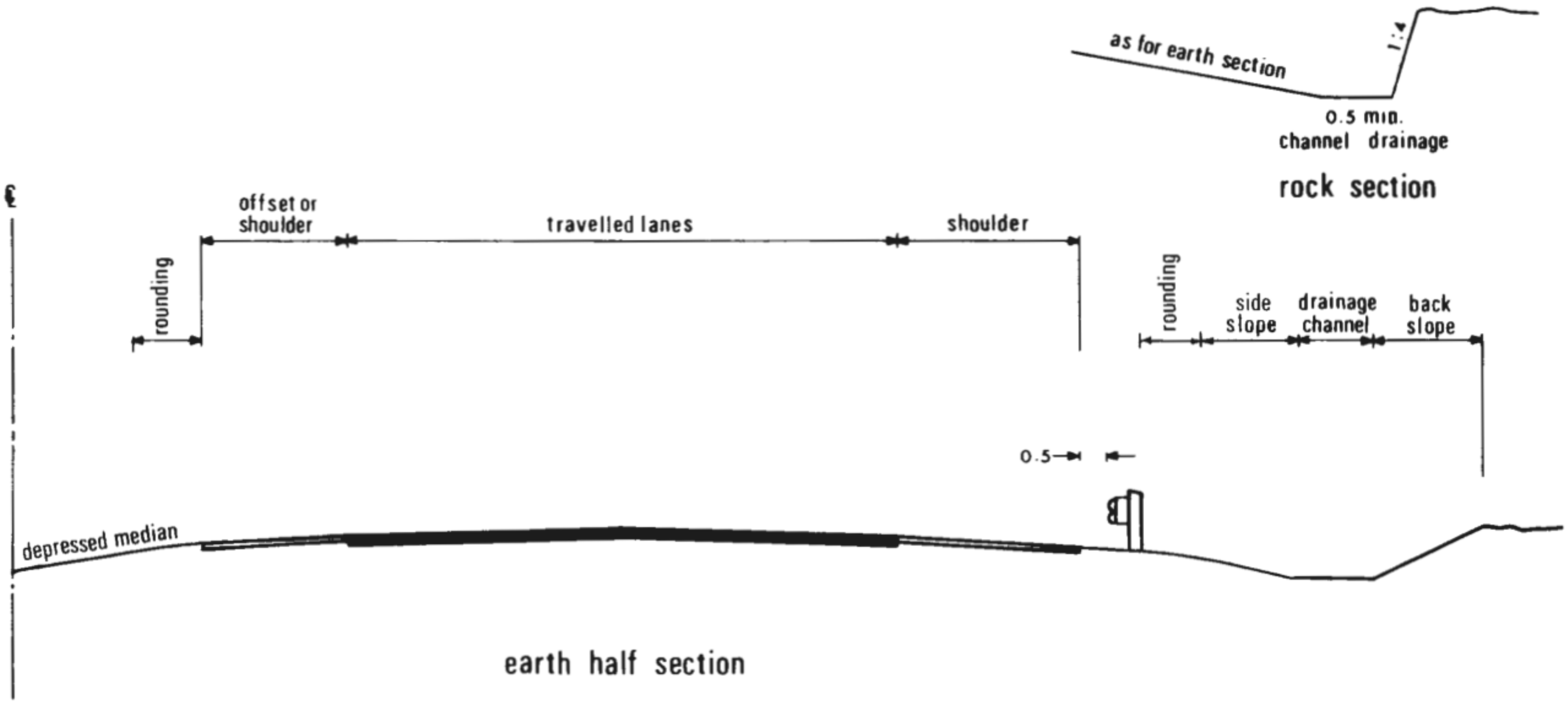
class RLU	earth cut slopes: back	earth cut slopes: side	rn'd	shoulder	travelled lanes	shoulder	rn'd	fill slopes, with guide rail: earth	fill slopes, with guide rail: rock	fill slopes: no guide rail
100 90	2:1	3:1	1.0 0.5	1.0	each lane 3.3	1.0	1.0 0.5	2:1	1.5:1	3:1
80	2:1	3:1	0.5	1.0	each lane 3.0	1.0	0.5	2:1	1.5:1	3:1
70	2:1	3:1	0.5	1.0	each lane 3.0	1.0	0.5	2:1	1.5:1	3:1
60 & 50	2:1	3:1	0.5	1.0	each lane 3.0	1.0	0.5	2:1	1.5:1	2:1



earth section

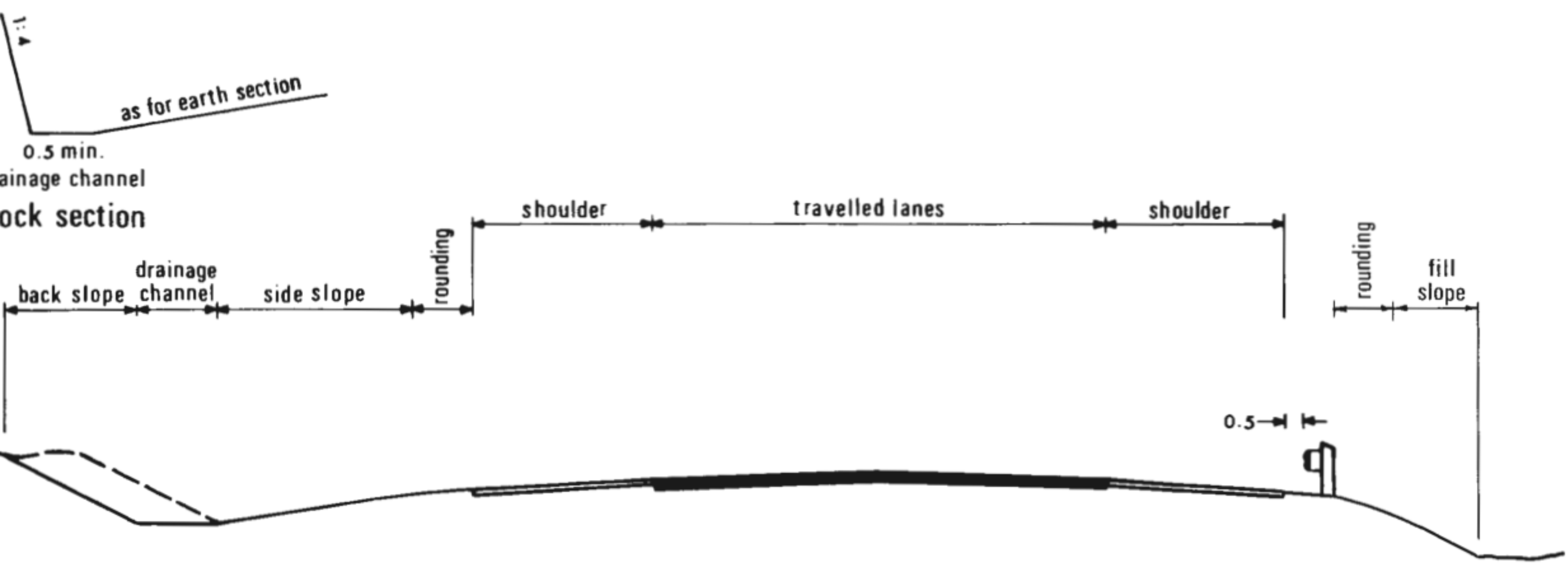
class RCU	design hour volume	earth cut slopes back	earth cut slopes side	rn'd	shoulder	travelled lanes	shoulder	rn'd	fill slopes with guide rail earth	fill slopes with guide rail rock	fill slopes no guide rail
100	>450	2:1	6:1	1.0	3.0	each lane 3.7	3.0	1.0	2:1	1.5:1	6:1
100	<450	2:1	6:1	1.0	2.5	each lane 3.5	2.5	1.0	2:1	1.5:1	6:1
90	>450	2:1	6:1	0.5	2.5	each lane 3.7	2.5	0.5	2:1	1.5:1	6:1
90	<450	2:1	4:1		2.0	each lane 3.5	2.0		2:1	1.5:1	4:1
80	>450	2:1	4:1		2.5	each lane 3.7	2.5		2:1	1.5:1	4:1
80	250–450	2:1	4:1		2.5	each lane 3.5	2.5		2:1	1.5:1	4:1
80	<250	2:1	3:1		2.0	each lane 3.3	2.0		2:1	1.5:1	4:1
70 & 60	>450	2:1	3:1		2.5	each lane 3.5	2.5		2:1	1.5:1	3:1
70 & 60	250–450	2:1	3:1		2.0	each lane 3.3	2.0		2:1	1.5:1	3:1
70 & 60	<250	2:1	3:1		1.5	each lane 3.0	1.5		2:1	1.5:1	3:1

Figure C.13.3
Rural collector divided



class RCD	rn'd	offset or shoulder		travelled lanes	shoulder	rn'd	cut side slope	drainage channel	cut back slope	fill slopes		
		*	+							with guide rail		no guide rail
										earth	rock	
100	1.0	1.5	2.5	each lane 3.7	3.0	1.0	6:1	varies	2:1	2:1	1.5:1	6:1
90 80 70	1.0	1.5	2.5	each lane 3.5	3.0	0.5	4:1	varies	2:1	2:1	1.5:1	4:1

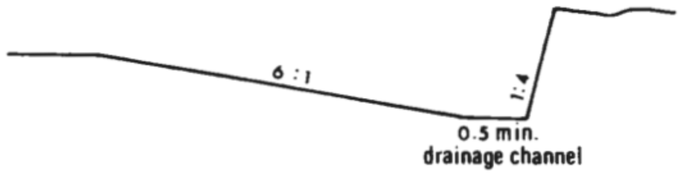
* 2 lanes
\+ 3 or more lanes



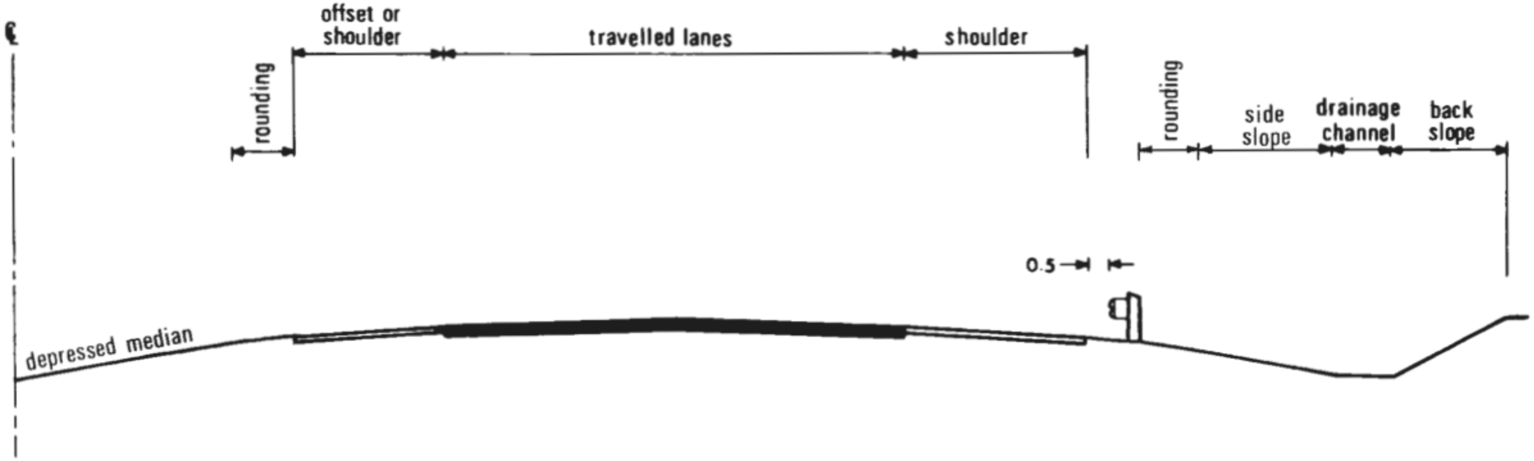
earth section

class RAU	D. H. V.	earth cut slopes back	earth cut slopes side	rn'd	shoulder	travelled lanes	shoulder	rn'd	fill slopes with guide rail earth	fill slopes with guide rail rock	fill slopes no guide rail
120&130		2:1	6:1	1.0	3.0	each lane 3.7	3.0	1.0	2:1	1.5:1	6:1
110	>450	2:1	6:1	1.0	3.0	each lane 3.7	3.0	1.0	2:1	1.5:1	6:1
110	<450	2:1	6:1	1.0	2.5	each lane 3.7	2.5	1.0	2:1	1.5:1	6:1
100 90 80	>450	2:1	6:1	1.0 0.5 0.5	3.0	each lane 3.7	3.0	1.0 0.5 0.5	2:1	1.5:1	6:1
100 90 80	<450	2:1	4:1	0.5	2.5	each lane 3.5	2.5	1.0	2:1	1.5:1	6:1

Figure C.13.5
Rural arterial divided



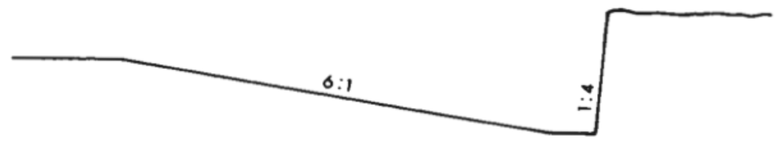
rock section



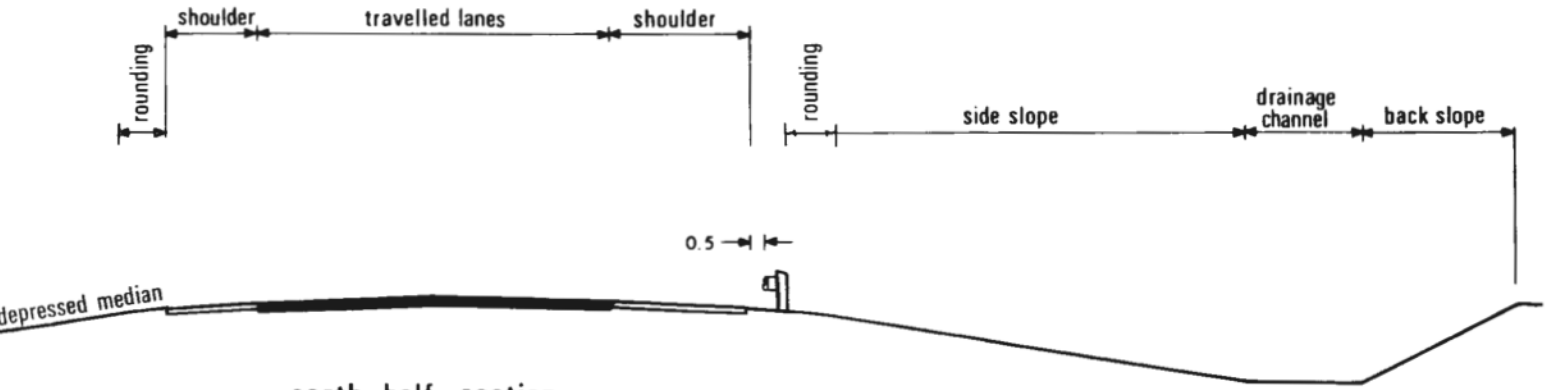
earth half section

class RAD	rn'd	offset or shoulder *	offset or shoulder +	travelled lanes	shoulder	rn'd	cut side slope	drainage channel	cut back slope	fill slope with guide rail earth	fill slope with guide rail rock	fill slope no guide rail
130 120 110 100	1.0	1.5	2.5	each lane 3.7	3.0	1.0	6:1	varies	2:1	2:1	1.5:1	6:1
90 80	0.5	1.5	2.5	each lane 3.5	3.0	0.5	6:1	varies	2:1	2:1	1.5:1	6:1

* 2 lanes
\+ 3 or more lanes



rock section

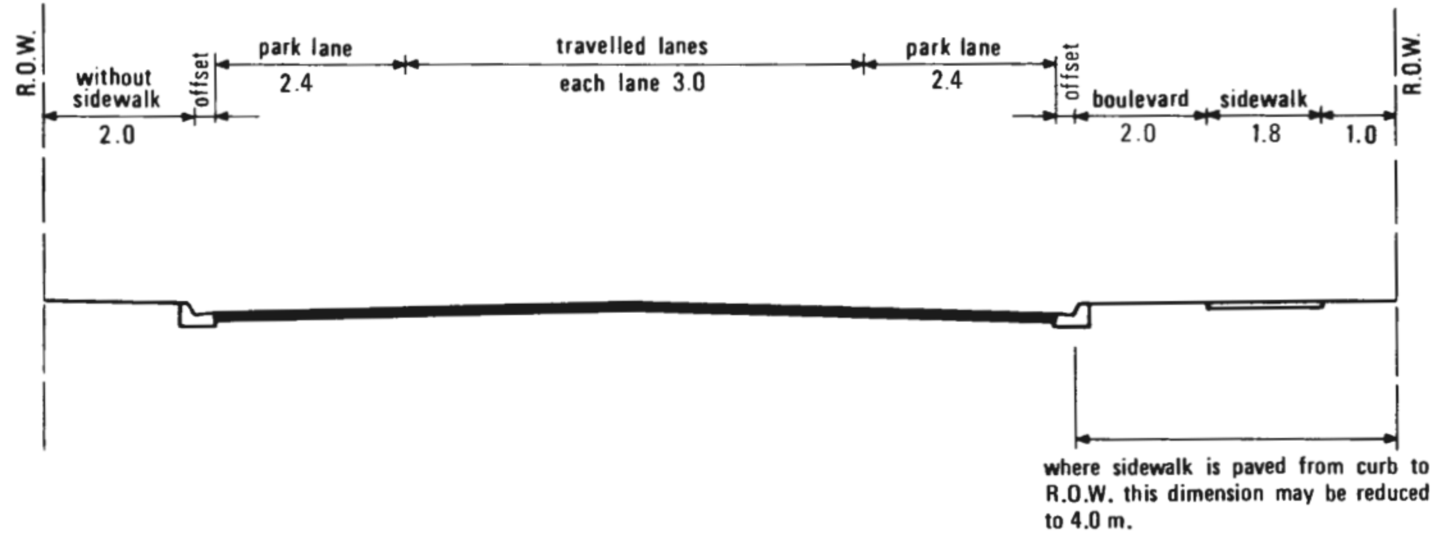


earth half section

lass RFD	rn'd	shoulder		travelled lanes	shoulder	rn'd	cut side slope	drainage channel	cut back slope	fill slopes		
		*	+							with guide rail		no guide rail
										earth	rock	
30 20 10 00	1.0	1.5	2.5	each lane 3.7	3.0	1.0	6:1	2.5	2:1	2:1	1.5:1	6:1

2 lanes
3 or more lanes

Figure C.13.7
Urban local undivided



- pavement width for short cul-de-sacs serving single family dwelling units, minimum 6.0 m.
- where parking on one side only is required (e.g. serving single family dwelling units only) pavement width = 8.5 m.
- where parking on both sides is required (e.g. serving multiple family dwelling units and other land use) pavement width = 11.0 m.

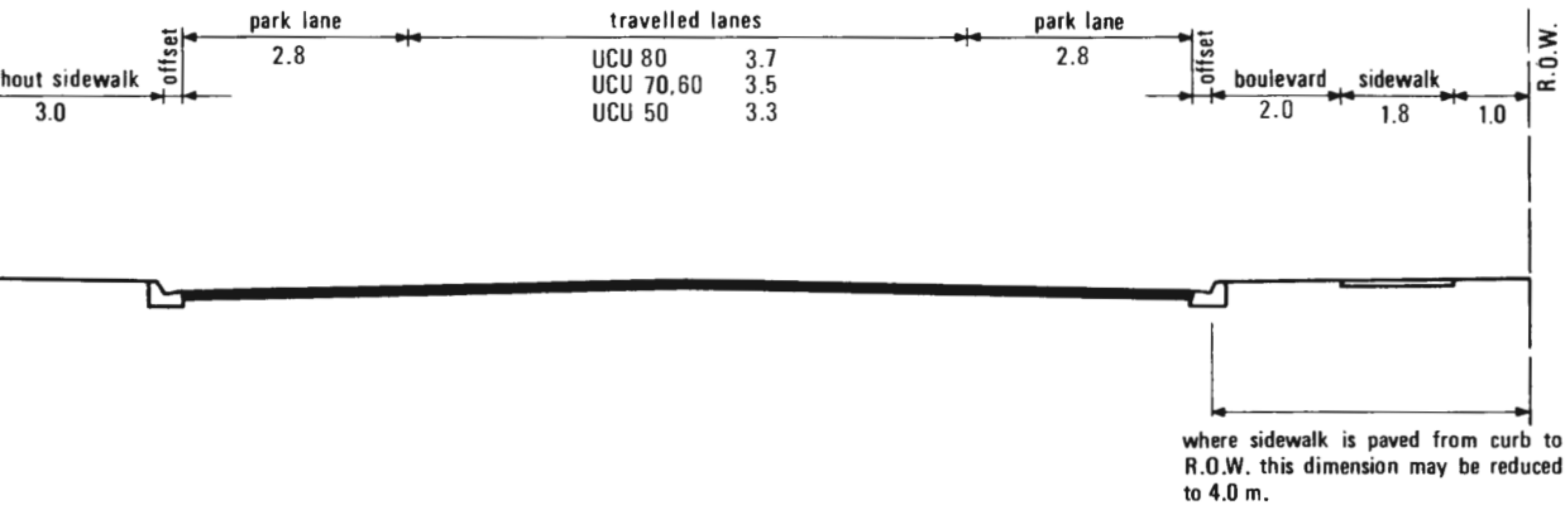
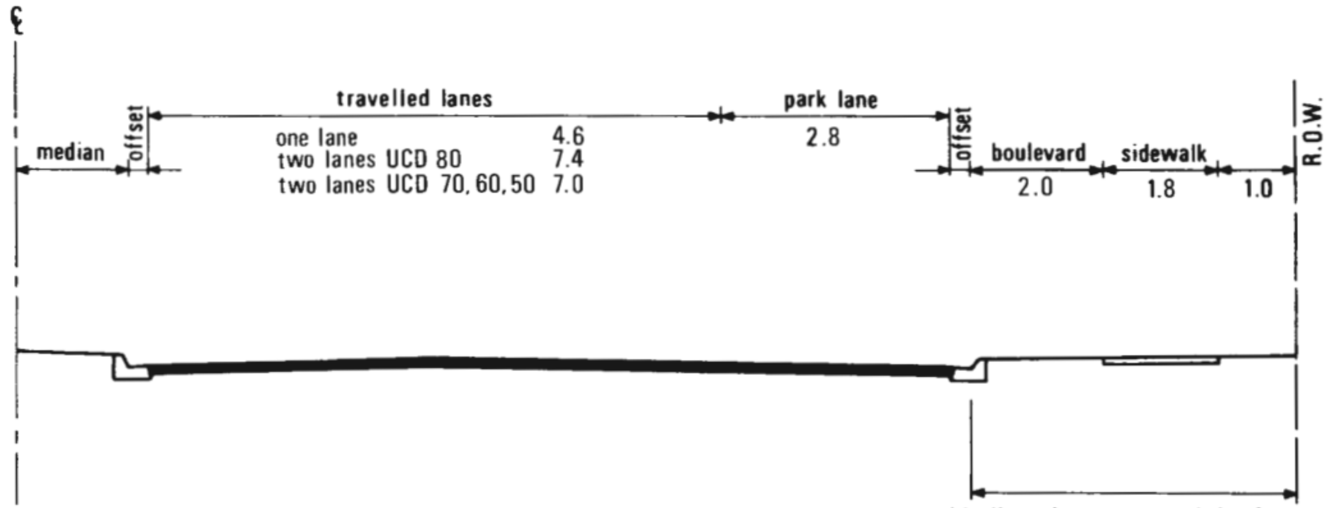

hout sidewalk
3.0
offset
park lane
2.8
travelled lanes
UCU 80 3.7
UCU 70,60 3.5
UCU 50 3.3
park lane
2.8
offset
boulevard
2.0
sidewalk
1.8
1.0
R.O.W.
where sidewalk is paved from curb to R.O.W. this dimension may be reduced to 4.0 m.

Figure C.13.9
Urban collector divided



this dimension may be varied as follows:
where no sidewalk is required, minimum 3.0 m.
where sidewalk is paved from curb to R.O.W., minimum 4.0 m.

- park lanes are not recommended for UCD 60, 70, 80.
- one half of this cross section is shown.
  symmetry about the centre line is assumed but unsymmetrical sections might be appropriate.

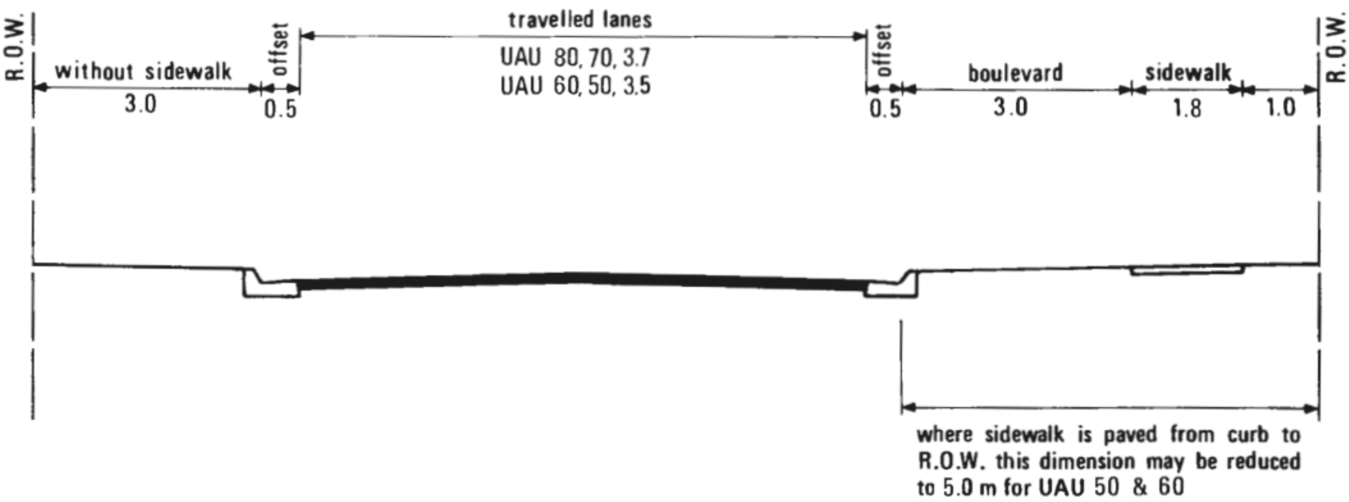
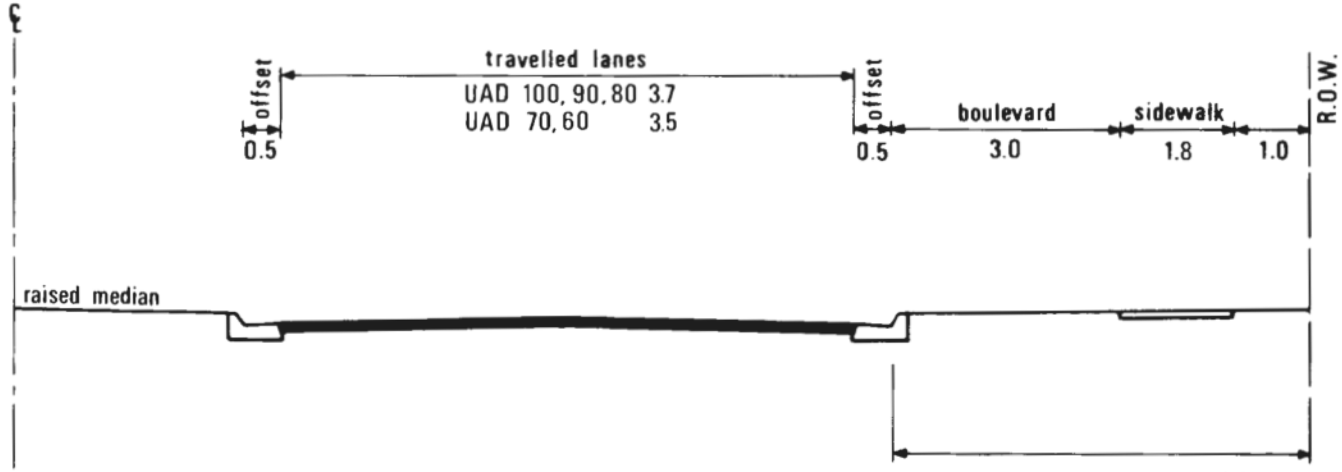
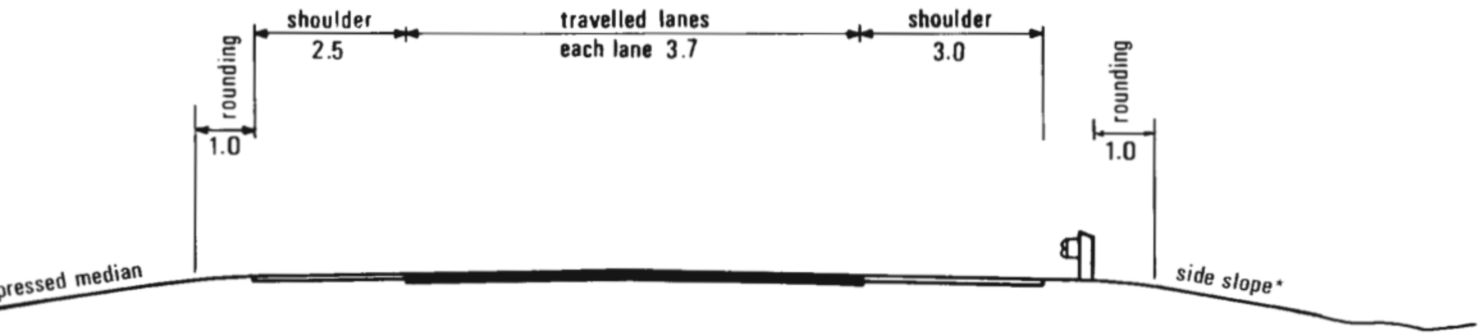

R.O.W.
without sidewalk
3.0
offset
0.5
travelled lanes
UAU 80, 70, 3.7
UAU 60, 50, 3.5
offset
0.5
boulevard
3.0
sidewalk
1.8
1.0
R.O.W.
where sidewalk is paved from curb to R.O.W. this dimension may be reduced to 5.0 m for UAU 50 & 60

Figure C.13.11
Urban arterial divided



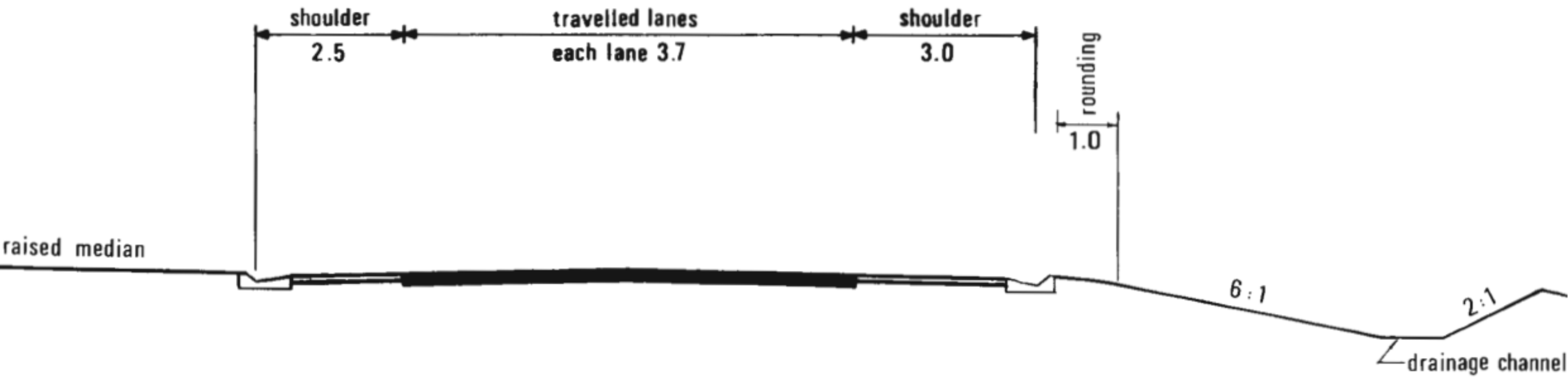
this dimension may be varied as follows:
where no sidewalk is required, minimum 3.0 m.
where sidewalk is paved from curb to R.O.W., minimum 5.0 m.

- one half of this cross section is shown.
  symmetry about the centre line is assumed but unsymmetrical sections might be appropriate.
- unidirection cross slope may be applied



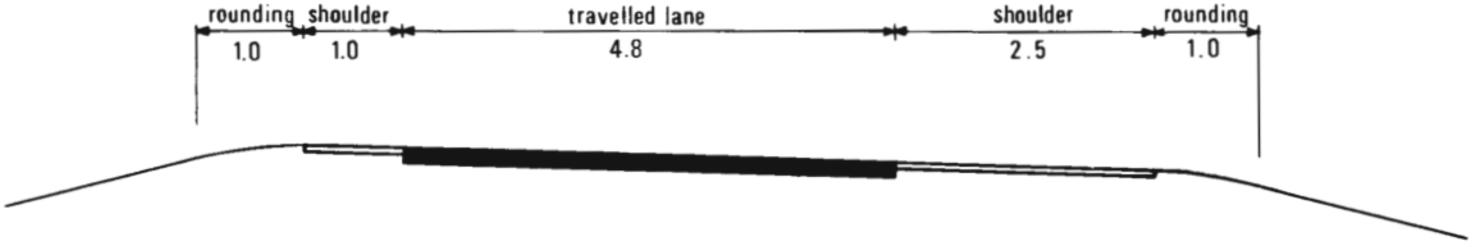
earth section without curb

*cut and fill side slopes
with guide rail 3:1
without guide rail 6:1
cut back slope 2:1

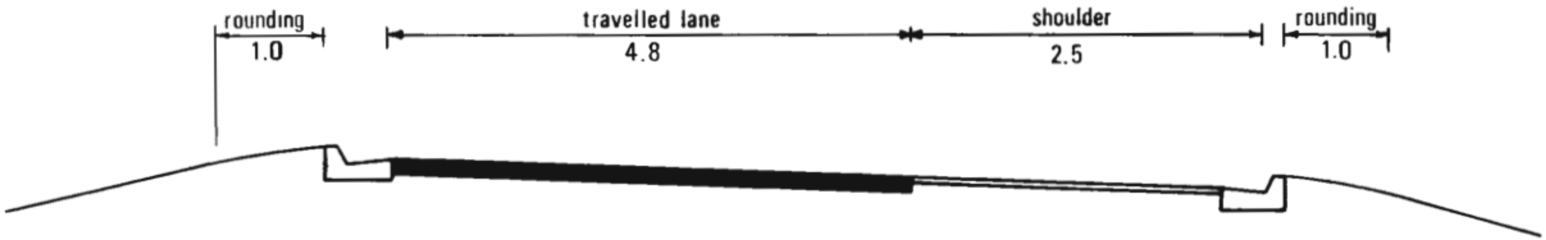


earth section with curbs

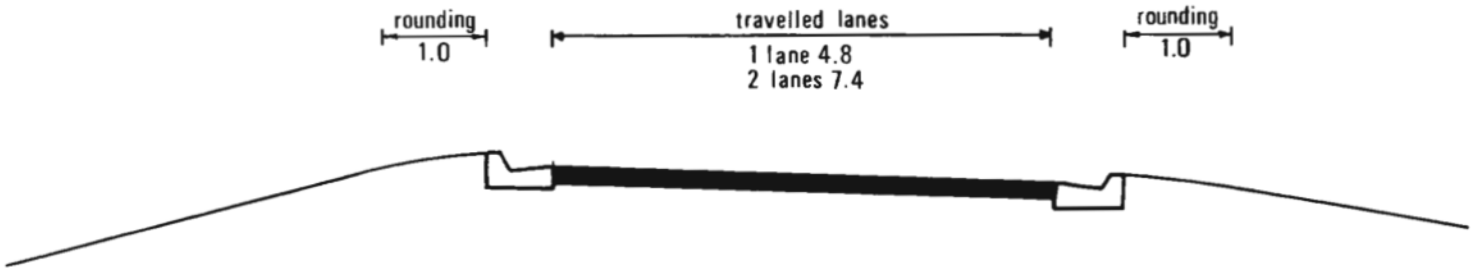
Figure C.13.13
Ramp cross sections



one lane ramp cross section
without curb



one lane ramp cross section
curbed with shoulder



ramp cross section
curb without shoulder

Project C- 3736

South Okanagan Electoral District

Coquihala Highway , Okanagan Connector

Construction: Cousin's Road To Gorman's Mill

Station 1169+00 To Station 1197+67.933

4.2 Km.

Contractor: Edgeworth Contruction Ltd.

Ministry Of Transportation And Highways Supervisor :

R. P. Zerr
Senior Project Supervisor

Report By :
G.T. Wells
Engineering Assistant

Index :

Coquihala Highway Okanagan Connector

Introduction

The project is located in the South Okanagan Electoral District on Highway No. 97, approximately 3.9 kilometres north of the community of Peachland, beginning at station 13+63.467 and runs along the old highway No. 97 to station 37+69.934. At this point it ties into the existing 4 lane highway, just south of Gorman Brother's Sawmill and 2 Kilometres south of the community of Westbank. This Project also runs from west to east, starting from station 1169+72.677 to station 1197+67.933 inclusive. The highway #97 portion included the reconstruction of approximately 2.41 kilometres of highway, the relocation of 0.6 Km. of Highway NO. 97 inclusive. The west to east portion required the new construction of approximately 1.9 kilometers of 4 lane heading east, with an interchange system intersecting highway No. 97.

Scope of Project

Construction work included the following :

a] Clearing and grubbing of the project right- of- way and minor working easements.

b] Sidehill cut and fill, including grading work.

c] Construction of interchange system.

d] Erection of walls.

e] Installation of an off-ramp underpass.

f] Realignment of one existing roadway to accomodate the new interchange.

g] Drainage works.

h] Construction of bridge end fills.

i] Production , Stockpiling and placement of granular materals, asphalt binder and asphalt concrete inclusive.

j] Electrical works.

k] Relocation of a domestic waterline system, construction of settlement pond inclusive.

l] Installation of a pedestrian underpass.

m] Erection of wild life fencing and installation of a ungulate underpass.

n] Paving of the new Highway No. 97.

o] Construction of two traffic islands.

p] Placement of concrete road barrier.

Tender

The tenders of project C-3736 were opened on Thursday may 8, 1986 with the low bid being submitted by and awarded to :

Edgeworth Construction Ltd.
104-346 Lawrence Avenue
Kelowna B.C. V1y 8L4

The contract had an orginal competion date of September 15, 1987, however an extension was granted and the project completed as of January 21, 1988.
The extension was necessiated by:

a] 1 month delay on the new design of the relocation of the domestic waterline on D.L. 2690.

b] The rock quantities overran by approximately 58 %.

c] Some delay was experienced in the relocation of the hydro powerlines.

Actual work commenced on June 18, 1986 with clearing and grubbing and was completed with the final clean up on November 30, 1987.

Contractor

Project Superintendent	Bob Gordon
Project Engineer	Bruce Rines
Project Foreman	Fred Ferris

The contractor located his office on top of the Cherry Pit resturant in Westbank. The hours of work were from 7.00 AM to 5.30 PM and usually 5 days per week. There was a night shift as well commencing in January,1987 to April,1987 inclusive.

Equipment:

The equipment was generally old and in disrepair. Some problems were experienced from lack of accessiblity to equipment caused by down time.

Sub-Contractors

Over the duration of the project three sub-contractors were approved. These were:

1] Gord-don trucking Ltd.

2] Janco Electric Ltd.

3] H. Williamson Blacktop and Landscaping Ltd.

All three sub-contractors worked efficiently and did well for edgeworth.

Ministry Personel

R.P. Zerr , Senior Project Supervisor, was assigned the project with an average staff size of 17 employees.

Senior personnel:
G.T. Wells - Engineering Assistant
V. Larsen - Engineering Aide
V. Naude' - Engineering Aide

Generally : Two field crews with six office personel.

Vechiles: Four Ministry vechiles and two Rentals.

Servicing: This was provided by the Kelowna yard and was exemplary.

The project was designed by U. M. A. Engineering Ltd. There were some important flaws encountered on the U.M.A. plans.

After a one month delay, a new design was recieved reguarding the drought waterline. This delay could have been avoided had more communication taken place between the drought estate and U.M.A. This delay was also one of the contrbuting factors in the extension of the project.

Future designs should also include an additional three metres of R/W at the base of any major fill. This would be used to erect a berm to protect the abutting property from rolling debris encountered in the construction of fills.

The typical sections failed to accommodate a provision for concrete barrier in areas of major fills [L- 1100,stations 1174+00 - 1179+00] . The Geometry and Laning illustrates the rounding on all ramps to be 0.5 m compared to 0.4 m indicated on the Typical Sections. The information reguarding the Future Truck Lane on the L-1100 line is unclear, especially in the areas were it blends into the L-20 and L-40 lines.

The typicals indicate the Truck lane to continue up to station 1185+04.509 with no information at all indicated on the L-40. Later the neccessary information was recieved as a 95 metre taper from stations 1182+75.480 to 1183+70.48.

The estimated rock quantity, on C-3736 was incorrect, leading to a overrun of approximately 58 % over the quantity in the Schedule of Approximate Quantities. This was the result of a discerpancy between the original geotechnical investigation report and the final as built volumes. [The orginal quantity was 330,000 cu. m. with the price remaining the orginal contract price until the 20% overrun point was reached [396,000 cu. m]. The remainder was renegotiated and a additional cost incurred to reach the total [564,405 cu. m.]. This also contributed greatly to the final cost of the project.}

The depth of rock below the overburden differed considerably, between the report [completed by Golder Associates] and that of the ministry cross sections.

Examples:

a] L 1100 Line - Station 1181+20 to 1183+00 : The rock depth illustrated on the U.M.A. cross sections varied from 2 to 4 metres below the acutal depth determined by ministry field measurements during construction.

b] 1100 Line - Station 1183+40 to 1184+00 : The U.M.A. rock depth varied from 10 to 20 metres below depths determined by the minstry field measurements.

c] L40 Line - Station 37+60 to 38+60 : Through interpelation the U.M.A. sections varied 12 to 14 metres below the minstry field measurements.

d] L40 Line - Station 38+60 to 40+40 [includes 1185 to 1186+40] : The U.M.A. rockdepth varied from 12 to 14 metres below the ministry field measurements

The mass haul diagram indicated that the excavated material from the L- 1100 line was to be hauled from the east[station 1184+00 approximately] to the west fills [stations 1169+80 - 1179+00 approx.] .

This resulted in west portion of the L-1100 line [stations 1169+80 - 1184+00 approx.] being completed to construction grade prior to the discouvery of the excess material in the interchange. At this time the completion of the L -1100 line dictated that a grade change to accomodate the excess material was impossible. Therefore a delema was experienced on what to do with the material. Fortunately Lot#3 , R2-158-004, became available to waste the excess material. Had this lot not become available, it would have been extremely difficult to finish the project.

The stationing on all the lines and ramps increases from west to east with the exception of the L-30 Line, which increases from east to west. This can easily lead to confusion as the station that the L-30 and L-40 meet [38+62.171] on the L-30 line is very close to the seperpate stationing of the L-40 lineThe selection of the L1100 line as the controlling factor, of the spot elevations, on the west section of the interchange system resulted in some difficulty. The spots on right angles to the 11100 line , having no real relevance to the necessary, even stations on the remaining interchange lines [L50, L40, L30]. This nesscitated the interpelation of these spot elevatons which was both, tedious and time consuming.

The Bin Wall [drawing R2-158-039] heights on the different bins were incorrect. The revision was done on site by using the fixed design heights for the different bins.

In three main areas the rock was not encoutered at the depth illustrated on the U.M.A. cross sections, but considerably lower.

Stations 1178+20 to 1181+00
Stations 1181+00 to 1182+60
Stations 1191+70 to 1196+78

This neccessitated a change from a Type"A" design to a Type"D" design. To accommodate this change additional R/W was required. This increased the quantity of Type"D" and Increased the amount of Clearing and Grubbing.

Changed Conditions

The rock design on C-3736 was typicaly 70 degrees and included a 1 metre bench every 8 meters of excavation and a 4 metre bench at 20 metre. The unstable condition of the rock necessitated the elimination of the 1 metre benches in the following appoximate stations: [L 40 - 37+60 to 44+00 , L 20 - 25+50 to 29+65 , This increased the quantity of Type"A". On the L-1100 line , the 4 metre bench was deleted entirely , as the rock was only slightly over the 20 metre mark [L1100 - 1190+30 to 1195+60] respectively . This decreased the amount of Type "A" that would have normally been excavated

Aggregates

All the S.G.S.B. material was located , produced and stockpiled on site , the paving aggregates[with the exception of the Class1 Paving Aggr.] inclusive. The source of the material being , L50 , L40 , L20 and L1100 lines respectively.The quantites in the Schedule of Approximate Quantities reflected only 50% of the total quantity neccessary to complete the project for paving. The contractor aggreed to produce the additional under the existing Unit Prices.

Aggregates cont'd

The original tests indicated that the material on site did not meet the requirements for granular materials. However, the contractor managed to achieve the desired product. This was accomplished with difficulty, by blending , wasting , and mixing of materials, from the various Lines, to achieve products within the specifications. The idea of using the material that was both readily available and a portion of the overrun, at first apperance seemed excellent. However, as production proceeded and stockpiling of the material commenced, it became apparent that the material being produced and the remaining excess material made areas to stockpile extremely scarce. The contractor stockpiled the material on the L-70 and L-1100 Lines and often experienced problems working around them.

All the granular materials were produced on site with the exception of the class 1 paving aggregate. The material on site failed to meet the neccessary soundness for paving.

Culverts

All the lengths of culverts shown on the drawings were given as horizontal distances scaled off the plan. Because of the steep terrain encountered and the fact that the culverts were designed to be installed roughly parallel to the lay of the ground a resulting 10 to 20 percent increase in the lengths was incurred. Also in the orginal contract, no provision was made for Type"A" Foundation Excavation. In several cases Type"A" was encountered in culvert installation , where it was impossible to change either the skew or the stationing in order to avoid the rock. A Unit Price was negotiated for this requirement. Both these factors also increased the final cost of the project.

Increased compaction & Watering

The final amount of increased compaction was approximately 50% of the amount in the original contract. It would appear that when the orginal amount was calculated that the divison by a factor of 2 was eliminated, leading to an underrun. The quantity of water overran by approximately 35% . This was the result of the granular nature of the material and the contractor's attempt at controlling the dust on the project, in the close proximity of s.22

Revisions

During the course of the project several revisions were received indicating various changes. An example of this is the electical drawings, which would illustrate various flares and additions not previously shown. In addition to this, at the time that the new revisions were received, most of the areas indicated had been completed to construction grade. A great deal of trouble was experienced with adding flares and additions after the fact.

Contract Quantites & Costs

Appendix 1	Project Progress Graphs
Appendix 11	Tabulation of Quantities
Appendix 111	Project Map

Appendix 11 illustrates a comparison between , the original Schedule of Approximate Quantities and the Final Quantities. An explanation and breakdown of the major additions is provided on Pages 8 - 10.

The costs are summarized as follows:

Tendered Value	4,901,141.00
Overruns	1,566,878.00
Additions	1,292,034.00
Extra Work Orders	87,937.00
Total contract cost	7,847,990.00

The ministry costs incurred were as follows:

Materials	703,000.00	
Engineering	1,144,000.00	
Miscellaneous	343,000.00	theoritcal
Total Project Cost	10,037,990.00	

Wildlife fencing

The Contract Specifications for fencing failed to specify the minor, but equally important requirements of the fencing. As a result the contrator was required to return on site in March of 1988 to improve areas of the fence and meet construction and evinromental requirements.

Traffic Control

Traffic control was required on highway # 97 during construction and was carried out by Edgeworth themselves.

The following Additions also affected the quantities as well as adding to the total cost of the project.

Item * of Tabulation of Quantities

a] Additions to domestic waterline system — Appendix 11, Item * 20

The domestic waterline system [D. L. 2690] was revised to include a settlement pond and associated works.

b] Additional blast hole spacing — Appendix 11, Item * 27

The nature of the material neccessitated closer spacing in the drilling pattern. This was done on the L-40 Line @ 44+00 only and used in pre-shear

c] Addition of Type A foundation excavation — Appendix 11, Item * 7

The presence of rock, in culvert designated areas required a negotiated Type A Unit price. page* 6

d] Addition of 54 M vechile underpass — Appendix 11, Item * 28

The revised design of the interchange system included an underpass on the L 70 off- ramp which was not included in the Schedule of Approximate quantites a the time of tender.

e] Additional bedding — Appendix 11, Item * 29; Appendix 11, Item * 34

The addition of the vechile underpass , and Binwall [L70 , L 50 Lines] neccessiated the presence of exta bedding.

f] The addition of concrete curb & gutter — Appendix 11, Item * 30

With the addition of the vehile underpass [L70 line], concrete curb & gutter were required to complete the design.

g] The addition of manholes & c.b. manholes — Appendix 11, Item * 32

The re-design of the interchange system [L70,L80 &L50 lines] required additional drainage works. This was not included in the S.O.A.Q. at the time of tender.

Explanation Cont'd | Item # of Tabulation of Quantities

h] The addition of a earth retaining wall — Appendix 11, Item # 33

The close proximity of the L1100 line to the L70 line in the interchange, neccessitated the wall and was included in the new design.

i] The addition of a metal binwall — Appendix 11, Item # 34

This was also included in the new design and was required as to deter any further expropriation of D.L. 2690 [L50 line]

j] The addition of overhaul on project C- 3907 — Appendix 11, Item # 4-b

With the excess material readily available on C-3736 and a perdicted shortage of fill material on C-3907 the decision was made to haul onto C-3907 at a negotiated Unit price.

k] The placement of rock at station 1169+50 — Appendix 11, Item # 35

This was a portion of the material hauled on to and placed on C-3907. This material was stockpiled only to be placed at a later date, as expropriation of additional R/W on D.L.449 had not yet taken place.

l] The Instalation of concrete road barrier — Appendix 11, Item # 36

This was placed on the newly reconstructed highway # 97 and was not included in the original contract.

m] The Overrrun ,"Type A" — Appendix 11, Item # 3-a

Note [see page # 4 for explaination of "Type A" overrun .]

n] The addition of filter coth — Appendix 11, Item # 37

This was used in conjunction with 200 mm sub - drains and was not in the original contract.

Explanation Cont'd | Item # of Tabulation of Quantities

o] Paving of the underpass off- ramp — Appendix 11, Item # 38

In order for the completion of the vehile underpass it was neccessary that it be paved. This also incorperated the paving of a temporary detour on highway #97. The underpass was not originaly included in the Schedule of Approximate Quantities at the time of tender and it's presence forced the contractor to make special arrangements for a seperate paving operation. A claim was reviewed and approved for the additional cost incurred by the contractor.

P] Vaults for hydro & telephone, conduit inclusive — Appendix 11, Item # 39

This was required for additional electrical in the interchange system. It was also not included in the original contract at time of tender.

q] Additional electrical — Appendix 11, Item # 40

A set of revised drawings arrived on 87-08-05 to include additional electrical. This was also not in the original contract at the time of tender.

r] Addition of extruded concrete curb — Appendix 11, Item # 41

The presence of the traffic Islands on the newly constructed highway # 97 required that an extruded curb be placed around the circumference.

s] Addition of Type A wildlife fencing — Appendix 11, Item # 18

This was related to the fact that rock fencing was required in areas not previously indicated on the construction drawings as well as the specifications being changed. The new unit price was accepted as the condition of the terrain [steep and rolling] neccessitated the use of handwork.

t] Double handled Type A — Appendix 11, Item # 18-d

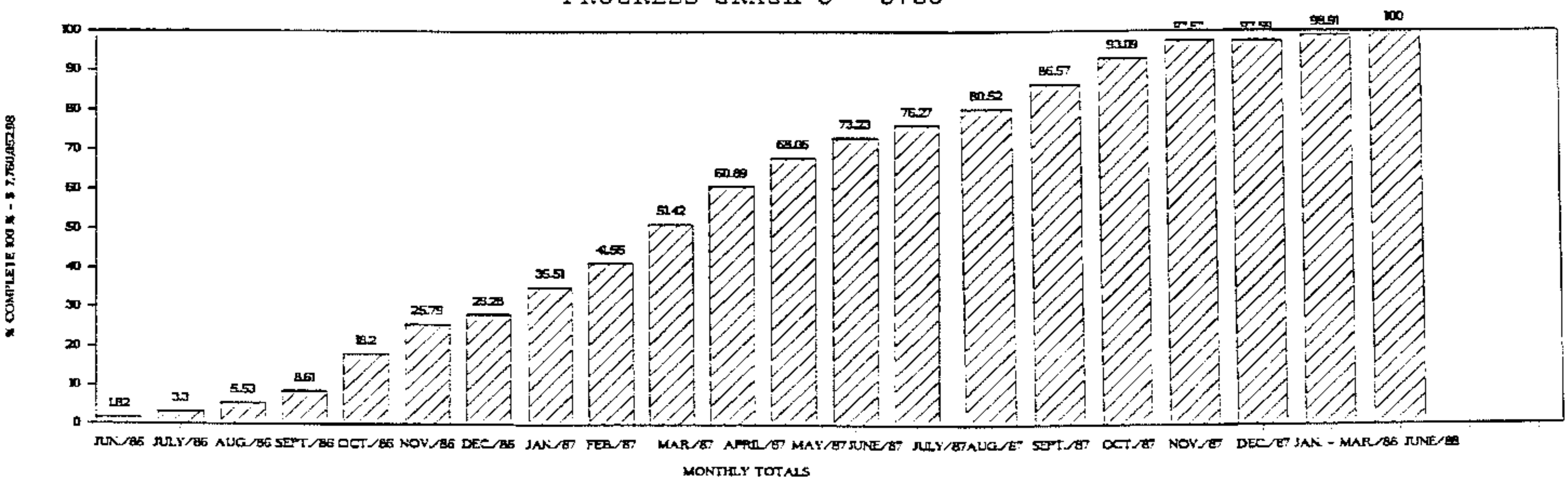
The presence of the vehicle underpass [L 70 line] inhibited the handling of the Type A material at stations 1188+36 to 1189+40. A claim was reviewed and granted for compensation.

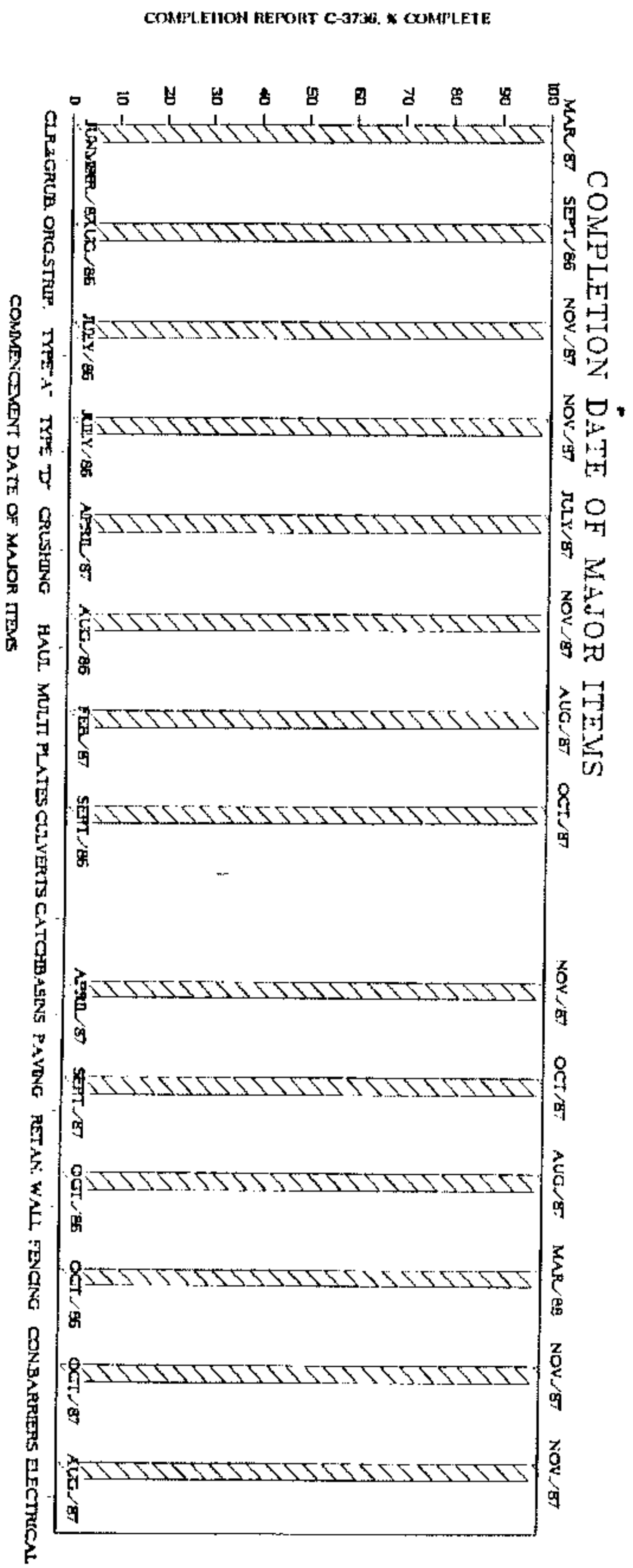
UNIT NO.	DESCRIPTION
110	D - 10 CAT - FINING
160	D - 6 CAT - FINING
184	D - 8 CAT - FINING
185	D - 8 CAT - FINING
194	D - 9 CAT - FINING
193	D - 9 CAT - FINING
200	D - 631 SCRAPER - FINING
201	D - 631 SCRAPER - FINING
202	D - 631 SCRAPER - FINING
203	D - 631 SCRAPER - FINING
275	WABCO WATER TANKER
340	LOADER - 992 - FINING
---	LOADER - 988 - FINING
402	CAT WAGON - 769 - FINING
403	CAT WAGON - 769 - FINING
404	CAT WAGON - 769 - FINING
405	CAT WAGON - 769 - FINING
605	BRONCO - 4 X 4
611	PICKUP - 2 X 4
612	PICKUP - 2 X 4
618	AMBULANCE - 2 X 4
622	T. FL. DECK - 3T CRANE
629	PROPANE PICKUP - 4 X 4
636	CREW CAB. - 4 X 4
640	OPEN LUBE TRUCK
642	FLAT DECK - 5T TRUCK
647	WASH TRUCK
649	LUBE TRUCK
650	FUEL TRUCK
651	POWDER TRUCK
670	WHITE WATER TANKER
700	INSLEY BACHOE
812	DYNAPACK - CA25
900	TANK DRILL - M32
901	TANK DRILL - M32
R903	TRACK DRILL PR-66 3700
1001	PITMAN -4T CRANE
1009	PETTIBONE - 12T CRANE
1010	LEROI COMPRESSOR
R1022	CFM COMPRESSOR - 750
R1100	ATCO TRAILER 10 X 16
1103	TANK DRILL - M32
---	MUSTANG DRILL

Appendix 1

Project Progress Gragh C - 3736

"PROGRESS GRAGH C - 3736"




COMPLETION DATE OF MAJOR ITEMS
COMPLETION REPORT C-3736, % COMPLETE
0
10
20
30
40
50
60
70
80
90
100
MAR./87
SEPT./86
NOV./87
NOV./87
JULY/87
NOV./87
AUG./87
OCT./87
NOV./87
OCT./87
AUG./87
MAR./88
NOV./87
NOV./87
JULY/86
JULY/86
APRIL/87
AUG./86
FEB./87
SEPT./86
APRIL/87
SEPT./87
OCT./86
OCT./86
OCT./87
AUG./87
CLR.&GRUB.
ORG.STRIP.
TYPE "A"
TYPE "D"
CRUSHING
HAUL
MULTI PLATES
CULVERTS
CATCHBASINS
PAVING
RETAN. WALL
FENCING
CON.BARRIERS
ELECTRICAL
COMMENCEMENT DATE OF MAJOR ITEMS

Appendix 11

Tabulation of Major Items

Item No.	Description of work	Tender Quantity		Finalized Quantity
1	: Mobilization	: L.S. :	240,000	: 240,000
2	: Clearing and grubbing			
	a] clearing	: ha. :	46.25	: 47.632
	b] Grubbing	: ha. :	46.25	: 47.632
3	: Roadway and Drainage			
	: Excavation			
	: 300 m Freehaul			
	a] Type "A"	: m3 :	330,000	: 564,405
	b] Type "D"	: m3 :	501,000	: 498,711.64
	c] Organic Stripping	: m3 :	87,500	: 6309.12
4	: Overhaul on Excavation			
	: 1,000 Sta. M	:	5,803	: 3,735.18
	: Overhaul on C-3907	:	Addition	: 775
5	: Increased Compaction			
	: and Watering			
	: Increased comp.	: m2 :	150,000	: 72,127.42
	: Watering	: Kl. :	53,300	: 74,961
6	: Base Course &			
	: Sub-Base Aggreg.			
	: a] Select granular			
	: Sub-Base			
	: 100% to pass 75 mm	: t :	113,003	: 146,902.04
	: b] Well Graded			
	: Base Course Agg.			
	: 100% to pass 75 mm	: t :	24,979	: 39,589.78
	: c] well Graded			
	: Base Course Agg.			
	: 100% to pass 25 mm	: t :	14,827	: 28,770.95
	: d] High Fines			
	: Surfacing Agg.	: t :	1,238	: 148
	: e] Bridge end fill	: t :	61,500	: 57,673.31
7	: Foundation Excavation			
	: Type "D"	: m3 :	1,760	: 13,660.83
	: Type "A"	: m3 :	Addition	: 419.46
	: Drought Cr. Con.			
	: Cut-off Headwall	: LS :	Addition	: 1
	: Install 200 mm Dia.			
	: perf. drain pipe	: m :	Addition	: 144

Item No.	Description of Work	Tender Quantity		Finalized Quantity
8	: Ungulate crossing			
	: a] 4288 x 3772 mm			
	: dia. S.P.C.S.P.	: M :	60	: 60
	: b] Select Gran.			
	: for bedding	: t :	5,750	: 7,894.95
	: c] Sand Agg.	: t :	60	: 42.7
9	: Pedestrian Crossing			
	: a] 2320 x 2680 mm			
	: dia. S.P.C.S.P.	: M :	56	: 56
	: b] S.G.S.B for			
	: bedding	: t :	4,565	: 3,178.81
10	: Culverts			
	: a] 500 mm CSP	: m :	30	: 24
	: b] 600 mm CSP	: m :	391	: 583.5
	: c] 800 mm CSP	: m :	213	: 227.5
	: d] 1400 mm CSP	: m :	106	: 103
11	: Catch Basins &			
	: Leads			
	: a] Catch basins	: ea. :	11	: 14
	: b] 600 mm CSP			
	: Lead pipe	: m :	24	: 75
	: c] 300 mm CSP			
	: Lead pipe	: m :	391	: 254
	: d] CSP elbows	: ea. :	12	: 5
12	: Catch Basin			
	: manholes			
	: a] 3.4 m high	deleated		
	: b] 4.1 m high	deleated		
13	: Rip - Rap			
	: a] Class 10 kg.	: m3 :	40	: 399.3
	: b] Class 50 kg.	: m3 :	32.5	: 1,055.93
14	: Paving			
	: a] Removal of			
	: Existing pavement	: m3 :	1,750	: 695.2
	: b] Sawcutting	: m :	30	: 72.4
	: c] RM20 Primer			
	: & Tack Coat	: L :	46,000	: 68,894.4
	: d] Asphalt Concrete			
	: Class 1	: t :	4,912	: 7,215.41
	: e] Asphalt Binder			
	: Course	: t :	7,596	: 13,715.05

Item No.	Description of Work		Tender Quantity		Finalized Quantity
15	: Shouldering Agg.	: t :	3,415	:	4,085.44
16	: Relocate concrete : Barrier	: m :	900	:	1,075
17	: Retaining Wall : Netupsky	: LS :	1	:	1
18	: Wildlife Fencing				
	: a] Wildlife Fence	: m :	6,975	:	3,940.35
	: b] One - Way : Deer Gates	: ea. :	16	:	12
	: c] Pedesrian Gates	: ea. :	2	:	6
	: * Type "A"	: m :	Addition	:	1,907.8
19	: 5 m Wide Cattle : Gates	: ea. :	2	:	2
20	: Water main : Relocation				
	: a] 150 mm & valves	: m :	825	:	827
	: b] 25 mm & Valves	: m :	90	:	92
	: c] 150 mm Casing	: m :	40	:	72
	: d] Conn. to existing : Irrigation Main	: ea. :	Addition	:	3
	: e] Air Valves	: ea. :	Addition	:	2
	: f] Irrig. Take - Offs	: ea. :	Addition	:	5
	: g] Bleed-off [Det. A]	: ea. :	Addition	:	1
	: h] Bleed-off [Det. B]	: ea. :	Addition	:	1
	: i] Bleed-off [Det. C]	: ea. :	Addition	:	1
	: j] Con. Thrust Block	: ea. :	Addition	:	9
21	: Rock bolting	: PS :	100,000	:	142,656.89
	Part 2 Electrical				
22	: Trenching Including : Backfill	: LM :	3,000	:	6,296.3
23	: Supply & Install : Rigid PVC Conduit				
	: 2.1 - 2 " RPVC	: LM :	300	:	1,989.63
	: 2.2 - 1 1/2 " RPVC	: LM :	2,800	:	5,284.25

Item No.	Description of Work		Tender Quantity		Finalized Quantity
24	: Install Plastic				
	: Junction Boxes				
	: 3.1 Type 6	: ea. :	65	:	96
	: 3.2 Type 6*	: ea. :	20	:	53
	: 3.2 type 8	: ea. :	4	:	4
25	: Install. of Concrete				
	: Pedestals				
	: 4.1 – *3 with				
	: 2 " RPVC	: ea. :	65	:	95
	: 4.2 – for Heavy				
	Duty Sign Pole	: ea. :	5	:	1
26	: Post Flasher				
	: Installation	: ea. :	4	:	2
27	: Smooth Blast				
	: hole Spacing	: m :	Addition	:	87.5
28	: Install 7828 x				
	: 6714mm St. Pipe	: m :	Addition	:	54
29	: SGSB for Bedding				
	: Supply & Place	: t :	Addition	:	6,972.34
30	: Concrete curb				
	: & Gutter	: m :	Addition	:	317
31	: 450mm Catch				
	: Basin CSP Leads	: m :	Addition	:	78
32	: Concrete Manholes				
	: & Catch Basin Man.				
	: a] 2.414m manhole	: ea. :	Addition	:	3
	: b] 1.4m catch basin	: ea. :	Addition	:	4
33	: Reinf. Earth				
	: Retaining Wall	: LS :	Addition	:	1
34	: Metal Bin Wall				
	: a] Type "B"	: m2 :	Addition	:	85.18
	: b] Type "c"	: m2 :	Addition	:	208.42
	: c] Backfill	: t :	Addition	:	1,829.37
35	: Shot Rock Place				
	: at station 1169+50	: m3 :	Addition	:	24,944

Item No.	Description of work		Tender Quantity		Finalized Quantity
36	: Install. of 690mm : x 810mm precast : concrete barriers	: m :	Addition	:	1,000
37	: Supply & Install : Filter coth for : 200mm Sub-drains	: m2 :	Addition	:	129.9
38	: Seclusion Bay Rd. : Underpass Paving	: t :	Addition	:	589.37
39	: B.C. Hydro Vault	: ea. :	Addition	:	1
	: B.C. Tel. Vault	: ea :	Addition	:	2
	: Conduit	: m :	Addition	:	2,755.22
	: Pilasters	: ea. :	Addition	:	8
40	: Install. Of plastic : Type 9 J.B.	: ea. :	Addition	:	1
	: Sup. & Install : 3/4 " PVC Con.	: ea. :	Addition	:	40
	: Install. of Frangible : Base	: ea. :	Addition	:	91
41	: Extruded Concrete : Curb	: m :	Addition	:	558.3
42	: Double Handling of : Type "A"	: m3 :	Addition	:	45,395

Appendix 111

Project Map & Location C-3736

PROJECT J. C-3736

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND HIGHWAYS

COQUIHALLA HIGHWAY

OKANAGAN CONNECTOR

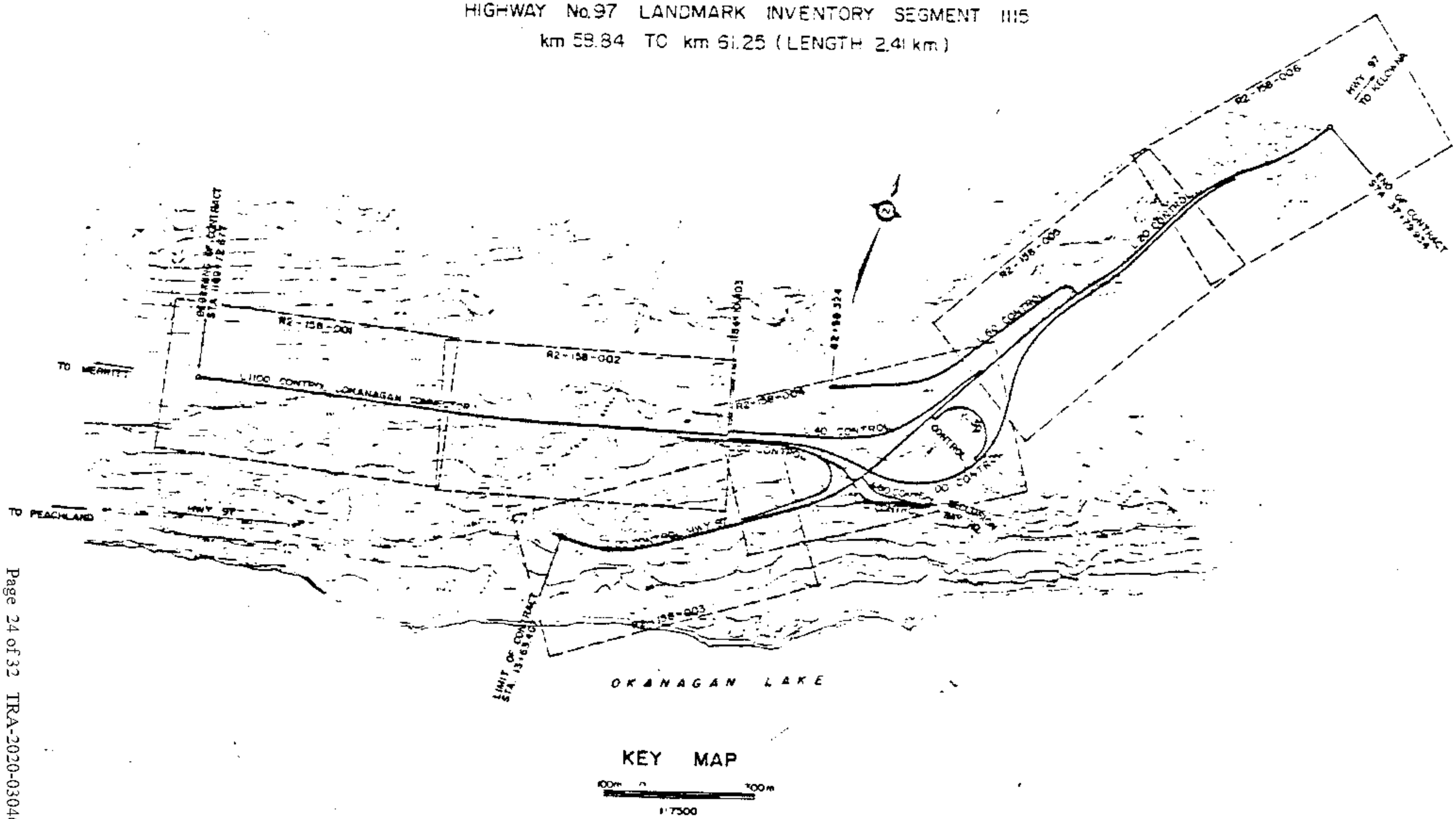
COUSINS ROAD TO GORMAN'S MILL (3.48 km)

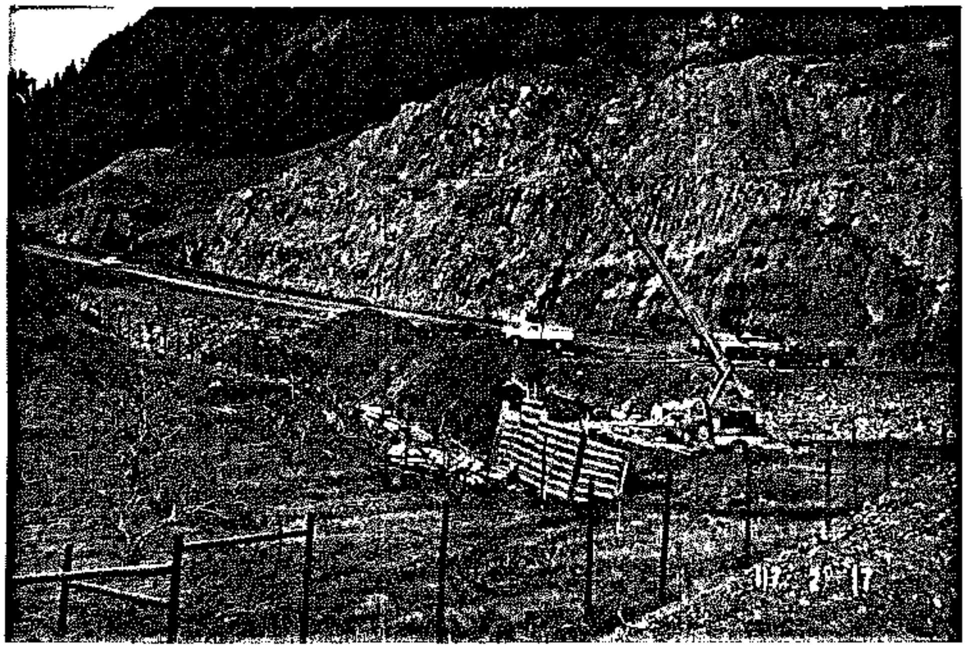
(L1100) STA. 1169+72.677 TO 1197+67.933

INCLUDING

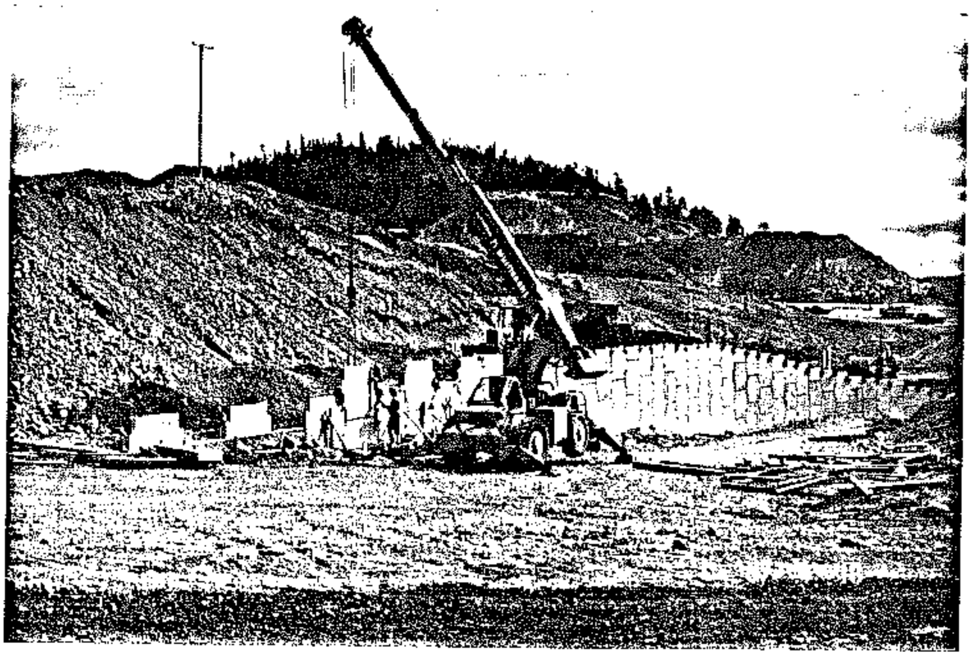
HIGHWAY No.97 LANDMARK INVENTORY SEGMENT 1115

km 58.84 TO km 61.25 (LENGTH 2.41 km)

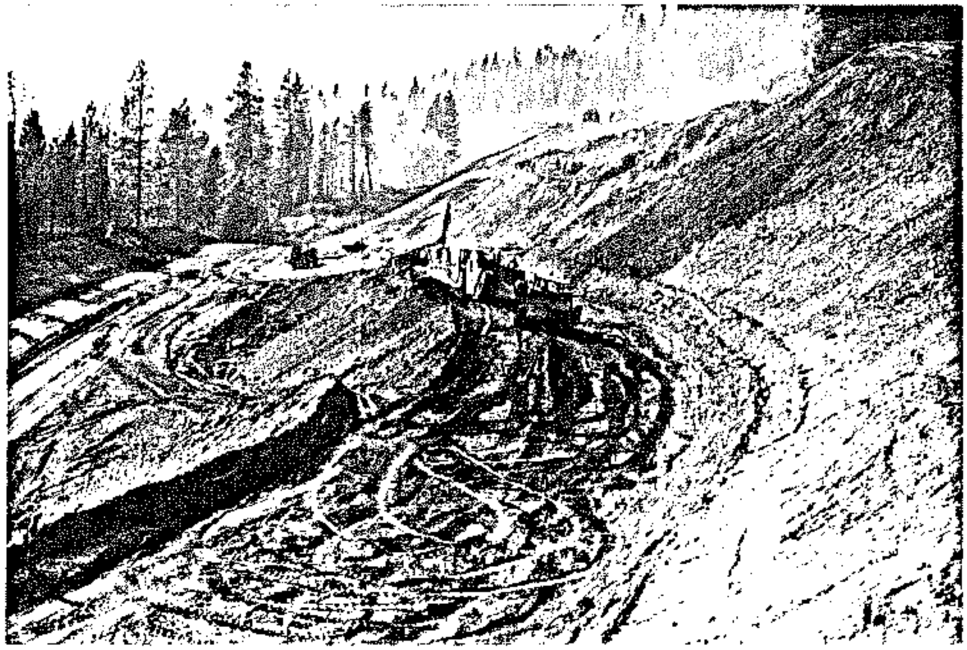




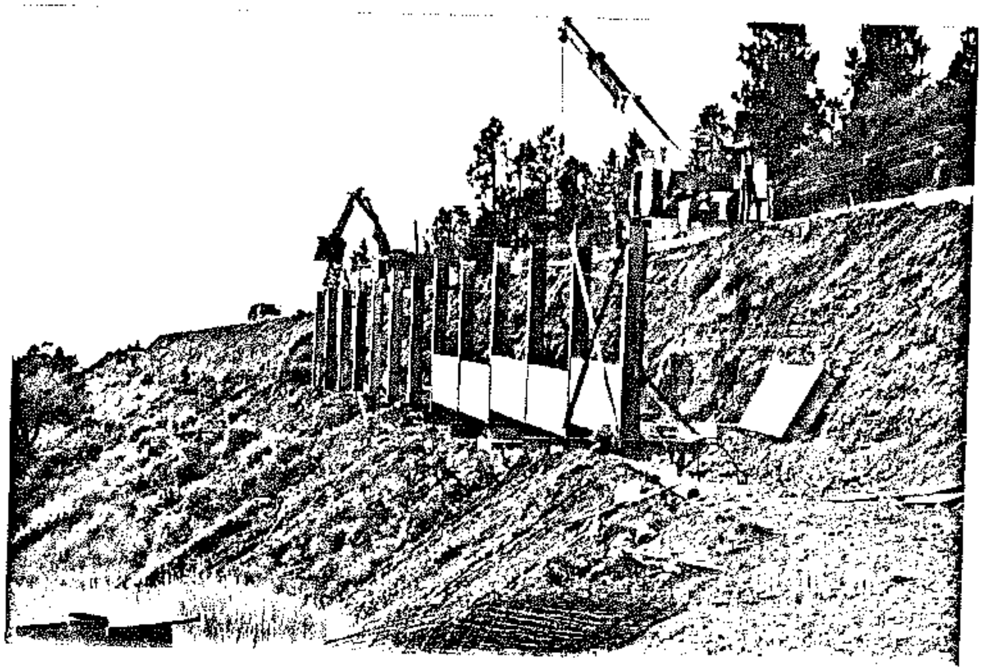
ERECTION OF BINWALL L-50



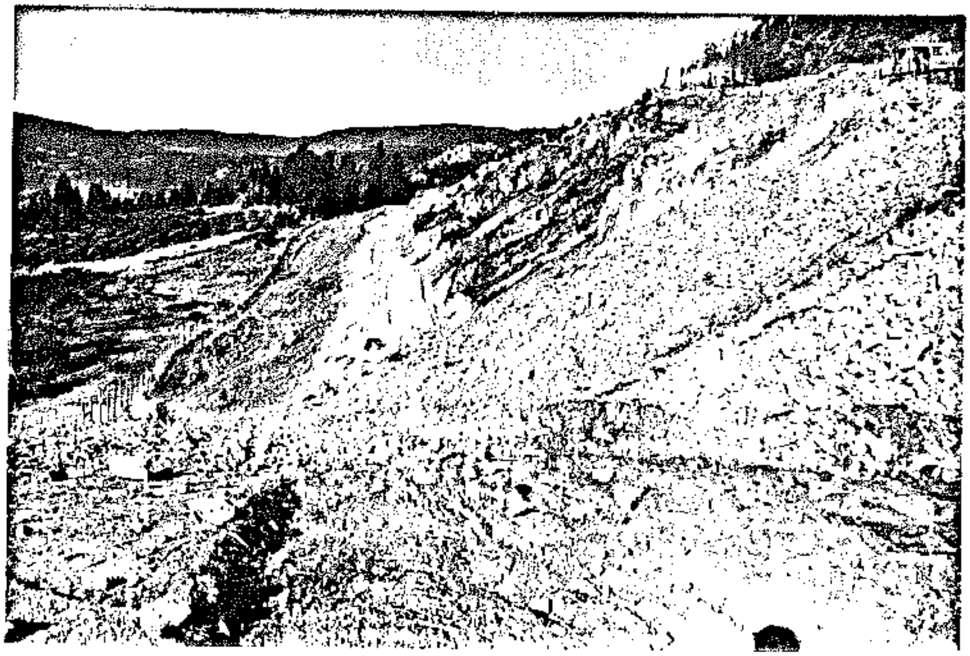
ERECTION OF RETAINING WALL
L-70



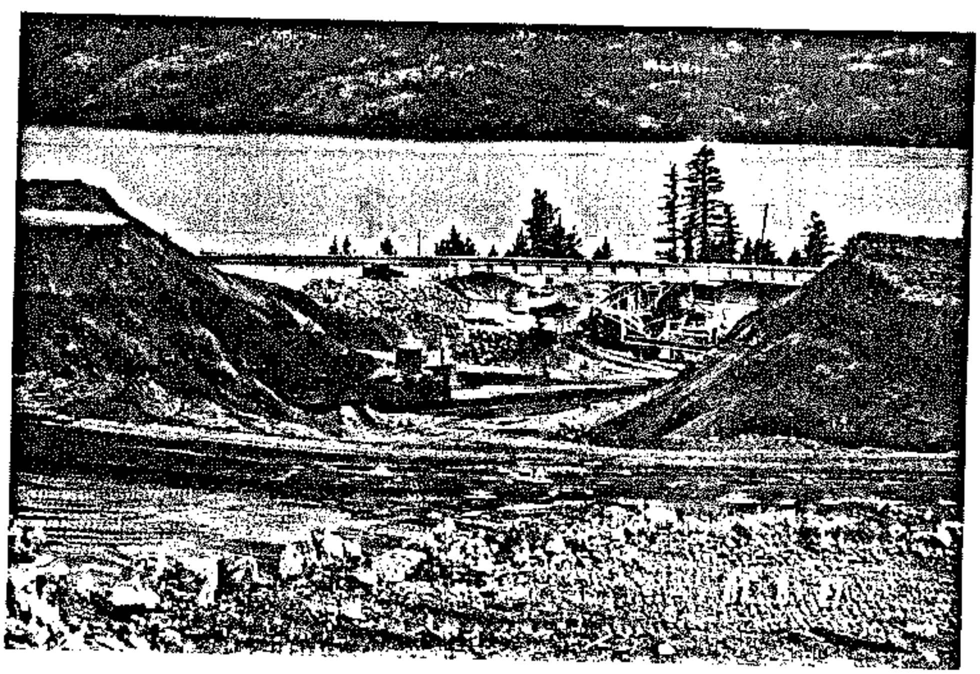
CONSTRUCTION L-1100



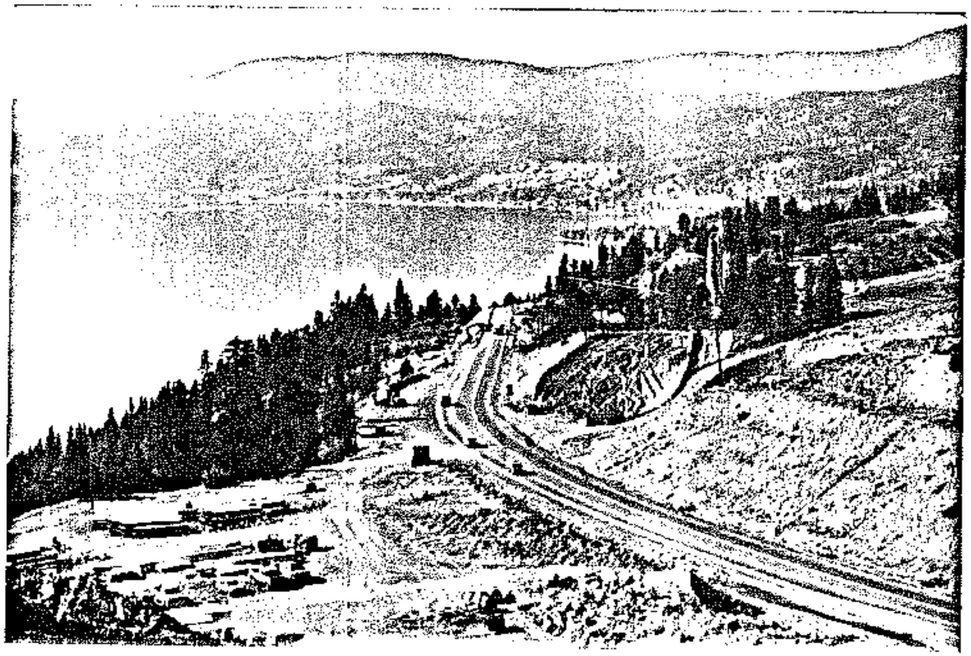
ERECTION OF NETUPSKY WALL L-20



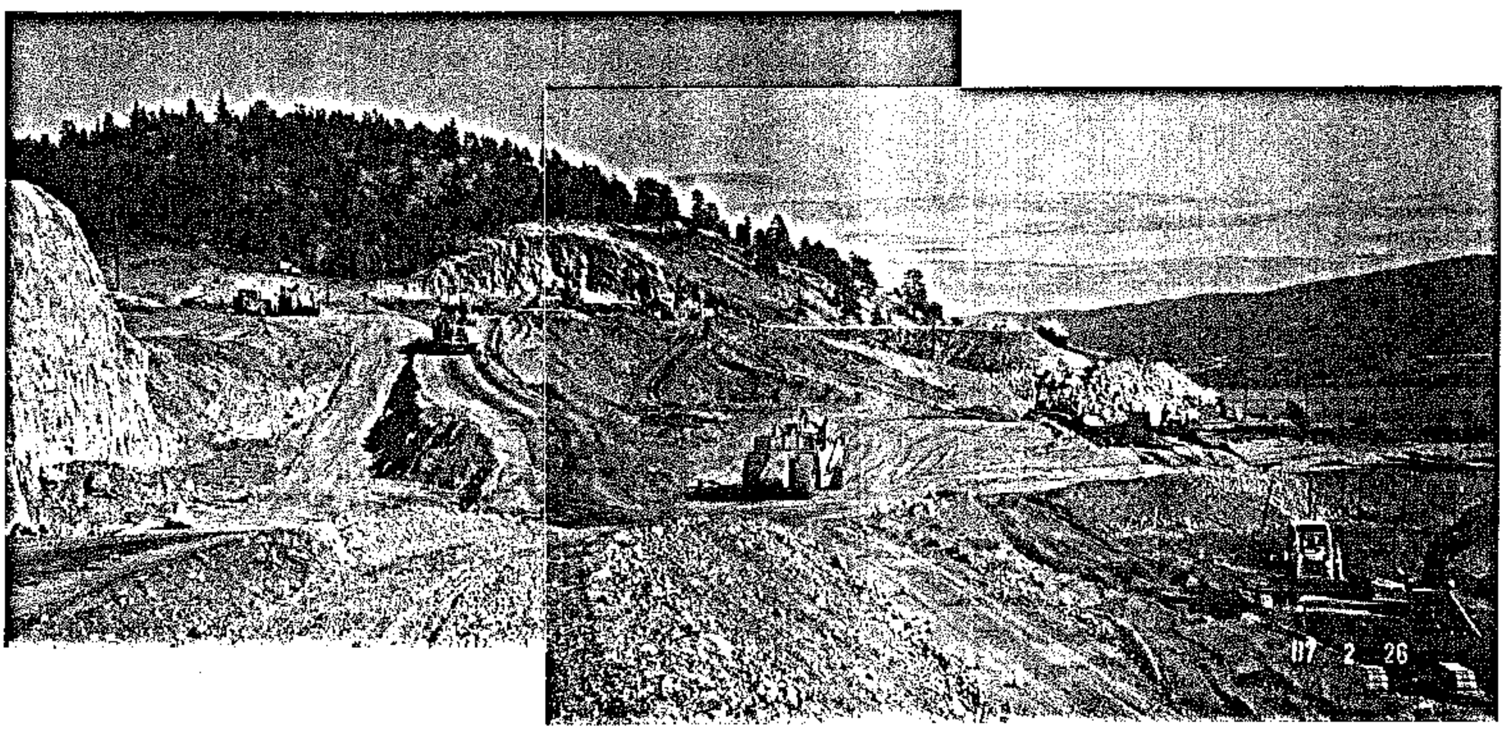
CONSTRUCTION L-40 LINE



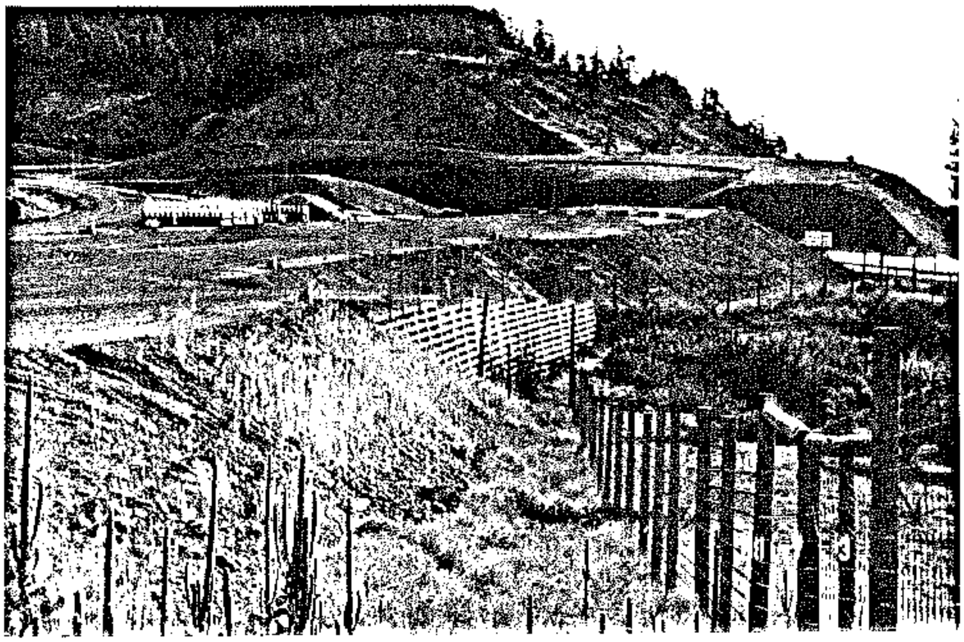
PRODUCTION OF GRANULAR MATERIALS



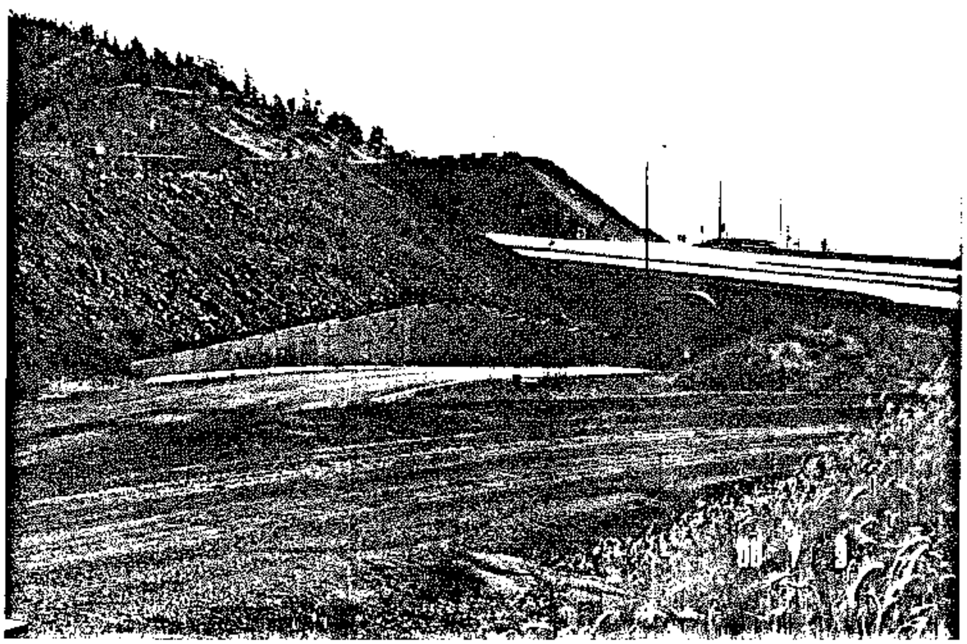
— OLD HIGHWAY 97 PRIOR TO CONSTR. —



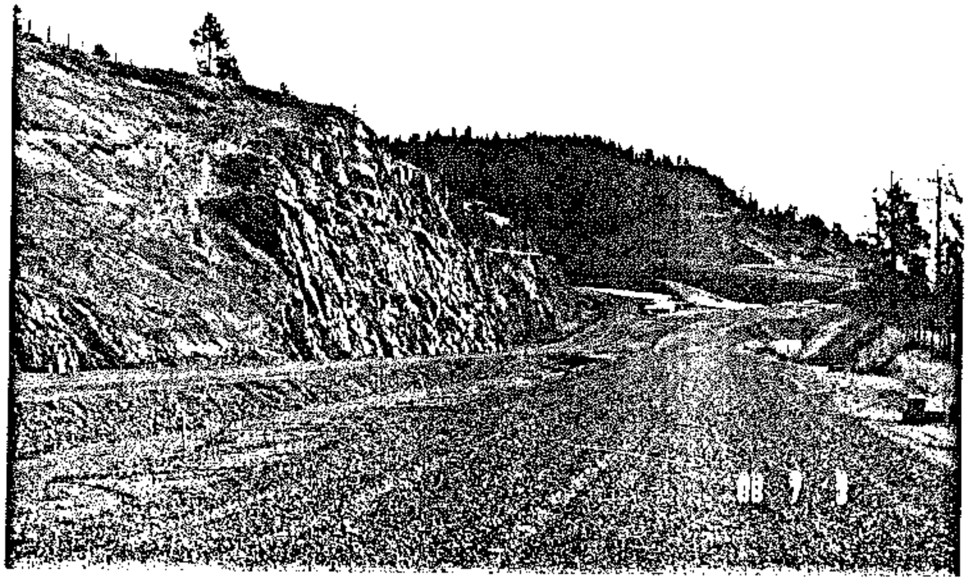
— CONSTRUCTION OF INTERCHANGE SYS. —



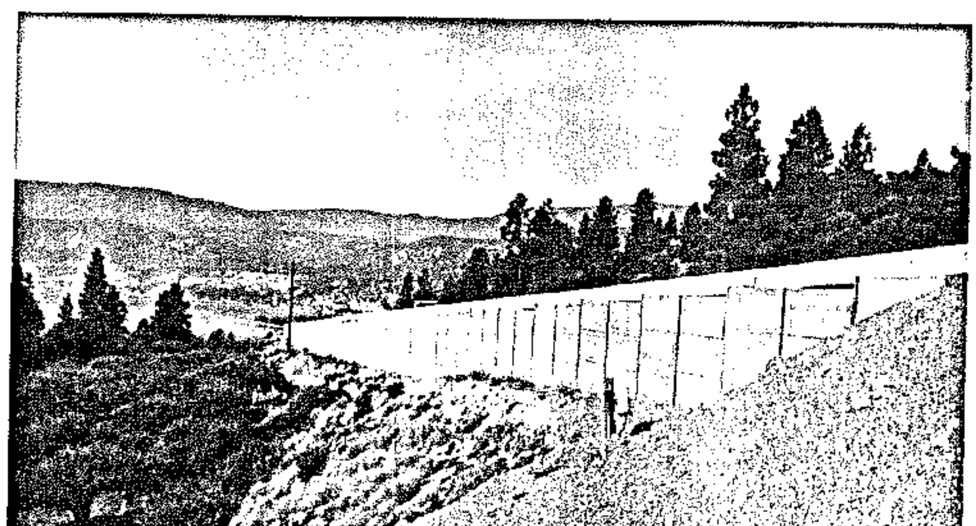
BINWALL AFTER CONSTRUCTION L-50



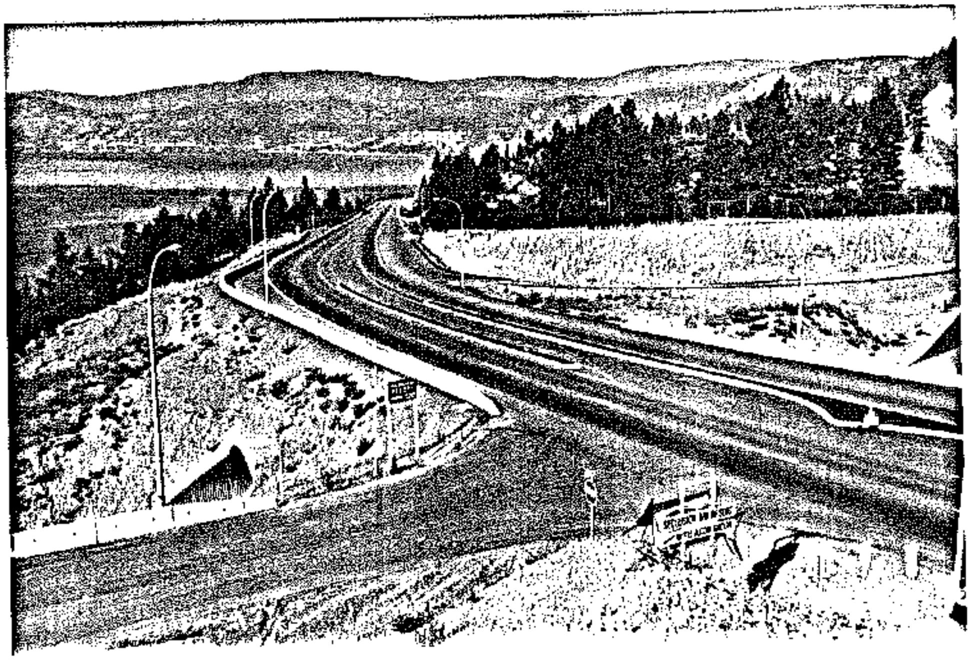
RETAINING WALL L-70 LINE



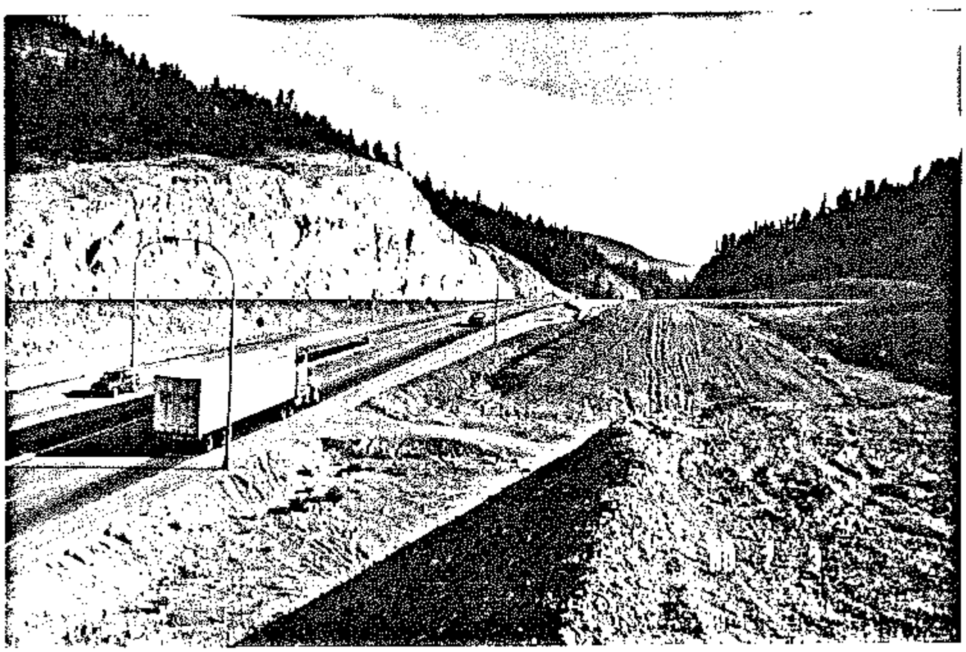
L-1100 & L-40 LINES AFTER CONSTR.



COMPLETION OF NETUPSKY WALL



—COMPLETED INTERCHANGE SYSTEM —



—RELOCATED HIGHWAY "97 —

DIRECTOR OF CONSTRUCTION
RECEIVED
FEB 8 1989
MINISTRY OF
TRANSPORTATION & HIGHWAYS
VICTORIA, B.C.