TSYH 4532: Kincaid Street from McDonald Ave to Willingdon Ave

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July 1, 2025

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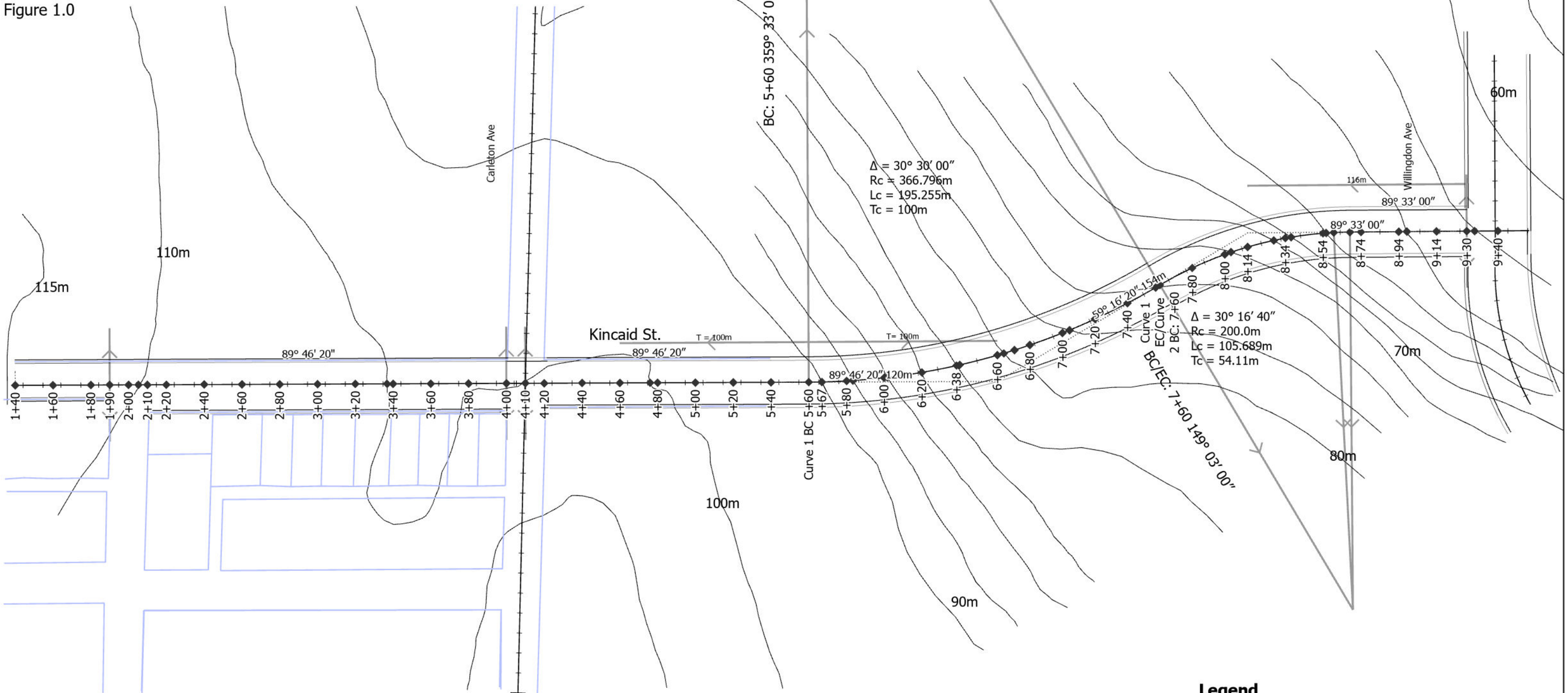
Kincaid Street Road Design Key Plan

MacDonald Ave to Willingdon Ave
TSYH 4532

Figure 1.0



Legend

- Station
- Elevation Point
- Dimension Holder
- Plot Point
- Plot Point on Contour
- Control Window
- EVC
- BVC
- VPI
- CL
- Contour
- PL
- Curb
- RoW
- Existing Elevation
- Road
- Plot Lines
- Control
- Trial Line
- Dimension

2.0

Roadworks Design Data Sheet				
Project Name: **Kincaid Connection - Willingdon Ave**		Project No.: TSYH 4532 Date: June 19, 2025		
Road Classification: Urban Collector (Med – High)	Posted Speed: 50km/h	Design Speed: 60km/h		
Level of Service: n/a	Capacity: 1,000 – 10,000	% Trucks: 25%	% Buses: 5%	
ADT: 1000-12,000	Peak Hour Factor: n/a	DHV: n/a	Service Volume: n/a	
Number of Lanes: 2	Lane Width: 13m standard width: 6.5m	Crossfall: 2%	Typical Section Provided: Yes	
Parking Lanes: Yes Lane Width: 2.5m		Description: North side only		
Curbs: Yes Type: Standard curb and gutter		Description: Both sides Barrier type: Standard Standard gutter (3.2B) Total Width required: 0.63m Height of curb: 0.155m Gutter Width: 0.395m		
Sidewalks: Yes Width: 1.5m o/s to curb: 0.6m		Description: North side only Crossfall: 2% 0.7m from sidewalk edge to edge of boulevard		
Streetlights: n/a				
Shoulders: No				
Ditches: No				
Slope details: Both cut and fill	Cut: 2:1 max between Kincaid & Frontage Rd	Fill: 1.5:1 max over all areas	Ditch side slope: n/a	No fill policy? No. Cut/fill may encroach on private property along north side only
Horizontal Alignment Controls				
RoW Width: 25m	Minimum radius: 130m	Taper ratio: 30:1		
Minimum Crown offset: 2.5m	Crown Throw ratio:			
Project Start Station: 1+90		Project End Station: Edge of Willingdon Ave (9+30)		
Existing Widths to Match? 13m (6.5m per lane); No, they will not match current width. Where: 1+90				
Vertical Alignment Controls				
Grade Controls: Maximum 10%		Minimum: 0.5%		
Vertical Curve K Values: Crest 15-20		Sag: 10-20		
Project Start Approach Grade: Station 1+90 (111.8m) to 2+10 (109.8m): 2m over 20m: -10% Station 4+20 (101.1m) to 4+40 (102.2m): 1.1m over 20m: 5.5% *However, must accommodate Carleton Ave*		Elevation: 111.8m		
Project Exit Grade %: (Willingdon Ave Crossfall) 2%		Elevation: Centerline Elevation 63.7m		
Mid Point Controls				
Station: 2+10	Min Elevation: 109.8m	Max Elevation: 109.8m	Item: McDonald Ave CL	
Station: 4+10	Min Elevation: 100.9	Max Elevation: 100.9	Item: Carleton Ave CL	
Station: 9+30	Min Elevation: 64.0	Max Elevation: 64.0	Item: W Edge of Willingdon Ave	

Notes:
Project is split into two halves: 1+90 – 4+10 (Project 1) & 4+20 – Willingdon Ave (Project 2)
3 stations elevations must be kept.
No cut/fill on private property on South side of entire project.

Along Frontage Rd: increase width of RoW (along southern side)

Can use maximum rate for changing crossfall at intersection (4%)

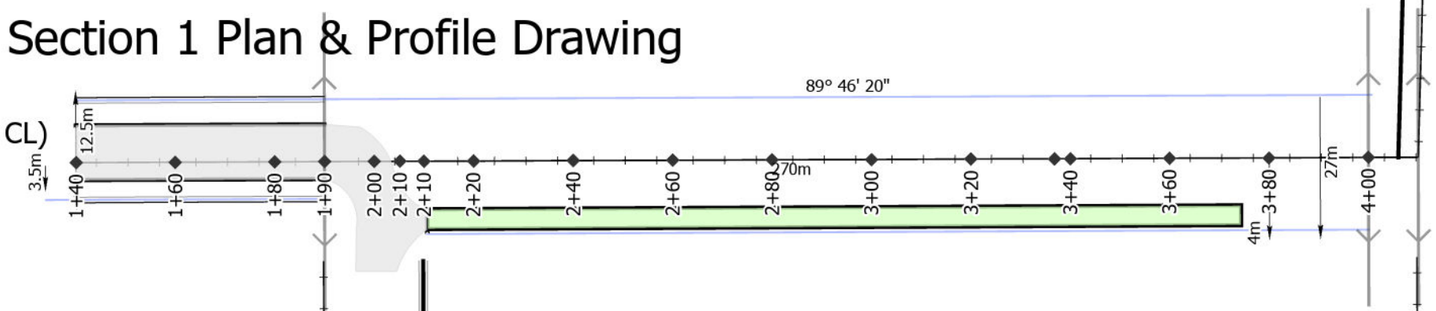
Post reduced speed at Station 6+60: horizontal curve on high downward slope.

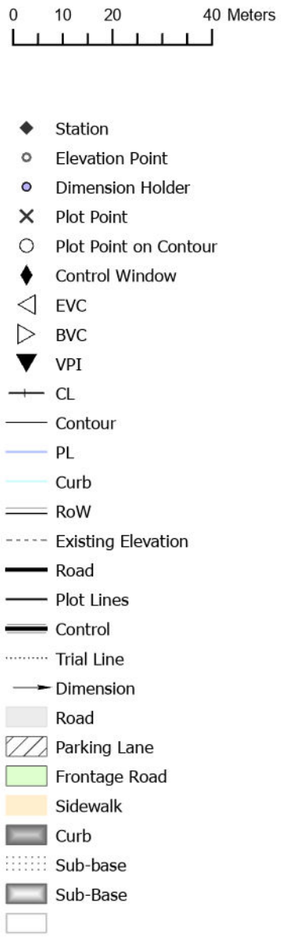
Total Project Length

Start	1+90
Curve 1 BC	5+60 (370m in total length)
Curve 1 Arc	195.255
Curve 2 Arc	105.689
Curve 2 EC to CL of Willingdon Ave	116m – tangent (54.11m) (61.89 (RoW Edge) + 16.5) 78.39
Total (minus 1+90)	749.334m to Willingdon Ave CL

Kincaid Street Project Section 1 Plan & Profile Drawing

Station 1+90 to Station 4+10
(MacDonald Ave CL - Carleton Ave CL)
Existing Roadway





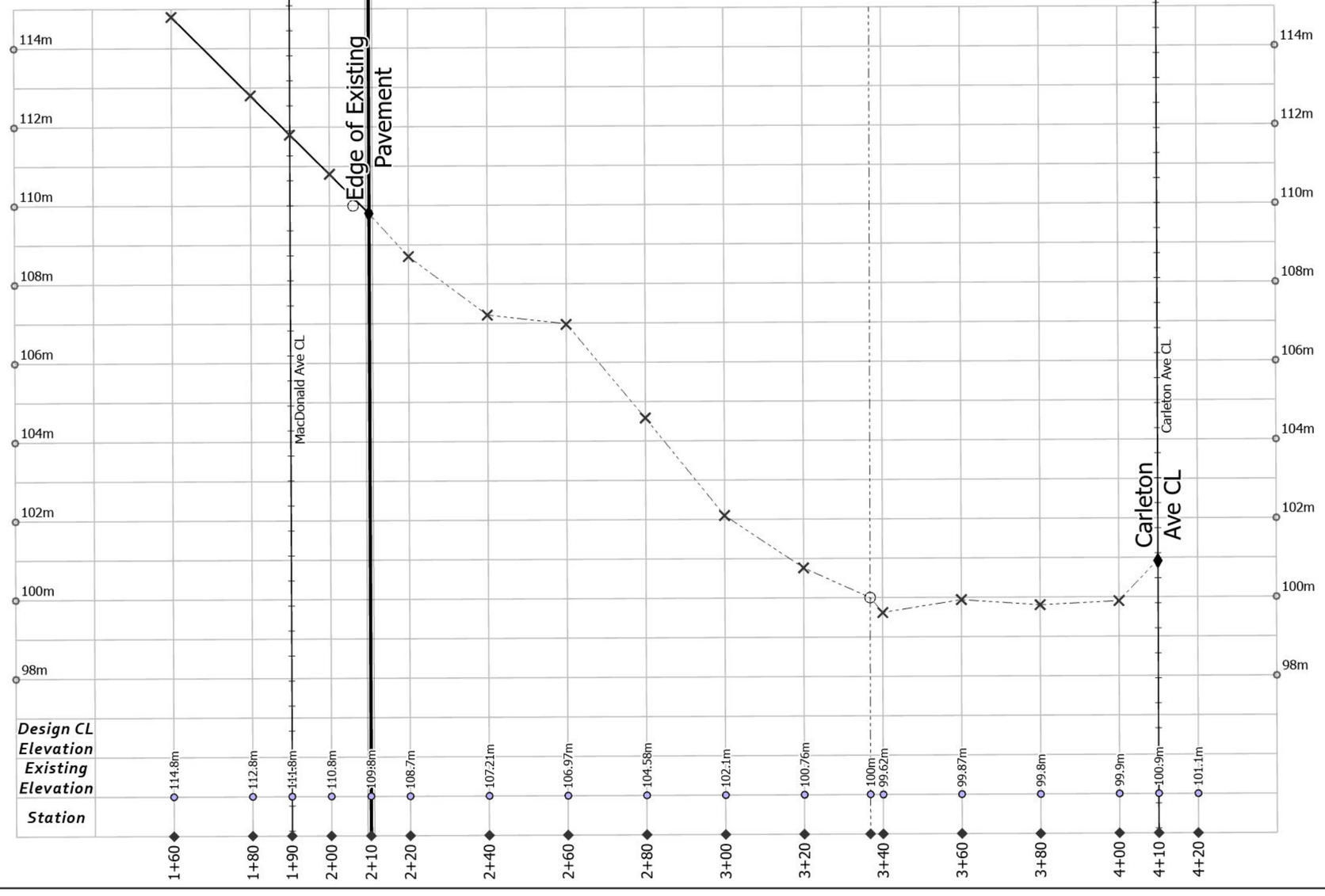


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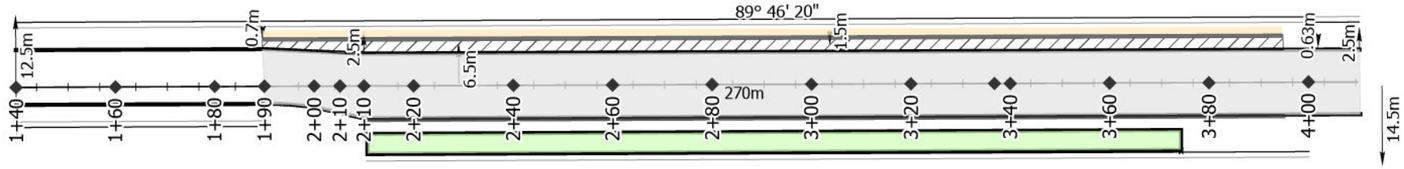
Figure 3.1

Kincaid Street Project Section 1 Plan & Profile Drawing

Station 1+90 to Station 4+10
(MacDonald Ave CL -
Carleton Ave CL)

Proposed Roadway



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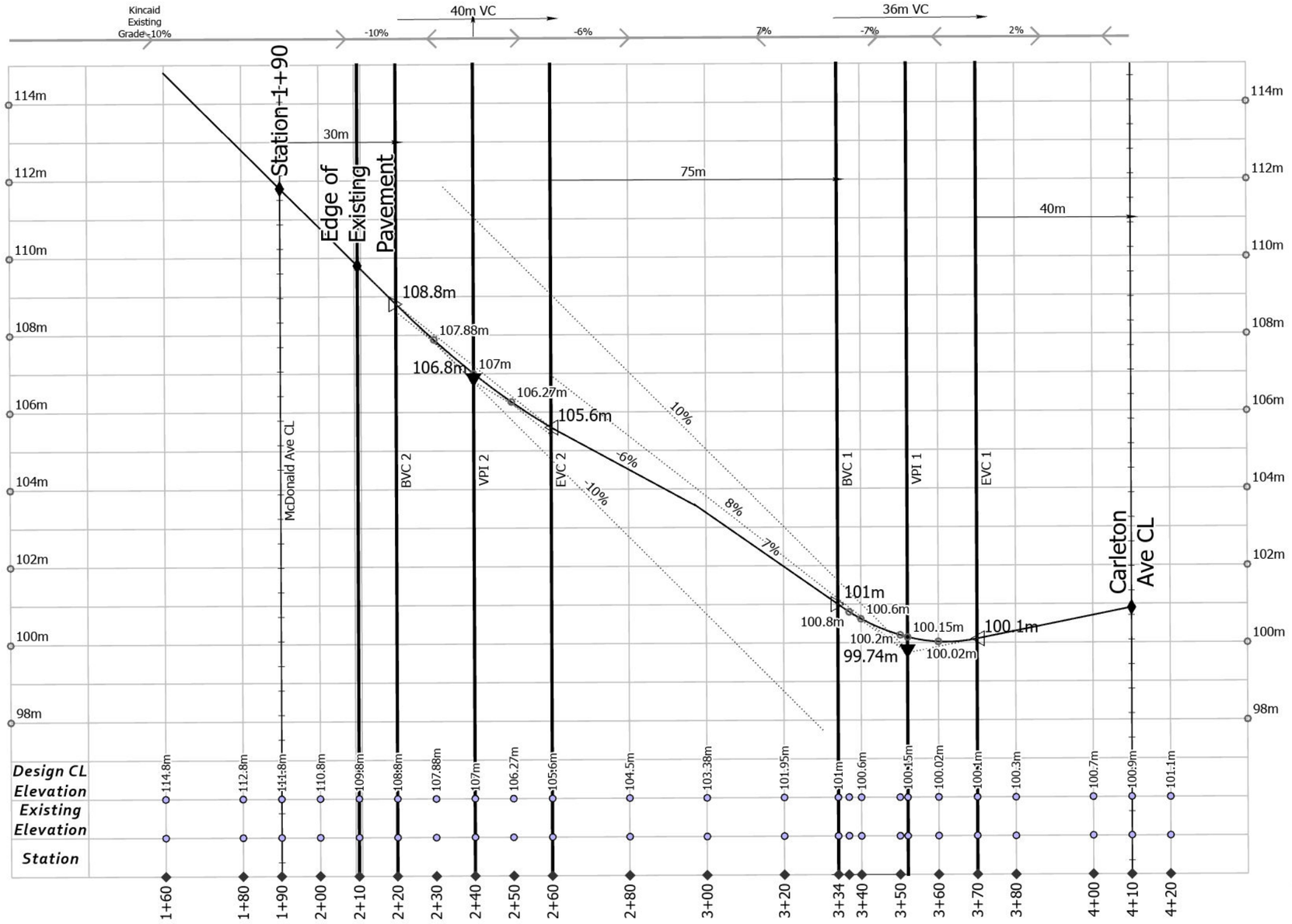
- Sub-Base



N

1:1200

Figure 3.2

Kincaid Street Project Section 1 Plan & Profile Drawing Inset

Station 1+90 to Station 4+10
(MacDonald Ave CL -
Carleton Ave CL)

Proposed Roadway

N

- Station
- Elevation Point
- Dimension Holder
- Plot Point
- Plot Point on Contour
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- BVC
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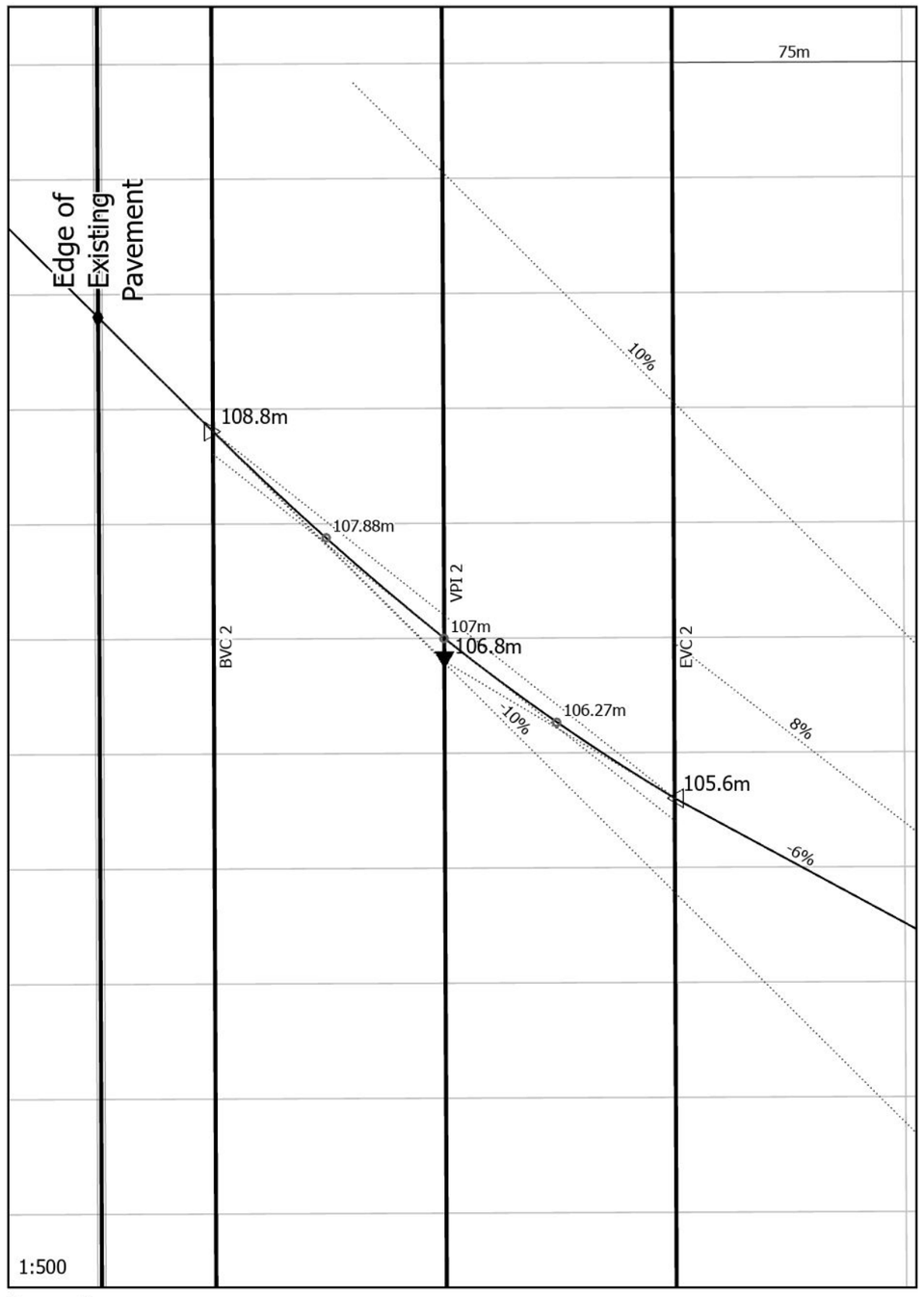
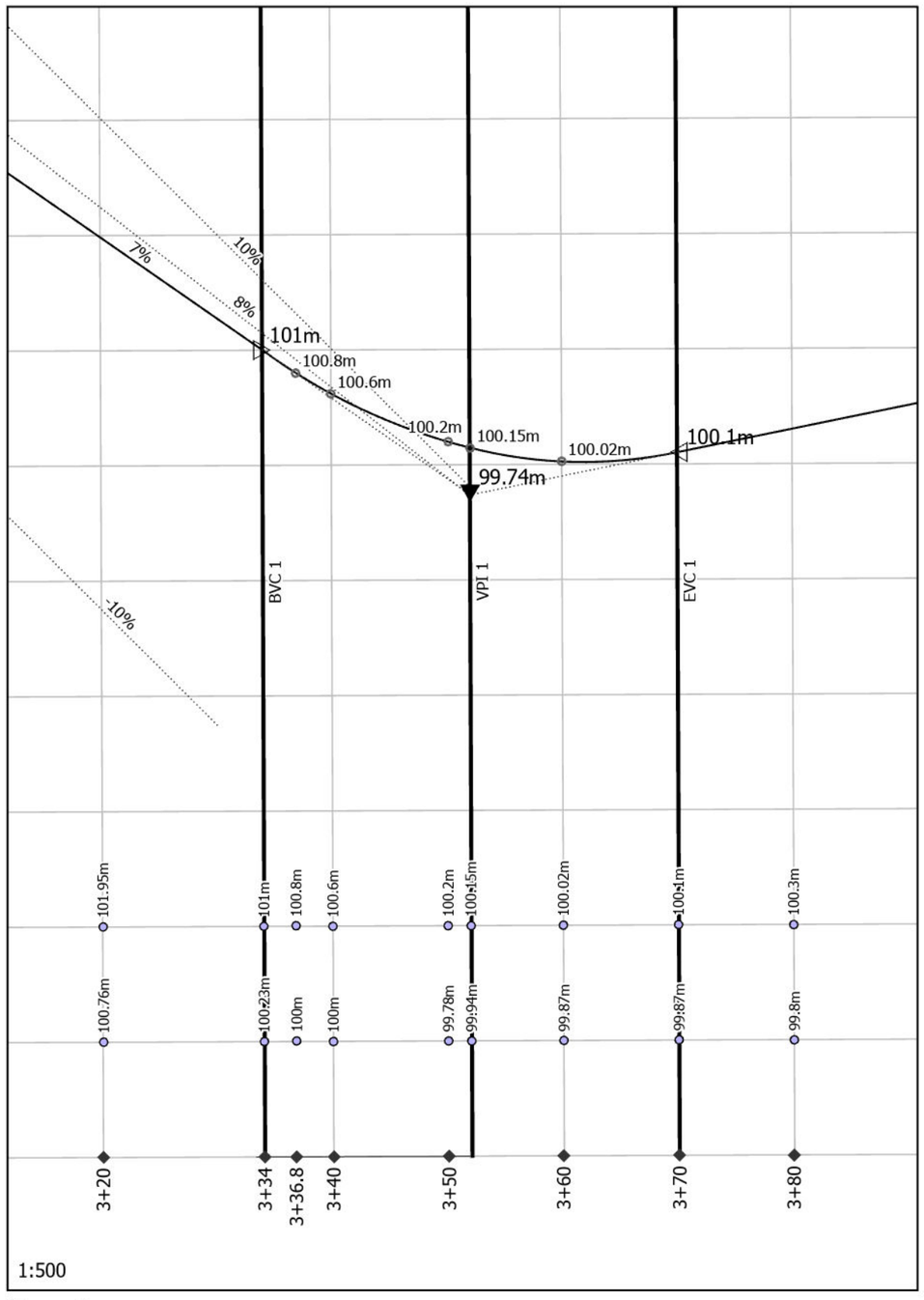


Curve 2



Curve 1

Figure 3.2.1

3.3: Project 1: 1+90 – 4+10 Elevation Data Sheet

Left				Centre Line	Right			
Distance	Distance	Distance	Distance	Design Elevation	Distance	Distance	Distance	Distance
Elevation	Elevation	Elevation	Elevation	Ground Elevation	Elevation	Elevation	Elevation	Elevation
				STATION				
	41	20	10	100.9	17.42	26.5	37	
	98.09	99.96	99.9	100.9	101.74	102.2	103.77	
				4+10 (Carleton Ave Centreline)				
	30	20	10	100.7	3.2	10	21.5	
	97.3	97.5	98.1	99.9	100	101.2	102.6	
				4+00				
	30	20	10	100.3	4	10	21	
	98.0	98.2	98.6	99.8	100	100.4	101.18	
				3+80				
	30	20	10	100.1	10	20		
	98.5	98.6	98.8	99.87	99.79	99.71		
				3+70				
	30	20	10	100.02	10	21.5		
	99.0	99.0	99.0	99.94	99.58	99.02		
				3+60				
	30	20	10	100.15	10	20		
	99.08	99.2	99	99.86	99.4	99.34		
				3+52				
	30	20	10	100.2	10	20		
	99.1	99.25	99	99.78	99.36	99.42		
				3+50				
	30	20	10	100.6	10	22		
	99.2	99.5	99	99.62	99.13	99.82		
				3+40				
	30	20	10	100.8	10	20		
	99.4	99.61	99.8	100	100.02	100.05		
				3+36.8				
	30	20	10	101.0	10	20		
	99.58	99.81	100.02	100.23	100.37	100.61		
				3+34				
	30	20	10	101.95	10	21		
	100	100.3	100.52	100.76	101.19	101.92		
				3+20				
	30	20	10	103.38	10	22		
	101.84	102.05	102.07	102.1	102.16	102.55		
				3+00				
	30	20	10	104.5	10	22		
	104.3	104.4	104.62	104.58	104.65	104.7		
				2+80				
	30	20	10	105.6	10	21		
	106.85	106.8	106.97	106.97	106.85	106.81		
				2+60				
	30	20	10	106.27	10	20		
	106.98	106.9	106.99	107.1	107.18	107.36		
				2+50				
	30	20.5	10	107.0	10	21.5		
	107.1	107	107	107.21	107.5	107.91		
				2+40				
	30	20	10	107.8	10	20		
	108.05	108.0	107.9	107.96	108.1	108.18		
				2+30				
	30	20.5	10	108.8	10	21.32		
	109	109	108.8	108.7	108.7	108.45		

				2+20				
	30	20	10	109.8	10	20	30	
	110.26	110.19	110.0	109.8	109.3	109.02	108.7	
				2+10				
	30	20	10	110.0	10	20	30	
	110.53	110.72	110.36	110.0	109.56	109.31	108.95	
				2+06				
	30	20	10	110.8	10	20	30	
	111.28	111.57	10.91	110.8	109.9	109.66	109.28	
				2+00				
	30	20	10	111.8	10	20	26.53	
	111.6	111.45	111.29	111.8	111.08	110.44	110.0	
				1+90				
Left				Start	Right			

Points on Curve 1 Elevation Calculations

Station	Elevation
3+40	100.6m
3+50	100.2m
3+60	100.02
Low Point Station	3+65

Points on Curve 2 Elevation Calculations

Station	Elevation
2+30	107.88
2+50	106.27m
Low Point Station	No low point calculated

Minimum Vertical Curve Lengths

Algebraic Grade Change	K Sag*	K Crest*	K T or Stop Intersections Sag & Crest	Minimum Length Sag (M)	Minimum Length Crest (m)	Minimum Length (T or Stop) Intersections Sag & Crest
A =				L =	L =	L =
1				0	0	0
2	10	15	4	20	30	8
3	10	15	4	30	45	12
4	10	15	4	40	60	16
5	10	15	4	50	75	20
6	10	15	4	60	90	24
7	10	15	4	70	105	28
8	10	15	4	80	120	32
9	10	15	4	90	135	36
10	10	15	4	100	150	40
11	10	15	4	110	165	44
12	10	15	4	120	180	48
13	10	15	4	130	195	52
14	10	15	4	140	210	56
15	10	15	4	150	225	60
16	10	15	4	160	240	64
17	10	15	4	170	255	68
18	10	15	4	180	270	72
19	10	15	4	190	285	76
20	10	15	4	200	300	80

*Taken from TSYH 4532 Course Manual

*Maximum algebraic change taken from -10% grade at beginning of project.

Match Points

Station	Elevation	Grade
1+90	111.8	-10%
4+00	99.9	2%
4+20	101.1	-2%
Willingdon Ave	64	2%

Control Windows

Station	Max Elevation	Min. Elevation	Control
2+10	109.8	109.8	Middle of McDonald Ave
4+10	100.9	100.9	Middle of Carleton Ave
9+30	64.0	64.0	Edge of Willingdon Ave

3.4: Project 1 (1+90 – Carleton Ave) Vertical Curve Calculations

***Intermediate trials included**

Last Possible EVC Station Trial 1

Centerline of Carleton Ave: 4+10

Road width (1/2): 10

Curb Return Radii: 9.0m

Intersection Storage: 12.0m

Grade: 2% (crossfall)

Total: 27.0

Last Possible EVC Station: 3+83 (3+80)

30m @ 2% grade: 0.6m of rise

EVC elevation: 99.4m

Try again; need a better starting point.

Last Possible EVC Station Trial 2

40m @ 2% grade: 0.8m of rise

Carleton CL elevation: 100.9

EVC Station: 3+70

EVC elevation: 101.1m

This works.

Vertical Curve 1 (EVC @ Carleton T Intersection Min Curve) Calculations Trial 1

Max grade of -10% approach meeting departing grade 2%: A = 12

T intersection Minimum Curve Length: 48m (60m to nearest station)

VPI: 3+50 (98.8m elevation) (30m @ 2%)

BVC: 3+20 (101.8m elevation) (30m @ 10%)

Grade @ Edge of Existing Pavement: -10%

Grade @ BVC: -10%

100m from Control (109.8m elevation) to BVC (101.8m elevation)

110m to control, with 8.0m elevation difference (7.27% grade). *Additional vertical curve needed?*

Do not use.

Vertical Curve 1 (EVC @ Carleton T Intersection Min Curve) Calculations Trial 2

Max grade of -8% approach meeting departing grade 2%: A = 10

T intersection Minimum Curve Length: 40m (40m to nearest station)

VPI: 3+60 (99.0m elevation) (20m @ 2%) (decrease of 0.4m)

BVC: 3+40 (100.6m elevation) (20m @ 8%) (increase of 1.6m)

Grade @ Edge of Existing Pavement: -10%

Grade @ BVC: -10%

130m from Control (109.8m elevation) to BVC (100.8m elevation)

130m to control, with 9.0m elevation difference (7.3% grade). *Additional vertical curve needed?*

Do not Use this Curve. Wrong starting value (CL of Carleton is 100.9m, not 100.0)

Vertical Curve 1 (EVC @ Carleton T Intersection Min Curve) Calculations Trial 3

Grade of -7% approach meeting departing grade 2%: A = 9

T intersection Minimum Curve Length: 36m (36m to nearest station)

EVC: 3+70 (100.1m elevation)

VPI: 3+52 (99.74m elevation) (18m @ 2%) (decrease of 0.36m)

BVC: 3+34 (101.0m elevation) (18m @ 7%) (increase of 1.26m)

Use this curve.

Vertical Curve 2 Calculations Trial 1 2 (VPI elevation taken from -10% grade from Control @ McDonald Ave)

-10% - -8% = 2% change A = 20m sag

Distance between Control and Curve 1 BVC: 130m. VPI at @ 2+40 (test)

BVC: 2+30 (107.8m elevation) (10m @ 10%) (increase of 1.0m)

VPI: 2+40 (106.8m elevation) (30m @ -10%) (decrease of 3.0m)

EVC: 2+50 (106.0m elevation) (10m @ -8%) (decrease of 0.8m)

End up with a 2% change in grade. Try one more.

Vertical Curve 2 Calculations Trial 2 (VPI elevation taken from -10% grade from Control @ McDonald Ave)

-10% - -6% =4% change A = 40m sag

Distance between Control and Curve 1 BVC: 130m. VPI at @ 2+40 (test)

BVC: 2+20 (108.8m elevation) (20m @ 10%) (increase of 2.0m)

VPI: 2+40 (106.8m elevation) (30m @ -10%) (decrease of 3.0m)

EVC: 2+60 (105.6m elevation) (20m @ -6%) (decrease of 1.2m)

EVC 2 – BVC 1: 3.9m elevation difference over 80m (6.25% grade)

Usable result!

Vertical Curve 2 Calculations Trial 3 (VPI elevation taken from -10% grade from Control @ McDonald Ave)

-10% - -4% =6% change A = 60m sag

Distance between Control and Curve 1 BVC: 130m. VPI at @ 2+40 (test)

BVC: 2+10 (109.8m elevation) (30m @ 10%) (increase of 3.0m)

VPI: 2+40 (106.8m elevation) (30m @ -10%) (decrease of 3.0m)

EVC: 2+70 (105.6m elevation) (30m @ -4%) (decrease of 1.2m)

Too big of a difference between grade of Curve 2 EVC and tangent grade leading into Curve 1 BVC.

Using Trial 2 for Curve 2 & Trial 3 for Curve 1 for Project 1

Vertical Curve 2 EVC elevation is 105.6

Vertical Curve 1 BVC elevation is 101.0m

Distance between these stations is 74m

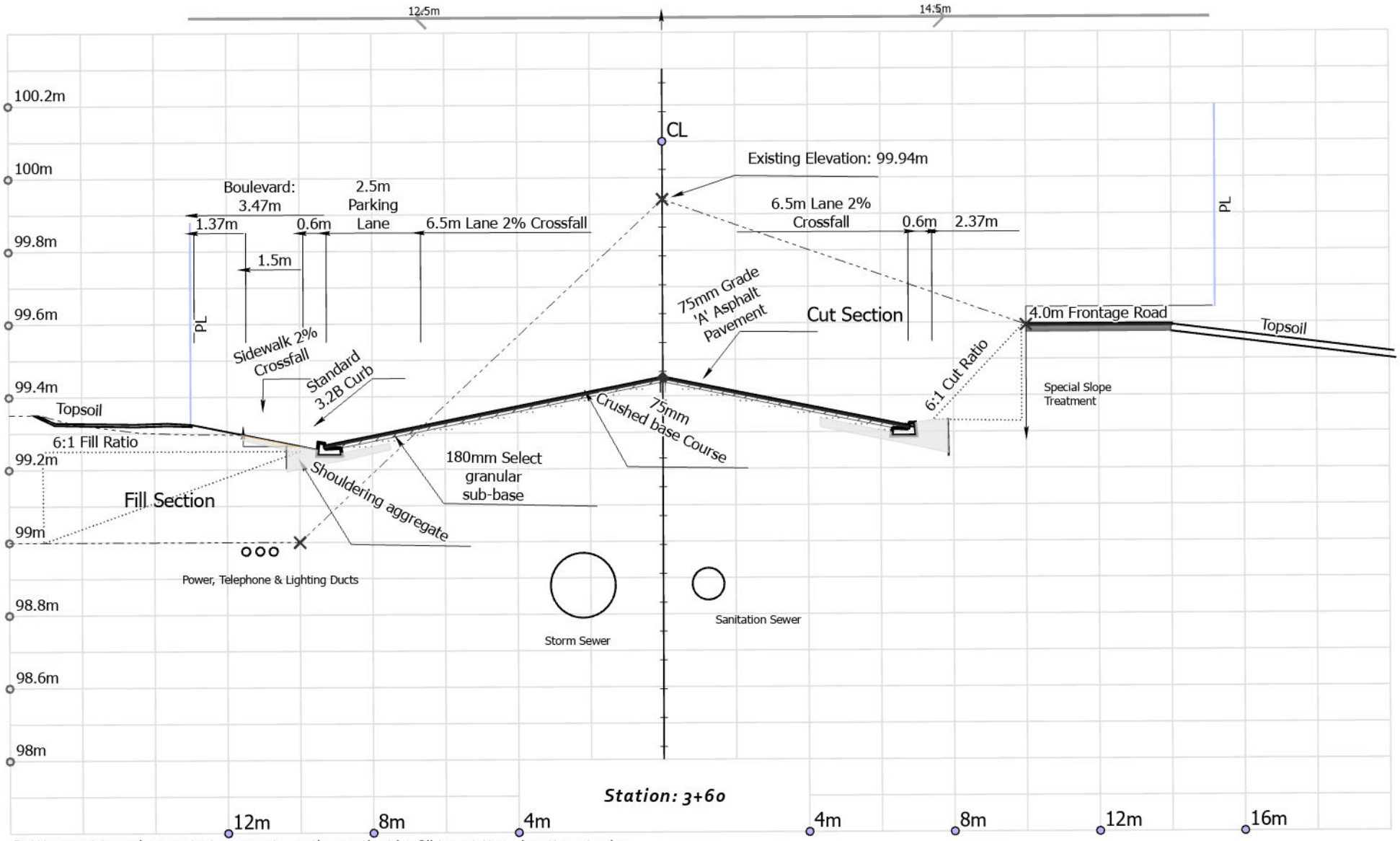
4.6m over 74m is approximately 6%, *a usable vertical slope between the two curves.*

Project 1: Station 3+60 Cross-Section Drawing

Figure 3.5

2 Lane Urban Collector w/ Parking on N. Side
Kincaid Street

27.0m R/W



RoW cannot impede on private property on the south side; fill to existing elevation at edge

Room for lighting on north side at outside edge of boulevard

Frontage Road left undisturbed

Figure 4.0

Kincaid Street Project Section 2 Plan & Profile Drawing

Station 4+20 to Station 9+34
(Centerline of Willingdon Ave.)
Existing Roadworks

N

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1:1,600

0 12.5 25 50 Meters

89° 33′ 00″

59° 16′ 20″ 154m

89° 46′ 20″ 120m

Carleton Ave

Willingdon Ave.

106m 104m 102m 100m 98m 96m 94m 92m 90m 88m 86m 84m 82m 80m 78m 76m 74m 72m 70m 68m 66m 64m 62m

Station	Existing Elevation	Design CL Elevation
4+10	101.9m	64m
4+20	101.1m	
4+40	102.2m	
4+60	101.5m	
4+80	99.7m	
5+00	97.7m	
5+20	95.8m	
5+40	93.3m	
5+60	90.84m	
5+67	90m	
5+80	88.46m	
6+00	86.24m	
6+20	84.09m	
6+40	82m	
6+60	80.4m	
6+80	79.34m	
7+00	78.28m	
7+20	77.47m	
7+40	76.66m	
7+57	75.85m	
7+80	75.02m	
8+00	74.19m	
8+14	74m	
8+28	73.08m	
8+34	72m	
8+54	70.66m	
8+74	68.21m	
8+94	67.51m	
9+14	67.24m	
9+30	66.31m	

Figure 4.1

Kincaid Street Project Section 2 Plan & Profile Drawing

Station 4+20 to Station 9+34
(Centerline of Willingdon Ave.)
Proposed Roadworks

N

Δ = 30° 30′ 00″
Rc = 366.796m
Lc = 195.255m
Tc = 100m

Δ = 30° 16′ 40″
Rc = 200.0m
Lc = 105.689m
Tc = 54.11m

T = 100m
T= 100m
89° 46′ 20″
T = 54.11m
89°-33′-00″ 54.11m
116m
1.5m
0.63m
6.5m
0.63m
Curve 1 BC
Curve 1 EC/Curve 2 BC: 7+60
Curve 2 EC: 8+65.689

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- Sub-Base

1:1,600

0 12.5 25 50 Meters

20m VC
40m VC
180m
180m
34m
40m VC
-2%
-9.1%
-10%
-8%
8%
2%
100.3m
99.9m
100.2m
99.58m
98.8m
97.9m
89.72
79.72m
80.72m
78.92m
63.85m
63.32m
BVC 2
VPI 2
EVC 2
BVC 3
VPI 3
EVC 3
BVC 1
VPI 1
EVC 1
Willingdon-Ave-CL

Design CL Elevation
Existing Elevation
Station

Kincaid Street Project Section 1 Plan & Profile Drawing Insets

Station 1+90 to Station 4+10
(MacDonald Ave CL -
Carleton Ave CL)

Proposed Roadway

- Station
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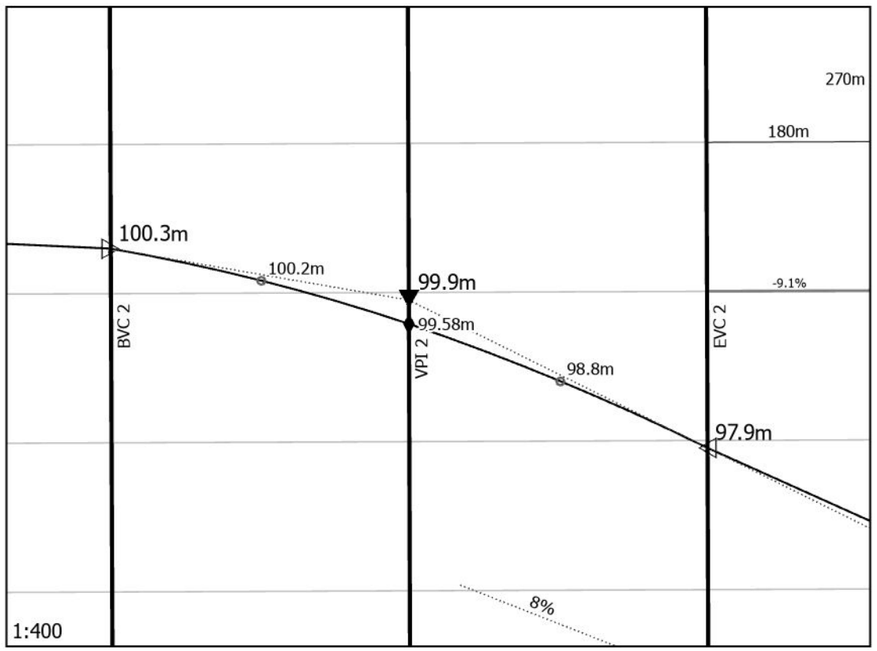
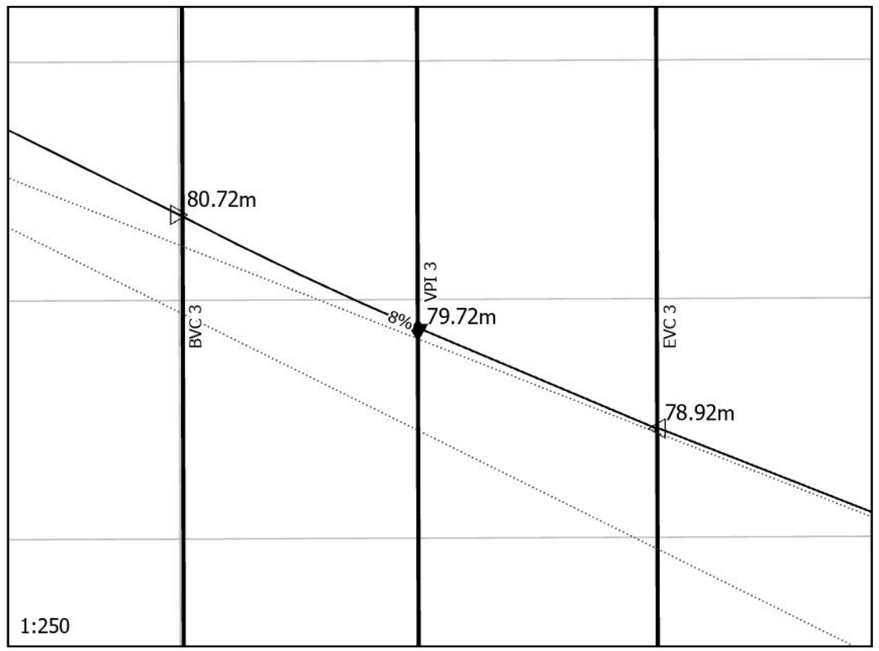
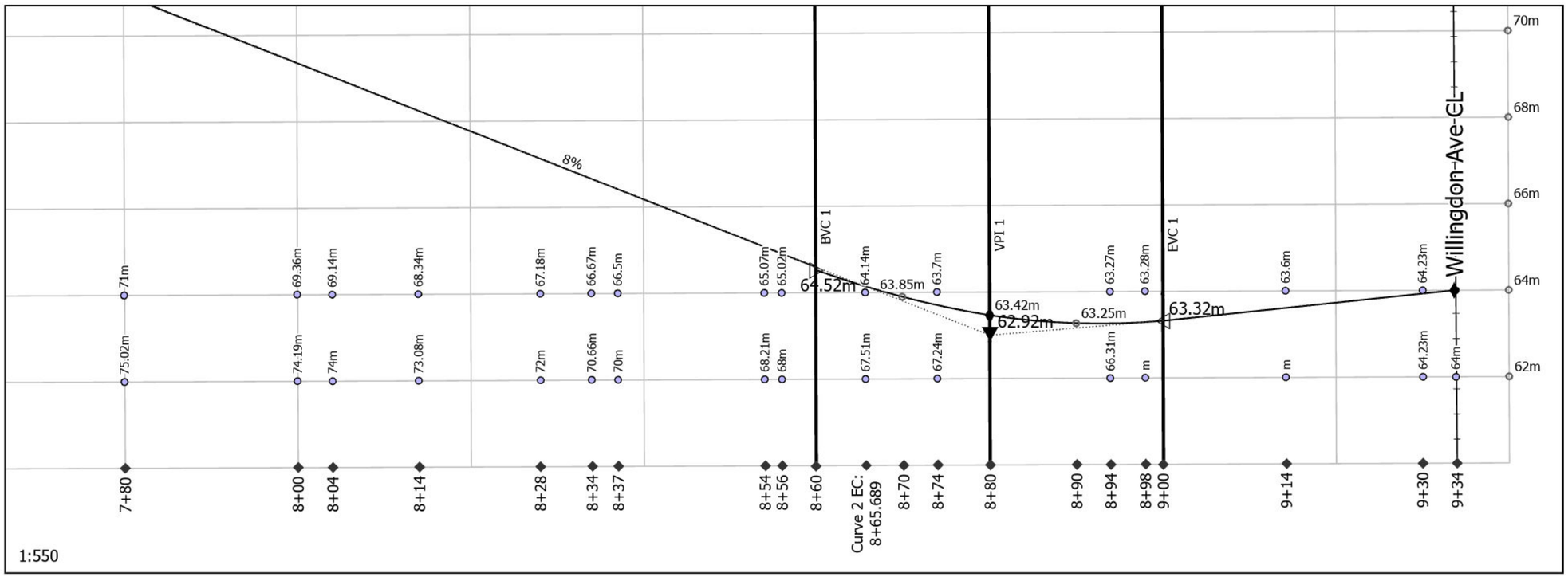


Curve 2



Curve 3



Curve 1

Figure 3.2.1

4.2: Project 4+20 – Willingdon Avenue Elevation Data Sheet

Left				Centre Line	Right			
Distance	Distance	Distance	Distance	Design Elevation	Distance	Distance	Distance	Distance
Elevation	Elevation	Elevation	Elevation	Ground Elevation	Elevation	Elevation	Elevation	Elevation
				STATION				
		12.5	10	64.0	10	12.5		
		63.38	63.66	64.0	63.80	64.62		
				9+34				
	20	10	4.8	63.93	10	20	30	
	63.56	63.87	64.0	64.23	64.65	65.06	65.43	
				9+30				
	30	20	10	63.6	10	20	24.8	
	64.08	64.35	64.7	65.15	65.48	65.81	66.0	
				9+14				
		20	10	63.28	10	20		
		65.39	65.75	66.0	66.49	67.0		
				8+98				
		20	10	63.32	10	20		
		65.88	65.99	65.83	66.714	67.256		
				9+00				
	20	11.1	10	63.27	10	20	30	
	65.68	66.0	66.05	66.31	66.77	67.32	68.0	
				8+94				
		20	10	63.25	10	20		
		65.91	66.15	66.43	66.91	67.55		
				8+90				
		20	10	63.42	10	20		
		66.29	66.68	66.90	67.36	67.95		
				8+80				
	30	20	10	63.7	10	16.6	20	
	66.21	66.52	66.91	67.24	67.64	68.0	68.49	
				8+74				
		20	10	63.85	10	14.3		
		66.64	67.02	67.36	67.74	68		
				8+70				
	30	20	10	64.14	10	12.5	20	
	66.45	66.77	67.14	67.51	67.85	68.0	69.16	
				8+65.689				
		20	10	64.52	5	10	19	
		67.15	67.53	67.78	68.0	68.6	70.0	
				8+60				
		20	10	65.02	10	16	20	
		67.36	67.69	68.0	69.11	70.0	71.04	
				8+56				
	20	10	2.6	65.07	10	14.7	20	
	67.44	67.77	68.0	68.21	69.27	70.0	71.28	
				8+54				
	26	20	10	66.5	8.5	10	20	
	68.0	68.46	69.13	70.0	72.0	72.03	73.51	
				8+37				
	20	10	2.6	66.67	5.8	10	20	

	68.64	69.38	70.0	70.66	72.0	72.53	73.92	
				8+34				
	20	10	9	67.18	10	17.2	20	
	69.24	69.8	70.0	72.0	73.08	74.0	74.38	
				8+28				
	20	12.2	10	68.34	7	10	20	
	70.57	72.0	72.19	73.08	74.0	74.31	75.41	
				8+14				
	20	17.5	10	69.14	10	20		
	71.61	72.0	72.87	74.0	74.94	76.0		
				8+04				
	19	10	3	69.36	10	18.5	20	
	72	73.13	74.0	74.19	75.18	76.0	76.11	
				8+00				
	20	11.9	10	71.0	10	20	30	
	72.94	74.0	74.14	75.02	76.0	76.70	77.34	
				7+80				
	23.25	20	10	72.53	2	10	20	
	74.0	74.21	74.98	75.85	76.0	76.61	77.34	
				7+60				
	25	20	10	72.77	10	20	27.5	
	74.0	74.31	75.09	76.0	76.72	77.48	78.0	
				7+57				
	20	10	6.9	74.1	10	16.5	20	
	74.96	75.76	76.0	76.66	77.45	78.0	78.35	
				7+40				
	20	16.47	10	75.7	8.7	10	20	
	75.83	76.0	76.49	77.47	78.0	78.14	78.74	
				7+20				
		20	10	77	10	20		
		76.71	77.32	78.0	78.59	78.95		
				7+04				
30	20	10	3.3	77.29	10	20	30	
76.70	76.95	77.55	78.0	78.28	78.72	79.01	79.79	
				7+00				
	30	20	10	78.92	10	19	30	
	78.17	78.33	78.71	79.34	79.60	80.0	80.32	
				6+80				
		20	10	79.77	8.3	10	20	
		79.01	79.32	79.82	80.0	80.15	80.60	
				6+70				
		20	10	80.47	10	20	30	
		79.46	79.68	80.0	80.47	80.92	81.17	
				6+64				
	20	10	6.8	80.72	10	20	30	
	79.74	79.92	80.0	80.4	80.68	81.14	81.37	
				6+60				
	30	20	10	82.73	4.2	10	20	30
	81.03	81.25	81.54	81.92	82.0	82.28	82.74	83.24
				6+40				
		20	10	82.9	10	20		
		81.45	81.73	82.0	82.46	82.94		
				6+38				
	20	10	1.7	84.82	3.7	10	20	
	83.22	83.76	84.0	84.09	84.0	84.38	85.08	
				6+20				

		20	10	86.79	10	20		
		85.12	85.59	86.0	86.5	87.07		
				6+02				
	20	10	4.7	86.82	10	20	30	
	85.3	85.76	86	86.24	86.69	87.25	88.0	
				6+00				
	32	20	10	88.05	10	27.5		
	86.0	86.89	87.46	88.0	88.64	89.66		
				5+84				
	36	20	6.8	88.72	10	27.45		
	86.0	87.19	88.0	88.46	89.04	90.0		
				5+80				
	35	29	10	89.77	10	24		
	87.4	88.0	89.3	90.0	89.87	90.23		
				5+67				
		35	10	90.62	10	21		
		88.0	90.0	90.842	90.31	90.45		
				5+60				
	30	20	10	92.45	10	20	30	
	90.3	91.7	92.1	93.3	93.9	94.2	94.6	
				5+40				
	30	20	10	94.27	10	20	30	
	93.1	94.0	95.0	95.8	96.2	96.7	97.1	
				5+20				
	30	20	10	96.1	10	20	30	
	95.0	96.2	97.0	97.7	98.2	99.0	100.1	
				5+00				
	30	20	10	97.9	10	20	30	
	96.7	97.9	98.6	99.7	100.4	101.7	102.3	
				4+80				
	30	20	10	98.2	10	20	30	
	96.94	97.94	100.0	100.0	100.78	101.96	102.6	
				4+76				
		20	10	100.6	10	20		
		98.0	100.06	98.8	101.35	102.35		
				4+70				
	30	20	10	99.58	10	20	30	
	97.9	98.1	100.15	101.5	102.3	103	103.8	
				4+60				
		20	10	100.2	10	20		
		98.68	100.58	101.85	102.65	103.4		
				4+50				
	30	20	10	102.3	10	20	30	
	97.7	99.25	101.1	102.2	103.0	103.8	104.2	
				4+40				
	30	20	10	100.7	10	20	30	
	97.6	99.1	100	101.1	101.8	102.7	103.8	
				4+20				
Left				Start	Right			

Note: Station 4+20 **must** become a 2% crossfall elevation from 4+10

Points on Curve 1 Elevation Calculations

Station	Elevation
8+90	63.25m
8+80	63.42m
8+70	63.85m
8+60	64.52m
Low Point Station	8+92

Points on Curve 3 Elevation Calculations

Station	Elevation
6+70	63.25m
Low Point Station	No low point

Points on Curve 2 Elevation Calculations

Station	Elevation
4+50	100.2m
4+70	98.8m
High Point Station	4+40

4.3: Horizontal Curve Data Sheet

Curve 2 calculation prior to Curve 1

Curve 2:

*T2 = 200m * tan(30.277778) / 2 = 54.11m*

*Arclength = (30.277778 * 3.14 * 200)/180 = 105.689*

Point of Intersection (PI) Station	8+14
Deflection Angle	30° 16’ 40” (30.277778°)
Starting Tangent Bearing	59° 16’ 20”
Finishing Tangent Bearing	89° 33’ 00”
Minimum Radius	130m
Centerline Radius	200m *based on project requirements
Tangent Length	54.11m *54m to make it at station
BC Station	7+60
Arc Length	105.689m
EC Station	8+65.689 *8+65 to make it at station

Curve 1: Design Constraints

EC must match Curve 2 BC

Calculated using Tangent length of Curve 2

PI 1 – PI 2 = 814 - 660 = 154m

T1 = 154 - 54.11 = 99.89m (or 100m)

*100 = R * tan * (30.5/2). So, R = 366.796*

Point of Intersection (PI) Station	6+60
Deflection Angle	30° 30’ 00” (30.5°)
Starting Tangent Bearing	89° 46’ 20”
Finishing Tangent Bearing	59° 16’ 20”
Minimum Radius	130m
Centerline Radius	366.796m *based on tangent length of 100m
Tangent Length	100m *Taken from calculations from Curve 2
BC Station	5+60
Arc Length	195.255m
EC Station *If EC must equal Curve 2 BC station, then the Curve 1 Arc length must land on point that is 54.11m tangent from Curve 2 PI* *The distance from PI1 to PI2 is T1 + T2*	7+60

4.4: Project 2 (4+20 – Willingdon Ave) Vertical Curve Calculations

Last Possible EVC Station Trial 1

Centerline of Willingdon Ave: 9+34

Road width (1/2): 16.5m (Control is at road edge, so only 4.5m)

Curb Return Radii: 9.0m

Intersection Storage: 12.0m

Grade: 2% (crossfall)

Total: 25.5

Last Possible EVC Station: 9+08 (9+00)

34m @ 2% grade: 0.68m of rise

EVC elevation: 63.32m

Vertical Curve 1 (EVC @ Willingdon T Intersection Min Curve) Calculations Trial 1

Max grade of -8% approach meeting departing grade 2%: A = 10

T intersection Minimum Curve Length: 40m (40m to nearest station)

EVC: 9+00 (63.32m elevation)

VPI: 8+80 (62.92m elevation) (20m @ 2%) (decrease of 0.4m)

BVC: 8+60 (64.52m elevation) (20m @ 8%) (increase of 1.6m)

This works

Vertical Curve 2 (BVC @ Carleton T Intersection Min Curve) Calculations Trial 1

Use the same intersection last station calculations from Project 1

Closest BVC: 30m (4+40)

30m @ 2% grade: 0.6m of fall

Max grade of -2% approach meeting departing grade -10%: A = 8

T intersection Minimum Curve Length: 32m (40m to nearest station)

EVC: 4+80 (97.9m elevation) (20m @ -10%) (decrease of 2.0m)

VPI: 4+60 (99.9m elevation) (20m @ -2%) (decrease of 0.4m)

BVC: 4+40 (100.3m elevation) (20m @ -2%) (decrease of 0.6m)

This works

Vertical Curve 3 (BVC @ Intersections of other two curves) Calculations Trial 1

Max grade of -10% approach meeting departing grade -8%: A = 2 sag curve

Minimum Sag Curve Length: 20m

Distance from Curve 1 BVC – Curve 2 EVC: 210m

Curve 2 is already at the max slope, so the higher elevation prevails

VPI @ 8+80 elevation: 62.92

Distance to VPI3: 210m

Trial design grade: -8%

Trial elevation VPI @ 6+70: 79.72m

VPI@ 4+60: 99.9m

Distance to VPI3: 210m

Trial Design grade: -10%

Trial elevation VPI @ 6+70: 78.9m

Use grade from VPI Curve 1 @ 8+80

Max grade of -10% approach meeting departing grade -8%: A = 2 sag curve

VPI: 6+70 (79.72m elevation) (210m @ -8% from VPI1) (increase of 16.8m)

EVC: 6+80 (78.92m elevation) (10m @ -8%) (decrease of 0.8m)

BVC: 6+60 (80.72m elevation) (10m @ -10%) (increase of 1.0m)

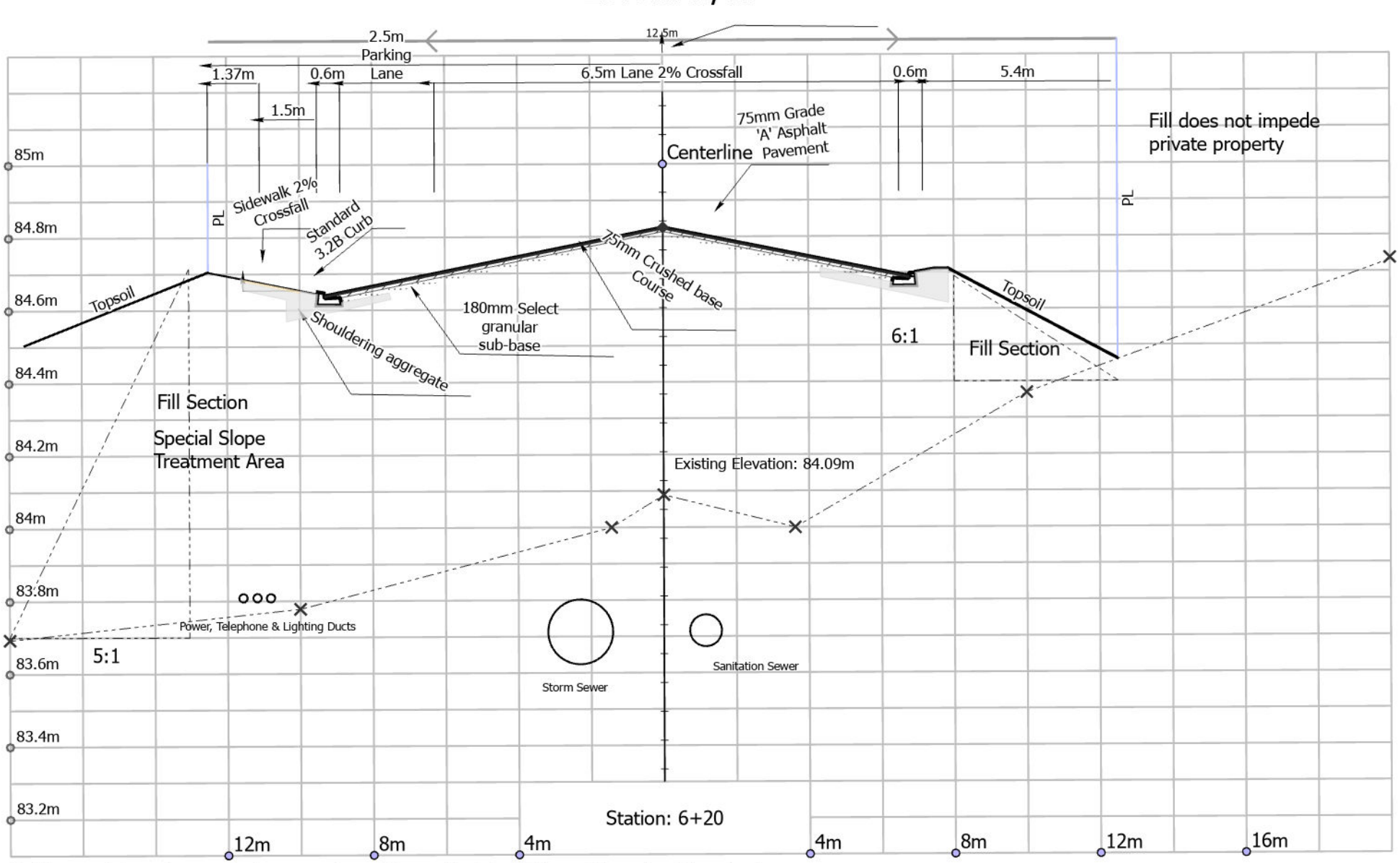
This works

Curve 3 connects the two tangents of -10% and -8%

Project 2: Station 6+20 Cross-Section Drawing

Figure 4.5

2 Lane Urban Collector w/ Parking on N. Side
Kincaid Street



RoW cannot impede on private property on the south side; fill to existing elevation at edge

Room for lighting on north side at outside edge of boulevard

Reduce posted speed; steep downward slope on horizontal curve