APPENDIX 7

AUXILIARY LANE ANALYSES

GREENBANK ROAD/ KILBIRNIE DRIVE

CCL/IBI
Cumming Cockburn Limited

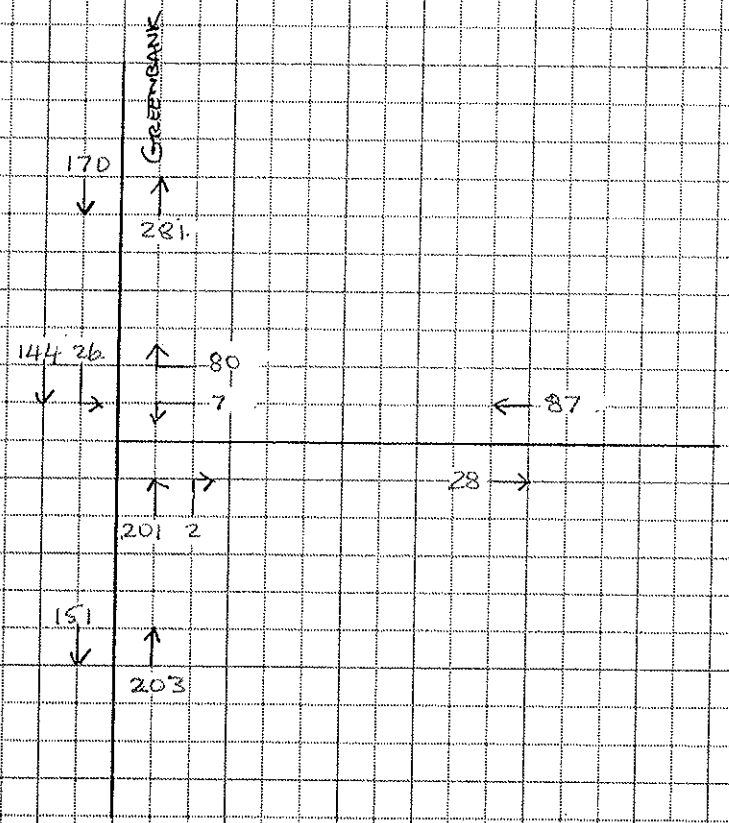
Sheet____ of____

Date July, 2007

PROJECT: STONEBRIDGE PH. 10-12 PROJECT NO. 15056 Designed By SCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By____

GREENBANK ROAD / KILBIRNIE DRIVE



FUTURE (2013) BACKGROUND PLUS SITE GENERATED TRAFFIC
AM PEAK HOUR

POSTED SPEED LIMIT ALONG GREENBANK = 80 km/h

∴ DESIGN SPEED = 90 km/h

ADVANCING VOLUME, V_A = 170 veh/h

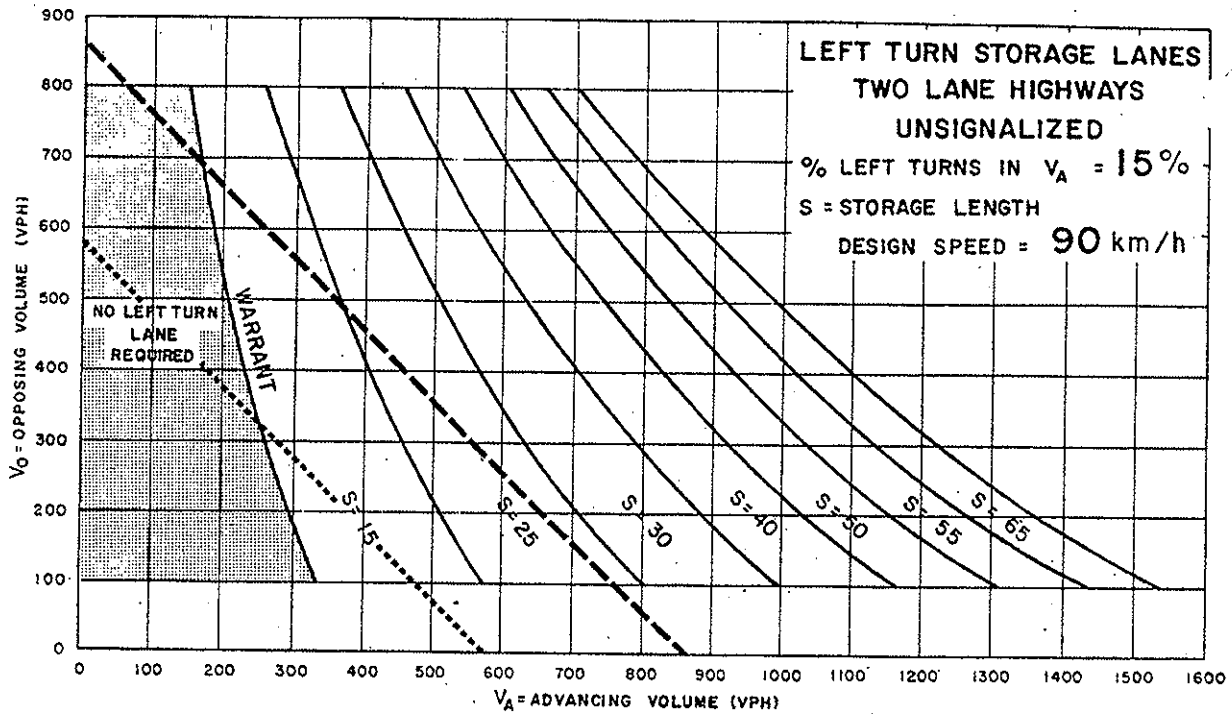
LEFT-TURN VOLUME, V_L = 26 veh/h

% LEFT-TURN = 15 %

∴ USE GRAPH FOR 15 % LEFT-TURNS

OPPOSING VOLUME, V_O = 203 veh/h

CONCLUSION: AUXILIARY LEFT-TURN LANE IS NOT REQUIRED.



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

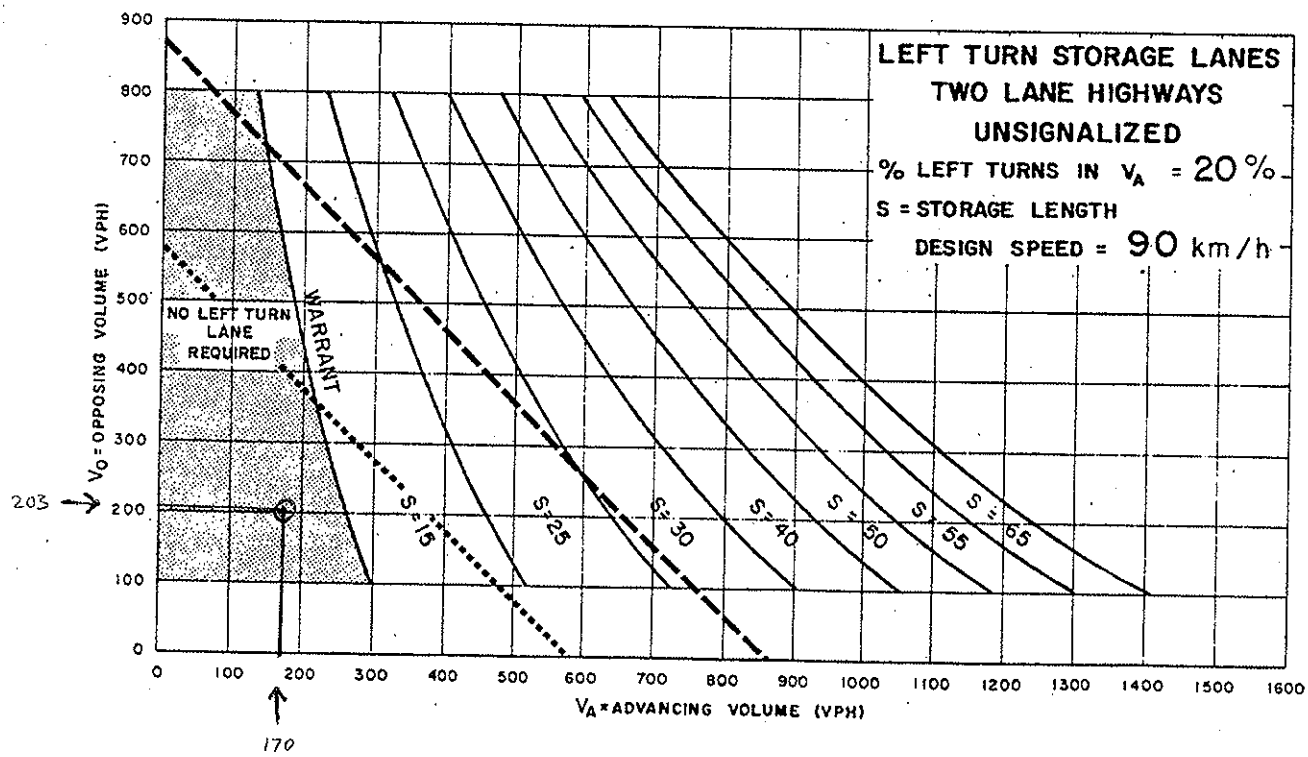


Figure EA-19

CCL/IBI
Cumming Cockburn Limited

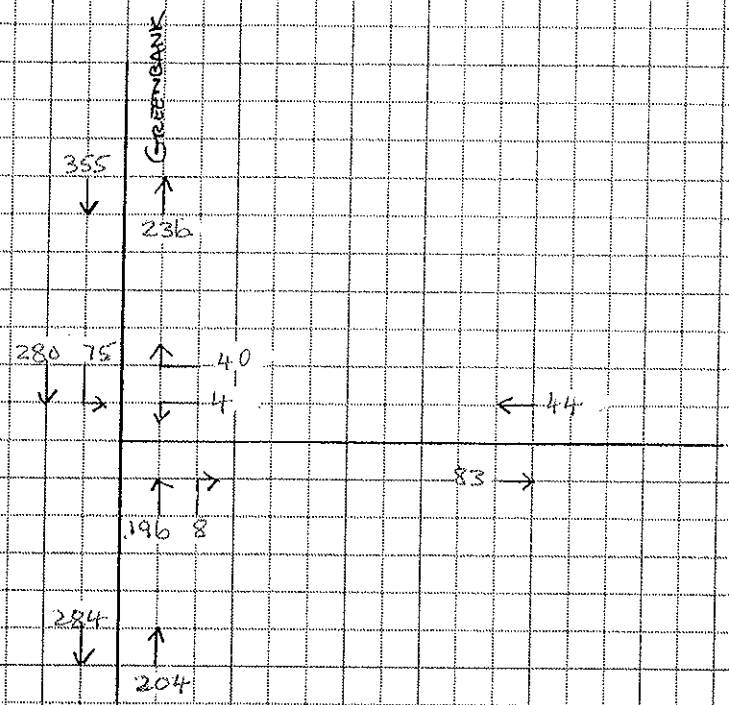
Sheet____ of____

Date July, 2007

PROJECT: STONEBRIDGE PH. 10-12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By____

GREENBANK ROAD / GILBRIDE DRIVE



FUTURE (2013) BACKGROUND PLUS SITE GENERATED TRAFFIC
PM PEAK HOUR

POSTED SPEED LIMIT ALONG GREENBANK = 80 km/h

∴ DESIGN SPEED = 90 km/h

ADVANCING VOLUME, V_A = 355 veh/h

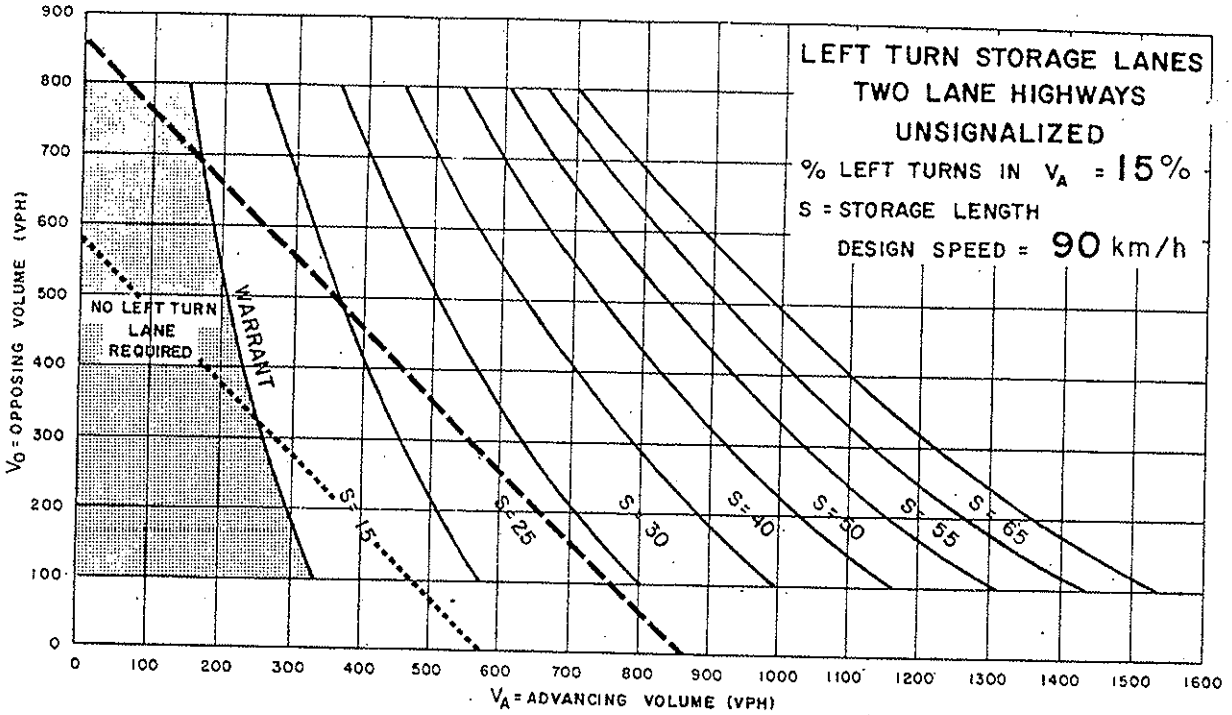
LEFT-TURN VOLUME, V_L = 75 veh/h

% LEFT-TURN = 21 %

∴ USE GRAPH FOR 20 % LEFT-TURNS

OPPOSING VOLUME, V_O = 204 veh/h

CONCLUSION : AUXILIARY LEFT-TURN LANE IS NOT REQUIRED



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

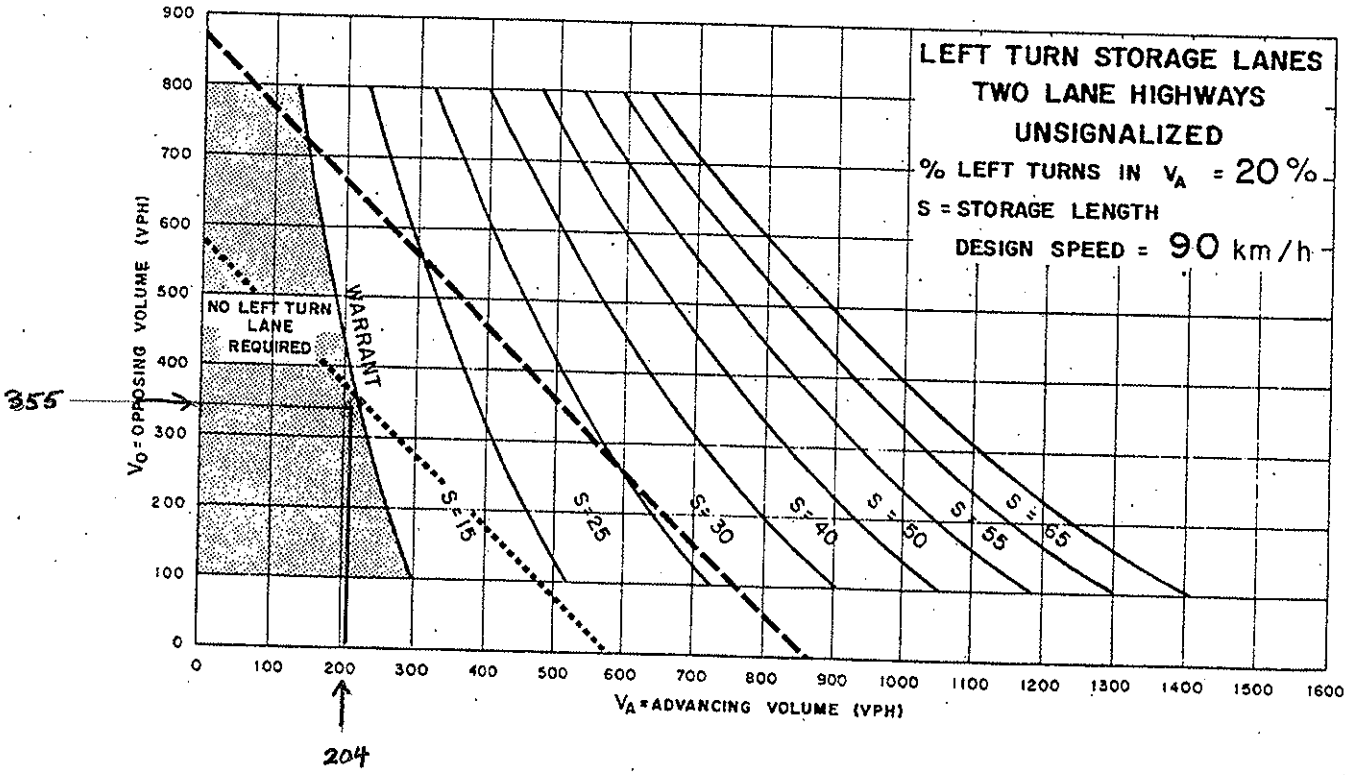


Figure EA-19

CCL/IBI
Cumming Cockburn Limited

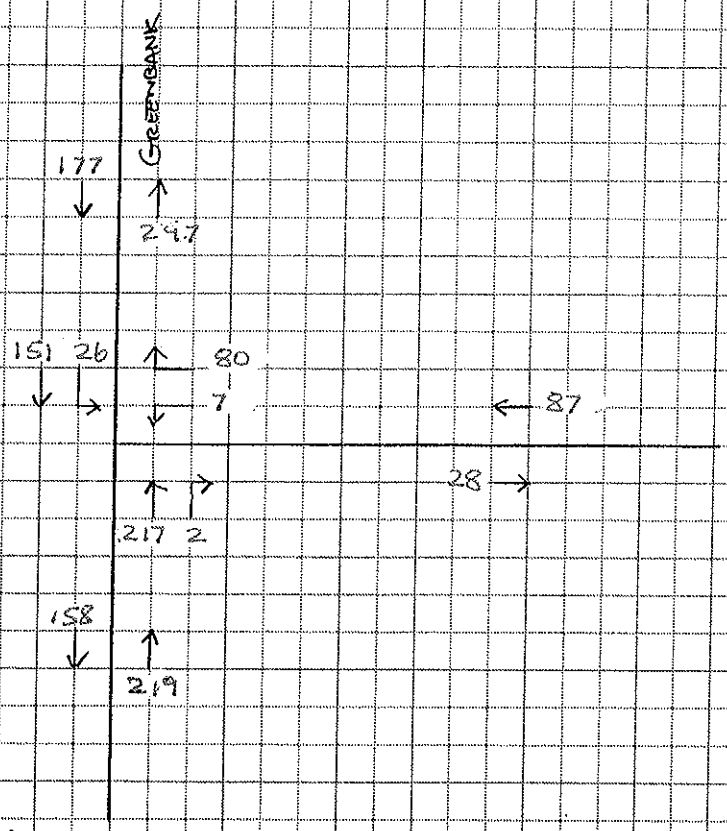
Sheet____ of____

Date JULY, 2007

PROJECT: STONEBRIDGE PH. 10-12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By____

GREENBANK ROAD / KILBIRNIE DRIVE



FUTURE (2018) BACKGROUND PLUS SITE GENERATED TRAFFIC
AM PEAK HOUR

POSTED SPEED LIMIT ALONG GREENBANK = 80 km/h

∴ DESIGN SPEED = 90 km/h

ADVANCING VOLUME, V_A = 177 veh/h

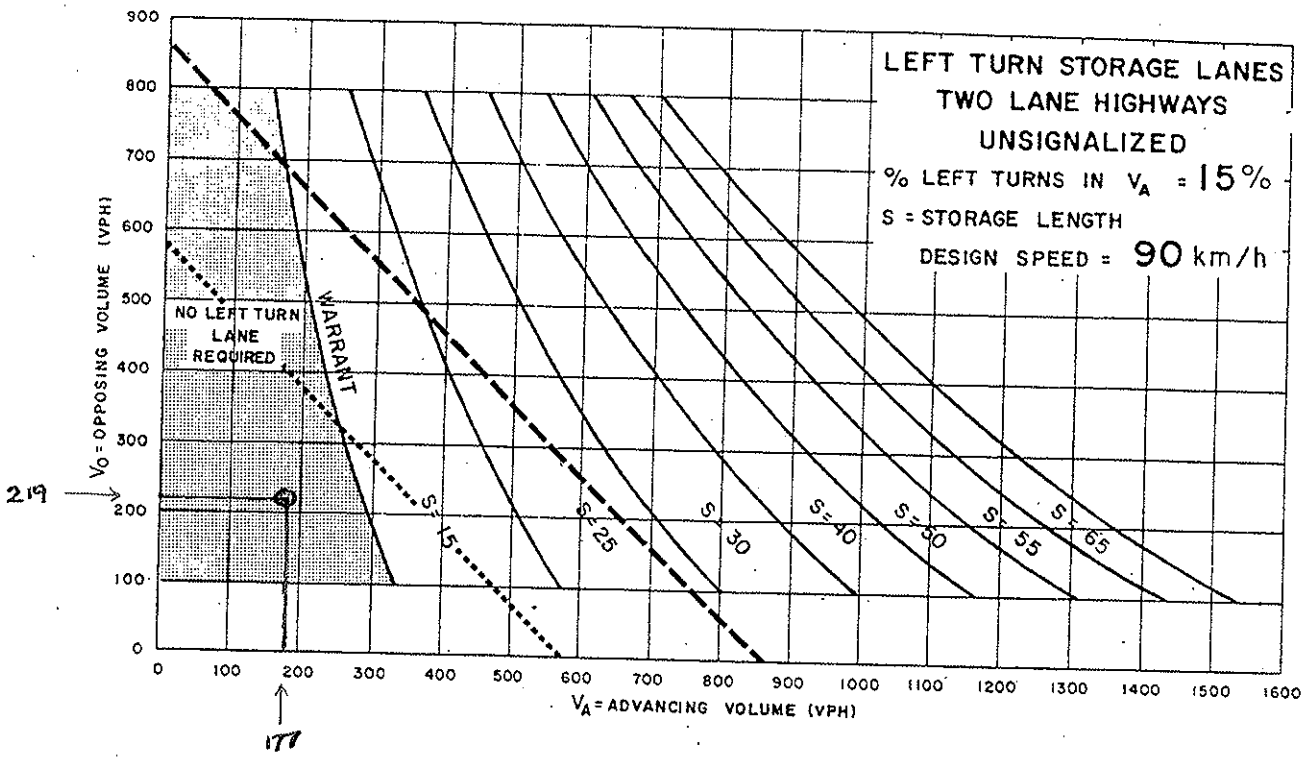
LEFT-TURN VOLUME, V_L = 26 veh/h

% LEFT-TURN = 15 %

∴ USE GRAPH FOR 15% LEFT-TURNS

OPPOSING VOLUME, V_O = 219 veh/h

CONCLUSION : AUXILIARY LEFT-TURN LANE IS NOT REQUIRED.


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 15%
S = STORAGE LENGTH
DESIGN SPEED = 90 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
2.19
ITT
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

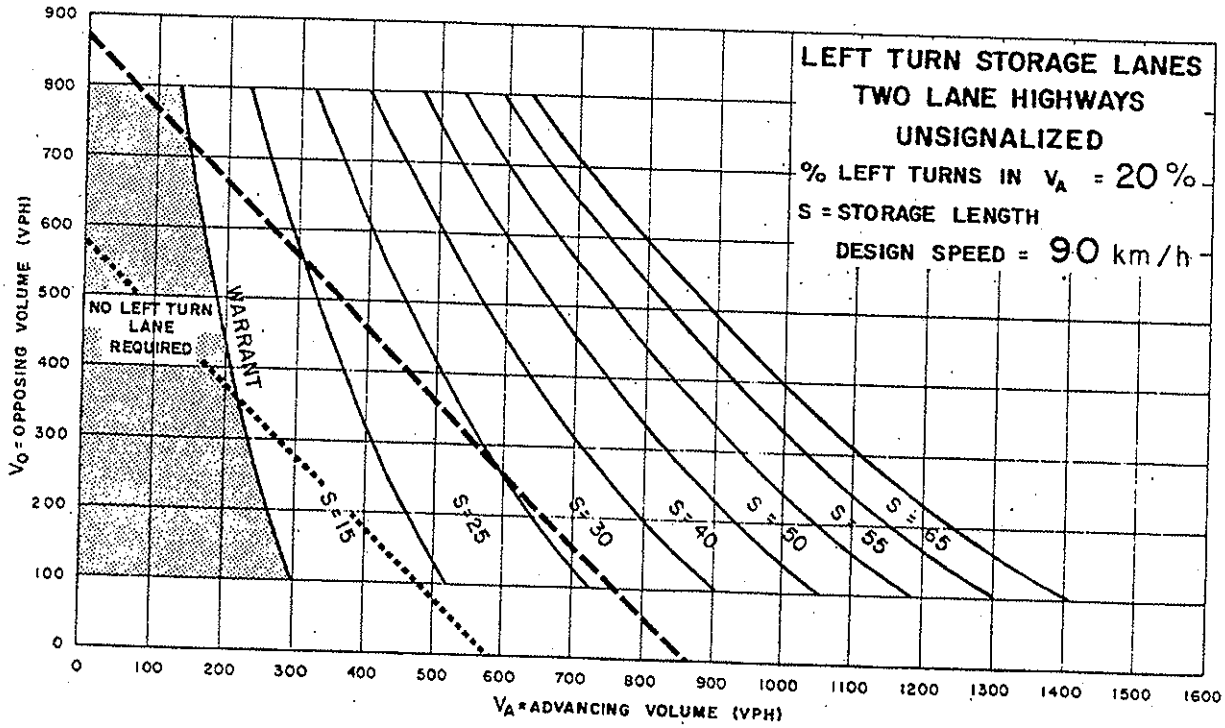

LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 20%
S = STORAGE LENGTH
DESIGN SPEED = 90 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)

Figure EA-19

CCL/IBI
Cumming Cockburn Limited

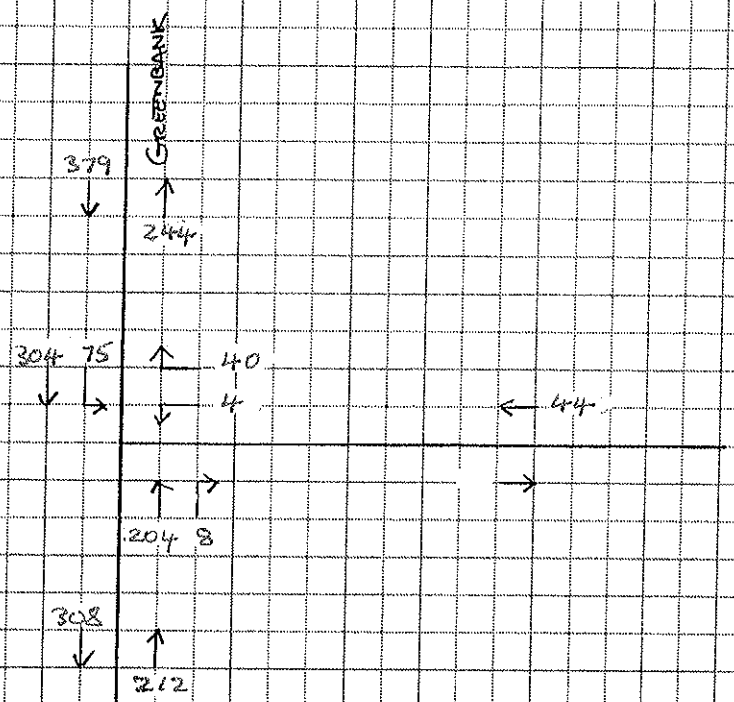
Sheet____ of____

Date JULY, 2007

PROJECT: STONEBRIDGE PH. 10-12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By____

GREENBANK ROAD / KILBIRNIE DRIVE



FUTURE (2018) BACKGROUND PLUS SITE GENERATED TRAFFIC
PM PEAK HOUR

POSTED SPEED LIMIT ALONG GREENBANK = 80 km/h

∴ DESIGN SPEED = 90 km/h

ADVANCING VOLUME, V_A = 379 veh/h

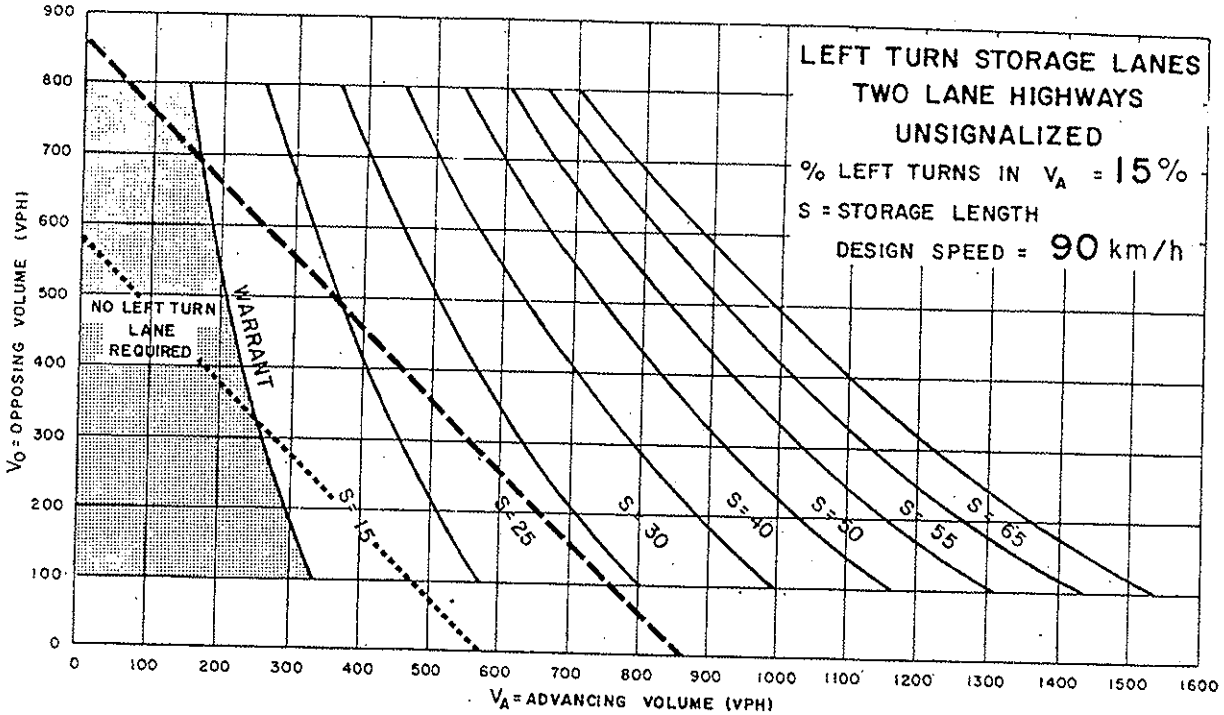
LEFT-TURN VOLUME, V_L = 75 veh/h

% LEFT-TURN = 20 %

∴ USE GRAPH FOR 20 % LEFT-TURNS

OPPOSING VOLUME, V_O = 212 veh/h

CONCLUSION : AUXILIARY LANE IS REQUIRED. MINIMUM STORAGE LENGTH = 15 m.



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

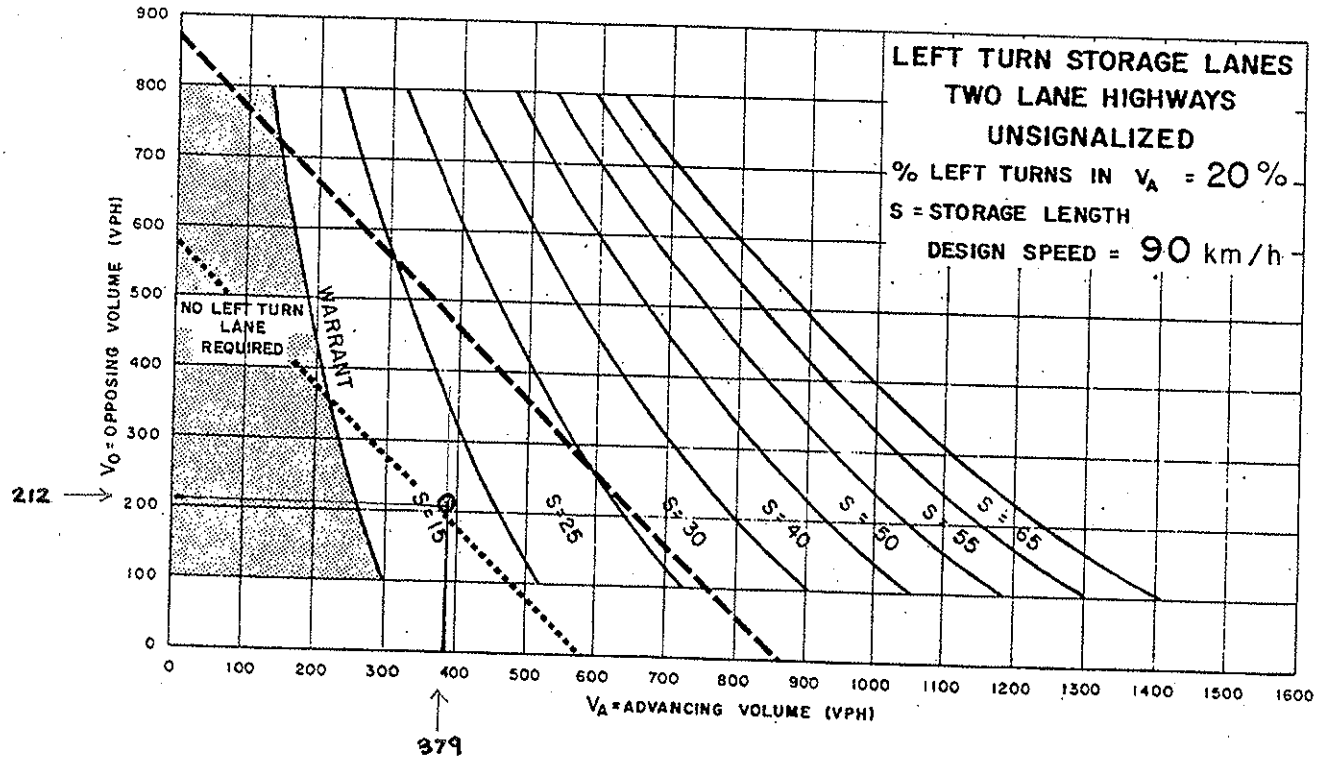


Figure EA-19

GREENBANK ROAD/ DUNDONALD DRIVE

CCL/IBI
Cumming Cockburn Limited

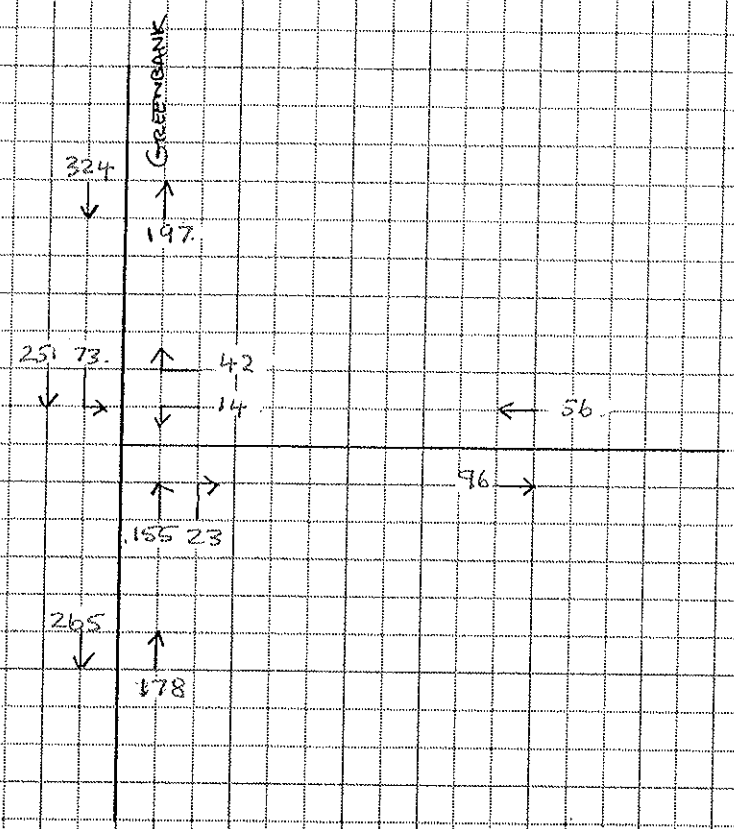
Sheet____ of____

Date JULY, 2007

PROJECT: STONEBRIDGE PH. 10-12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By____

GREENBANK ROAD / DUNDONALD DRIVE



FUTURE (2013) BACKGROUND TRAFFIC
PM PEAK HOUR

POSTED SPEED LIMIT ALONG GREENBANK = 80 km/h

∴ DESIGN SPEED = 90 km/h

ADVANCING VOLUME, V_A = 324 veh/h

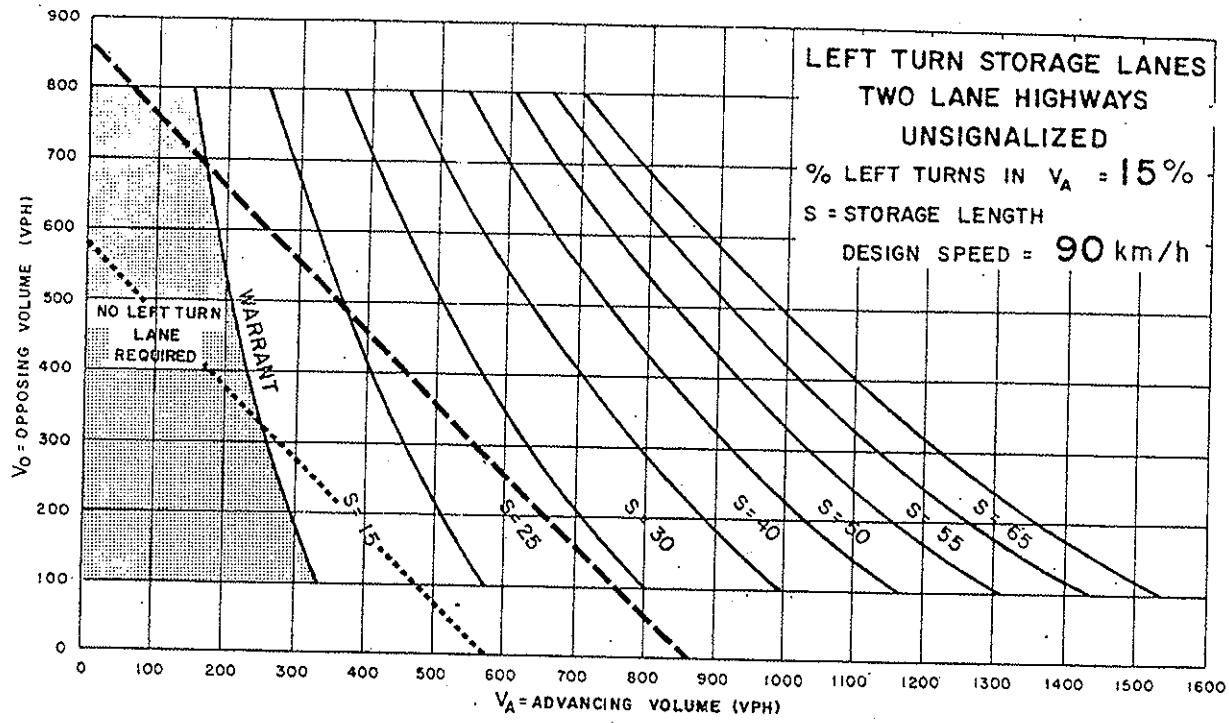
LEFT-TURN VOLUME, V_L = 73 veh/h

% LEFT-TURN = 22 %

∴ USE GRAPH FOR 20 % LEFT-TURNS

OPPOSING VOLUME, V_O = 178 veh/h

CONCLUSION : AUXILIARY LEFT-TURN LANE IS REQUIRED. MINIMUM STORAGE LENGTH = 15m.



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

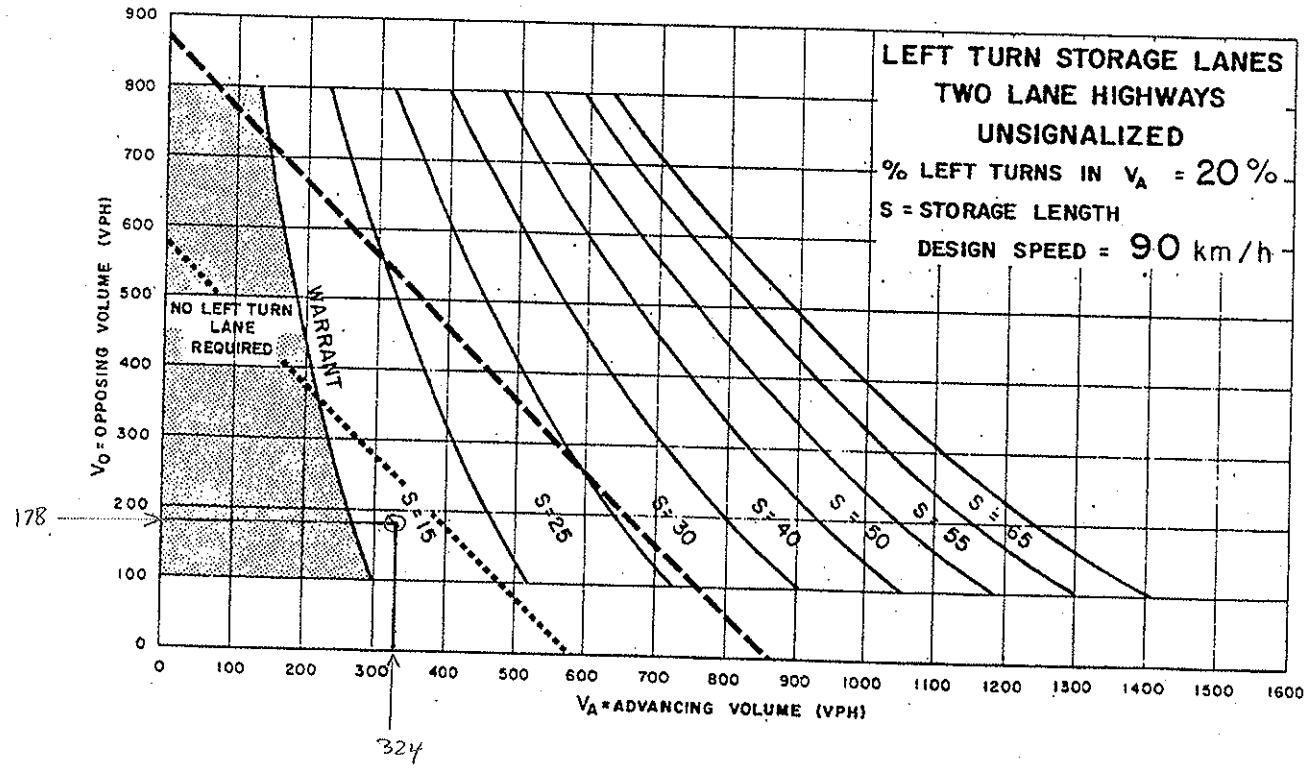


Figure EA-19

CCL/IBI
Cumming Cockburn Limited

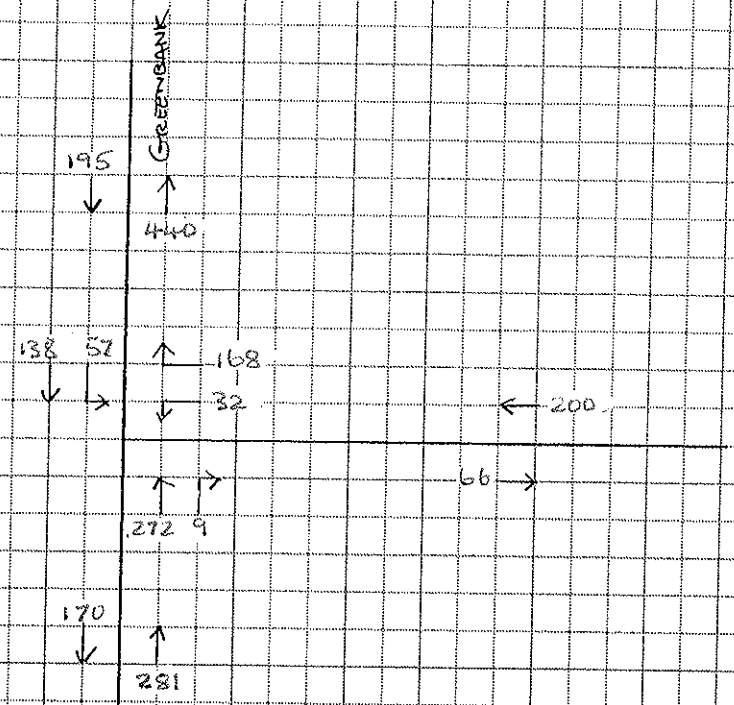
Sheet____ of____

Date July, 2007

PROJECT: STONEBRIDGE PH. 10-12 PROJECT NO. 15056 Designed By SCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By____

GREENBANK ROAD / DUNDONALD DRIVE



FUTURE (2013) BACKGROUND PLUS SITE GENERATED TRAFFIC
AM PEAK HOUR

POSTED SPEED LIMIT ALONG GREENBANK = 80 km/h

∴ DESIGN SPEED = 90 km/h

ADVANCING VOLUME, V_A = 195 veh/h

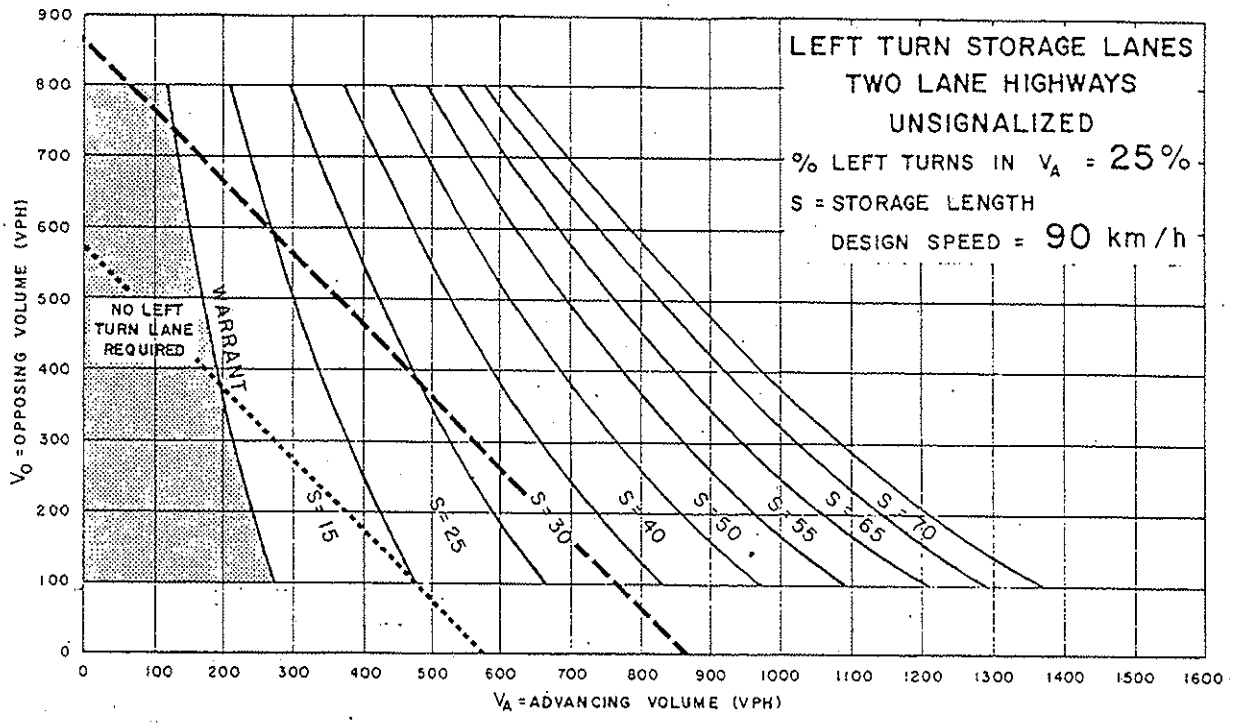
LEFT-TURN VOLUME, V_L = 57 veh/h

% LEFT-TURN = 29 %

∴ USE CRAMPIT FOR 30 % LEFT-TURNS

OPPOSING VOLUME, V_O = 281 veh/h

CONCLUSION : NO LEFT-TURN LANE REQUIRED



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

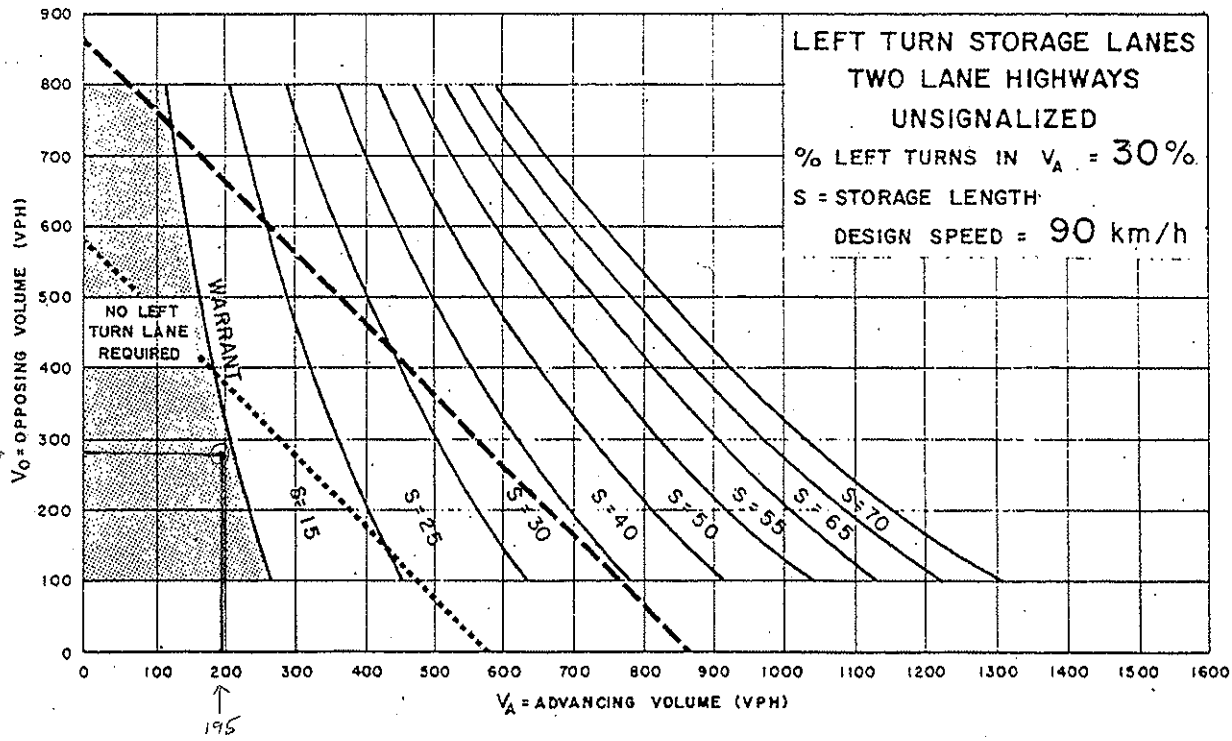


Figure EA-20

CCL/IBI
Cumming Cockburn Limited

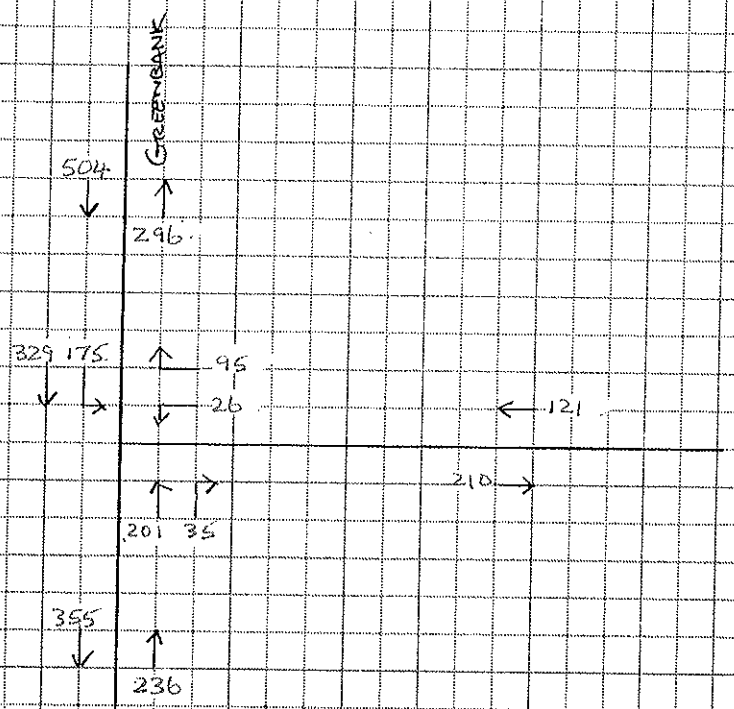
Sheet _____ of _____

Date JULY, 2007

PROJECT: STONEBRIDGE PH. 10-12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By _____

GREENBANK ROAD / DUNDONALD DRIVE



FUTURE (2013) BACKGROUND PLUS SITE GENERATED TRAFFIC
PM PEAK HOUR

POSTED SPEED LIMIT ALONG GREENBANK = 80 km/h

∴ DESIGN SPEED = 90 km/h

ADVANCING VOLUME, V_A = 504 veh/h

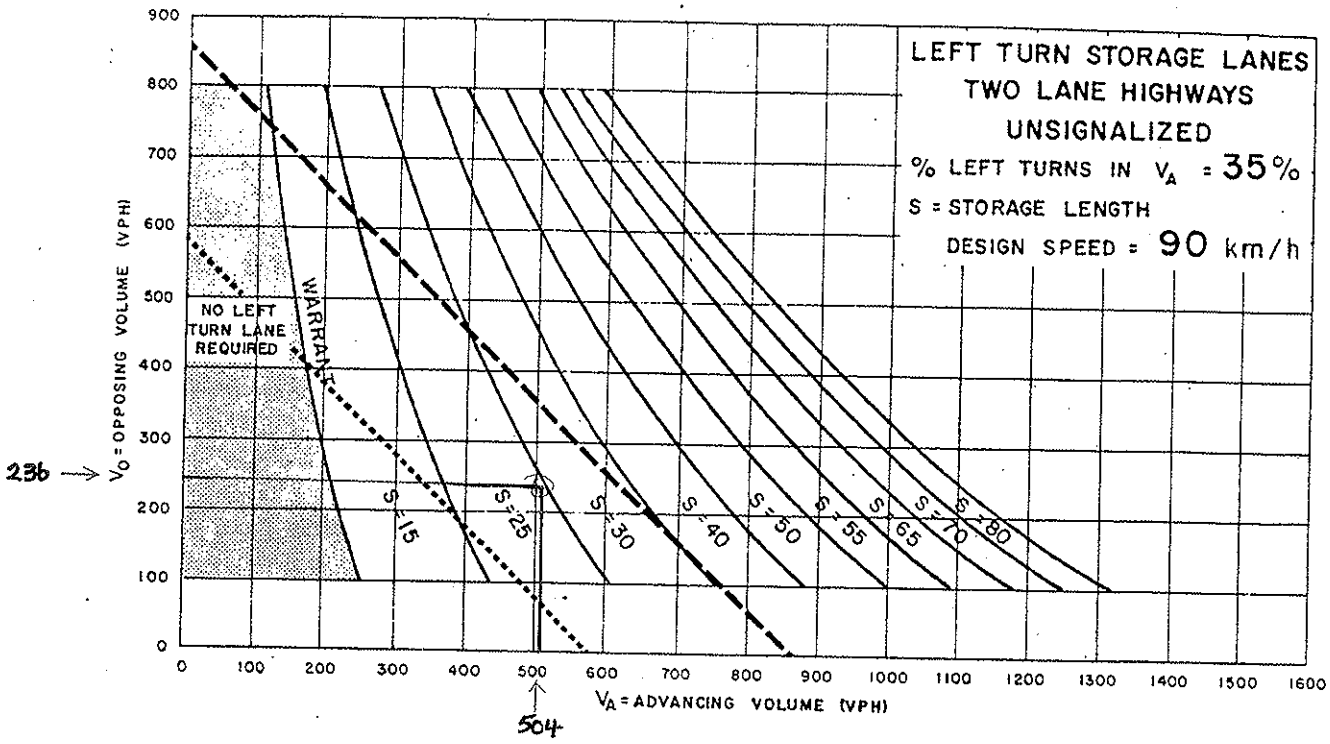
LEFT-TURN VOLUME, V_L = 175 veh/h

% LEFT-TURN = 35 %

∴ USE GRAPH FOR 35 % LEFT-TURNS

OPPOSING VOLUME, V_O = 236 veh/h

CONCLUSION : AUXILIARY LEFT-TURN LANE IS REQUIRED. MINIMUM STORAGE LENGTH = 25 m.



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

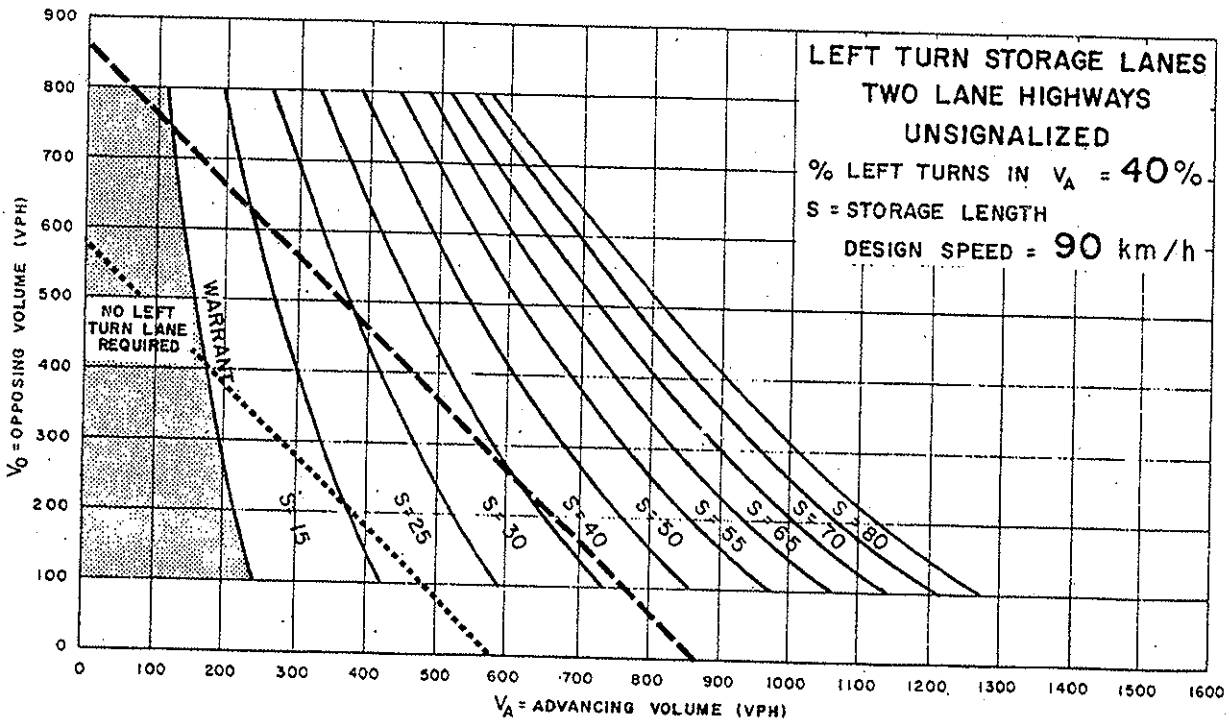


Figure EA-21

CCL/IBI
Cumming Cockburn Limited

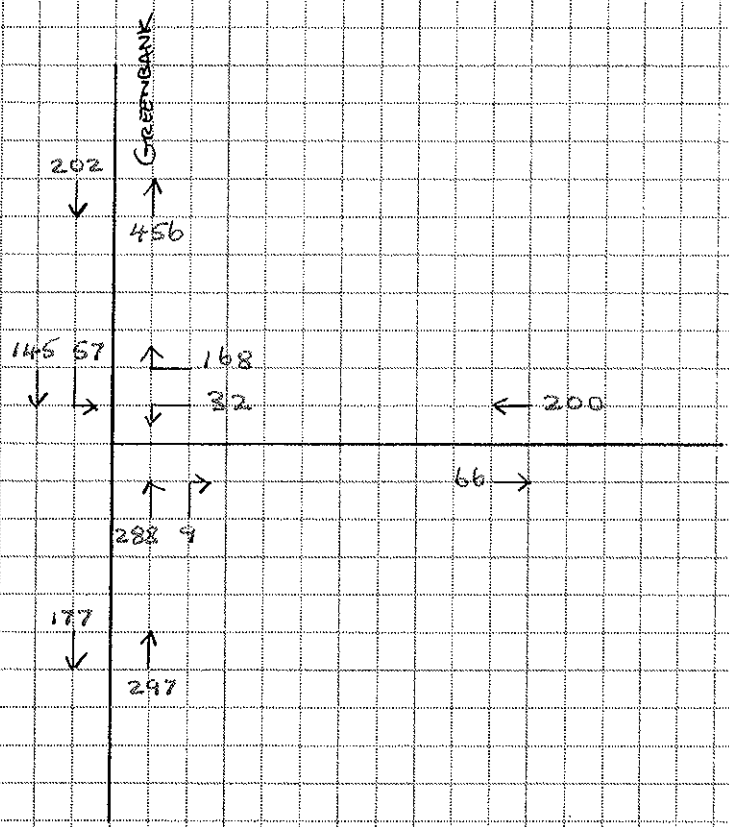
Sheet____ of____

Date July, 2007

PROJECT: STONEBRIDGE PH. 10-12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By____

GREENBANK ROAD / DUNDONALD DRIVE



FUTURE (2018) BACKGROUND PLUS SITE GENERATED TRAFFIC
AM PEAK HOUR

POSTED SPEED LIMIT ALONG GREENBANK = 80 km/h

∴ DESIGN SPEED = 90 km/h

ADVANCING VOLUME, V_A = 202 veh/h

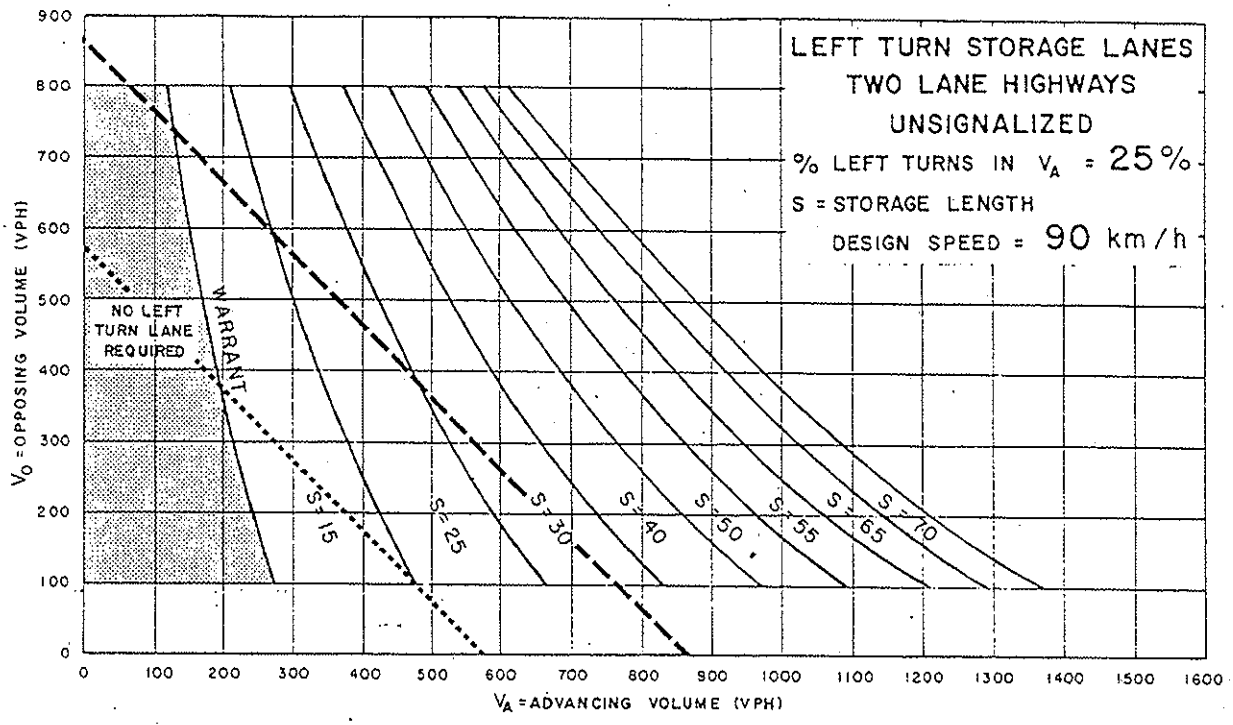
LEFT-TURN VOLUME, V_L = 57 veh/h

% LEFT-TURN = 28 %

∴ USE CRAPIT FOR 30% LEFT-TURNS

OPPOSING VOLUME, V_o = 297 veh/h

CONCLUSION : AUXILIARY LEFT-TURN LANE IS NOT REQUIRED.



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

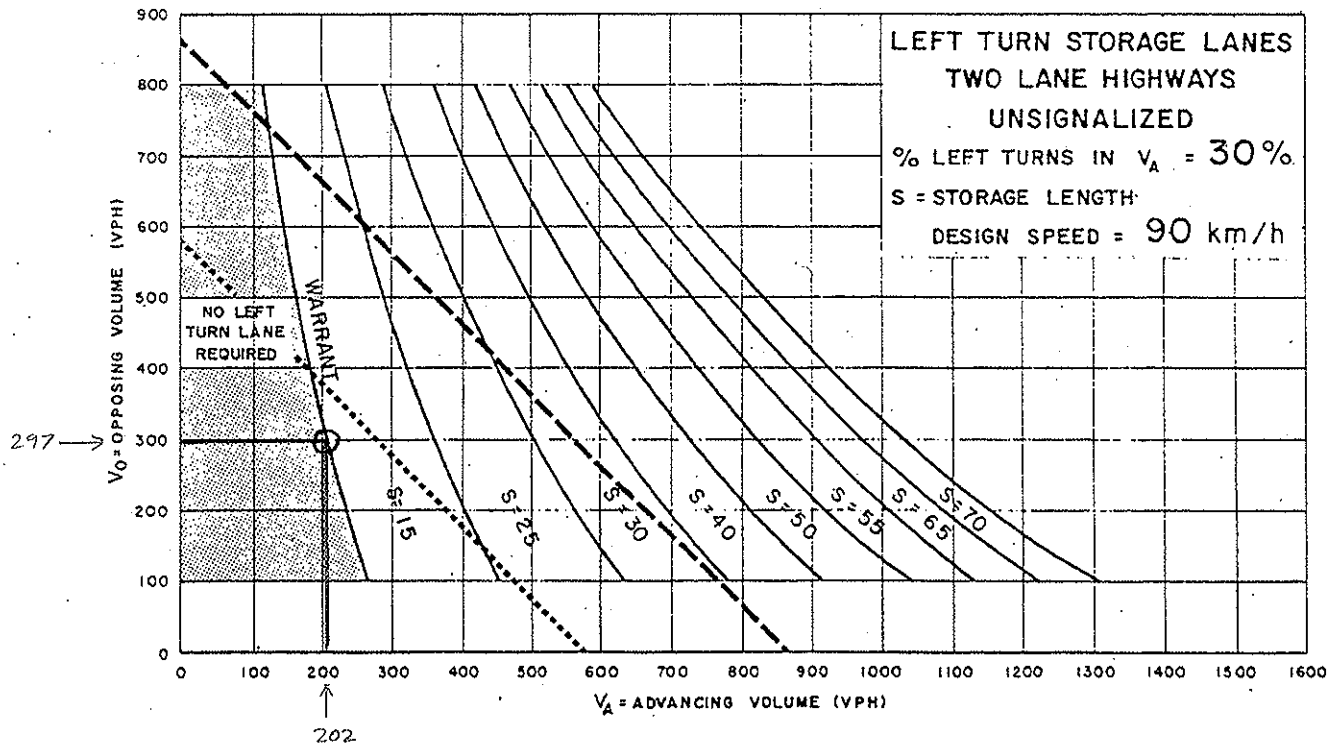


Figure EA-20

CCL/IBI
Cumming Cockburn Limited

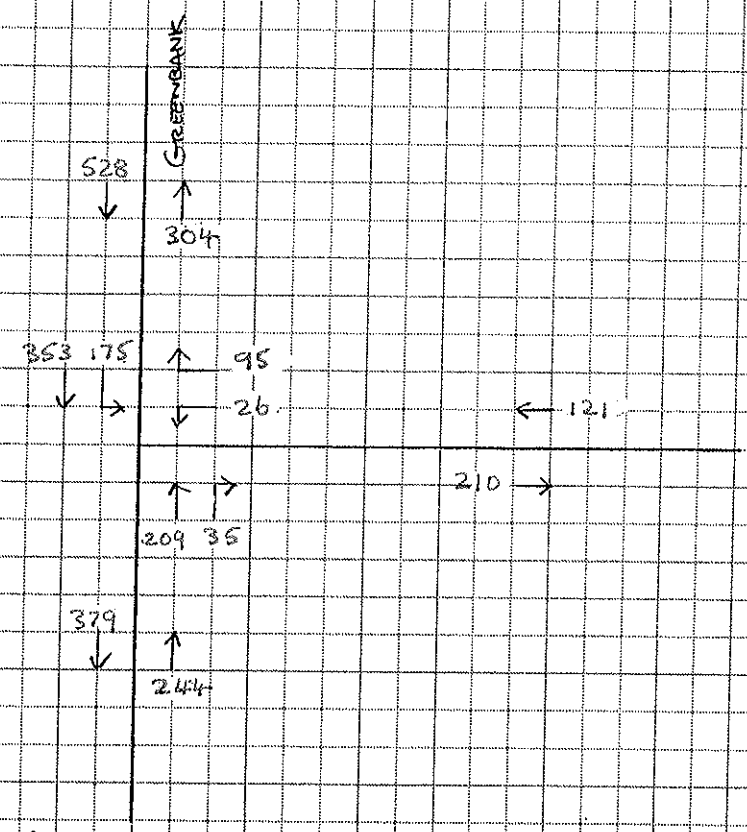
Sheet____ of____

Date JULY, 2007

PROJECT: STONEBRIDGE PH. 10-12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By____

GREENBANK ROAD / DUNDONALD DRIVE



FUTURE (2018) BACKGROUND PLUS SITE GENERATED TRAFFIC
PM PEAK HOUR

POSTED SPEED LIMIT ALONG GREENBANK = 80 km/h

∴ DESIGN SPEED = 90 km/h

ADVANCING VOLUME, V_A = 528 veh/h

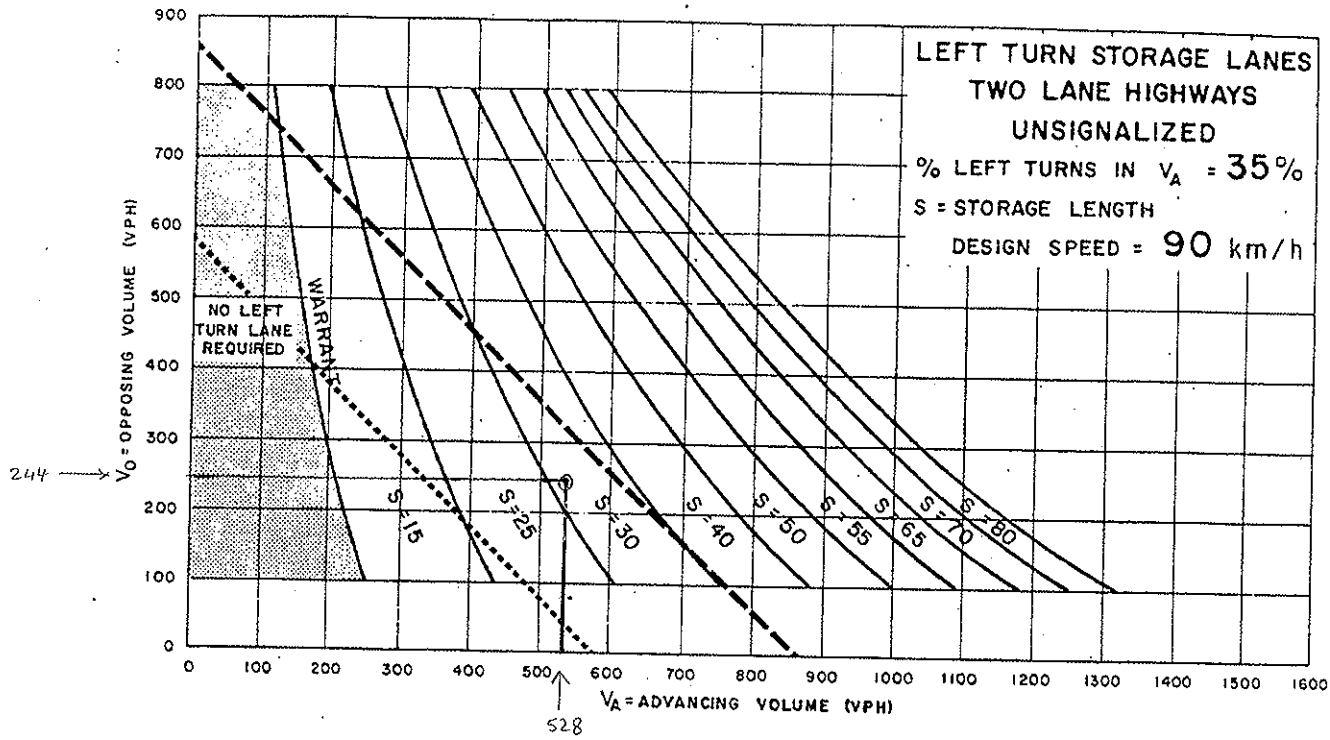
LEFT-TURN VOLUME, V_L = 175 veh/h

% LEFT-TURN = 33 %

∴ USE GRAPH FOR 35 % LEFT-TURNS

OPPOSING VOLUME, V_O = 244 veh/h

CONCLUSION : AUXILIARY LEFT-TURN LANE IS REQUIRED. MINIMUM STORAGE LENGTH = 30m



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

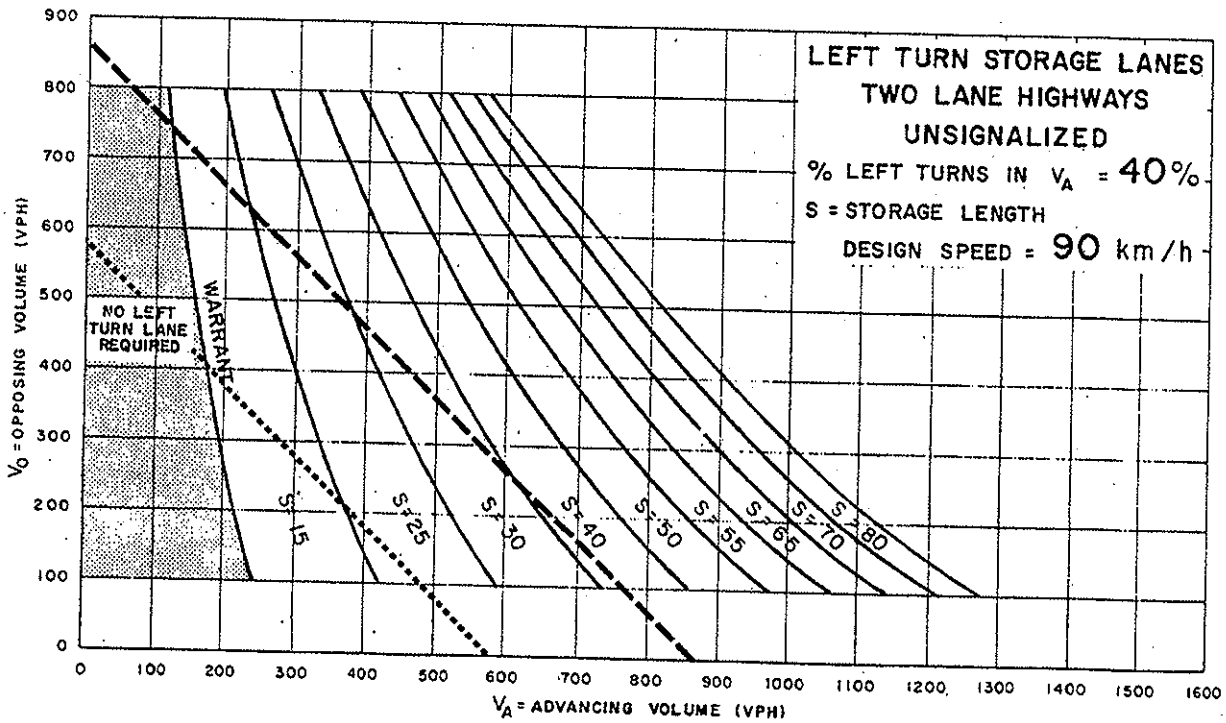


Figure EA-21

CAMBRIAN ROAD/ KILBIRNIE DRIVE

CCL / IBI
Cumming Cockburn Limited

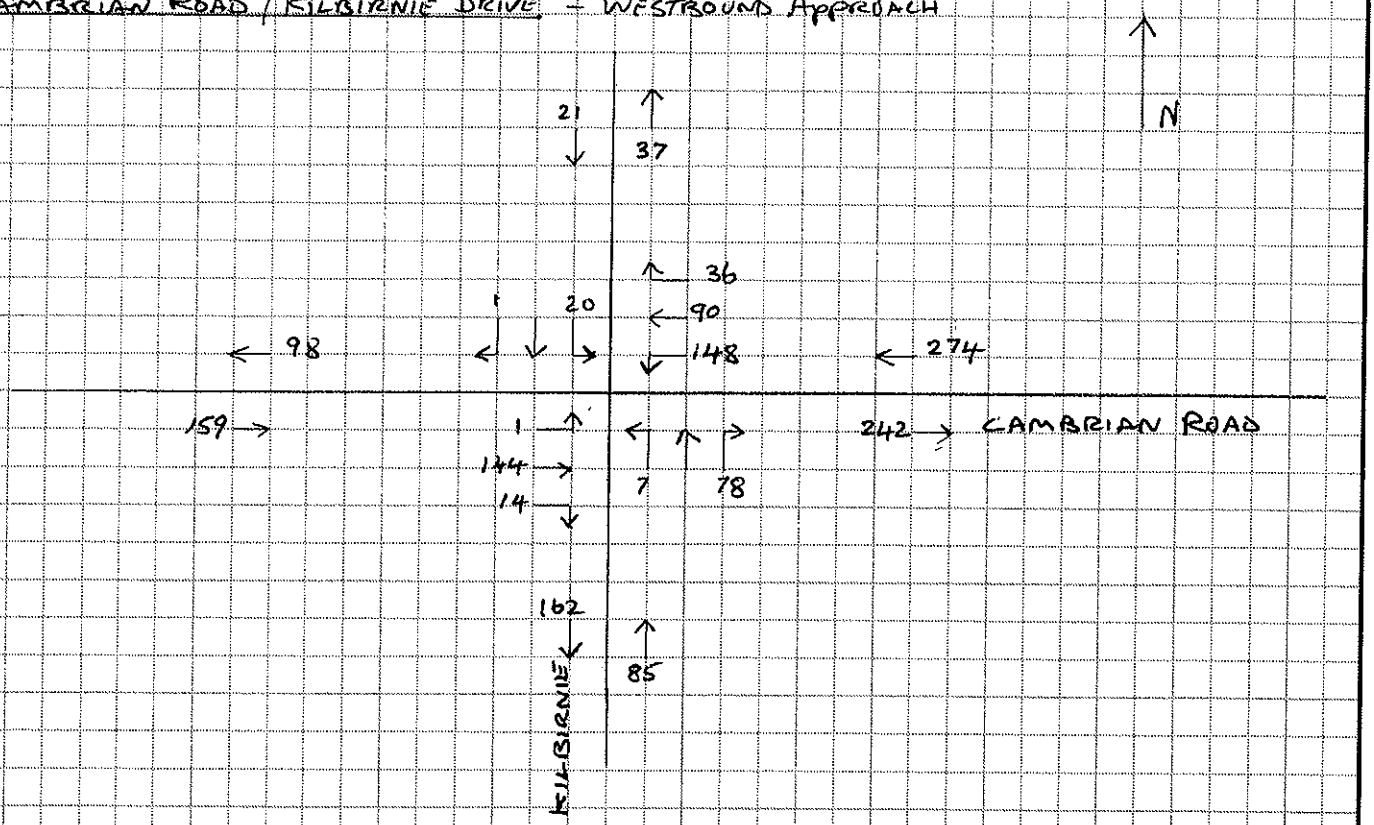
Sheet _____ of _____

Date JULY 2007

PROJECT: STONEBRIDGE - PH. 10 TO 12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By _____

CAMBRIAN ROAD / KILBIRNIE DRIVE - WESTBOUND APPROACH



FUTURE (2013) BACKGROUND TRAFFIC
PM PEAK HOUR

SPEED LIMIT ALONG CAMBRIAN ROAD = 50 km/h

DESIGN SPEED = 60 km/h

APPROACHING VOLUME, V_A = 274 veh/h

LEFT-TURN VOLUME, V_L = 148 veh/h

% LEFT TURNS = 54 %

USE GRAPH FOR 40 % LEFT-TURNS

OPPOSING VOLUME = 159 veh/h

CONCLUSION: AN AUXILIARY LEFT-TURN LANE IS NOT REQUIRED.

CCL / IBI
Cumming Cockburn Limited

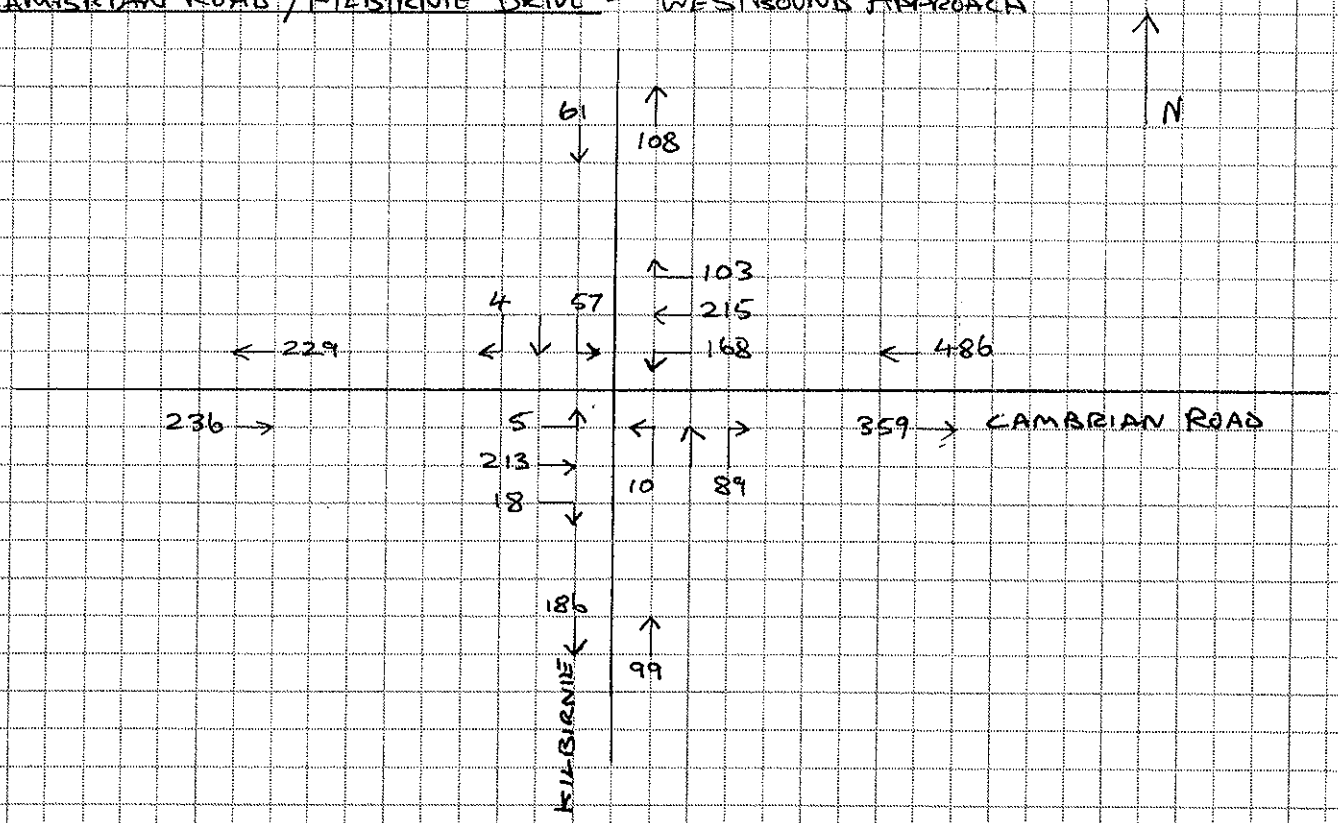
Sheet _____ of _____

Date JULY 2007

PROJECT: STONEBRIDGE - PH. 10 TO 12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By _____

CAMBRIAN ROAD / FILBIRNIE DRIVE - WESTBOUND APPROACH



FUTURE (2013) BACKGROUND PLUS SITE GENERATED TRAFFIC
PM PEAK HOUR

SPEED LIMIT ALONG CAMBRIAN ROAD = 50km/h

DESIGN SPEED = 60km/h

APPROACHING VOLUME, V_A = 486 veh/h

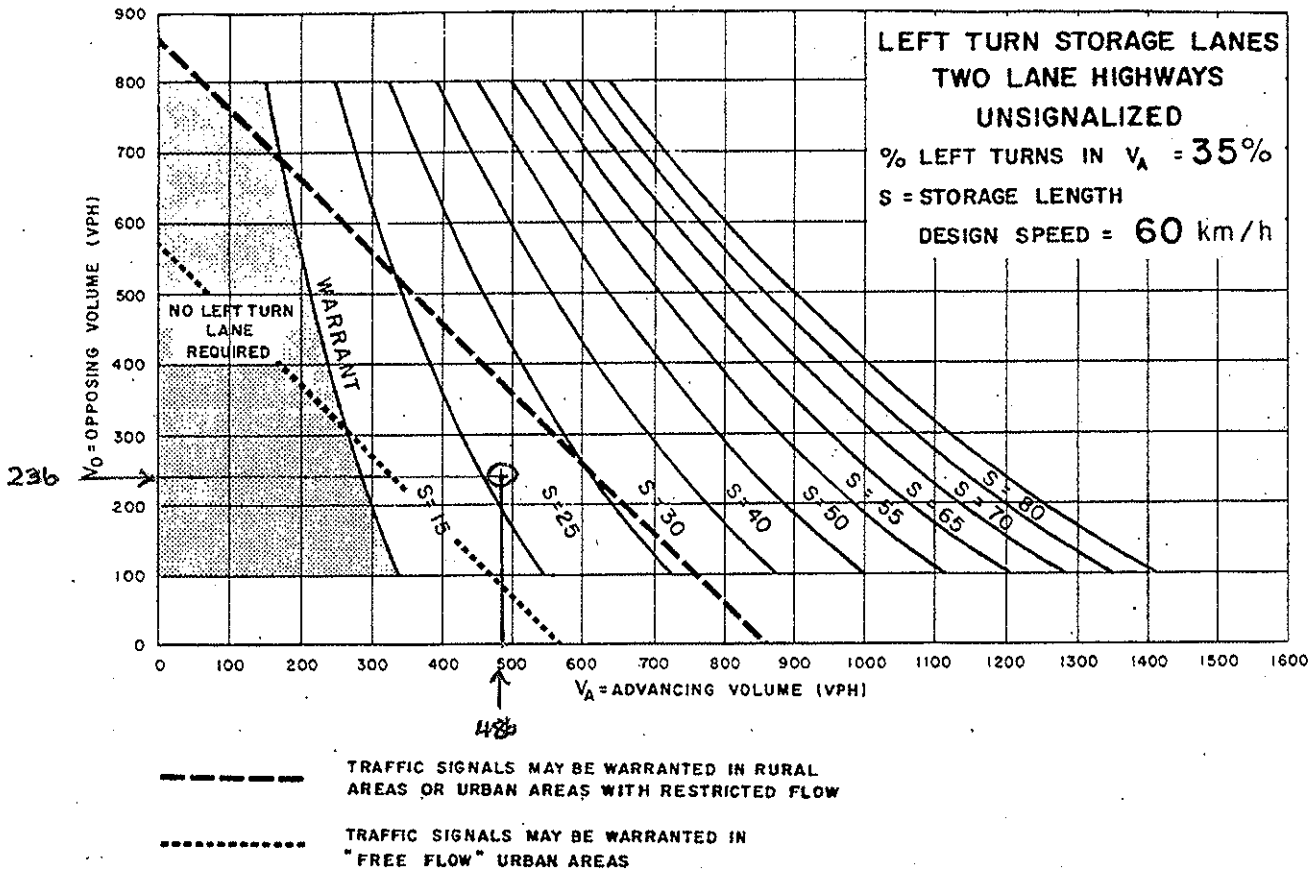
LEFT-TURN VOLUME, V_L = 168 veh/h

% LEFT TURNS = 35%

USE GRAPH FOR 35% LEFT-TURNS

OPPOSING VOLUME = 236 veh/h.

CONCLUSION: AN AUXILIARY LEFT-TURN LANE IS REQUIRED. MINIMUM STORAGE LENGTH = 25m.


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 35%
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
S=70
S=80
236
488
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

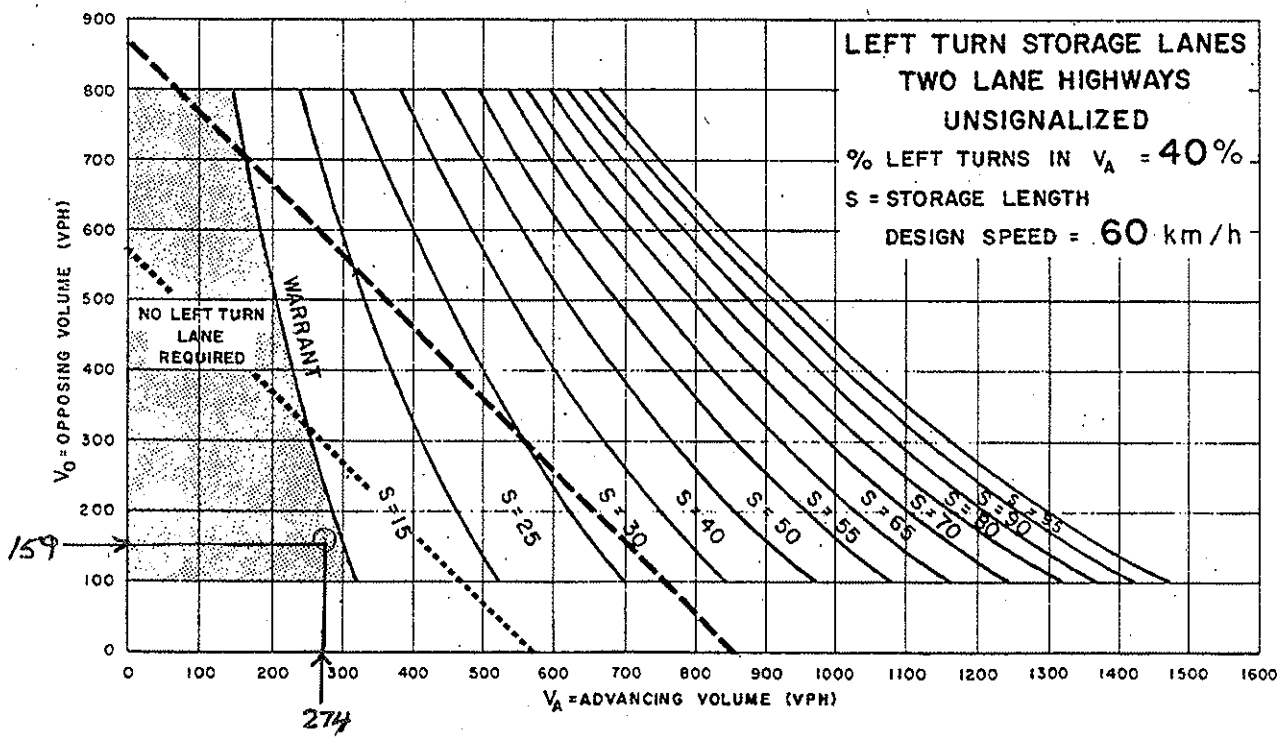

LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 40%
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
S=70
S=80
S=90
S=95
159
274

Figure EA-9

CCL / IBI
Cumming Cockburn Limited

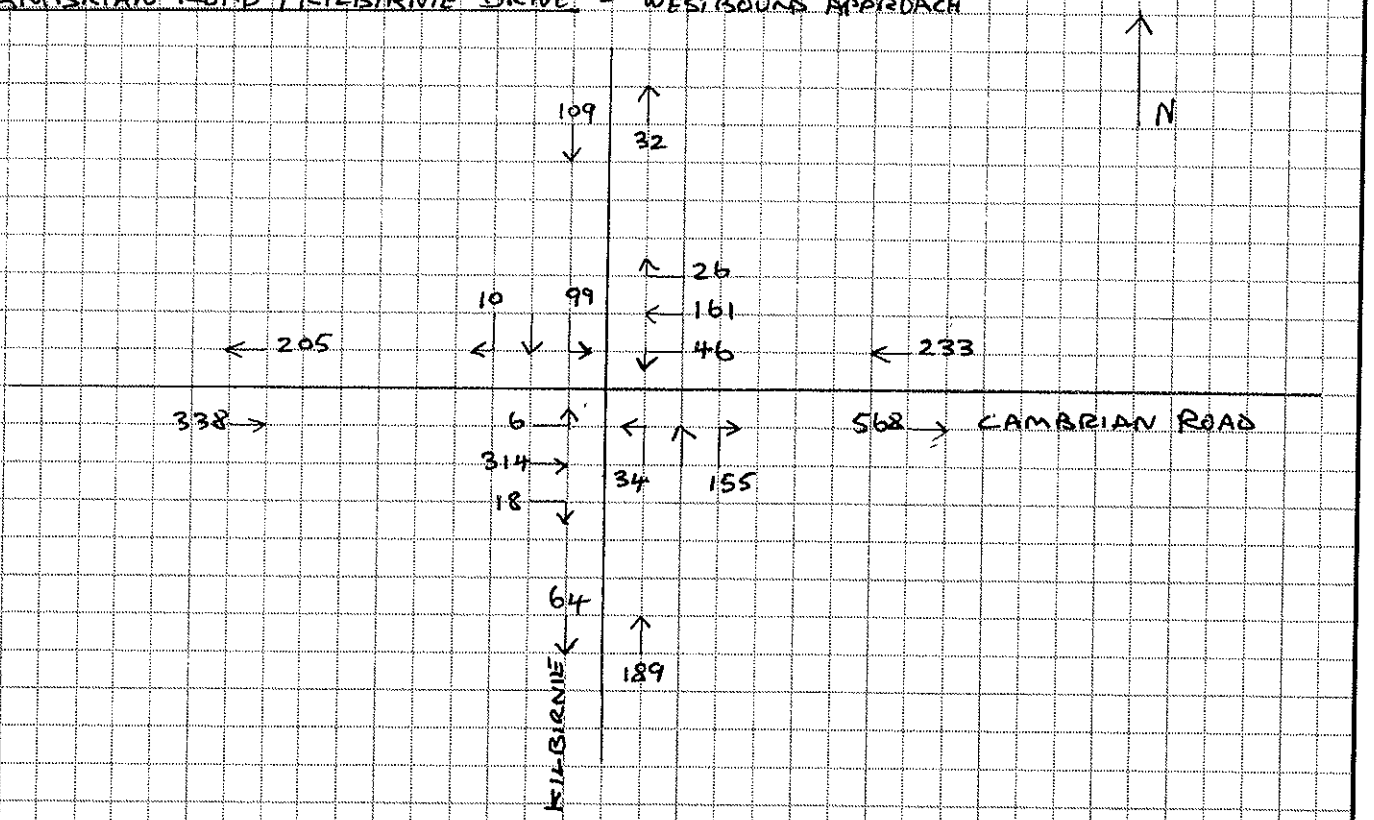
Sheet _____ of _____

Date JULY 2007

PROJECT: STONEBRIDGE - PH. 10 TO 12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By _____

CAMBRIAN ROAD / KILBIRNIE DRIVE - WESTBOUND APPROACH



FUTURE (2018) BACKGROUND PLUS SITE GENERATED TRAFFIC
AM PEAK HOUR

SPEED LIMIT ALONG CAMBRIAN ROAD = 50km/h

DESIGN SPEED = 60km/h

APPROACHING VOLUME, V_A = 233 veh/h

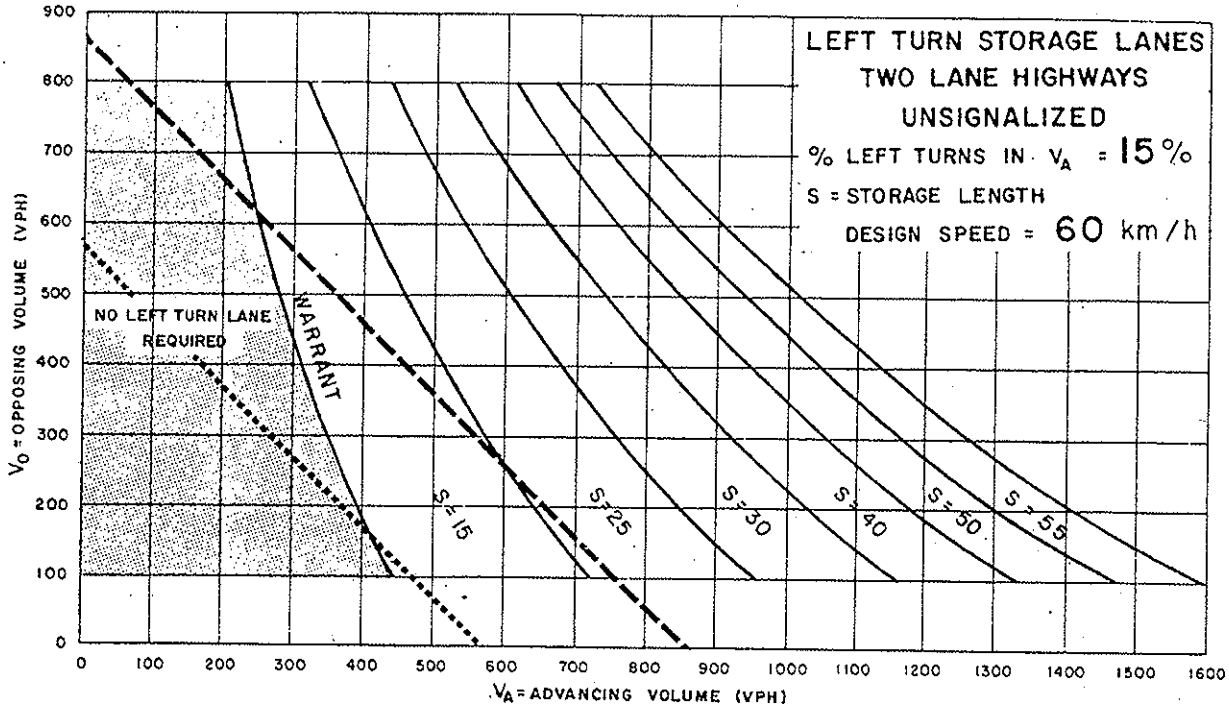
LEFT-TURN VOLUME, V_L = 46 veh/h

% LEFT TURNS = 20%

USE GRAPH FOR 20% LEFT-TURNS

OPPOSING VOLUME = 338 veh/h.

CONCLUSION: AUXILIARY LEFT-TURN LANE IS NOT REQUIRED.



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

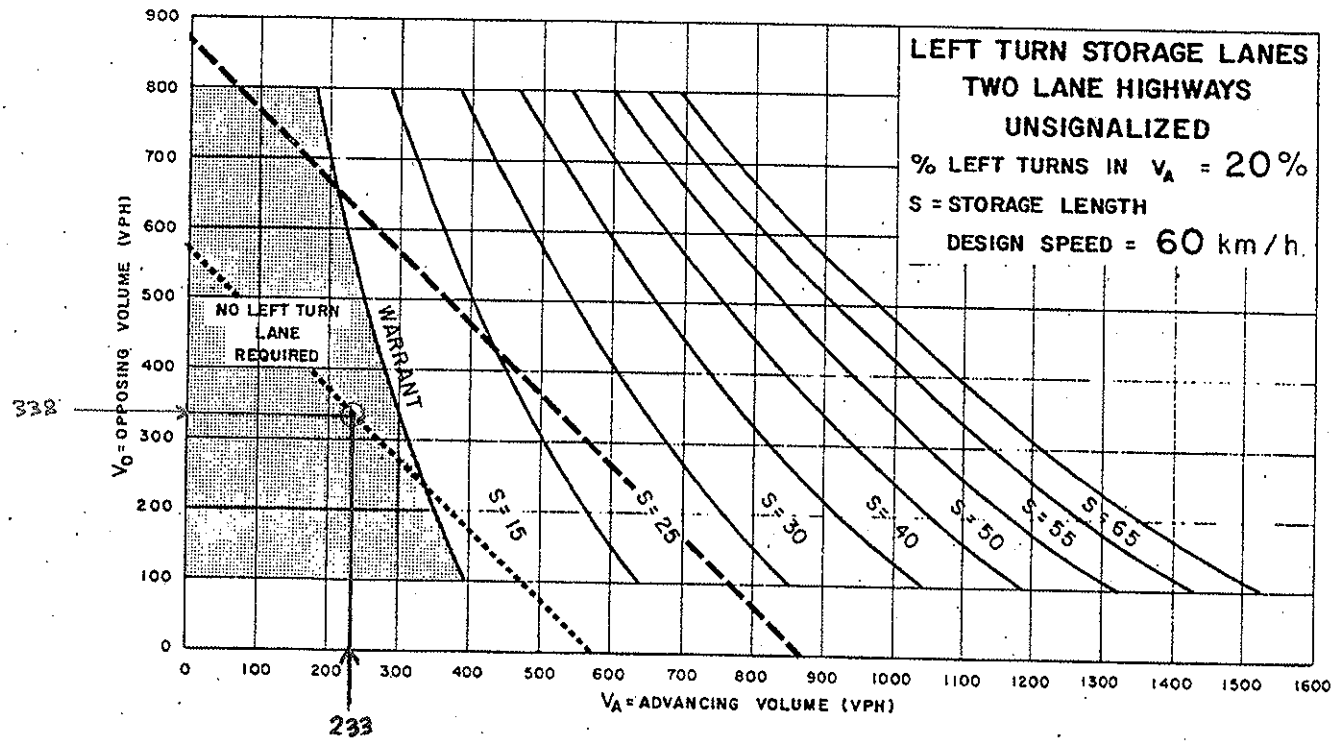


Figure EA-7

CCL/IBI
Cumming Cockburn Limited

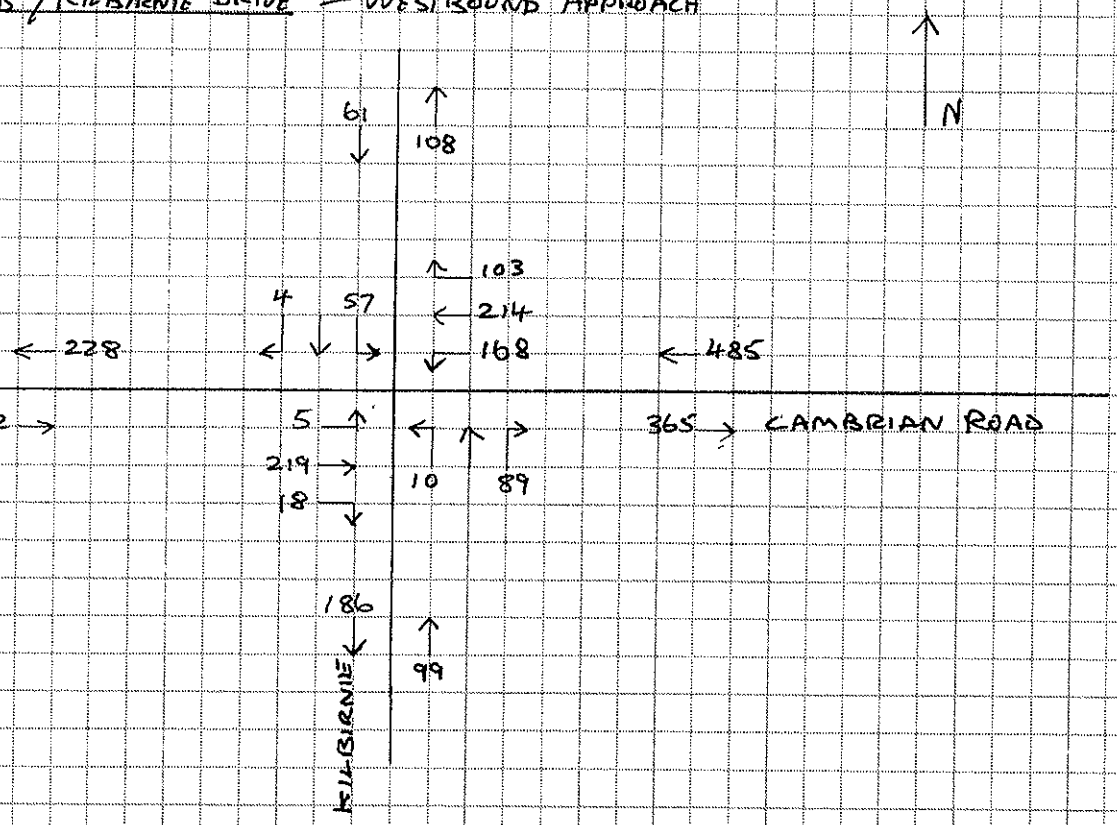
Sheet _____ of _____

Date JULY 2007

PROJECT: STONEBRIDGE - PH. 10 TO 12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By _____

CAMBRIAN ROAD / KILBIRNIE DRIVE – WESTBOUND APPROACH



FUTURE (2018) BACKGROUND PLUS SITE GENERATED TRAFFIC
PM PEAK HOUR

SPEED LIMIT ALONG CAMBRIAN ROAD = 50 km/h

DESIGN SPEED = 60 km/h

APPROACHING VOLUME, V_A = 485 veh/h

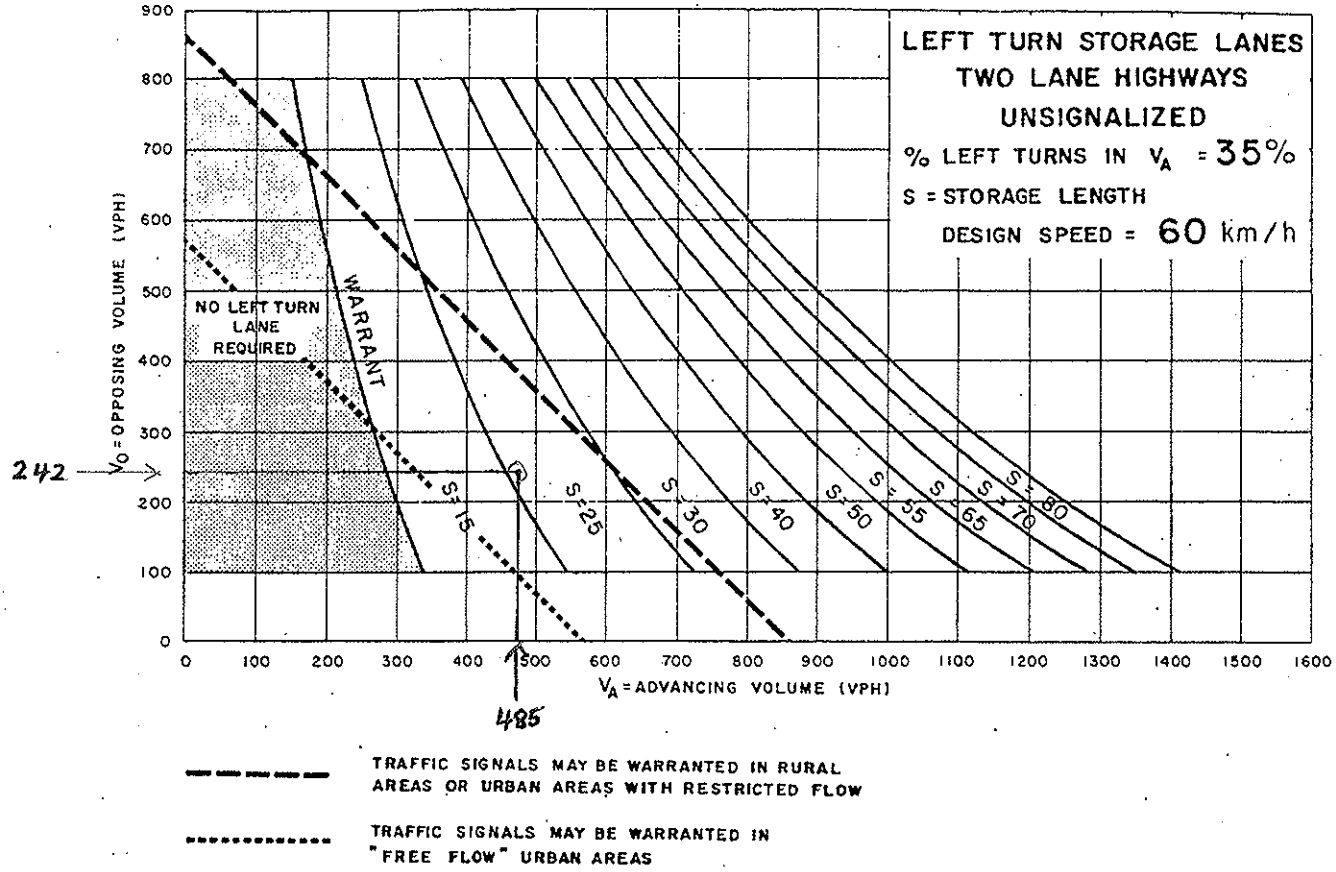
LEFT-TURN VOLUME, V_L = 168 veh/h

% LEFT TURNS = 35 %

USE GRAPH FOR 35 % LEFT-TURNS

OPPOSING VOLUME = 242 veh/h

CONCLUSION: AN AUXILIARY LEFT-TURN LANE IS REQUIRED. MINIMUM STORAGE LENGTH = 25m.


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 35%
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
S=70
S=80
242
485
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

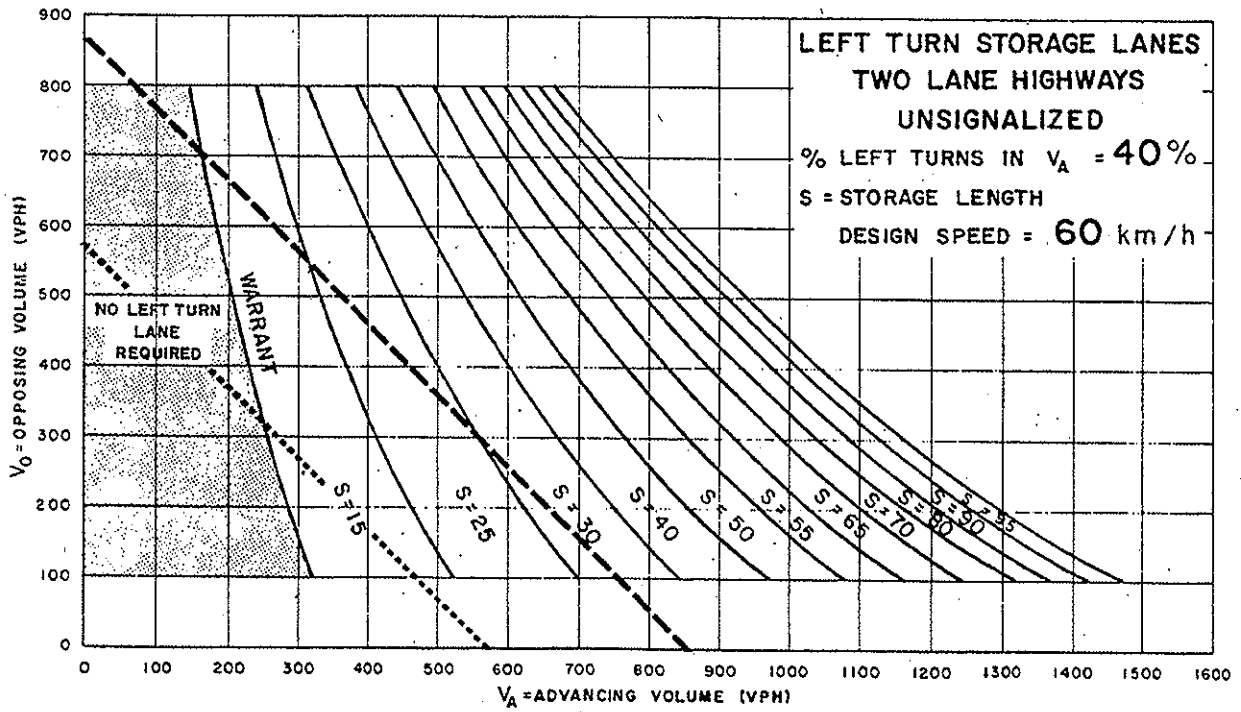

LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 40%
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
S=70
S=80
S=90
S=95
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)

Figure EA-9

CCL/IBI
Cumming Cockburn Limited

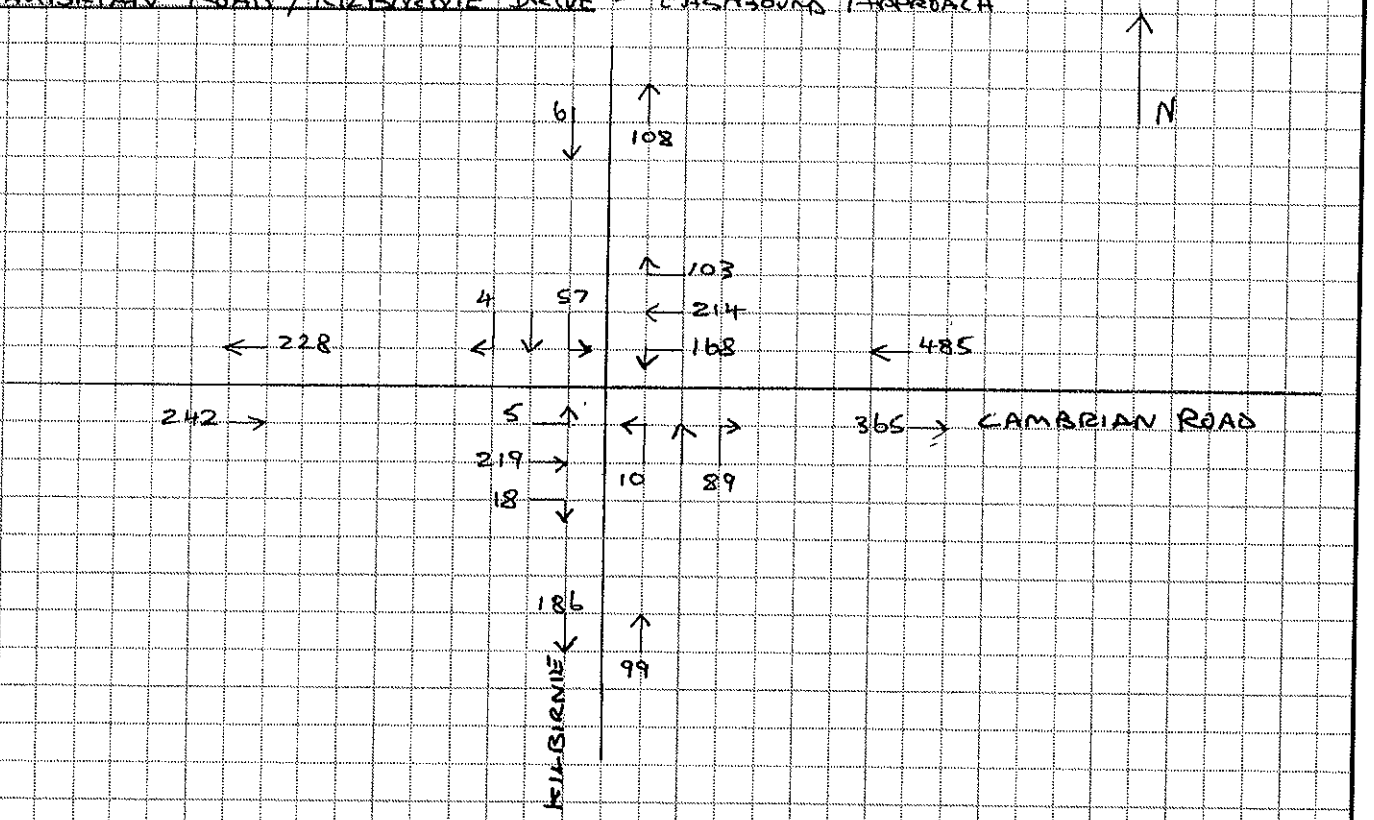
Sheet _____ of _____

Date JULY 2007

PROJECT: STONEBRIDGE - PH. 10 TO 12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By _____

CAMBRIAN ROAD / KILBIRNIE DRIVE - EASTBOUND APPROACH



FUTURE (2018) BACKGROUND PLUS SITE GENERATED TRAFFIC
PM PEAK HOUR

SPEED LIMIT ALONG CAMBRIAN ROAD = 50 km/h

DESIGN SPEED = 60 km/h

APPROACHING VOLUME, V_A = 242 veh/h

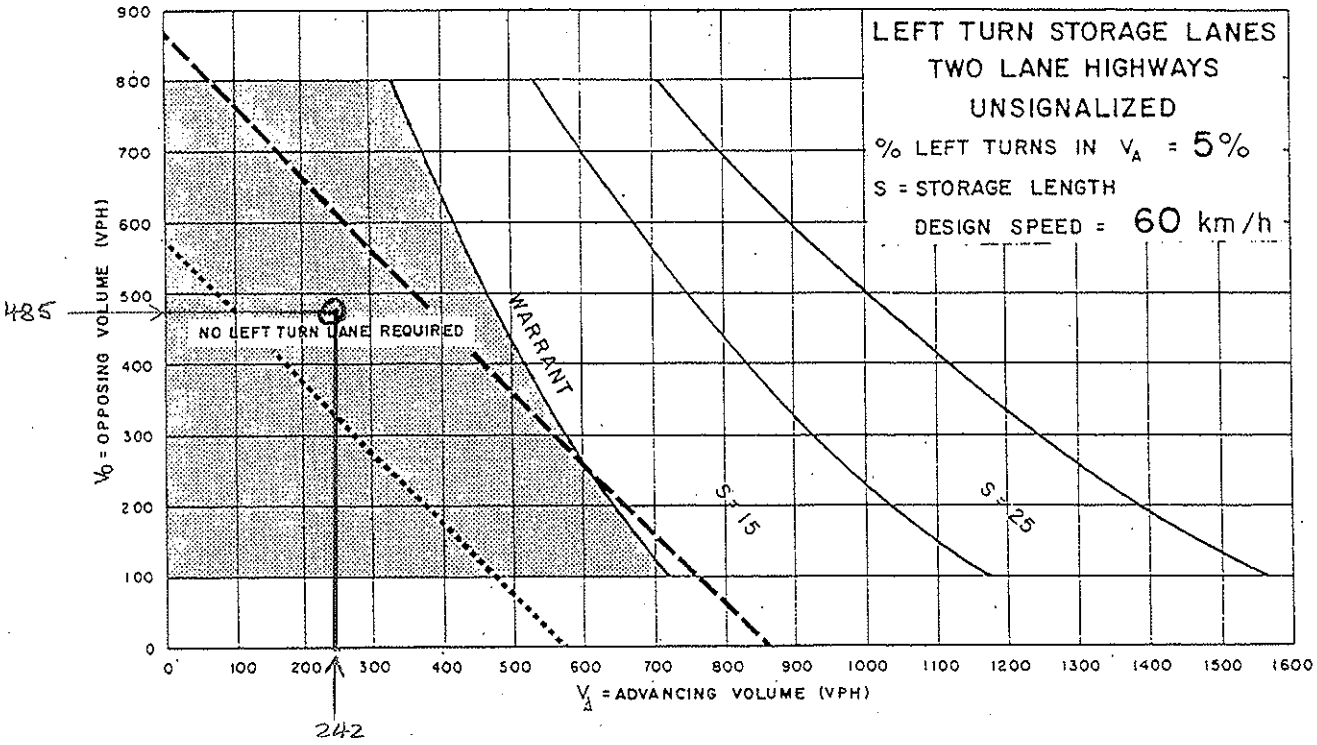
LEFT-TURN VOLUME, V_L = 5 veh/h

% LEFT TURNS = 2 %

USE GRAPH FOR 5 % LEFT-TURNS

OPPOSING VOLUME = 485 veh/h.

CONCLUSION: AN AUXILIARY LEFT-TURN LANE IS NOT REQUIRED.



TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

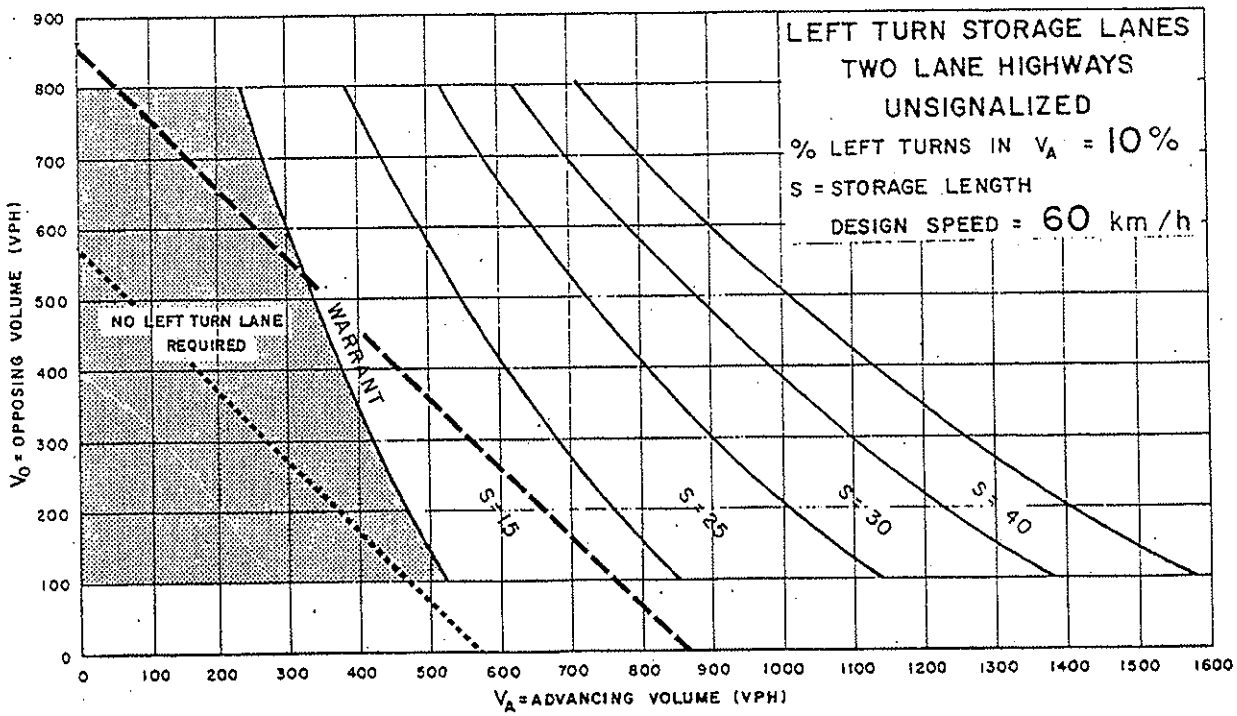


Figure EA-6

CCL/IBI
Cumming Cockburn Limited

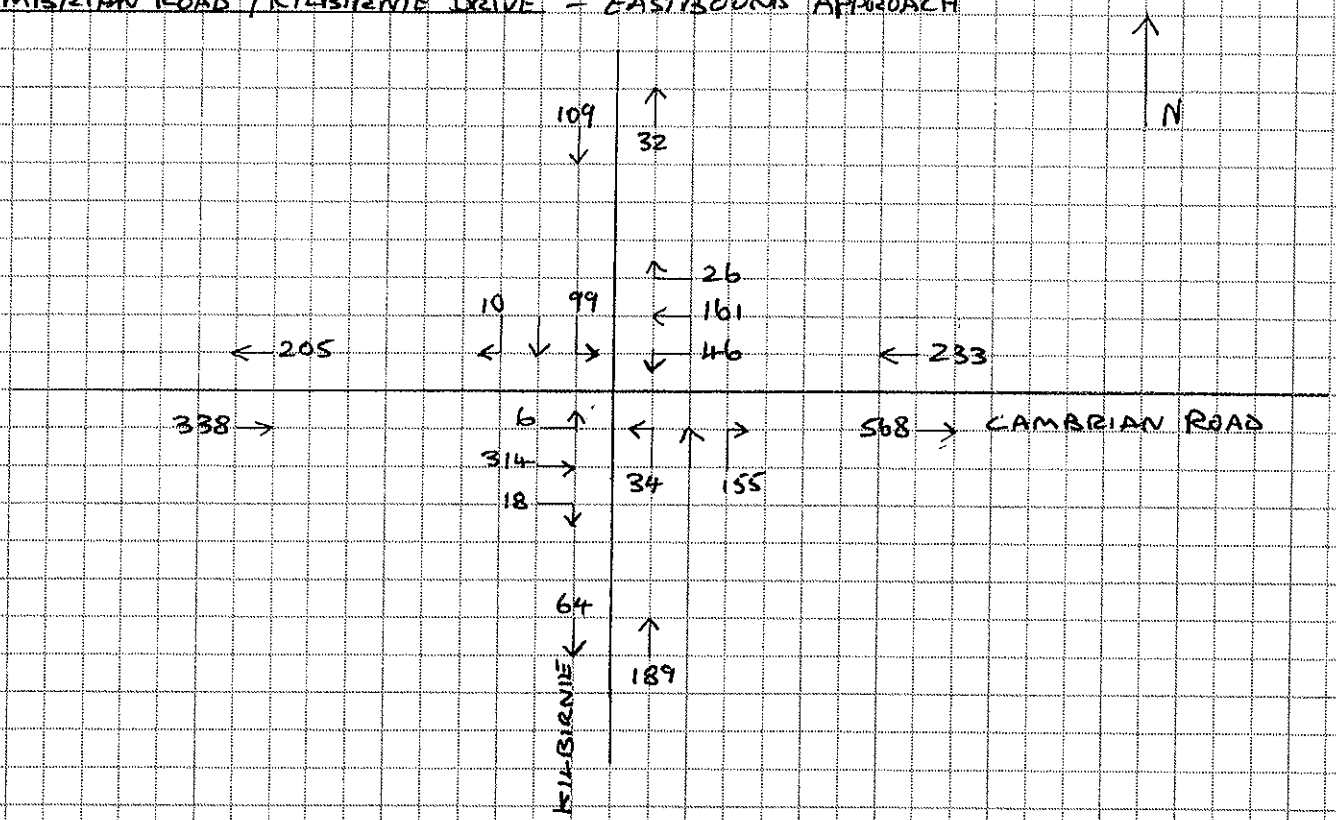
Sheet____ of____

Date JULY 2007

PROJECT: STONEBRIDGE - PH. 10 TO 12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE ANALYSIS Checked By____

CAMBRIAN ROAD / KILBIRNIE DRIVE - EASTBOUND APPROACH



FUTURE (2018) BACKGROUND PLUS SITE GENERATED TRAFFIC
AM PEAK HOUR

SPEED LIMIT ALONG CAMBRIAN ROAD = 50 km/h

DESIGN SPEED = 60 km/h

APPROACHING VOLUME, V_A = 338 veh/h

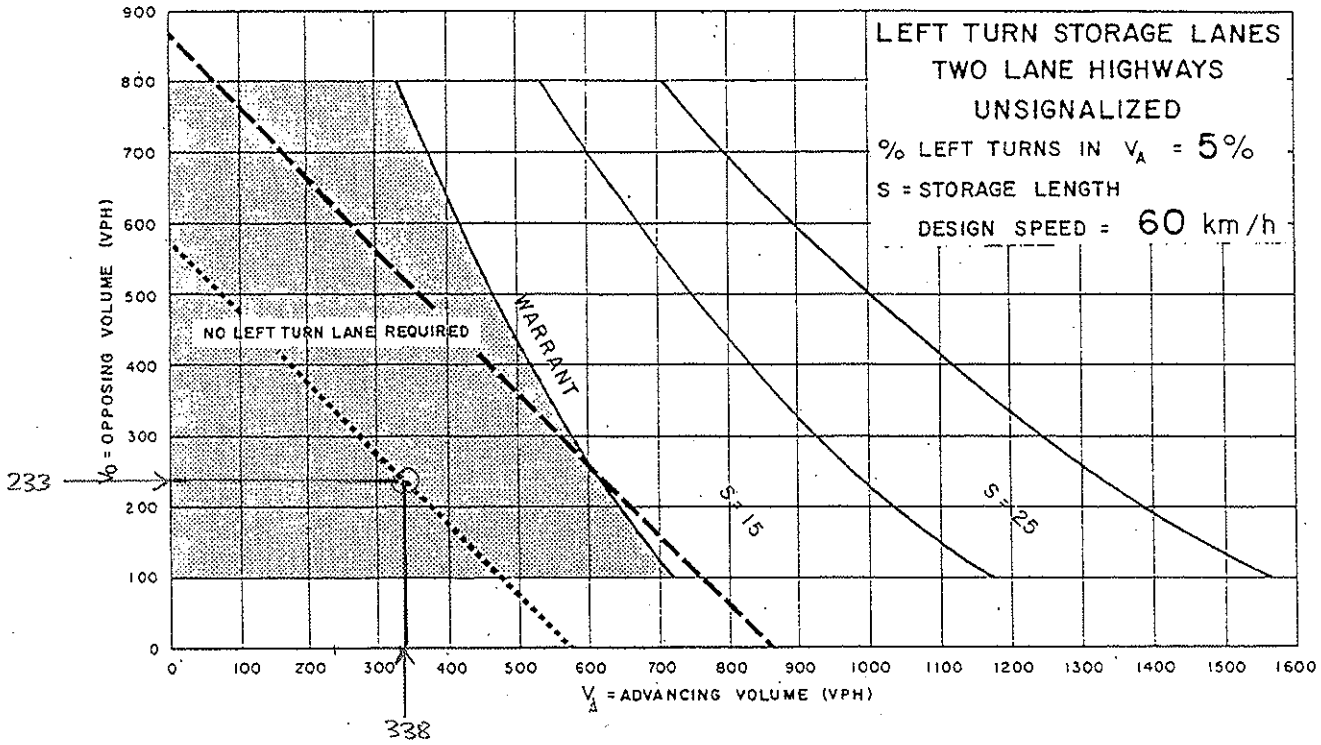
LEFT-TURN VOLUME, V_L = 6 veh/h

% LEFT TURNS = 2%

USE GRAPH FOR 5% LEFT-TURNS

OPPOSING VOLUME = 233 veh/h

CONCLUSION: AN AUXILIARY LEFT-TURN LANE IS NOT REQUIRED


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 5%
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
233
338
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

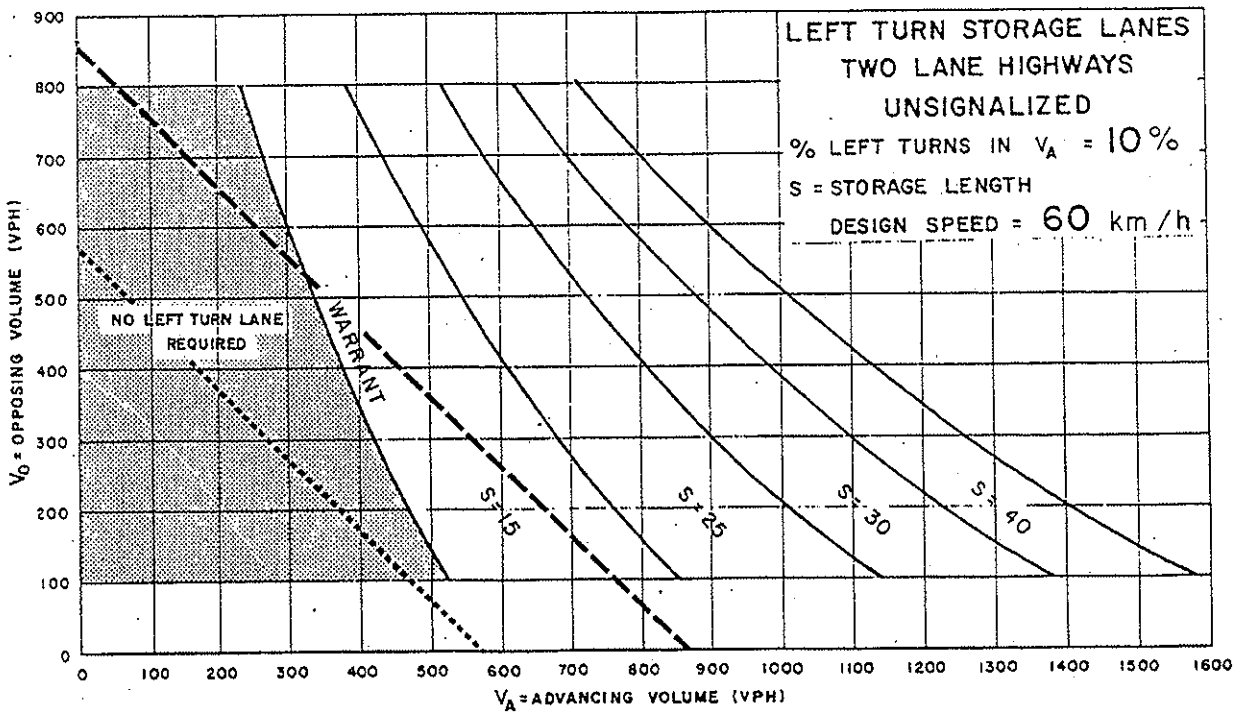

LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 10%
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)

Figure EA-6

APPROACH TAPER LENGTHS

CCL/IBI
Cumming Cockburn Limited

Sheet____ of____

Date JULY, 2007

PROJECT: STONEBRIDGE PH. 10-12 PROJECT NO. 15056 Designed By JCD

SUBJECT: AUXILIARY LANE TAPER LENGTHS. Checked By____

GREENBANK ROAD

* GEOMETRIC DESIGN GUIDELINES FOR CANADIAN ROADS, 1999 EDITION, TRANSPORTATION ASSOCIATION OF CANADA.

POSTED SPEED LIMIT = 80 km/h

DESIGN SPEED = 90 km/h

APPROACH TAPER LENGTH = 95m - 189m. (TABLE 2.3.8.1)

∴ MINIMUM TAPER LENGTH = 95m.

CAMBRIAN ROAD

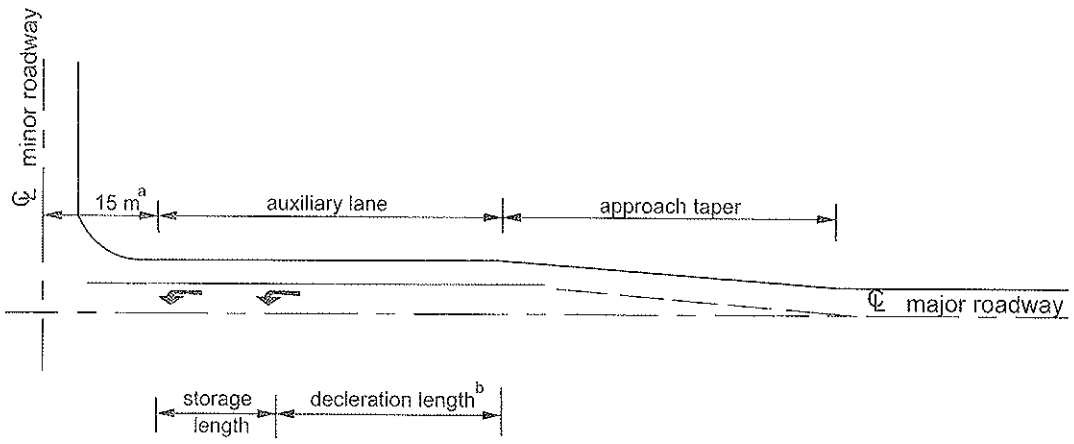
SPEED LIMIT = 50 km/h

DESIGN SPEED = 60 km/h

APPROACH TAPER LENGTH = 52.5m - 126m (TABLE 2.3.8.1.)

MINIMUM TAPER LENGTH = 55m.

Figure 2.3.8.1 Left-Turn Lane, Pictorial Description of Terms



Notes : a. 15 m is the assumed distance from minor roadway centreline to auxiliary lane.
b. In a constrained urban environment, deceleration may occur over taper length.
c. Terms also apply to divided roadways.

Table 2.3.8.1 Approach and Departure Taper Ratios and Lengths for Left Turns at Intersections

Design Speed (km/h)	Design Domain for Taper Ratio	Horizontal Curve to Smooth Taper R (m)
50	8:1 – 30:1	500
60	15:1 – 36:1	750
70	15:1 – 42:1	1000
80	15:1 – 48:1	1200
90	27:1 – 54:1	1500
100	30:1 – 60:1	2000
110	33:1 – 66:1	2500
120	36:1 – 72:1	3000