Appendix A: Grade-Separated Intersection Designs with Different Left-Turn Treatments

TABLE 1 POSSIBLE COMBINATIONS OF DESIGNS

Design	DL-D	DL-U	SPL	RCUT (U-R)	Contra-RCUT	RCUT (R-U)	QUA (SE)
DL-D	O	O	O	O	O	X	X
DL-U	O	O	O	O	O	X	X
SPL	O	O	O	O	O	X	X
RCUT (U-R)	O	O	O	O	O	X	X
Contra-RCUT	O	O	O	O	O	X	X
RCUT (R-U)	O	O	O	O	O	O	X
QUA (SE)	O	O	O	O	O	X	O

DL-D = Direct Left – Downstream
DL-U = Direct Left – Upstream
SPL = Single Point Left
RCUT (U-R) = Restricted Crossing U-Turn (U-Turn then Right Turn)
Contra-RCUT = Contraflow - Restricted Crossing U-Turn (U-Turn then Right Turn)
RCUT (R-U) = Restricted Crossing U-Turn (Right Turn then U-Turn)
QUA (SE) = Quadrant (Southeast) Intersection
O = Possible combination of designs
X = Impossible combination of designs

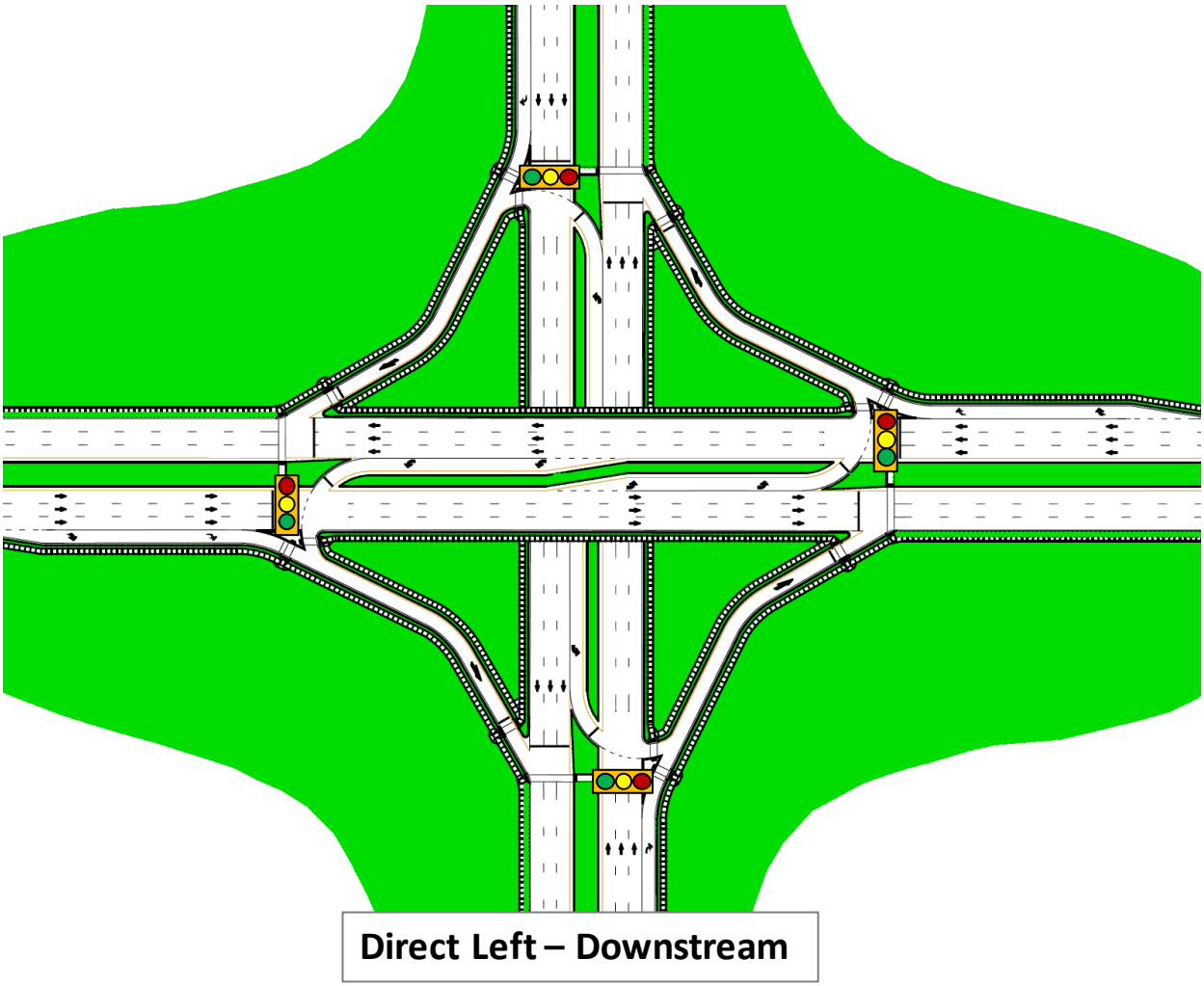

FIGURE 1 GRADE-SEPARATED INTERSECTION DESIGN – DIRECT LEFT - DOWNSTREAM

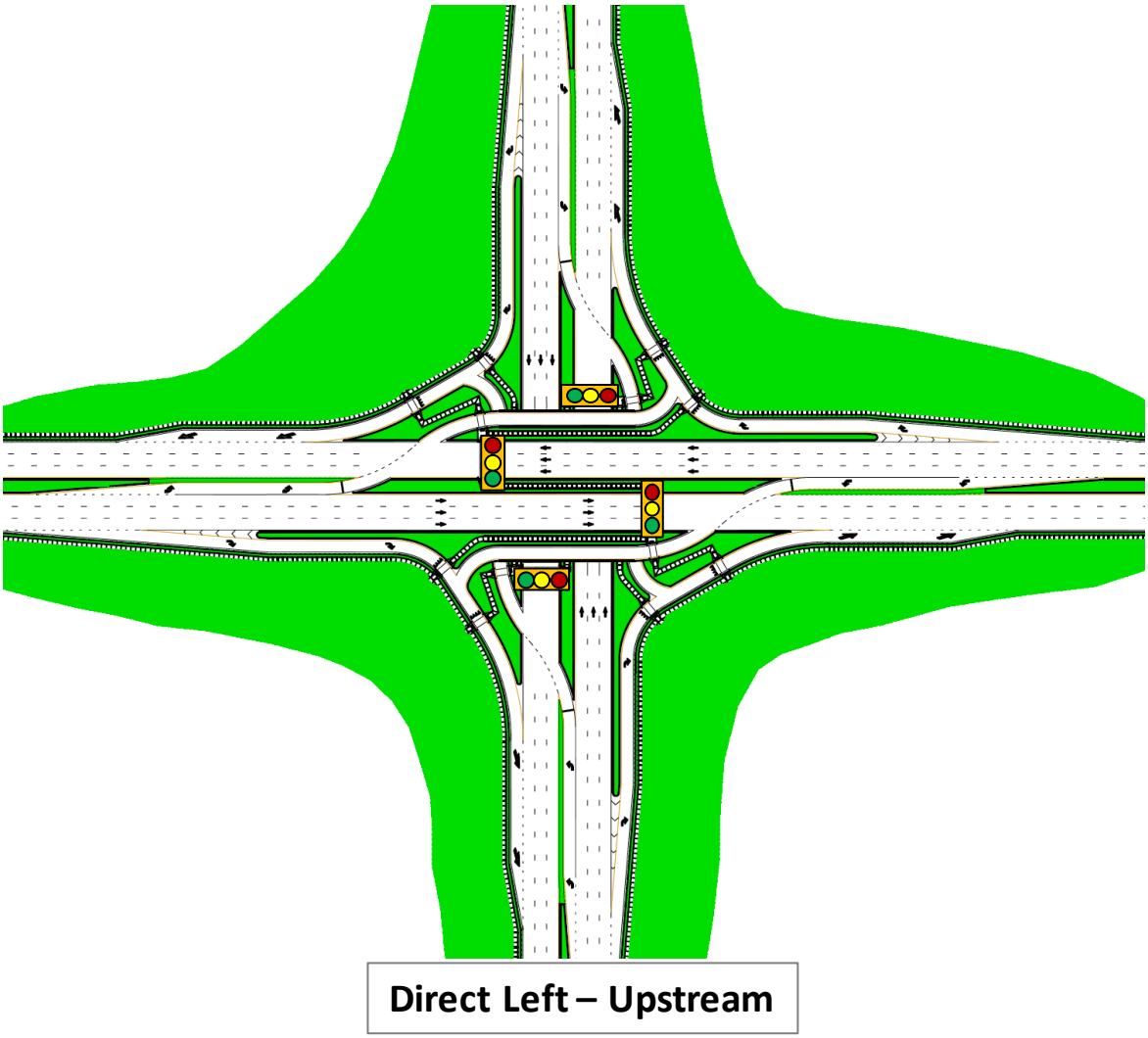

FIGURE 2 GRADE-SEPARATED INTERSECTION DESIGN –DIRECT LEFT - UPSTREAM

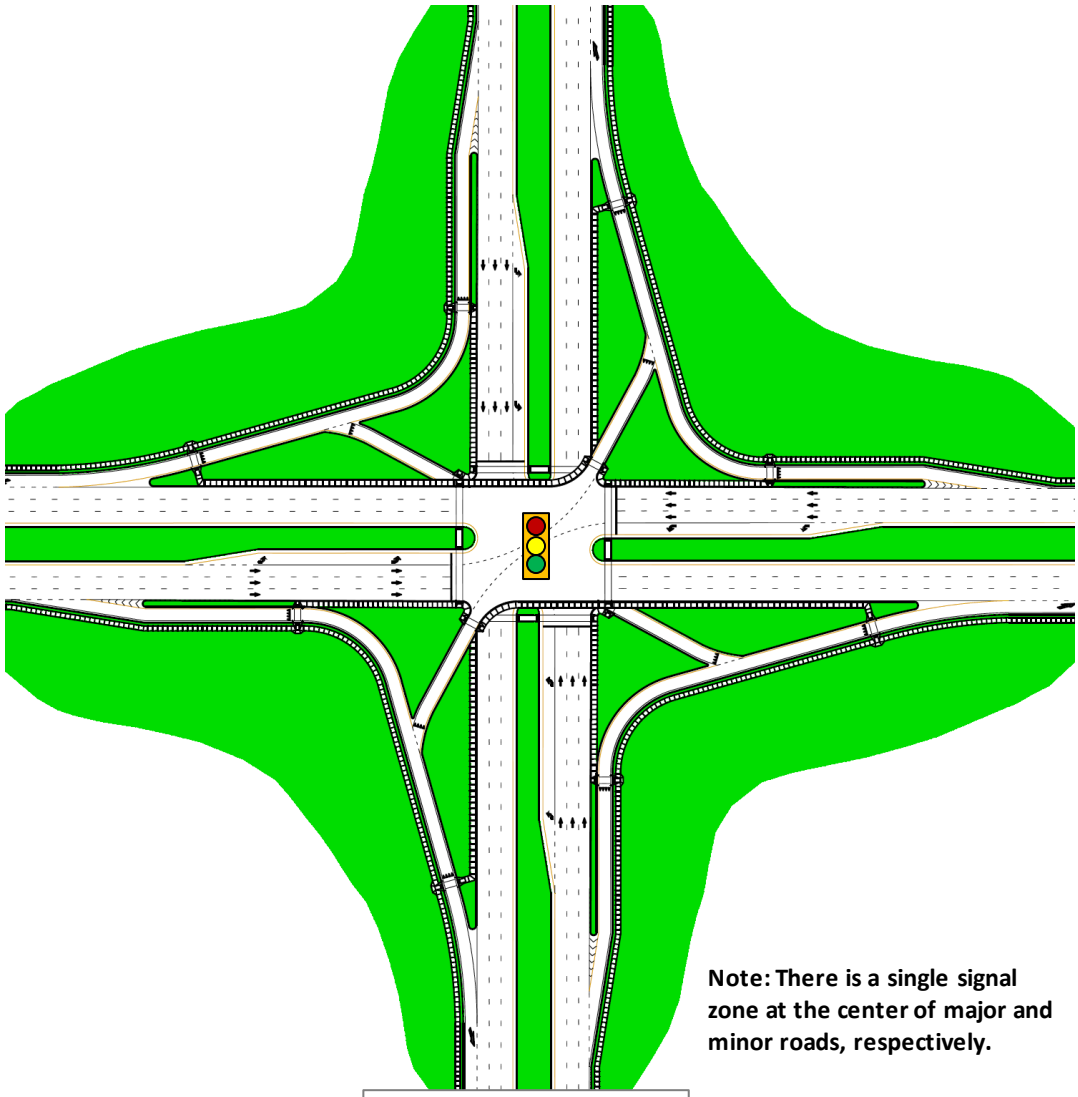

FIGURE 3 GRADE-SEPARATED INTERSECTION DESIGN – SINGLE POINT LEFT

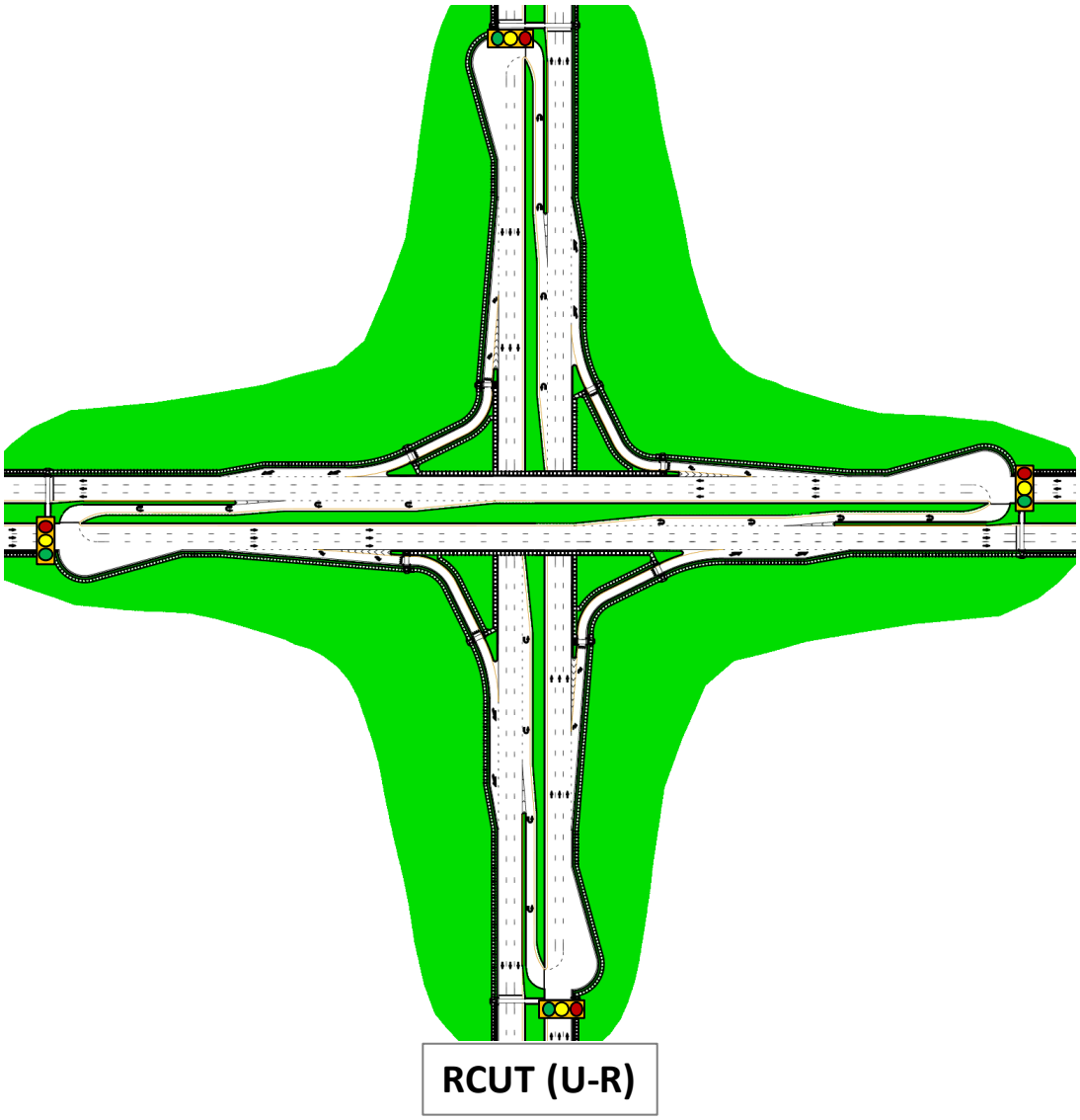

FIGURE 4 GRADE-SEPARATED INTERSECTION DESIGN – RCUT (U-R)

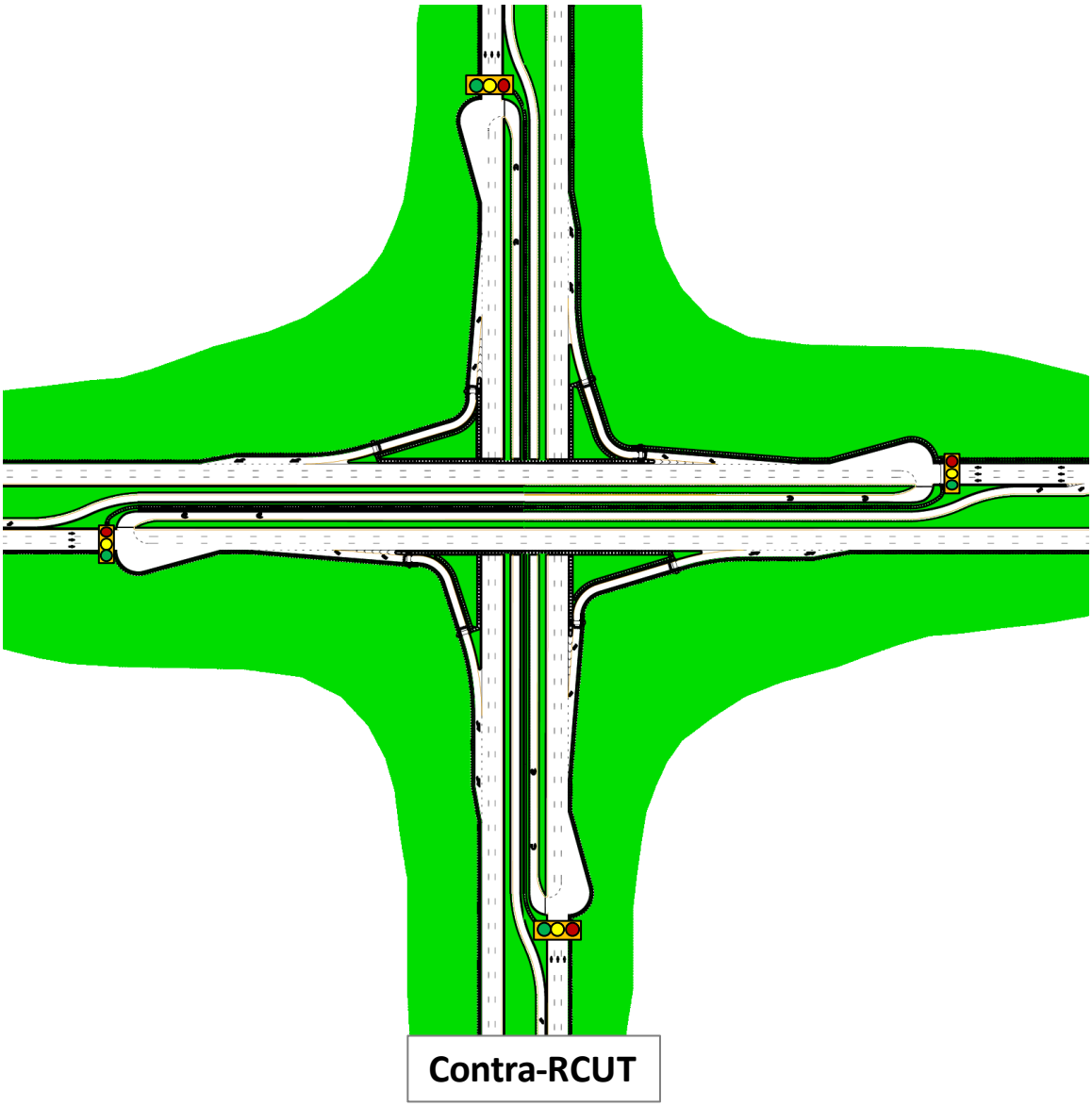

FIGURE 5 GRADE-SEPARATED INTERSECTION DESIGN – CONTRA-RCUT

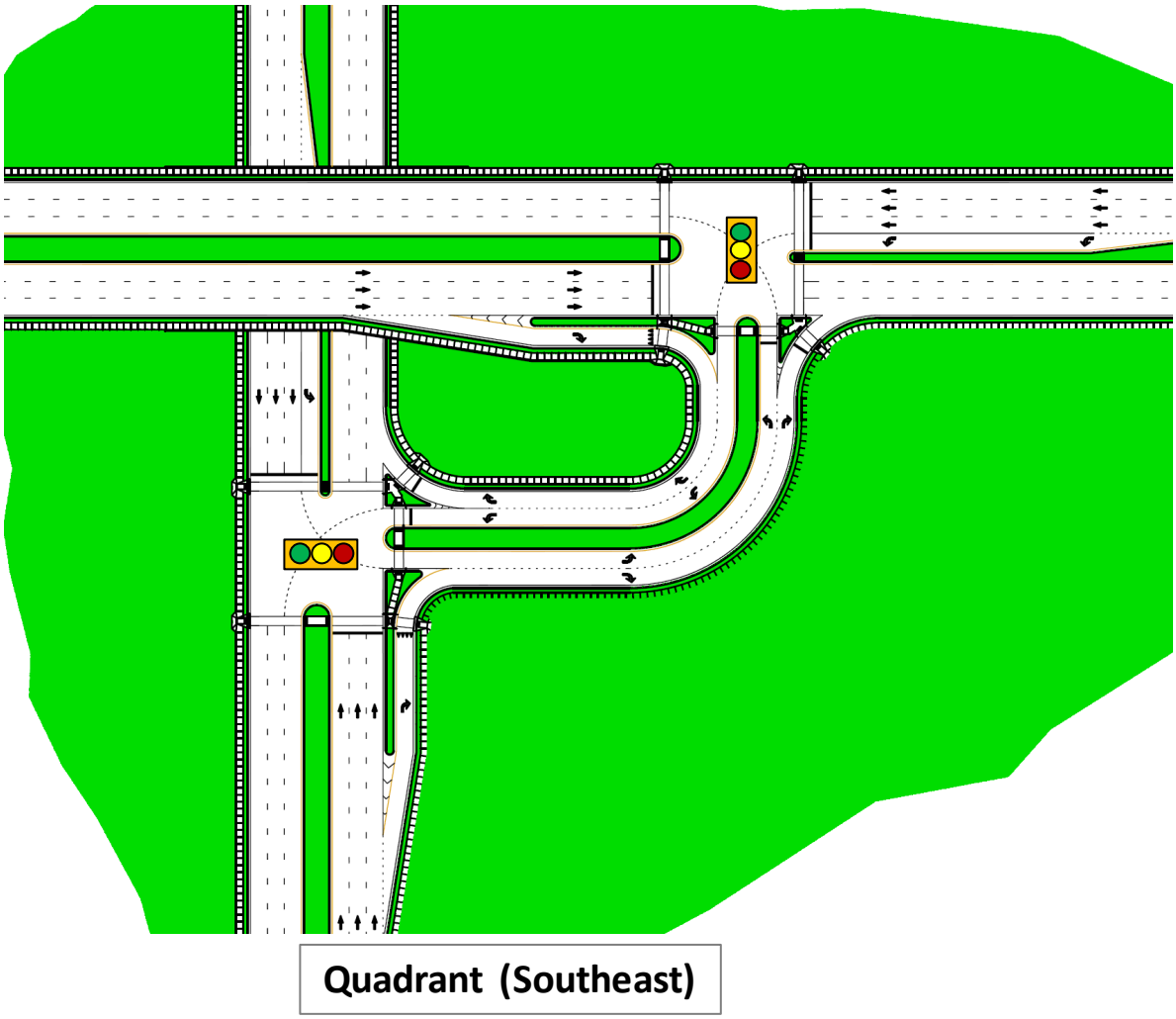

FIGURE 6 GRADE-SEPARATED INTERSECTION DESIGN – QUADRANT (SOUTHEAST)

Appendix B: Patent Review – Full Report

Market Landscape Research Report

October 13, 2017

Research and Analysis Completed by

Cynthia Reifsnider, Research Analyst, MSIS

Clients

Shannon Warchol

Thomas Chase

NCSU Institute for Transportation Research and Education

Project

Grade Separated Intersection

Goals

Patent Landscape Analysis

Contents

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

INNOVATE CAROLINA

MARKET LANDSCAPE RESEARCH SERVICE

IDEA — RESEARCH — MARKET

Custom research reports support business decision making for ideas to reach commercial potential

- Competitive landscape, including potential competitors, partners, and licensees
- Market size and customer demographics
- Industry characteristics
- Grant and funding opportunities

Resources include patent databases and patent analytics tools, market research resources, government and foundation and funding databases.

AVAILABLE TO UNC-CHAPEL HILL FACULTY, STAFF AND STUDENTS

OFFICE of COMMERCIALIZATION and ECONOMIC DEVELOPMENT

COMMERCIALIZATION@UNC.EDU
OCED.UNC.EDU/TCC/PLME

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

INNOVATE CAROLINA

MARKET LANDSCAPE RESEARCH SERVICE

IDEA — RESEARCH — MARKET

The Market Landscape Research Service is an initiative under the Office of Commercialization and Economic Development at UNC-Chapel Hill supporting the university's innovators and inventors through commercialization and entrepreneurship training, early-stage venture launch support and funding.

- Established in 2012 and supported by the U.S. Economic Development Administration (EDA)
- Over 300 projects completed to date
- Value to UNC-Chapel Hill and North Carolina is estimated to be over $3.2M

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Analysis of Findings

Patent Landscape: Insights from the Research

The patent landscape returned some results that should be reviewed by the project researchers for relevance. In addition to several patent applications and granted patents held by the designers whose names were provided, other published applications and patents were identified.

It is notable that many of the results are patents and applications filed for China, Korea, and other Asian countries. This is a reasonable finding, given that they have a greater number of vehicles – plus bicycles and pedestrians – on their roads than we have in the US. The researchers will need to review their project guidelines from DOT regarding whether or not foreign filings are of concern, or only US filings.

Characteristics that are likely to be differentiators from the researchers' work include:

- Focus on pedestrians and pedestrian-specific solutions
- Focus on bicycle traffic and bicycle-specific solutions
- Flyovers or tunnels, rather than a more simplified grade separation
- Add-ons of sensors, computer calculations, and other traffic-flow assistance
- Greater numbers of inflows and outflows than a standard/common 4-way traffic intersection

I recommend that after the researchers review these findings that we discuss additional design characteristics in their plans to help narrow the patent landscape.

At this time I have not searched the technical journal literature. I recommend we do that after reaching a more focused scope on the design, given the breadth of findings in the patent literature. (Let me know if you'd rather complete the technical journal research now, using the broader context.)

How to Review this Research

- This document provides a synopsis and the overall analysis of research for this project. Please read it thoroughly.
- Retain copies of all digital files and e-mails shared for this project. They may be used in future reviews with OCED staff and with patent attorneys.
- Review search terms below and let me know if there are any typos or missing synonyms/variations that may be key to the research.
- Excel spreadsheets of patents and applications from search results are ordered by geography and status of application: US patents are listed first, followed by US patent applications; European patents, European patent applications, then WIPO patents, and so on. Within these groupings, the documents are listed from most recent to oldest.
- Excel spreadsheets of patents and applications from search results have multiple tabs. The first tab shows a smaller set of selected results for additional review, given their relevance to your invention either in a single significant correlation or through multiple elements of correlation.
- Additional full-text documents are provided for patents, patent applications, and articles of greatest relevance to your research. Please note that these are provided from UNC-Chapel Hill resources for its faculty, staff, and students, and should not be distributed more broadly. This report provides a summary and analysis of findings to serve your needs for wider distribution. Always follow copyright law and cite sources in any presentations or other re-packaging of information.

Disclaimer: This analytical report is provided to you for information purposes only. Detailed findings should be reviewed by you and your team (including your legal team) for final interpretation and decision-making. Remember that patents don't give anyone the right to practice, only a right to exclude others from practicing. To this end, some results presented herein should be considered as prior art for your patent filings. We are not rendering any legal opinion of which prior art overlaps or infringes, as that could be damaging to those for whom we do provide this service. We are not lawyers: we will only go as far as listing POTENTIALLY relevant prior art to give inventors a sense of crowdedness.

Research and Analysis

Patent Landscape – Review of Best Results

Search 1

Title, Abstract, or Claims =

("grade separated intersection" OR "grade-separated intersection")

AND

(road* OR street* OR highway* OR automobile* OR car OR cars OR vehicle*)

In years 1993 to present

Results: 10 DWPI families with 11 records

Of these, 3 results are of interest.

Files:

- JP2006274782A road grade-separated intersection.pdf
- JP2006274793A road grade-separated intersection.pdf
- KR899789B1 two-phased signalized grade separated intersection.pdf
- Confidential patent search ITRE 1 10132017.xlsx

Publication Number	Title	Title - DWPI
KR899789B1	2-PHASE SIGNALIZED GRADE SEPARATED INTERSECTION SYSTEM	Two-phase signalized grade separated road intersection system, has straight road in which cross road is entered through U-turn lane to allow left turn of vehicle in cross road to enter into straight road
JP2006274782A	ROAD GRADE-SEPARATED INTERSECTION STRUCTURE EQUIPPED WITH BARRIER-FREE ROUNDABOUT	Barrier free type road three dimension intersection structure for pedestrian has middle zone for pedestrians that communicates pedestrian crossing and formed in barrier free without the step-difference
JP2006274793A	ROAD GRADE-SEPARATED INTERSECTION STRUCTURE EQUIPPED WITH BARRIER-FREE ROUNDABOUT	Barrier free type intersection structure for road has middle zone communicating with pedestrian crossing and right and left turn bypass

Search 2: Antonio Loro as inventor/assignee/applicant

Results: 1 DWPI family with 3 records

US20130279977A1 LORO ANTONIO MARIO 2013-10-24 E01C 1/04

Title: Weaving-free interchange with few bridges and exterior exits and entrances only

DWPI Title: Traffic-weaving-free grade-separated road junction has grade-separated crossing that is arranged intermediately along traveled length of specific road surface between respective grade-separated crossings

CA2736686A1 LORO ANTONIO M 2012-05-13 E01C 1/02

Title: WEAVING-FREE INTERCHANGE WITH FEW BRIDGES AND EXTERIOR EXITS AND ENTRANCES ONLY

DWPI Title: Traffic-weaving-free grade-separated road junction has grade-separated crossing that is arranged intermediately along traveled length of specific road surface between respective grade-separated crossings

WO2012061925A1 LORO ANTONIO 2012-05-18 E01C 1/04

Title: WEAVING-FREE INTERCHANGE WITH FEW BRIDGES AND EXTERIOR EXITS AND ENTRANCES ONLY

DWPI Title: Traffic-weaving-free grade-separated road junction has grade-separated crossing that is arranged intermediately along traveled length of specific road surface between respective grade-separated crossings

File: US20130279977(A1) weaving-free interchange.pdf

Search 3: Robert (Bob) Clayton as inventor/assignee/applicant

Results: 2 DWPI families with 2 record – only 1 of relevance

US5921701A CLAYTON; ROBERT F 1999-07-13 E01C 1/04

Title: Traffic interchange

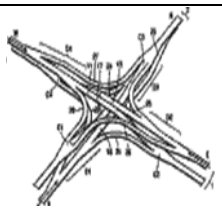
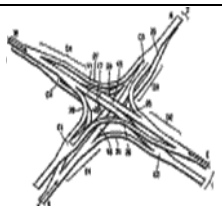
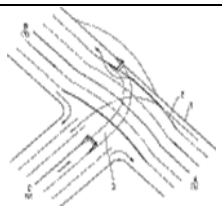
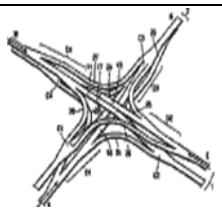
DWPI Title: Traffic interchange for use with intersecting city streets

File: US5921701(A) traffic interchange Bob Clayton.pdf

Search 4: Jang Hee Lee as inventor/assignee/applicant

Results: 6 DWPI families with 36 record – 5 DWPI families of relevance

File: Confidential patent search ITRE Jang Lee 10132017.xlsx

Publication Number	Title	Title - DWPI	Front-Page Drawing
CA2588576C	INTERSECTION SYSTEMS	Road intersection system for controlling traffic with as few traffic lights as possible has main roads with diverging and converging sections	
CA2311120A1	INTERSECTION SYSTEMS		
AU1999010554A1	Intersection systems		(No drawing/image available)
KR247325B1	ROAD CROSSING SYSTEM	Intersection system for traffic efficiency	
IL136067D0	INTERSECTION SYSTEMS		

Search 5

Title, Abstract or Claims =

((interchange* OR intersection* OR junction*) NEAR2 (traffic OR "grade separated" OR signalized OR grade-separated OR "surface street" OR surface-street OR overpass OR eschelon))

AND

(road* OR street* OR highway*)

AND

Any IPC = ((E01C000100))

In years 1993 to present

Results: 171 DWPI families with 217 records

Of these, 43 DWPI families appear to me to be potentially relevent. Of the 43, only 10 are US-based or WIPO-based patent families – the rest are from Asian countries including China, Korea and India.

IPC = International Patent Classification code for Fixed Construction – Construction of Roads, Railways, or Bridges - CONSTRUCTION OF, OR SURFACES FOR, ROADS, SPORTS GROUNDS, OR THE LIKE; MACHINES OR AUXILIARY TOOLS FOR CONSTRUCTION OR REPAIR(forming road or like surfaces by compacting or grading snow or ice E01H) - E01C000100 Design or layout of roads, e.g. for noise abatement, for gas absorption(design or layout of sports grounds A63C001900; design or layout of airfields B64F) (2child classes)

File: Confidential patent search ITRE 5 10132017.xlsx

Additional patent searches with variations of the above search strategies and search terms yielded similar results, thereby signaling a high level of confidence in our having a complete view of the surrounding invention space to your work.

Regarding patent landscape maps above, "This material is reproduced under a license from Clarivate Analytics. You may not copy or re-distribute this material in whole or in part without the written consent of Derwent Innovation, a product of Clarivate Analytics."

About Us and Our Research Process

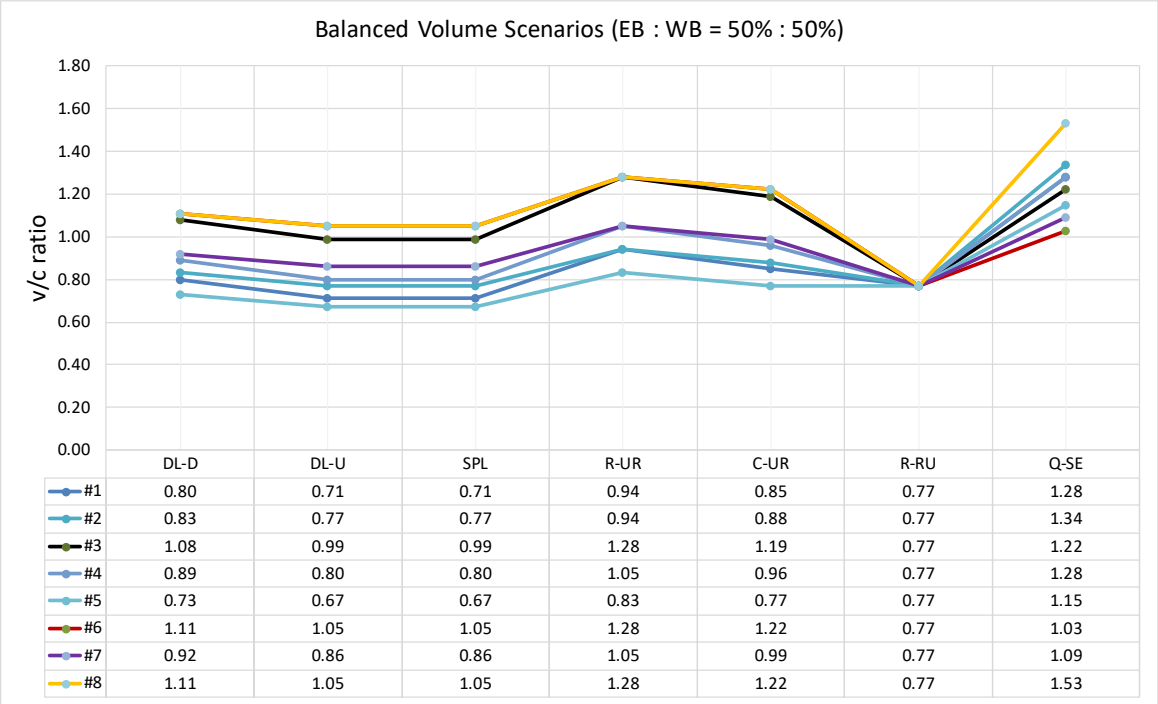
- Cindy Reifsnider, Cindy.Reifsnider@unc.edu, 919.843.3323
- Patrick Kastian, Patrick.Kastian@unc.edu, 919.962.4954
- Market Landscape Research Service: http://oced.unc.edu/tcc/plme/

Derwent Innovation (formerly Thomson Innovation) for patent landscape

1. This tool includes multiple databases of patents and patent applications from the US, Europe, World Intellectual Property Organization (WIPO), China, and many more geographies.
2. It includes analytical tools for creating landscape maps, publication trends, assignees/applicants, and geographies.
3. The Derwent World Patents Index (DWPI) is accessible within this tool, enabling powerful searching of English language abstracts from expert (human!) editorial staffers, an indexing system and patent families that group inventions across geographic filings. See http://en.wikipedia.org/wiki/Derwent_World_Patents_Index for more details. A DWPI "family" is a group of patent application documents and granted patent documents with the same filing but filed with different patent-granting entities (geographically); the family is referred to in this report using its most recent document in the patent literature.
4. Regarding patent landscape maps above, "This material is reproduced under a license from Clarivate Analytics. You may not copy or re-distribute this material in whole or in part without the written consent of Derwent Innovation, a product of Clarivate Analytics."

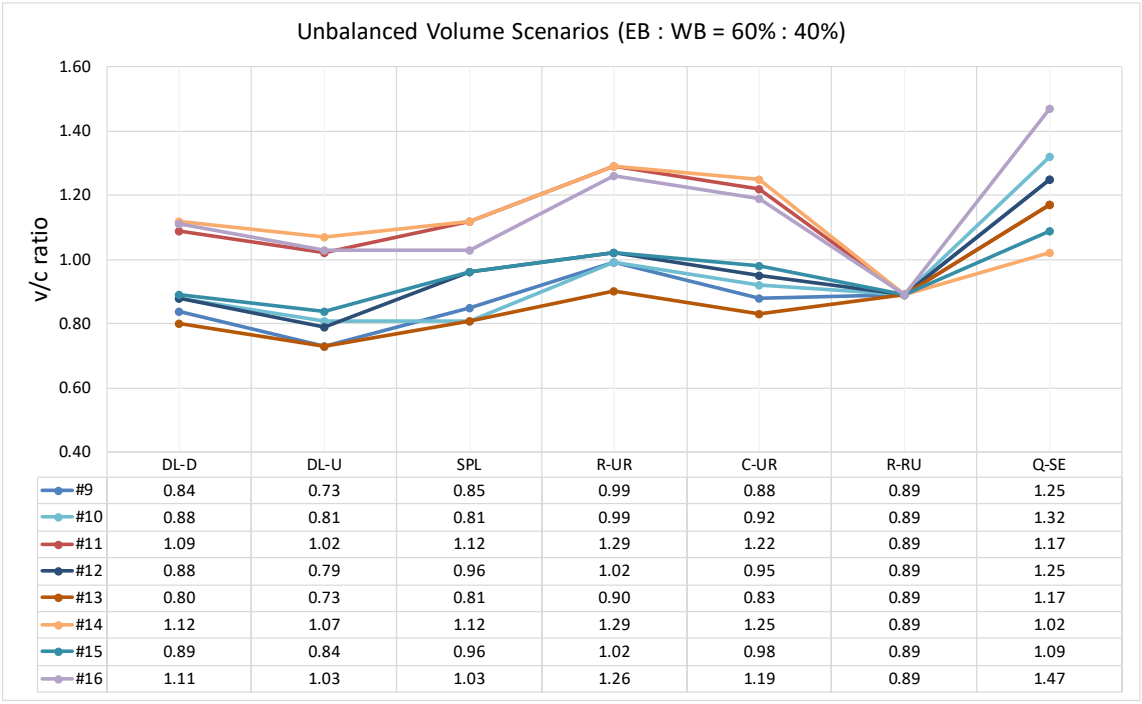
Search terms were used in multiple search strings connected by Boolean terminology and additional connectors such as "near." We used varying combinations of terms in the search strings (not all major terms were used in every string). Dates searched were from 1988 to present.

Appendix C: Graphs for Macroscopic Operational Analysis Results



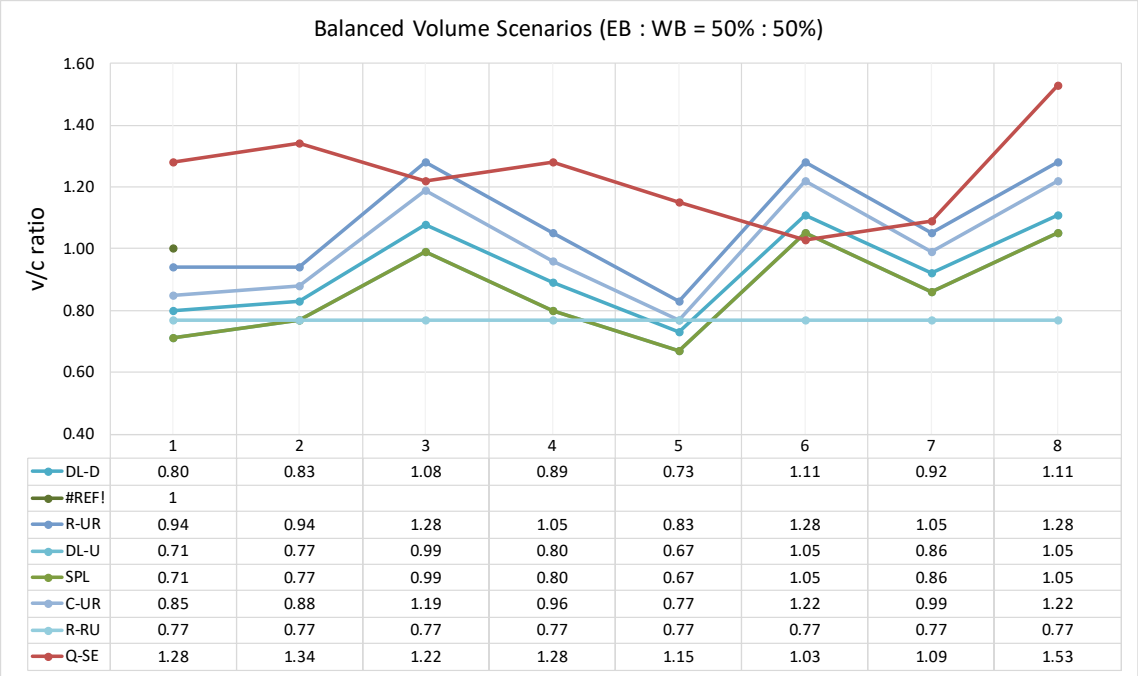
	DL-D	DL-U	SPL	R-UR	C-UR	R-RU	Q-SE
#1	0.80	0.71	0.71	0.94	0.85	0.77	1.28
#2	0.83	0.77	0.77	0.94	0.88	0.77	1.34
#3	1.08	0.99	0.99	1.28	1.19	0.77	1.22
#4	0.89	0.80	0.80	1.05	0.96	0.77	1.28
#5	0.73	0.67	0.67	0.83	0.77	0.77	1.15
#6	1.11	1.05	1.05	1.28	1.22	0.77	1.03
#7	0.92	0.86	0.86	1.05	0.99	0.77	1.09
#8	1.11	1.05	1.05	1.28	1.22	0.77	1.53

FIGURE 7 V/C RATIOS OF INTERSECTION DESIGNS FOR BALANCED VOLUME SCENARIOS



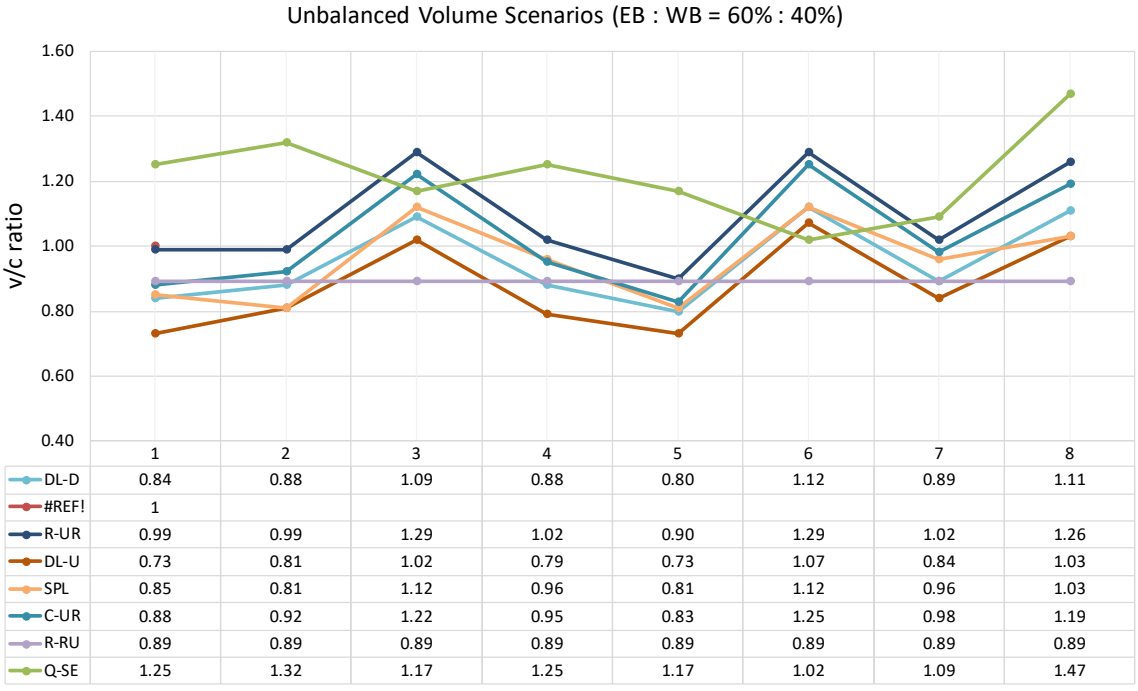
	DL-D	DL-U	SPL	R-UR	C-UR	R-RU	Q-SE
#9	0.84	0.73	0.85	0.99	0.88	0.89	1.25
#10	0.88	0.81	0.81	0.99	0.92	0.89	1.32
#11	1.09	1.02	1.12	1.29	1.22	0.89	1.17
#12	0.88	0.79	0.96	1.02	0.95	0.89	1.25
#13	0.80	0.73	0.81	0.90	0.83	0.89	1.17
#14	1.12	1.07	1.12	1.29	1.25	0.89	1.02
#15	0.89	0.84	0.96	1.02	0.98	0.89	1.09
#16	1.11	1.03	1.03	1.26	1.19	0.89	1.47

FIGURE 8 V/C RATIOS OF INTERSECTION DESIGNS FOR UNBALANCED VOLUME SCENARIOS



	1	2	3	4	5	6	7	8
DL-D	0.80	0.83	1.08	0.89	0.73	1.11	0.92	1.11
#REF!	1							
R-UR	0.94	0.94	1.28	1.05	0.83	1.28	1.05	1.28
DL-U	0.71	0.77	0.99	0.80	0.67	1.05	0.86	1.05
SPL	0.71	0.77	0.99	0.80	0.67	1.05	0.86	1.05
C-UR	0.85	0.88	1.19	0.96	0.77	1.22	0.99	1.22
R-RU	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Q-SE	1.28	1.34	1.22	1.28	1.15	1.03	1.09	1.53

FIGURE 9 V/C RATIOS OF BALANCED VOLUME SCENARIOS FOR INTERSECTION DESIGNS



	1	2	3	4	5	6	7	8
DL-D	0.84	0.88	1.09	0.88	0.80	1.12	0.89	1.11
#REF!	1							
R-UR	0.99	0.99	1.29	1.02	0.90	1.29	1.02	1.26
DL-U	0.73	0.81	1.02	0.79	0.73	1.07	0.84	1.03
SPL	0.85	0.81	1.12	0.96	0.81	1.12	0.96	1.03
C-UR	0.88	0.92	1.22	0.95	0.83	1.25	0.98	1.19
R-RU	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Q-SE	1.25	1.32	1.17	1.25	1.17	1.02	1.09	1.47

FIGURE 10 V/C RATIOS OF UNBALANCED VOLUME SCENARIOS FOR INTERSECTION DESIGNS

Appendix D: Turning Movement Volume Proportions

In the volume scenario design, the volume proportions for the four turning movement volume scenarios (no heavy movement, heavy left turn, heavy left turn + thru, and heavy thru) are determined by referring actual turning movement counts data. The following table shows the turning movement counts and volume proportions collected from the 84 approaches on 21 conventional four-leg signalized intersections in North Carolina.

TABLE 2 TURNING MOVEMENT COUNTS COLLECTED FOR VOLUME PROPORTIONS DETERMINATION

Site No	TM %	Southbound					Westbound					Northbound					Eastbound				
		U	L	T	R	Sum	U	L	T	R	Sum	U	L	T	R	Sum	U	L	T	R	Sum
1	Grand Total	65	1264	6041	2547	9917	4	333	3572	1109	5018	2	3244	5756	232	9234	0	2614	3213	3219	9046
	Approach %	0.7	12.7	60.9	25.7	100	0.1	6.6	71.2	22.1	100	0	35.1	62.3	2.5	100	0	28.9	35.5	35.6	100
	Total %	0.2	3.8	18.2	7.7	29.9	0	1	10.8	3.3	15.1	0	9.8	17.3	0.7	27.8	0	7.9	9.7	9.7	27.2
2	Grand Total	0	2127	6544	1040	9711	0	2371	3309	1792	7472	0	1034	6898	3232	11064	0	1129	3152	560	4841
	Approach %	0	21.9	67.4	10.7	100	0	31.7	44.3	24	100	0	9.3	62.3	28.3	100	0	23.3	65.1	11.6	100
	Total %	0	6.4	19.8	3.1	29.3	0	7.2	10	5.4	22.6	0	3.1	20.8	9.5	33.4	0	3.4	9.2	1.7	14.6
3	Grand Total	0	298	2113	634	3045	0	412	3559	270	4241	0	1872	2942	491	5305	0	680	4030	1416	6126
	Approach %	0	9.8	69.4	20.8	100	0	9.7	83.9	6.4	100	0	35.3	55.5	9.3	100	0	11.1	65.8	23.1	100
	Total %	0	1.6	11.3	3.4	16.3	0	2.2	19	1.4	22.7	0	10	15.7	2.6	28.3	0	3.6	21.5	7.6	32.7
4	Grand Total	25	1711	6842	3547	12125	170	2513	7664	1329	11676	83	1945	7251	1789	11068	68	4255	7935	1232	13490
	Approach %	0.2	14.1	56.4	29.3	100	1.5	21.5	65.6	11.4	100	0.7	17.6	65.5	16.2	100	0.5	31.5	58.8	9.1	100
	Total %	0.1	3.5	14.1	7.3	25.1	0.4	5.2	15.8	2.7	24.1	0.2	4	15	3.7	22.9	0.1	8.8	16.4	2.5	27.9
5	Grand Total	-	27	458	49	534	-	238	4140	28	4406	-	561	501	118	1180	-	191	3344	569	4104
	Approach %	-	5.1	85.8	9.2	100	-	5.4	94	0.6	100	-	47.5	42.5	10	100	-	4.7	81.5	13.9	100
	Total %	-	0.3	4.5	0.5	5.2	-	2.3	40.5	0.3	43.1	-	5.5	4.9	1.2	11.5	-	1.9	32.7	5.6	40.1
6	Grand Total	0	1288	4973	340	6601	0	1724	5868	1267	8859	1	1358	4495	1563	7417	0	257	6731	635	7623
	Approach %	0	19.5	75.3	5.2	100	0	19.5	66.2	14.3	100	0	18.3	60.6	21.1	100	0	3.1	88.3	8.3	100
	Total %	0	4.2	16.3	1.1	21.6	0	5.7	19.2	4.2	29	0	4.5	14.7	5.1	24.3	0	0.8	22.1	2.1	25
7	Grand Total	6	743	6730	762	8241	2	3129	4878	428	8437	0	4332	7011	2402	13745	10	902	5343	3006	9261
	Approach %	0.1	9	81.7	9.2	100	0	37.1	57.8	5.1	100	0	31.5	51	17.5	100	0.1	9.7	57.7	32.5	100
	Total %	0	1.9	17	1.9	20.8	0	7.9	12.3	1.1	21.3	0	10.9	17.7	6.1	34.6	0	2.3	13.5	7.6	23.3
8	Grand Total	2	3000	9901	2441	15344	416	1759	8095	2301	12571	17	3056	11071	982	15126	59	2671	7464	3169	13363
	Approach %	0	19.6	64.5	15.9	100	3.3	14	64.4	18.3	100	0.1	20.2	73.2	6.5	100	0.4	20	55.9	23.7	100
	Total %	0	5.3	17.6	4.3	27.2	0.7	3.1	14.4	4.1	22.3	0	5.4	19.6	1.7	26.8	0.1	4.7	13.2	5.6	23.7
9	Grand Total	-	264	2027	187	2478	-	552	2335	297	3184	-	285	2260	554	3099	-	162	2103	258	2523
	Approach %	-	10.7	81.8	7.5	100	-	17.3	73.3	9.3	100	-	9.2	72.9	17.9	100	-	6.4	83.4	10.2	100
	Total %	-	2.3	18	1.7	22	-	4.9	20.7	2.6	28.2	-	2.5	20	4.9	27.5	-	1.4	18.6	2.3	22.4
10	Grand Total	-	460	2073	445	2978	-	119	2072	578	2769	-	133	1822	149	2104	-	344	2350	180	2874
	Approach %	-	15.4	69.6	14.9	100	-	4.3	74.8	20.9	100	-	6.3	86.6	7.1	100	-	12	81.8	6.3	100
	Total %	-	4.3	19.3	4.1	27.8	-	1.1	19.3	5.4	25.8	-	1.2	17	1.4	19.6	-	3.2	21.9	1.7	26.8
11	Grand Total	-	248	2093	538	2879	-	340	1947	440	2727	-	485	2673	277	3435	-	494	3098	403	3995
	Approach %	-	8.6	72.7	18.7	100	-	12.5	71.4	16.1	100	-	14.1	77.8	8.1	100	-	12.4	77.5	10.1	100
	Total %	-	1.9	16.1	4.1	22.1	-	2.6	14.9	3.4	20.9	-	3.7	20.5	2.1	26.4	-	3.8	23.8	3.1	30.6
12	Grand Total	-	3483	4583	1709	9776	-	2101	4568	3581	10250	-	1121	4522	2293	7936	-	1828	5474	904	8206
	Approach %	-	35.6	46.9	17.5	100	-	2.5	44.6	34.9	100	-	14.1	57	28.9	100	-	22.3	66.7	11	100
	Total %	-	9.6	12.7	4.7	27	-	5.8	12.6	9.9	28.3	-	3.1	12.5	6.3	21.9	-	5.1	15.1	2.5	22.7
13	Grand Total	-	1066	4379	989	6434	-	537	101	582	1220	-	2407	3347	770	6524	-	226	6580	717	7523
	Approach %	-	16.6	68.1	15.4	100	-	44	8.3	47.7	100	-	36.9	51.3	11.8	100	-	3	87.5	9.5	100
	Total %	-	4.9	20.2	4.6	29.6	-	2.5	0.5	2.7	5.6	-	11.1	15.4	3.5	30.1	-	1	30.3	3.3	34.7
14	Grand Total	-	220	5790	177	6187	-	122	585	203	910	-	468	6034	89	6591	-	146	932	471	1549
	Approach %	-	3.6	93.6	2.9	100	-	13.4	64.3	22.3	100	-	7.1	91.5	1.4	100	-	9.4	60.2	30.4	100
	Total %	-	1.4	38	1.2	40.6	-	0.8	3.8	1.3	6	-	3.1	39.6	0.6	43.3	-	1	6.1	3.1	10.2
15	Grand Total	-	4164	3666	2678	10508	-	822	9020	4570	14412	-	924	3805	351	5080	-	2835	8371	985	12191
	Approach %	-	39.6	34.9	25.5	100	-	5.7	62.6	31.7	100	-	18.2	74.9	6.9	100	-	23.3	68.7	8.1	100
	Total %	-	9.9	8.7	6.3	24.9	-	1.9	21.4	10.8	34.2	-	2.2	9	0.8	12	-	6.7	19.8	2.3	28.9
16	Grand Total	-	1653	3209	1076	5938	-	2156	7886	1570	11612	-	480	3352	2348	6180	-	867	8199	639	9705

	Approach %	-	27.8	54	18.1	100	-	186	67.9	13.5	100	-	7.8	54.2	38	100	-	8.9	84.5	6.6	100
	Total %	-	4.9	9.6	3.2	17.8	-	6.4	23.6	4.7	34.7	-	1.4	10	7	18.5	-	2.6	24.5	1.9	29
17	Grand Total	-	311	1968	532	2811	-	867	1710	241	2818	-	142	2101	1462	3705	-	239	1547	166	1952
	Approach %	-	11.1	70	18.9	100	-	30.8	60.7	8.6	100	-	3.8	56.7	39.5	100	-	12.2	79.3	8.5	100
	Total %	-	2.8	17.4	4.7	24.9	-	7.7	15.2	2.1	25	-	1.3	18.6	13	32.8	-	2.1	13.7	1.5	17.3
18	Grand Total	-	239	6822	319	7380	-	490	1923	186	2599	-	454	7598	372	8424	-	362	2278	257	2897
	Approach %	-	3.2	92.4	4.3	100	-	18.9	74	7.2	100	-	5.4	90.2	4.4	100	-	12.5	78.6	8.9	100
	Total %	-	1.1	32	1.5	34.6	-	2.3	9	0.9	12.2	-	2.1	35.7	1.7	39.5	-	1.7	10.7	1.2	13.6
19	Grand Total	-	491	1200	4	1695	-	693	6955	978	8626	-	363	1140	755	2258	-	690	6721	332	7743
	Approach %	-	29	70.8	0.2	100	-	8	80.6	11.3	100	-	16.1	50.5	33.4	100	-	8.9	86.8	4.3	100
	Total %	-	2.4	5.9	0	8.3	-	3.4	34.2	4.8	42.4	-	1.8	5.6	3.7	11.1	-	3.4	33.1	1.6	38.1
20	Grand Total	0	1854	9848	3043	14745	0	3186	6418	1394	10998	0	4829	9635	2167	16631	0	4186	7099	3714	14999
	Approach %	0	12.6	66.8	20.6	100	0	29	58.4	12.7	100	0	29	57.9	13	100	0	27.9	47.3	24.8	100
	Total %	0	3.2	17.2	5.3	25.7	0	5.6	11.2	2.4	19.2	0	8.4	16.8	3.8	29	0	7.3	12.4	6.5	26.1
21	Grand Total	17	3565	7641	1670	12893	19	1435	8376	3514	13344	25	1627	7820	1082	10554	21	2172	8379	949	11521
	Approach %	0.1	27.7	59.3	13	100	0.1	10.8	62.8	26.3	100	0.2	15.4	74.1	10.3	100	0.2	18.9	72.7	8.2	100
	Total %	0	7.4	15.8	3.5	26.7	0	3	17.3	7.3	27.6	0.1	3.4	16.2	2.2	21.8	0	4.5	17.3	2	23.8