Chapter 8

Base Model Development

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Overview

- Goals
- Data Assembly Review
- Link-Node Diagram
- Lane Schematic
- Building Model
- Traffic Volumes
- Submittal Requirements

Base Model Development Goals

- To Create a Process in Which Complex Models Can be Verified and Recreated by Independent Parties (Credibility)
- To Standardize Criteria Allowing For the Re-Use and Expansion of Existing Models
- To Minimize the Modeling Time and Effort by Standardizing Model Development, Calibration and Output

Data Assembly Review

- Field Review - Operations
  - Speed runs
  - Lane Changing Behavior
  - Queuing
- Field Review - Geometrics
  - Lane Geometry
  - Striping
  - Signing
- Traffic Volumes

Link-Node Diagram: Purpose

- Blueprint of the Model
- Organizes Model Information
- Establishes a Direct Connection Between the Model and Design Process
- For Freeway Models too Long to Adequately View on the Screen, a Drawing Provides an Overview.

Link-Node Criteria

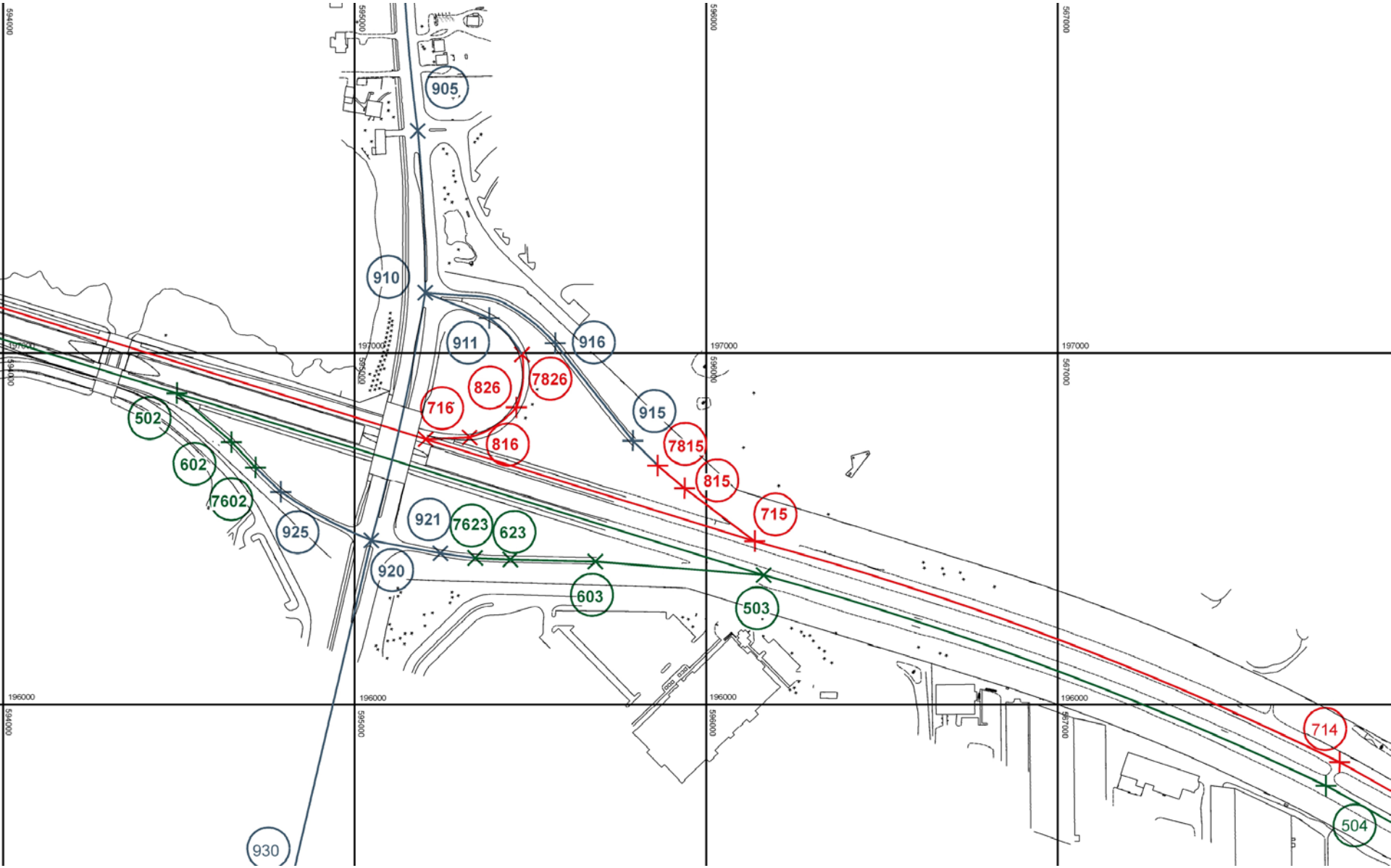
- Existing Base Mapping Using Real World Coordinates
- Node Numbering
  - Base Numbering Scheme (Table)
  - Expanding Models Add 1,000-6,000 Value

Segments	Range		Description
	From	To	
0s	1	99	Miscellaneous
100s	100	199	Northbound Freeway Mainline
200s	200	299	Northbound Freeway Ramps
300s	300	399	Southbound Freeway Mainline
400s	400	499	Southbound Freeway Ramps
500s	500	599	Eastbound Freeway Mainline
600s	600	699	Eastbound Freeway Ramps
700s	700	799	Westbound Freeway Mainline
800s	800	899	Westbound Freeway Ramps
900s	900	999	Arterials

Node Locations

- Freeways
  - Ramp Junctions
  - Points of Curvature
- Arterials
  - Intersections
  - Approaches to Intersections
  - Lane Drop Locations

Link Node Diagram Sample



Lane Schematic Purposes

- Base Modeling Process: to Aid in the Coding of the Model
- Qa/Qc Process: Provides an Illustration of the Intent of the Model and Inputs
- Output: to Provide an Illustration of Measure's of Effectiveness and Other Operational Issues

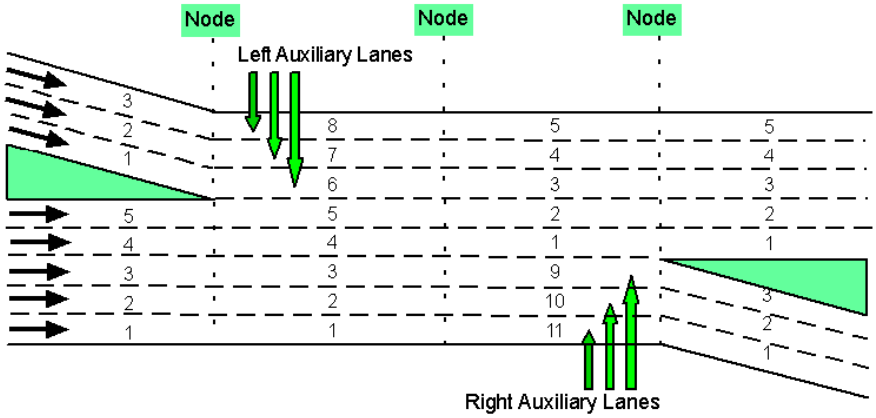
Lane Schematic Criteria

- Exaggerated Width to Length Representation of Freeway
- Lane Numbering Convention to Match CORSIM Criteria
- Diagram to Include
  - Lengths Between Nodes, Storage Lanes, Lane Drop Locations
  - Node Numbering
  - Peak Hour Traffic Volumes
  - Grades

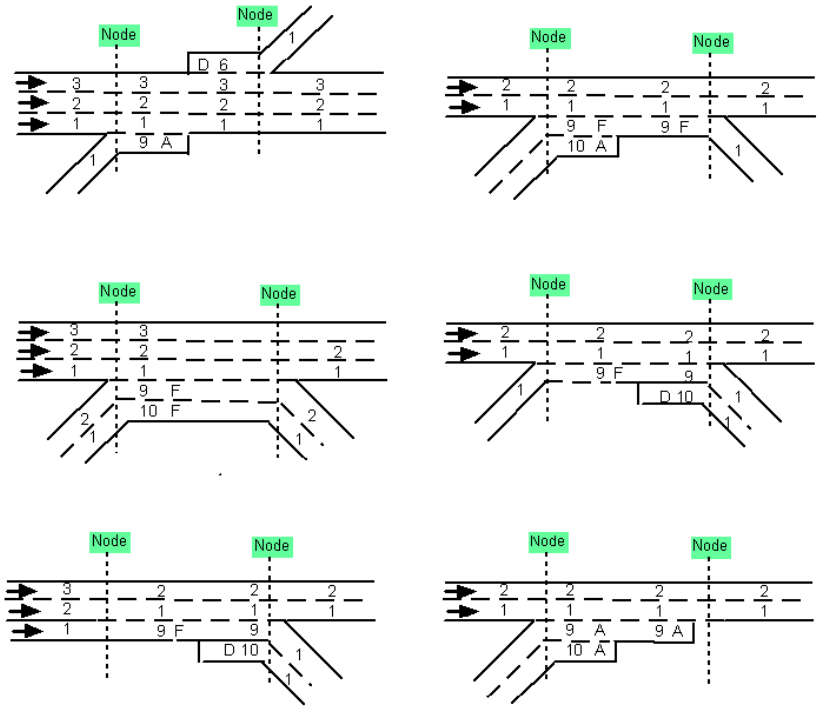
CORSIM Lane Numbering

- Lane Numbering Based On Basic Lane And Auxiliary Lane Criteria
- Diagram Similar To Lane Schematic Requirement

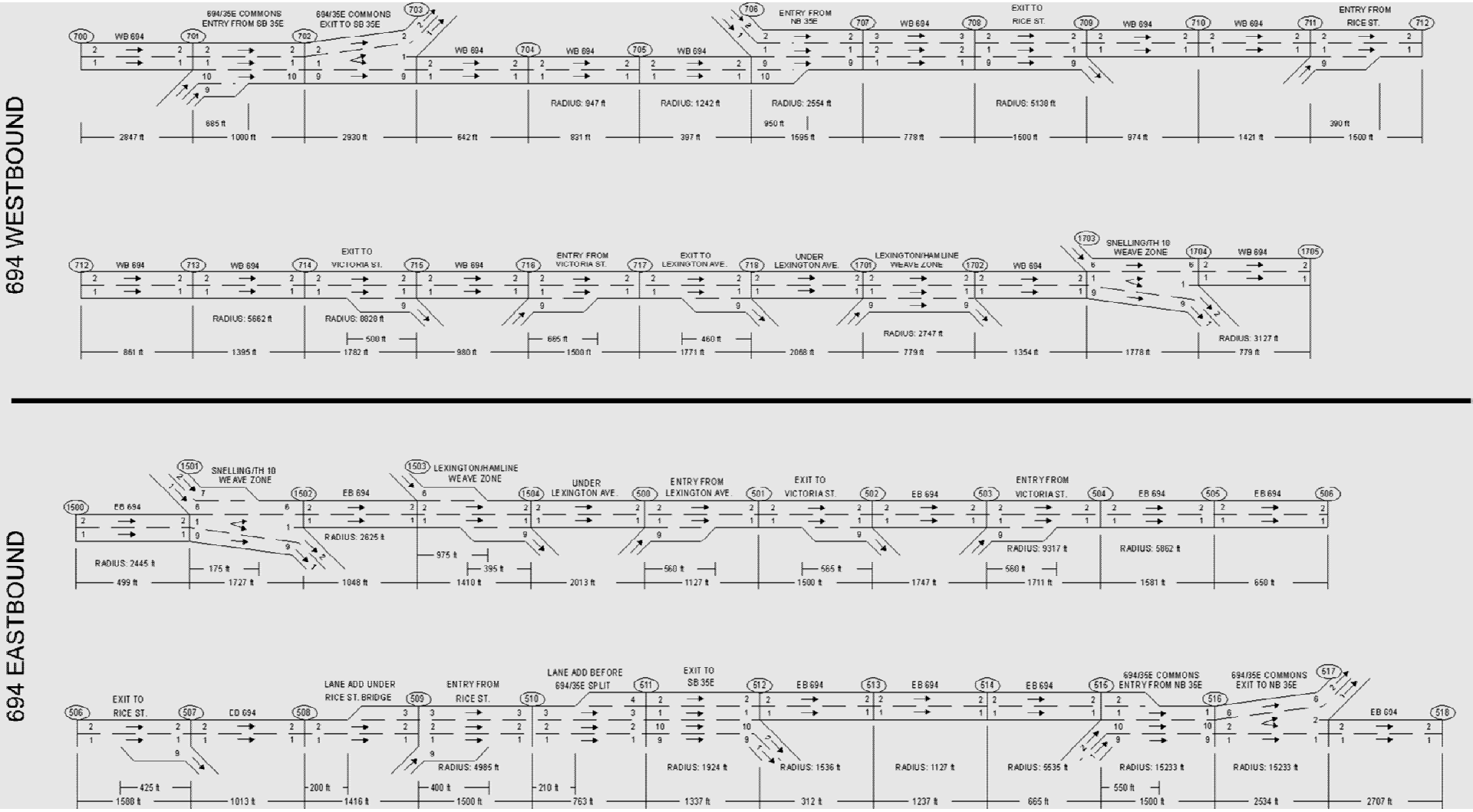
CORSIM Freeway Lane Numbering Criteria



CORSIM Freeway Lane Numbering Samples

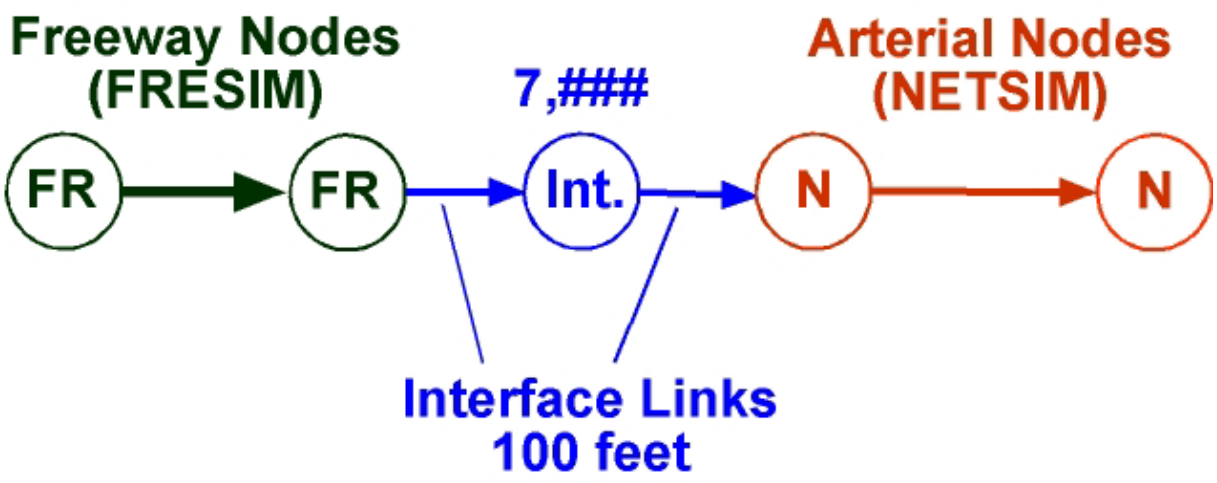


Sample Lane Schematic



Interface Links

- Connecting Freeway Model to Arterial Model
- Minimum Distance 100’ Per Link
- Interface Link Does Not Fully Report MOE’s

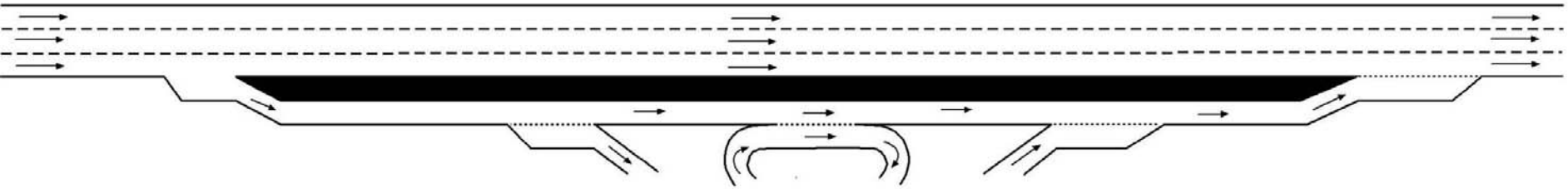


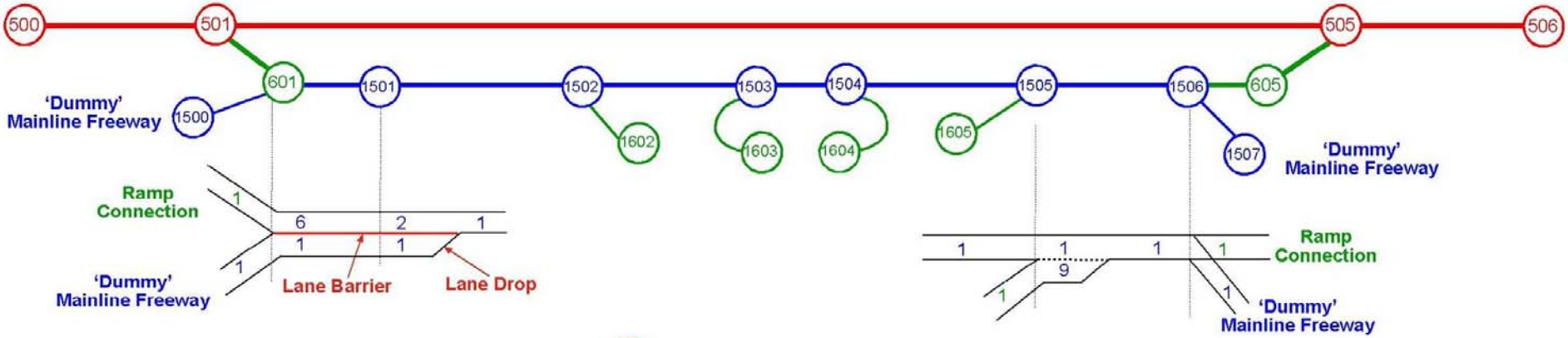
Freeway Bifurcations and Collector Distributor Roads

- CORSIM Allows For Only Ramp Type Links to Split From Mainline Type Links
- C-D Roads and Freeway Splits May Require Special Treatment
- A ‘Dummy’ Freeway Link Can be Developed to Allow For a Ramp Link to be Converted Into a Segment Which Can Then Have Other Ramp Connections

C-D Road Coding Sample

CORSIM Coding Example: Collector-Distributor Road System





500 Mainline Freeway Node

605 Freeway Ramp Node

1500 C-D Road Node

note: All nodes are FRESIM Nodes

Standardized Model Elements

- Manual And Website Contain Typical Samples Of Coding:
  - Diamond Interchanges
  - Single Point Diamonds
  - Collector-Distributor Road Systems
- Standardized Model Elements Expanding As Different Projects Are Developed

Traffic Volume Issues

- Requirements
  - Balanced Data Sets
  - Multiple Time Periods
  - Origin-Destination
- Organization
  - Large Amounts of Data (10,000-30,000 Numbers)
  - Conversion of Base Data to Future Data

Volume Databases Uses

- Used to Automate Inputs
  - Origin-Destination
  - RT 50’s
- Used to Evaluate Output
- Document Volumes
- Used in Creating Forecasts

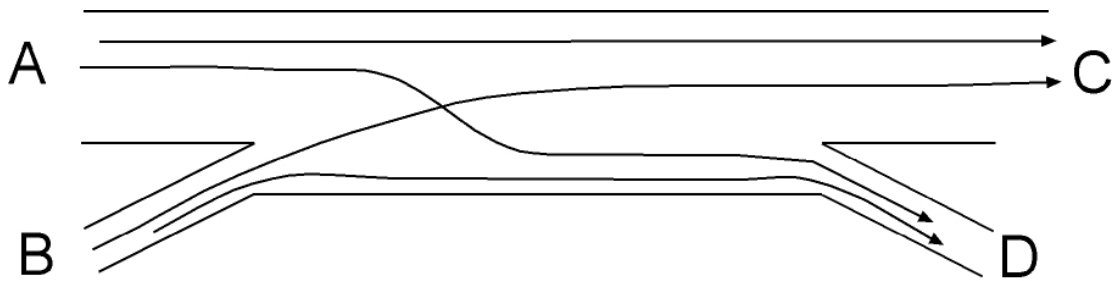
Traffic Volume Database: Freeway

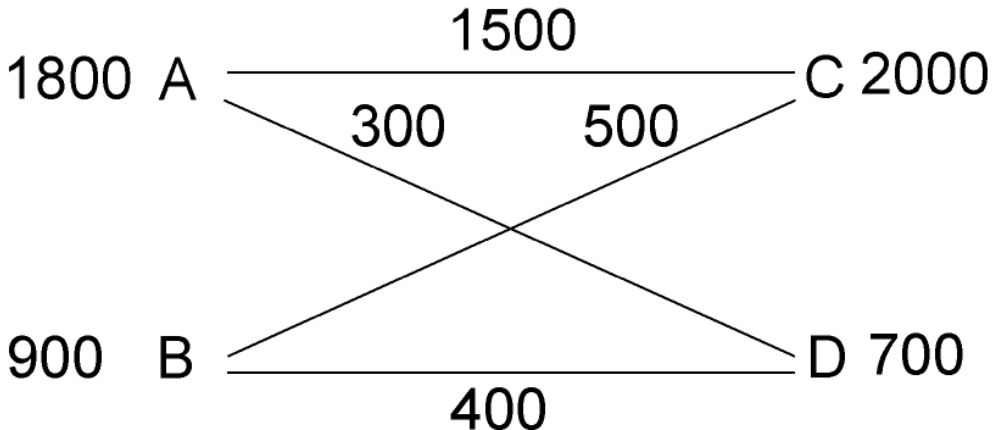
- Time Across Top
- Follow Freeway Direction
- ‘Fill In’ Volumes Where Stations Do Not Exist, e.g. Station 517a
- Develop Equivalency Table (CORSIM Link = Detector Station #)

			Time Period											
	Type		1	2	3	4	5	6	7	8	9	10	11	12
Description	m, off, on	Station Number	**6:00 AM**	**6:15 AM**	**6:30 AM**	**6:45 AM**	**7:00 AM**	**7:15 AM**	**7:30 AM**	**7:45 AM**	**8:00 AM**	**8:15 AM**	**8:30 AM**	**8:45 AM**
NB I-494	m	485	231	298	382	464	392	455	449	510	531	505	468	470
Valley View On	on	1227	33	51	82	70	110	129	168	161	131	96	92	82
NB I-494	m	486	264	349	464	534	502	584	617	671	662	601	560	552
TH 62 Off	off	1233	39	41	51	61	71	82	84	121	120	72	55	61
NB I-494	m	487	225	308	413	473	431	502	533	550	542	529	505	491
TH 62 On	on	1236	59	99	147	142	188	186	228	207	197	171	188	175
NB I-494	m	488	284	407	560	615	619	688	761	757	739	700	693	666
TH 7 Off Ramp	off	1842	6	8	7	10	15	17	16	20	14	18	15	18
NB I-494	m	512	278	399	553	605	604	671	745	737	725	682	678	648
TH 7 On Ramp	on	1845	162	224	242	205	216	238	247	233	211	194	186	183
NB I-494	m	512a	440	623	795	810	820	909	992	970	936	876	864	831
TH 7 Off Ramp	off	1846	37	58	78	57	55	59	69	72	41	63	74	68
NB I-494	m	512b	403	565	717	753	765	850	923	898	895	813	790	763
TH 7 On Ramp	on	1847	20	29	29	28	38	44	51	49	43	39	39	38
NB I-494	m	513	423	594	746	781	803	894	974	947	938	852	829	801
Minnetonka Off	off	1850	15	30	42	42	50	60	81	75	55	52	50	47
NB I-494	m	514	408	564	704	739	753	834	893	872	883	800	779	754
Minnetonka On	on	1853	45	60	71	81	75	103	108	141	94	99	91	97
NB I-494	m	515	453	624	775	820	828	937	1001	1013	977	899	870	851
NB I-494	m	516	453	624	775	820	828	937	1001	1013	977	899	870	851
EB I-394 Off Ramp	off	1649	95	145	212	188	178	185	167	158	191	189	206	205
NB I-494	m	517	358	479	563	632	650	752	834	855	786	710	664	646
EB I-394 On Ramp	on	1860	26	35	51	57	66	58	74	74	81	117	74	72
NB I-494	m	517a	384	514	614	689	716	810	908	929	867	827	738	718
WB I-394 Off Ramp	off	1810	37	59	80	84	98	121	117	147	161	139	114	126
NB I-494	m	518	347	455	534	605	618	689	791	782	706	688	624	592
WB I-394 On Ramp	on	1863	92	152	202	260	232	243	272	338	289	249	250	223

Freeway Origin-Destination

- Weaving Created by Traffic Merging and Diverging Based on Traffic Desires
- CORSIM Internally Creates O-D if None is Manually Entered
- CORSIM Does Not Interpret Local Conditions





Origin-Destination Table Sample

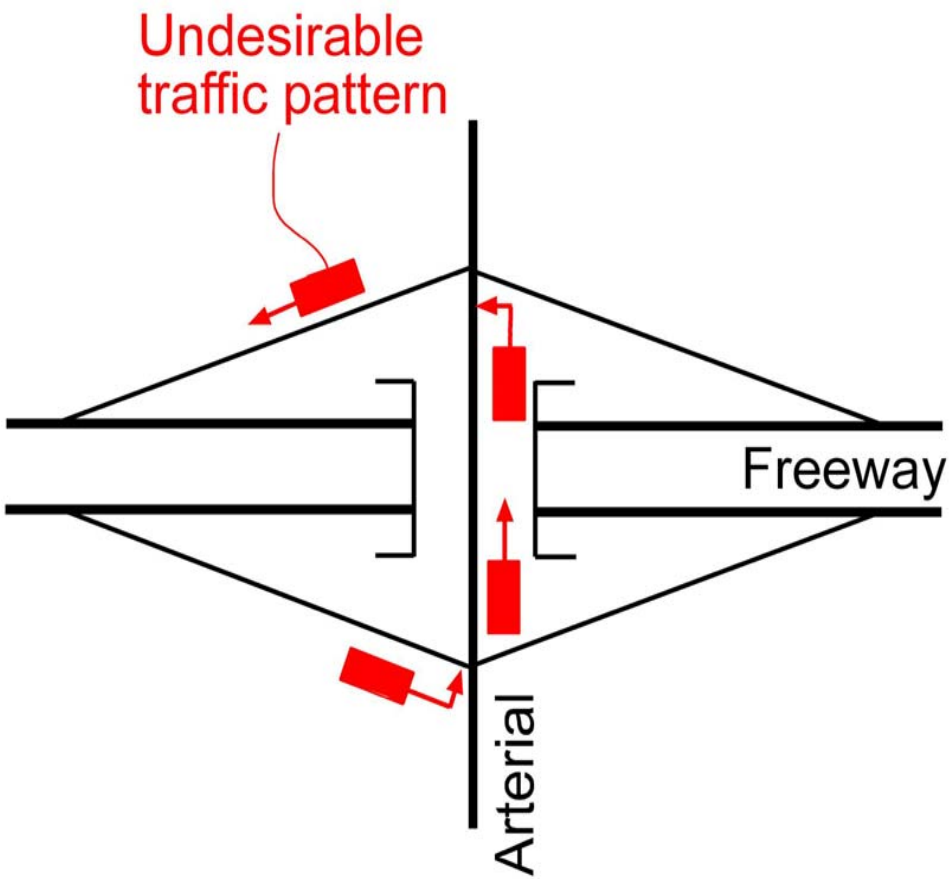
I-394 Eastbound (AM)																					
				Exit Location																	
				Central Avenue			494/Carlson Parkway			Plymouth/Ridgedale			CSAH 73			TH 169 CD			end/exit		
Entry Location					541			550			557			562			565			571		
	Detector				1630			1639			1653a			1668			1627			276		
Name	Station	Node #	Volume	Vol	Vol %	New Volume	Vol	Vol %	New Volume	Vol	Vol %	New Volume	Vol	Vol %	New Volume	Vol	Vol %	New Volume	Vol	Vol %	New Volume	
EB 394	264a	540	461	23	0.05	438	136	0.30	302	15	0.03	287	11	0.02	276	34	0.07	242	242	0.52	242	100%
Central Avenue	1628a	543	88	0	0.00	88	27	0.31	61	3	0.03	58	2	0.02	56	7	0.08	49	49	0.56	49	100%
CR 101	1629a	546	55	0	0.00	55	17	0.31	38	2	0.04	36	1	0.02	35	4	0.07	31	31	0.56	31	100%
494/Carlson Parkway CD	1650a	555	320	0	0.00	320	0	0.00	320	16	0.05	304	12	0.04	292	36	0.11	256	256	0.80	256	100%
Plymouth	1659	558	41	0	0.00	41	0	0.00	41	0	0.00	41	2	0.05	39	5	0.12	34	34	0.83	34	100%
Ridgedale	1667	560	20	0	0.00	20	0	0.00	20	0	0.00	20	1	0.05	19	2	0.10	17	17	0.85	17	100%
CSAH 73	1675	563	42	0	0.00	42	0	0.00	42	0	0.00	42	0	0.00	42	5	0.12	37	37	0.88	37	100%
TH 169 CD Road	1690a	570	251	0	0.00	251	0	0.00	251	0	0.00	251	0	0.00	251	0	0.00	251	251	1.00	251	100%
			1278	23			181			35			29			94			916			1278
				23			180			36			29			93			917			1278

Traffic Volumes: Arterials

	NB 494 Ramp at Bass Lake Road, CSAH 10											
	987-918				986-918				919-918			
Link	NBL	NBT	NBR	diag	WBL	WBT	WBR	diag	EBL	EBT	EBR	diag
6:00	14	1	17	0	0	49	24	0	28	101	0	0
6:15	28	0	30	0	0	51	29	0	47	161	0	0
6:30	32	1	49	0	0	84	14	0	39	190	0	0
6:45	72	0	59	0	0	78	29	0	37	306	0	0
7:00	42	0	55	0	0	105	49	0	42	308	0	0
7:15	37	0	86	0	0	105	42	0	26	328	0	0
7:30	45	0	76	0	0	142	36	0	31	386	0	0
7:45	51	1	104	0	0	149	44	0	24	349	0	0
8:00	65	0	100	0	0	100	32	0	26	307	0	0
8:15	57	1	77	0	0	116	22	0	28	231	0	0
8:30	42	0	73	0	0	83	30	0	35	158	0	0
8:45	31	0	57	0	0	116	38	0	32	131	0	0
	NBL	NBT	NBR	diag	WBL	WBT	WBR	diag	EBL	EBT	EBR	diag
15:00	81	1	59	0	0	190	74	0	45	83	0	0
15:15	75	0	56	0	0	179	94	0	44	93	0	0
15:30	75	0	62	0	0	174	109	0	34	127	0	0
15:45	85	0	50	0	0	227	107	0	35	119	0	0
16:00	74	0	52	0	0	258	94	0	29	98	0	0
16:15	71	1	59	0	0	213	109	0	28	86	0	0
16:30	99	1	55	0	0	245	85	0	32	125	0	0
16:45	104	0	54	0	0	293	86	0	30	138	0	0
17:00	102	0	57	0	0	305	108	0	43	137	0	0
17:15	116	0	61	0	0	312	83	0	23	142	0	0
17:30	124	0	64	0	0	273	101	0	22	121	0	0
17:45	118	0	59	0	0	256	72	0	34	124	0	0

- Traffic Count Data Converted Into Table
- Time by Row
- Approach and Movement by Column
- Group Intersections Together

Arterial Conditional Turn Movements



- Used at Interchanges to Accurately Model Diamond Interchange Operations
- Eliminates Traffic Exiting Freeway and Returning to Freeway
- Can be Applied Partially

Building CORSIM Model

- Manual on WEB Site Provides a Step-by-Step Guide to Build a CORSIM Model
- TRAFED is Used to Build the Freeway
  - To Be Successful, Knowledge of and Abilities of Using the *.trf is Required
- SYNCHRO is Used to Build Arterials
- File Combining
  - Allows For Multi-Tasking
  - Allows For Synchro to be Used Independently

Building CORSIM Model

- Link Order Requirements
  - Grouping Freeway Segments by:
    - Mainline Segments in Order
    - Ramp Segments in Order
  - Grouping NETSIM Segments by:
    - Intersection Approaches
    - Departing Links

Traffic Control

- Arterials: Signalized
  - Generally Use Pre-Timed Control as Primary Purpose of Studies Are to Evaluate Freeway Operations
  - Convert Actuated Signal Timings Into Pre-Timed With SYNCHRO by Setting Phasing, Cycle Lengths, Clearances and Minimums
- Arterials: Unsignalized
  - Stop Control and Yield Control. CORSIM's Unsignalized Operations Have Been Enhanced

Ramp Metering

- 3 Different Ramp Metering Strategies Available
- Pre-Timed Ramp Metering Used
  - Average IRIS Reports
  - Rates Can be Modified by Time Period
- Once Ramp Meter is Specified in the Model it Can Not be Turned Off. Rate Should be Lowered to the Minimum Value

Quality Assurance/Quality Control

- Requirement For All Projects
- Used to Review Model Geometry and Calibration Inputs
- Should be Used by Modeler to Review Work.
- Series of Tables That Assemble Model Inputs in a Logical Sequence and Provides Heading of the Inputs
- Table Should be Prepared to be Understood by Non-Modeler

QA/QC Sample

Link Descriptions at:

-On Ramps

-Off Ramps

-Key Features

FRESIM QA/QC

NORTH BOUND I-494

	Link Description		Link Geometrics													
Record & entry:			19-1	19-2	19-3	19-4	19-5	19-6	20-3	20-4	20-5	20-8	20-17	20-12	20-15	
	From	To	Node From	Node To	Receiving Node	Length	Type	No. of lanes	Grade	Super-Elev.	Radius	Speed	Car Following Factor	Warning Sign Distance	Anticipat Min. Speed to Trigger	
70	**NB I-494**		110	111	112	1378	0	2				70	100			
71		Valley View Road On Ramp	111	112	113	510	0	2				70	100			
72	Valley View Road On Ramp		112	113	114	1493	0	2				70	100		10	
73			113	114	115	798	0	2				70	100			
74			114	115	116	1101	0	2				70	100			
75			115	116	117	1005	0	2				70	100			
76		TH 62 Off Ramp	116	117	118	1570	0	2		5	2815	70	100	5000		
77	TH 62 Off Ramp		117	118	119	1147	0	2				70	100			
78		TH 62 On Ramp	118	119	120	987	0	2				70	100			
79	TH 62 On Ramp		119	120	121	1505	0	2				70	100		10	
80			120	121	122	2142	0	2		3	5740	70	100			
81			121	122	123	1070	0	2				70	100			
82			122	123	124	940	0	2				70	100			
83			123	124	125	1077	0	2				70	100			
84			124	125	126	1220	0	2		4	4560	70	100			
85			125	126	127	685	0	2		5	2940	70	100			
86		EB TH 7 Off Ramp	126	127	128	1529	0	2				70	100	5000		
87	EB TH 7 Off Ramp	EB TH 7 On Ramp	127	128	129	1093	0	2				70	100			
88	EB TH 7 On Ramp	WB TH 7 Off Ramp	128	129	130	374	0	2				70	100	5000	10	
89	WB TH 7 Off Ramp	WB TH 7 On Ramp	129	130	131	1276	0	2		5	3860	70	100			
90	WB TH 7 On Ramp		130	131	132	1517	0	2		5	3860	70	100		10	
91			131	132	133	1748	0	2				70	100			
92		Minnetonka Blvd Off Ramp	132	133	134	1478	0	2		5	2940	70	100	5000		
93	Minnetonka Blvd Off Ramp		133	134	135	500	0	2				70	100			
94		Minnetonka Blvd On Ramp	134	135	136	461	0	2				70	100			
95	Minnetonka Blvd On Ramp		135	136	137	1542	0	2		5	3240	70	100		10	
96			136	137	138	950	0	2				70	100			
97			137	138	139	1648	0	2				70	100			
98			138	139	140	1550	0	2		3	5770	70	100			
99			139	140	141	1400	0	2				70	100			
100		EB I-394 Off Ramp	140	141	142	1530	0	2				70	100	5000		
101	EB I-394 Off Ramp	EB I-394 On Ramp	141	142	143	1104	0	2				70	100			
102	EB I-394 On Ramp	WB I-394 Off Ramp	142	143	144	468	0	3				70	100	5000	10	
103	WB I-394 Off Ramp	WB I-394 On Ramp	143	144	145	1105	0	3				70	100			
104	WB I-394 On Ramp		144	145	146	973	0	2				70	100		10	
105		Carlson Parkway Off Ramp	145	146	147	922	0	2				70	100	2500		
106	Carlson Parkway Off Ramp		146	147	148	1179	0	2				70	110			
107		Carlson Parkway On Ramp	147	148	149	1377	0	2				70	110			
108	Carlson Parkway On Ramp		148	149	150	1537	0	2				70	110			45
109		County Road 6 Off Ramp	149	150	151	928	0	3				70	100	2500		
110	County Road 6 Off Ramp		150	151	152	1095	0	3				70	100			
111		County Road 6 On Ramp	151	152	153	1091	0	3				70	100			
112	County Road 6 On Ramp		152	153	154	945	0	3				70	100			45
113			153	154	155	944	0	3				70	100			
114		TH 55 Off Ramp	154	155	156	835	0	3				70	100	2500		
115	TH 55 Off Ramp		155	156	157	1213	0	3				70	100			
116		TH 55 On Ramp	156	157	158	1254	0	2				70	100			
117	TH 55 On Ramp		157	158	159	1258	0	2				70	100		10	
118			158	159	160	1652	0	2				70	100			
119		Rockford Road Off Ramp	159	160	161	1433	0	2				70	100	5000		
120	Rockford Road Off Ramp		160	161	162	976	0	2				70	100			
121		Rockford Road On Ramp	161	162	163	969	0	2				70	100			
122	Rockford Road On Ramp		162	163	164	1385	0	2				70	100		10	
123			163	164	165	2116	0	2				70	100			
124			164	165	166	1636	0	2				70	100			
125			165	166	167	1900	0	2				70	100			
126			166	167	168	1568	0	2				70	100			
127			167	168	169	2172	0	2				70	100			
128		Bass Lake Road Off Ramp	168	169	170	1445	0	2				70	100	5000		
129	Bass Lake Road Off Ramp		169	170	171	1263	0	2				70	100			
130		Bass Lake Road On Ramp	170	171	172	1296	0	2				70	100			
131	Bass Lake Road On Ramp		171	172	173	1524	0	2				70	100		10	
132			172	173	174	1580	0	2				70	100			
133			173	174	175	1548	0	2				70	100			
134		Diverge	174	175	176	1502	0	2				70	100	5000		
135	Diverge	WB I-94	175	176	8176	1292	0	2				70	100			

MOE Tables

- Model Output to be Summarized and Compared to Input Data
  - Volumes
  - Speeds
- Required to Conduct Calibration
- Format Consistent With QA/QC Structure

Issues

- Traffic Volume Inputs Account For Most Problems in Modeling
- Not Planning Time to Modify Model
  - Node Numbering
  - Unique Situations May Require a Different Coding to Replicate Conditions
    - 2-Lane Exit Ramp Treatments
    - Multiple Exits at Same Location
    - C-D Roads

Submittal Requirements: “Model Manual”

- Link Node Diagram
  - Plan Sheet Format
  - Electronic Microstation Files
- Lane Schematic Diagrams
- QA/QC Tables
- *.trf Files
- Traffic Volume Data Bases
- Field Observation Report
- Preliminary Measures of Effectiveness Tables