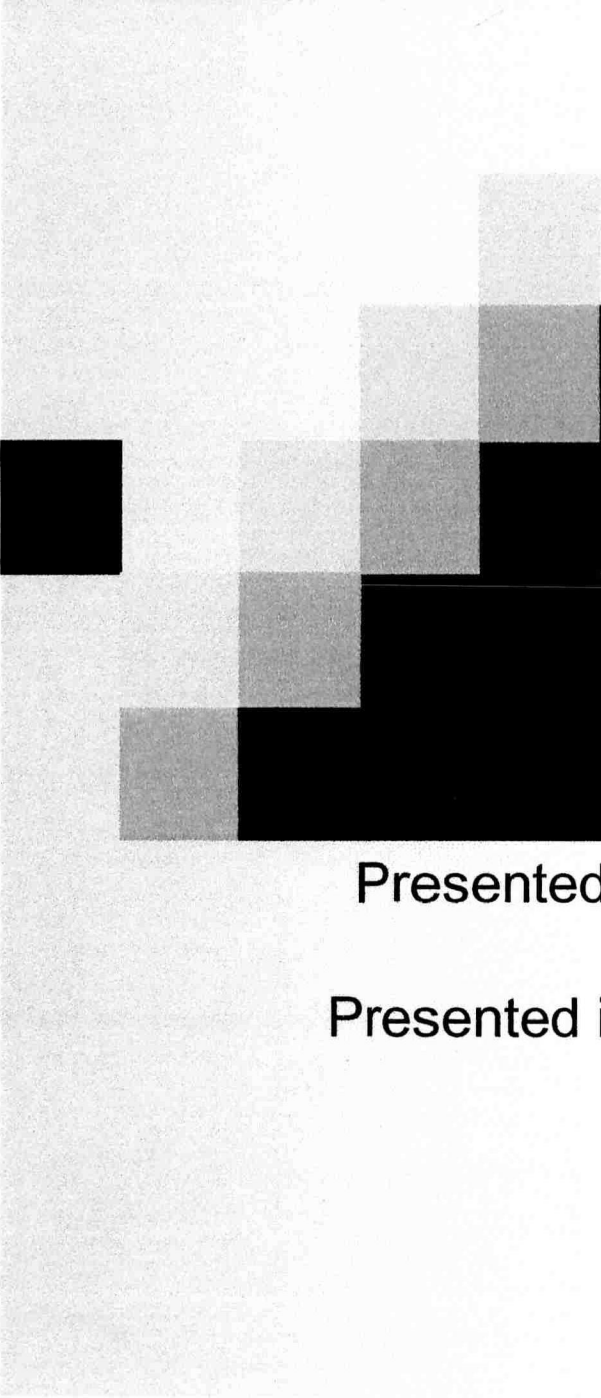


Separator

5-1752-01-P12



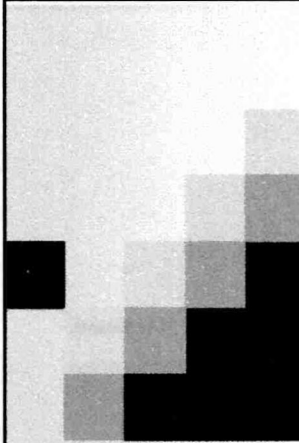
Hardware-in-the-Loop Demonstration/ Workshop

Presented to TxDOT Traffic Management Section – Austin

Presented in partial completion of requirements of 5-1752-01

By the Texas Transportation Institute

July 8, 2005



Hardware-in-the-Loop Demonstration/ Workshop

Presented to TxDOT Traffic Management Section – Austin

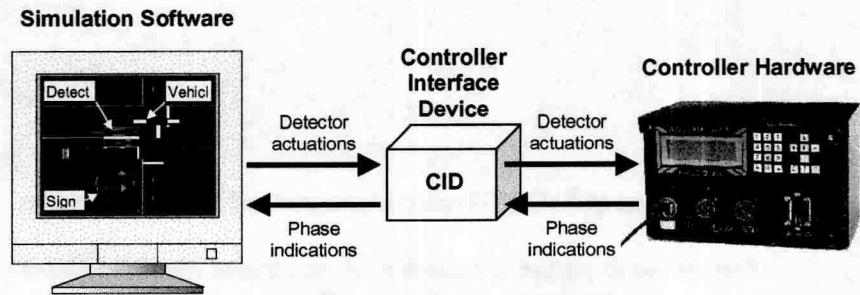
Presented in partial completion of requirements of 5-1752-01
By the Texas Transportation Institute
July 8, 2005



Purpose of Workshop

- Demonstrate HITL capabilities
- Show default files
 - ☐ T-Intersection
 - ☐ 4-leg
 - ☐ Diamond
- Step through modifying default files
 - ☐ Modifying volume
 - ☐ Modifying phasing
 - ☐ Modifying detectors
 - ☐ Modifying geometry
- Special Cases

Elements of HITL



CID Interface Device

- Allows controller to communicate with simulation software
- Three interface devices
 - Eagle TS-2
 - Naztec TS-2
 - NIATT TS-1
- Two files
 - “.exe” file
 - “.ini” file

Simulation Files

- TSIS CORSIM files

- ☐ “.trf” files → actual simulation files
- ☐ “.sdi” files → maps approaches with phases

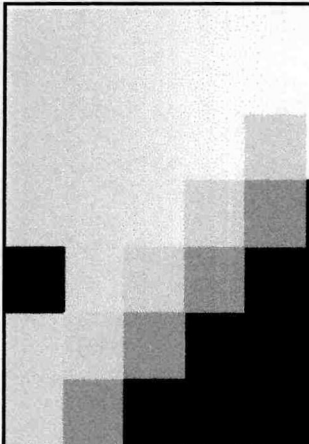
IMPORTANT

.trf and .sdi files NEED to have same file name!!!

Example: “*Example_diamond.trf*” must have corresponding “*Example_diamond.sdi*” file

Look at files

- HITL CID .ini file
- TSIS CORSIM .sdi file
- TSIS CORSIM .trf file



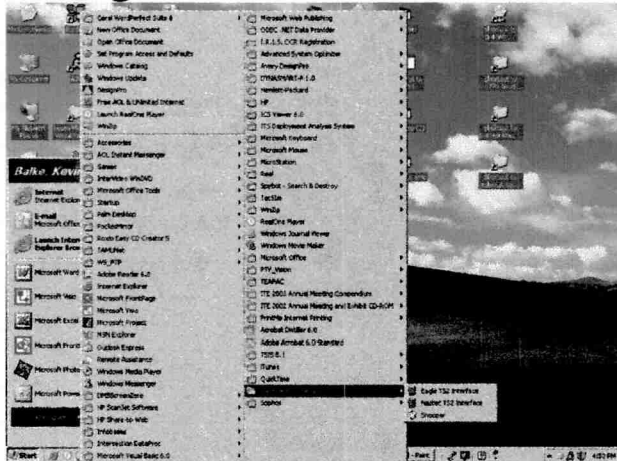
Running HITL Scenario



Sequence of Programs

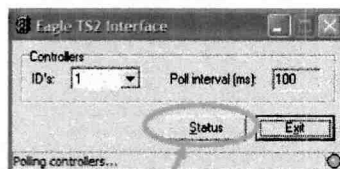
- Step 1. Start CID Interface Program
 - ☐ EagleTs2Interface.exe
 - ☐ NaztecTs2Interface.exe
- Step 2. Open Snooper
- Step 3. Start TSIS
 - ☐ Real-Time CORSIM
 - ☐ TRAFVU (after equilibrium reached)

Step 1. Running CID Interface Program



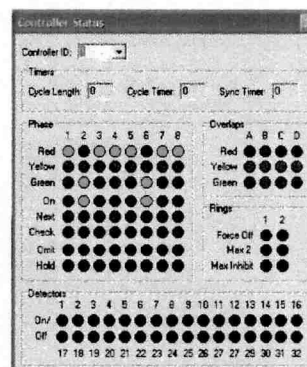
- "Start"
- "All Programs"
- "Hardware-in-the-Loop" Folder
- Appropriate CID Interface Icon

Step 1. Running CID Interface Program (cont.)

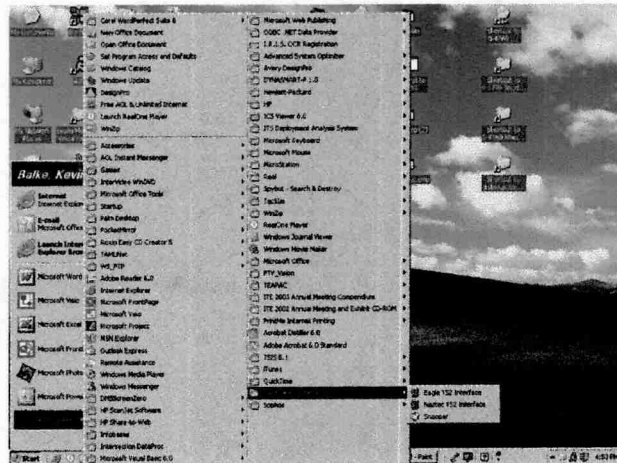


If you click on "Status"

Green Light means CID communicating with Controller

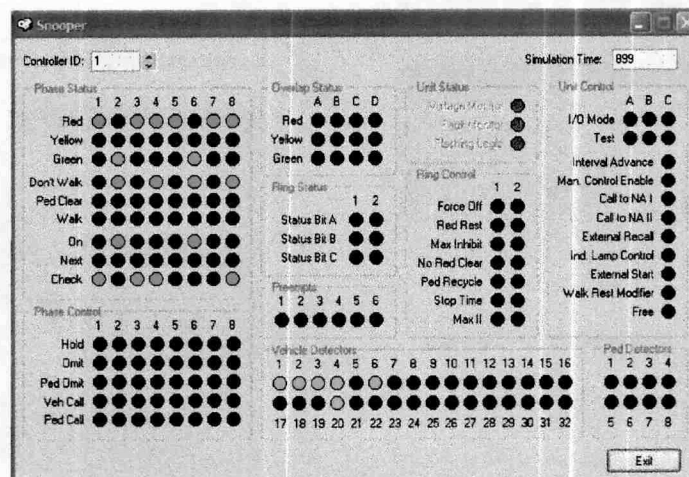


Step 2. Running Snooper

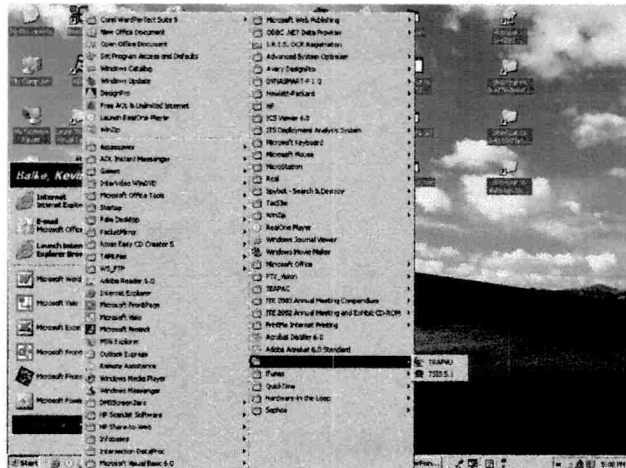


- "Start"
- "All Programs"
- "Hardware-in-the-Loop" Folder
- "Snooper" Icon

Step 2. Running Snooper (cont.)

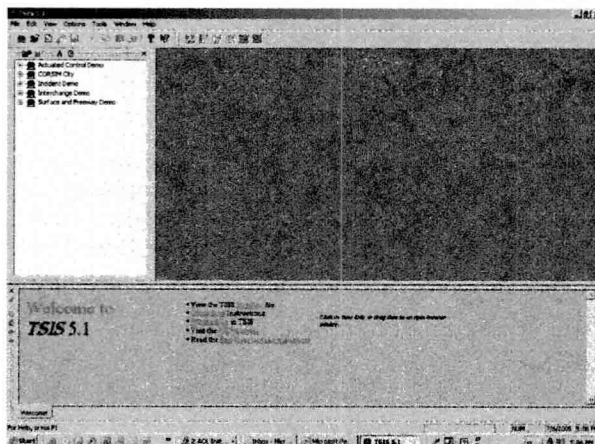


Step 3. Running Simulation



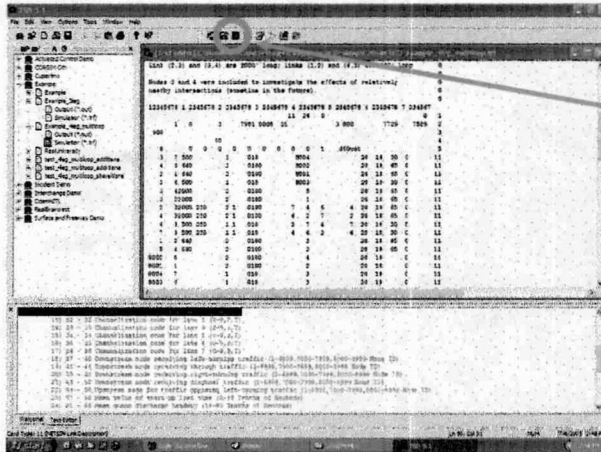
- "Start"
- "All Programs"
- "TSIS 5.1" Folder
- "TSIS 5.1" Icon

Step 3. Running Simulation



- "File"
- "Open"
- Navigate to folder and click on ".trf" file

Step 3. Running Simulation (Cont.)

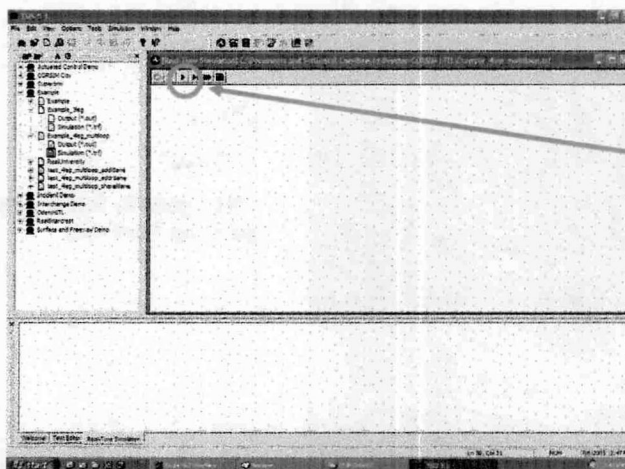


Click on



icon to run
Real-Time
TSIS

Step 3. Running Simulation (Cont.)

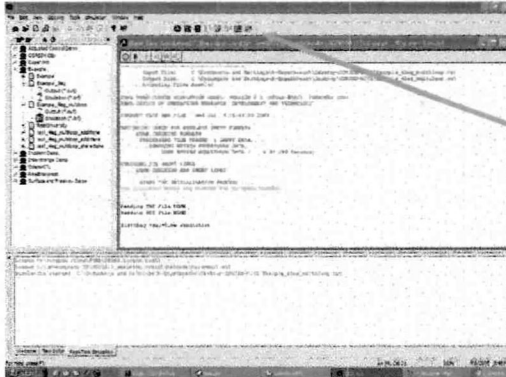


Click on



icon to
start real-
time
simulation

Step 3. Running Simulation (Cont.)



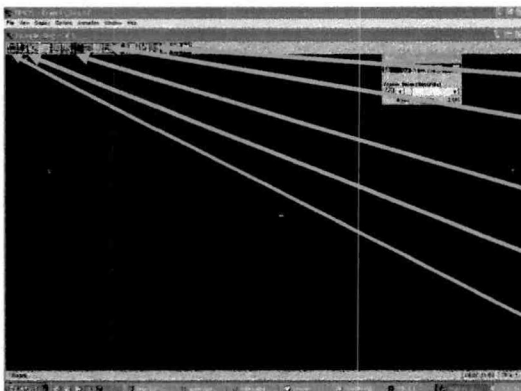
Once simulation finishes initialization period:

Click on



icon to run animation

Step 3. Running Simulation (Cont.)



Click on :



To zoom in



To see detectors



To see markings

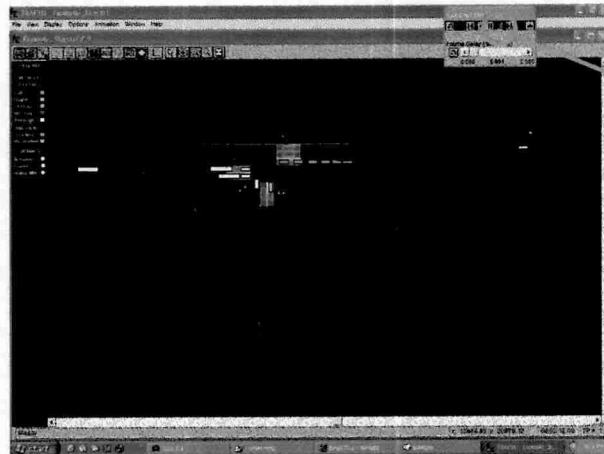


To see signals



To see vehicles

Step 3. Running Simulation (Cont.)



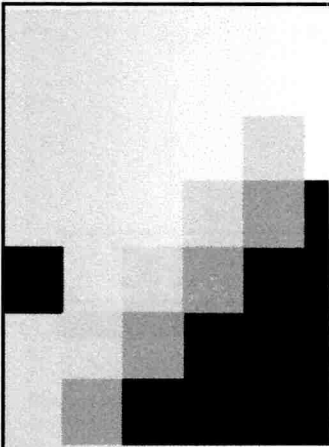
Click on



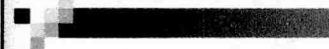
icon to
start real-
time
animation

Hands-On Practice

- Run Example_4leg_Multiloop.trf



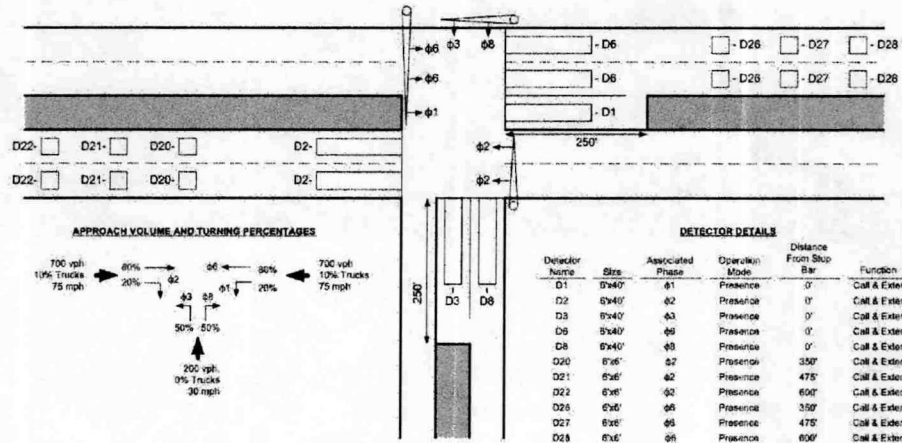
Default intersections



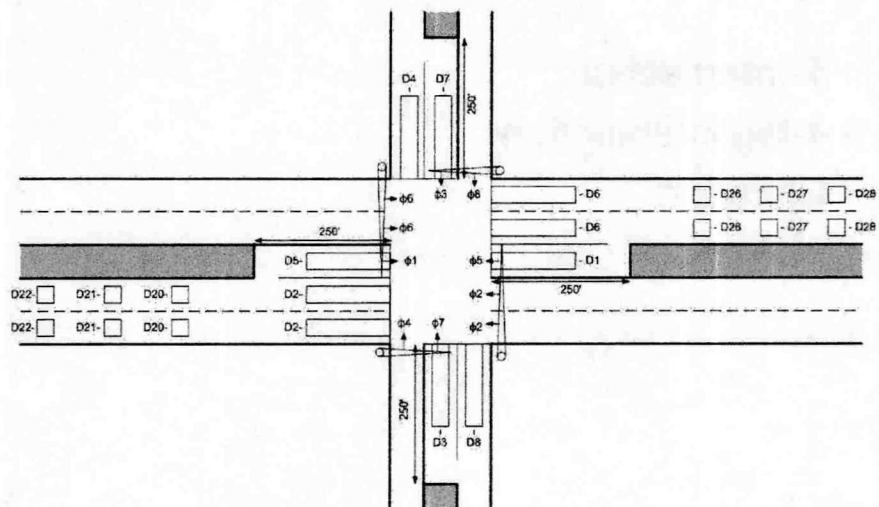
Default TSIS files

- T-intersection
- 4-leg intersection
- Diamond

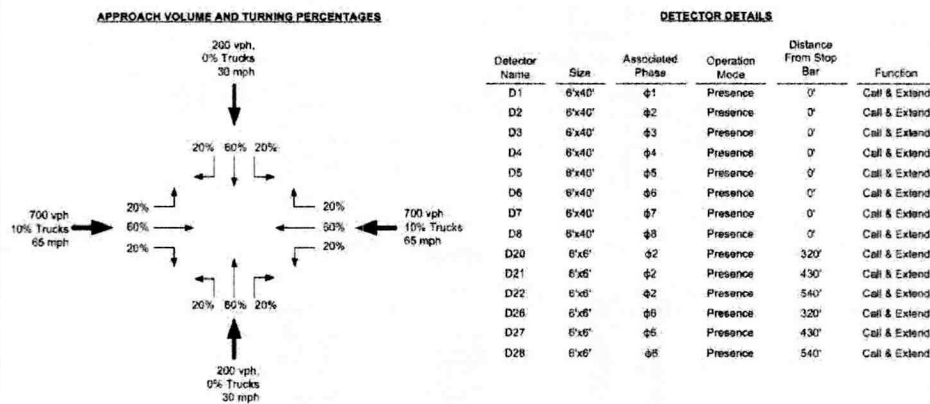
Default T-Intersection



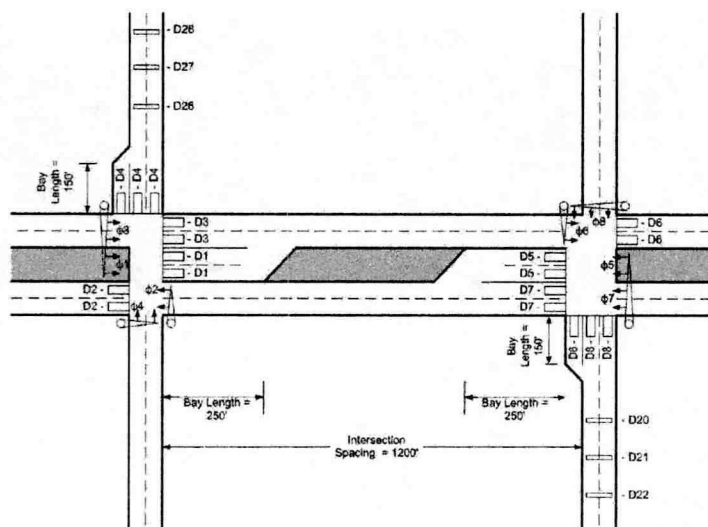
Default 4-leg Intersection



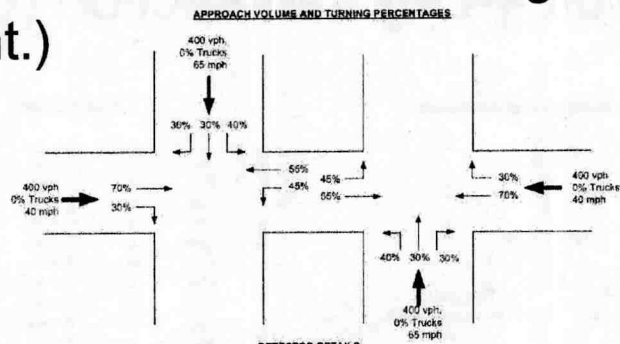
Default 4-Leg Intersection (Cont.)



Default Diamond Interchange



Default Diamond Interchange (Cont.)



DETECTOR DETAILS

Detector Name	Size	Associated Phase	Operation Mode	Distance From Stop Bar	Function
D1	6'x40'	41	Presence	0'	Call & Extend
D2	6'x40'	42	Presence	0'	Call & Extend
D3	6'x40'	43	Presence	0'	Call & Extend
D4	6'x40'	44	Presence	0'	Call & Extend
D5	6'x40'	45	Presence	0'	Call & Extend
D6	6'x40'	46	Presence	0'	Call & Extend
D7	6'x40'	47	Presence	0'	Call & Extend
D8	6'x40'	48	Presence	0'	Call & Extend
D20	6'x6'	49	Presence	320'	Call & Extend
D21	6'x6'	48	Presence	430'	Call & Extend
D22	6'x6'	48	Presence	540'	Call & Extend
D25	6'x6'	44	Presence	320'	Call & Extend
D27	6'x6'	44	Presence	430'	Call & Extend
D28	6'x6'	44	Presence	540'	Call & Extend

Modifying Default Simulations

Modifying Defaults

- Change Volume Conditions
- Change Phasing Conditions
- Modify Detectors
- Change Intersection Geometry

IMPORTANT

Always rename “Example” files
(i.e., do not save **over** “Example” files)

Modifying Volumes

Volume-Related Cards

- Total Approach Flow Rate – Card Type 50
- % Trucks – Card Type 50
- Turning Movement Percentages – Card Type 21

Flow Rates -- Card Type 50

8004	7	200	0	0	100	50
8002	5	700	10	0	100	50
8001	1	700	10	0	100	50
8003	6	200	0	0	100	50

Card Type

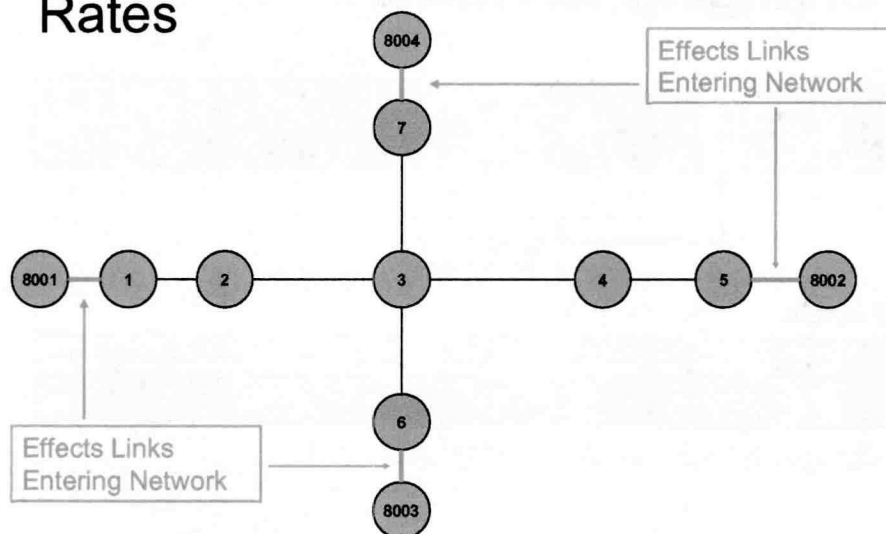
% Trucks

Entering Flow Rate (vph)

Downstream Node

Upstream Node

Changing Total Approach Flow Rates



Changing Total Approach Flow Rates

8004	7	200	0	0	100	50
8002	5	700	10	0	100	50
8001	1	700	10	0	100	50
8003	6	200	0	0	100	50

Entering Flow Rate (vph)

Example:

8004	7	200	0	0	100	50
8002	5	1200	10	0	100	50
8001	1	700	10	0	100	50
8003	6	200	0	0	100	50

Changes Total Approach Flow Rate on WB Entering Link to 1200 vph

Changing % Trucks

8004	7	200	0	0	100	50
8002	5	700	10	0	100	50
8001	1	700	10	0	100	50
8003	6	200	0	0	100	50

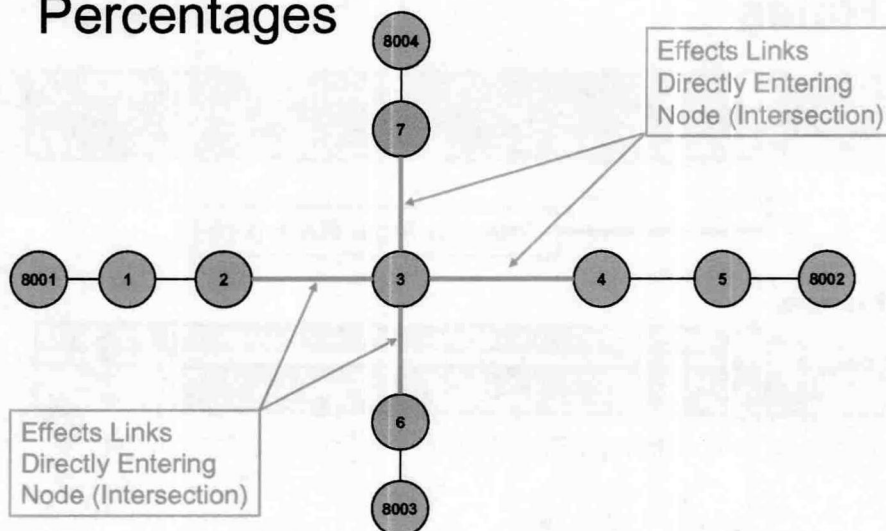
% Trucks

Example:

8004	7	200	0	0	100	50
8002	5	700	25	0	100	50
8001	1	700	10	0	100	50
8003	6	200	0	0	100	50

Changes % Trucks on WB Entering Link to 25%

Changing Turning Movement Percentages



Turning Movements -- Card Type 21

3	7	100				21
4	5	100				21
2	1	100				21
3	6	100				21
3	4	100				21
3	2	100				21
2	3	20	60	20	0	21
4	3	20	60	20	0	21
6	3	20	60	20	0	21
7	3	20	60	20	0	21
1	2	100				21
5	4	100				21
8002	5	100				21
8001	1	100				21
8004	7	100				21
8003	6	100				21

Entering Node

Card Type

Departing Node

Turning Movements -- Card Type 21 (Cont.)

3	7	100				21
4	5	100				21
2	1	100				21
3	6	100				21
3	4	100				21
3	2	100				21
2	3	20	60	20	0	21
4	3	20	60	20	0	21
6	3	20	60	20	0	21
7	3	20	60	20	0	21
1	2	100				21
5	4	100				21
8002	5	100				21
8001	1	100				21
8004	7	100				21
8003	6	100				21

% Diagonal

% Left-Turn

% Right-Turn

% Through

Changing Turning Movement Percentages

3	7	100					21
4	5	100					21
2	1	100					21
3	6	100					21
3	4	100					21
3	2	100					21
2	3	20	60	20	0		21
4	3	20	60	20	0		21
6	3	20	60	20	0		21
7	3	20	60	20	0		21
1	2	100					21
5	4	100					21
8002	5	100					21
8001	1	100					21
8004	7	100					21
8003	6	100					21

These cards describe turning movement percentages at the test intersection.

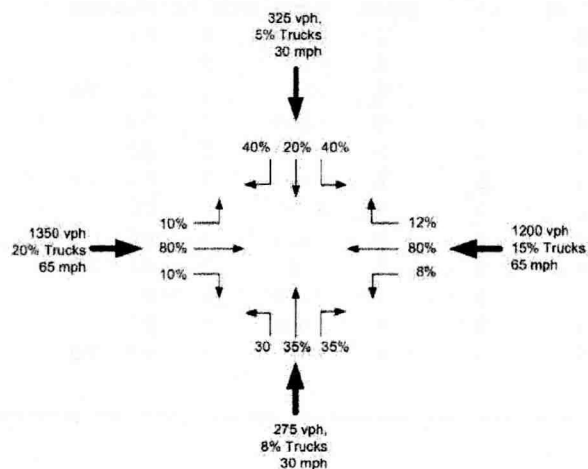
Changing Turning Movement Percentages -- Example

3	7	100					21
4	5	100					21
2	1	100					21
3	6	100					21
3	4	100					21
3	2	100					21
2	3	20	60	20	0		21
4	3	8	77	15	0		21
6	3	20	60	20	0		21
7	3	20	60	20	0		21
1	2	100					21
5	4	100					21
8002	5	100					21
8001	1	100					21
8004	7	100					21
8003	6	100					21

Changes turning movement distribution on WB approach to 8% Left-turns, 77% Through, and 15% Right-turns

Hands-On Practice

APPROACH VOLUME AND TURNING PERCENTAGES



Modifying Phasing

Default ".sdi" File

*	from	to	turn	type	contlr	phases
	7	3	T	Prot	1	P4
	7	3	R	Perm	1	P4
	7	3	L	P+P	1	P7 P4
	2	3	T	Prot	1	P2
	2	3	R	Perm	1	P2
	2	3	L	P+P	1	P5 P2
	4	3	T	Prot	1	P6
	4	3	R	Perm	1	P6
	4	3	L	P+P	1	P1 P6
	6	3	T	Prot	1	P8
	6	3	R	Perm	1	P8
	6	3	L	P+P	1	P3 P8

Protected Only Phasing

*	from	to	turn	type	contlr	phases
	7	3	T	Prot	1	P4
	7	3	R	Perm	1	P4
	7	3	L	P+P	1	P7 P4
	2	3	T	Prot	1	P2
	2	3	R	Perm	1	P2
	2	3	L	Prot	1	P5 
	4	3	T	Prot	1	P6
	4	3	R	Perm	1	P6
	4	3	L	Prot	1	P1 
	6	3	T	Prot	1	P8
	6	3	R	Perm	1	P8
	6	3	L	P+P	1	P3 P8

Permissive Only Phasing

* from	to	turn	type	ctrlr	phases
7	3	T	Prot	1	P4
7	3	R	Perm	1	P4
7	3	L	Perm	1	P4
2	3	T	Prot	1	P2
2	3	R	Perm	1	P2
2	3	L	P+P	1	P1 P2
4	3	T	Prot	1	P6
4	3	R	Perm	1	P6
4	3	L	P+P	1	P5 P6
6	3	T	Prot	1	P8
6	3	R	Perm	1	P8
6	3	L	Perm	1	P8

Overlaps

* from	to	turn	type	ctrlr	phases
7	3	T	Prot	1	P4
7	3	R	Perm	1	P4
7	3	L	P+P	1	P7 P4
2	3	T	Prot	1	P2
2	3	R	Prot	1	O1
2	3	L	P+P	1	P5 P2
4	3	T	Prot	1	P6
4	3	R	Perm	1	P6
4	3	L	P+P	1	P1 P6
6	3	T	Prot	1	P8
6	3	R	Perm	1	P8
6	3	L	P+P	1	P3 P8

Hands-On Practice

- E-W Protected Only Left-turn
- N-S Permissive Only Left-turn

Default:

* from	to	turn	type	cntl	phases
7	3	T	Prot	1	P4
7	3	R	Perm	1	P4
7	3	L	P+P	1	P7 P4
2	3	T	Prot	1	P2
2	3	R	Perm	1	P2
2	3	L	P+P	1	P5 P2
4	3	T	Prot	1	P6
4	3	R	Perm	1	P6
4	3	L	P+P	1	P1 P6
6	3	T	Prot	1	P8
6	3	R	Perm	1	P8
6	3	L	P+P	1	P3 P8

Change to:

* from	to	turn	type	cntl	phases
7	3	T	Prot	1	P4
7	3	R	Perm	1	P4
7	3	L	Perm	1	P4
2	3	T	Prot	1	P2
2	3	R	Perm	1	P2
2	3	L	Prot	1	P5
4	3	T	Prot	1	P6
4	3	R	Perm	1	P6
4	3	L	Prot	1	P1
6	3	T	Prot	1	P8
6	3	R	Perm	1	P8
6	3	L	Perm	1	P8

- Save as Pract2_Phasing

Modifying Detectors

Basic Detector Configuration

2	3	8	0	2	400	0	42
4	3	1	0	9999	10	0	42*
*This card is included as a work around for a programming error in TSIS.							
Do not remove.							
4	3	8	3200	26	60	0	42
4	3	8	4300	27	60	0	42
4	3	8	5400	28	60	0	42
4	3	8	0	6	400	0	42
4	3	7	0	1	400	0	42
2	3	8	3200	20	60	0	42
2	3	8	4300	21	60	0	42
2	3	8	5400	22	60	0	42
2	3	7	0	5	400	0	42
6	3	1	0	8	400	0	42
6	3	7	0	3	400	0	42
7	3	1	0	4	400	0	42
7	3	7	0	7	400	0	42

■ CORSIM Card Type 42

Basic Detectors Configuration

2	3	8	0	2	400	0	42
4	3	1	0	9999	10	0	42*
*This card is included as a work around for a programming error in TSIS.							
Do not remove.							
4	3	8	3200	26	60	0	42
4	3	8	4300	27	60	0	42
4	3	8	5400	28	60	0	42
4	3	8	0	6	400	0	42
4	3	7	0	1	400	0	42
2	3	8	3200	20	60	0	42
2	3	8	4300	21	60	0	42
2	3	8	5400	22	60	0	42
2	3	7	0	5	400	0	42
6	3	1	0	8	400	0	42
6	3	7	0	3	400	0	42
7	3	1	0	4	400	0	42
7	3	7	0	7	400	0	42

DO NOT REMOVE THESE LINES !!!

Basic Detector Configuration

2	3	8	0	2	400	0	42
4	3	1	0	9999	10	0	42*
*This card is included as a work around for a programming error in TSIS. Do not remove.							
4	3	8	3200	26	60	0	42
4	3	8	4300	27	60	0	42
4	3	8	5400	28	60	0	42
4	3	8	0	6	400	0	42
4	3	7	0	1	400	0	42
2	3	8	3200	20	60	0	42
2	3	8	4300	21	60	0	42
2	3	8	5400	22	60	0	42
2	3	7	0	5	400	0	42
6	3	1	0	8	400	0	42
6	3	7	0	3	400	0	42
7	3	1	0	4	400	0	42
7	3	7	0	7	400	0	42

Multi-Loop Detectors for High
Speed Approach

Basic Detector Configuration

2	3	8	0	2	400	0	42
4	3	1	0	9999	10	0	42*
*This card is included as a work around for a programming error in TSIS. Do not remove.							
4	3	8	3200	26	60	0	42
4	3	8	4300	27	60	0	42
4	3	8	5400	28	60	0	42
4	3	8	0	6	400	0	42
4	3	7	0	1	400	0	42
2	3	8	3200	20	60	0	42
2	3	8	4300	21	60	0	42
2	3	8	5400	22	60	0	42
2	3	7	0	5	400	0	42
6	3	1	0	8	400	0	42
6	3	7	0	3	400	0	42
7	3	1	0	4	400	0	42
7	3	7	0	7	400	0	42

Long-Loop (40') Stop Bar
Detectors

Modifying Detector Configuration

2	3	8	0	2	400	0	42
4	3	1	0	9999	10	0	42*
*This card is included as a work around for a programming error in TSIS.							
Do not remove.							
4	3	8	3200	26	60	0	42
4	3	8	4300	27	60	0	42
4	3	8	5400	28	60	0	42
4	3	8	0	6	400	0	42
4	3	7	0	1	400	0	42
2	3	8	3200	20	60	0	42
2	3	8	4300	21	60	0	42
2	3	8	5400	22	60	0	42
2	3	7	0	5	400	0	42
6	3	1	0	8	400	0	42
6	3	7	0	3	400	0	42
7	3	1	0	4	400	0	42
7	3	7	0	7	400	0	42

Lane Covered: 1=Through
7= Left-turn
8=All-lanes

Downstream Node

Upstream Node

Modifying Detector Configuration

2	3	8	0	2	400	0	42
4	3	1	0	9999	10	0	42*
*This card is included as a work around for a programming error in TSIS.							
Do not remove.							
4	3	8	3200	26	60	0	42
4	3	8	4300	27	60	0	42
4	3	8	5400	28	60	0	42
4	3	8	0	6	400	0	42
4	3	7	0	1	400	0	42
2	3	8	3200	20	60	0	42
2	3	8	4300	21	60	0	42
2	3	8	5400	22	60	0	42
2	3	7	0	5	400	0	42
6	3	1	0	8	400	0	42
6	3	7	0	3	400	0	42
7	3	1	0	4	400	0	42
7	3	7	0	7	400	0	42

Operating Mode: 0=Presence

Detector Length (tenths of feet)

Detector Number

Distance from
Stop Bar
(tenths of feet)

Deleting Detectors

2	3	8	0	2	400	0	42
4	3	1	0	9999	10	0	42*
*This card is included as a work around for a programming error in TSIS.							
Do not remove.							
4	3	8	3200	26	60	0	42
4	3	8	4300	27	60	0	42
4	3	8	5400	28	60	0	42
4	3	8	0	6	400	0	42
4	3	7	0	1	400	0	42
2	3	8	3200	20	60	0	42
2	3	8	4300	21	60	0	42
2	3	8	5400	22	60	0	42
2	3	7	0	5	400	0	42
6	3	1	0	8	400	0	42
6	3	7	0	3	400	0	42
7	3	1	0	4	400	0	42
7	3	7	0	7	400	0	42

Simply remove "42" from last column

Adding Detectors

2	3	8	0	2	400	0	42
4	3	1	0	9999	10	0	42*
*This card is included as a work around for a programming error in TSIS.							
Do not remove.							
4	3	8	3200	26	60	0	42
4	3	8	4300	27	60	0	42
4	3	8	5400	28	60	0	42
4	3	8	0	6	400	0	42
4	3	7	0	1	400	0	42
2	3	8	3200	20	60	0	42
2	3	8	4300	21	60	0	42
2	3	8	5400	22	60	0	42
2	3	7	0	5	400	0	42
6	3	1	0	8	400	0	42
6	3	7	0	3	400	0	42
6	3	8	1000	10	60	0	42
7	3	1	0	4	400	0	42
7	3	7	0	7	400	0	42

Example: Adds a 6' detector across all lanes 100 ft upstream of stop bar on NB approach. Label as Detector 10.

DON'T FORGET TO CHANGE .INI File !!!

Adding Detector – Changing .INI File

```
NumberOfMappedDetectors = 18
MappedDetector[1] = SimulationDetector[1]->RealDetector[1]
MappedDetector[2] = SimulationDetector[2]->RealDetector[2]
MappedDetector[3] = SimulationDetector[3]->RealDetector[3]
MappedDetector[4] = SimulationDetector[4]->RealDetector[4]
MappedDetector[5] = SimulationDetector[5]->RealDetector[5]
MappedDetector[6] = SimulationDetector[6]->RealDetector[6]
MappedDetector[7] = SimulationDetector[7]->RealDetector[7]
MappedDetector[8] = SimulationDetector[8]->RealDetector[8]
MappedDetector[9] = SimulationDetector[9]->RealDetector[6]
MappedDetector[10] = SimulationDetector[10]->RealDetector[6]
MappedDetector[11] = SimulationDetector[11]->RealDetector[11]
MappedDetector[12] = SimulationDetector[12]->RealDetector[12]
MappedDetector[13] = SimulationDetector[20]->RealDetector[2]
MappedDetector[14] = SimulationDetector[21]->RealDetector[2]
MappedDetector[15] = SimulationDetector[22]->RealDetector[2]
MappedDetector[16] = SimulationDetector[26]->RealDetector[6]
MappedDetector[17] = SimulationDetector[27]->RealDetector[6]
MappedDetector[18] = SimulationDetector[28]->RealDetector[6]
```

Changing Multi-Loop Spacing

2	3	8	0	2	400	0	42
4	3	1	0	9999	10	0	42*
*This card is included as a work around for a programming error in TSIS.							
Do not remove.							
4	3	8		26	60	0	42
4	3	8		27	60	0	42
4	3	8		28	60	0	42
4	3	8	0	6	400	0	42
4	3	7	0	1	400	0	42
2	3	8		20	60	0	42
2	3	8		21	60	0	42
2	3	8		22	60	0	42
2	3	7	0	5	400	0	42
6	3	1	0	8	400	0	42
6	3	7	0	3	400	0	42
7	3	1	0	4	400	0	42
7	3	7	0	7	400	0	42

- Default spacing for 65 mph
- Example: change for 60 mph

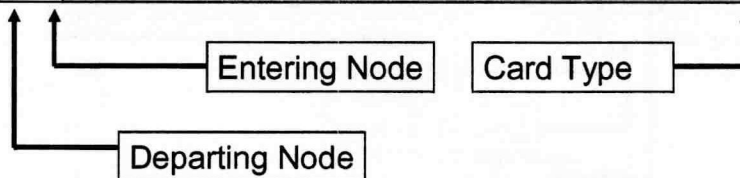
Hands-On Practice

- Add 6x6 loop on NB and SB approaches 150 ft from stop line
- Change spacing on dilemma zone loops to 60 mph
- Delete stop bar detectors on EB and WB through lanes
- Save as "Pract3_detectors"

Modifying Geometry

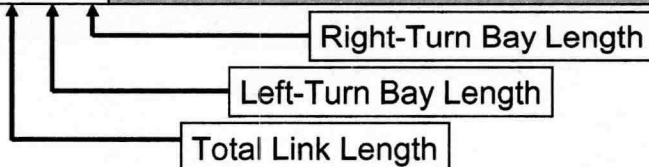
Geometry -- Card Type 11

3	7	500	1	010	8004	20	18	30	0	11	
4	5	640	2	0100	8002	20	18	65	0	11	
2	1	640	2	0100	8001	20	18	65	0	11	
3	6	500	1	010	8003	20	18	30	0	11	
3	4	2000	2	0100	5	20	18	65	0	11	
3	2	2000	2	0100	1	20	18	65	0	11	
2	3	2000 250	2 1	0100	7 4 6	4	20	18	65	0	11
4	3	2000 250	2 1	0100	6 2 7	2	20	18	65	0	11
6	3	500 250	1 1	010	2 7 4	7	20	18	30	0	11
7	3	500 250	1 1	010	4 6 2	6	20	18	30	0	11
1	2	640	2	0100	3	20	18	65	0	11	
5	4	640	2	0100	3	20	18	65	0	11	
8002	5		2	0100	4	20	18		0	11	
8001	1		2	0100	2	20	18		0	11	
8004	7		1	010	3	20	18		0	11	
8003	6		1	010	3	20	18		0	11	



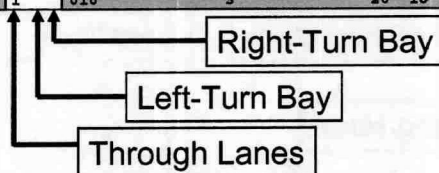
Lengths -- Card Type 11 (Cont.)

3	7	500	1	010	8004	20	18	30	0	11	
4	5	640	2	0100	8002	20	18	65	0	11	
2	1	640	2	0100	8001	20	18	65	0	11	
3	6	500	1	010	8003	20	18	30	0	11	
3	4	2000	2	0100	5	20	18	65	0	11	
3	2	2000	2	0100	1	20	18	65	0	11	
2	3	2000 250	2 1	0100	7 4 6	4	20	18	65	0	11
4	3	2000 250	2 1	0100	6 2 7	2	20	18	65	0	11
6	3	500 250	1 1	010	2 7 4	7	20	18	30	0	11
7	3	500 250	1 1	010	4 6 2	6	20	18	30	0	11
1	2	640	2	0100	3	20	18	65	0	11	
5	4	640	2	0100	3	20	18	65	0	11	
8002	5		2	0100	4	20	18			11	
8001	1		2	0100	2	20	18			11	
8004	7		1	010	3	20	18			11	
8003	6		1	010	3	20	18			11	



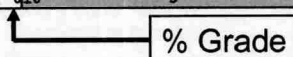
Number of Lanes -- Card Type 11 (Cont.)

3	7	500	1	010	8004	20	18	30	0	11		
4	5	640	2	0100	8002	20	18	65	0	11		
2	1	640	2	0100	8001	20	18	65	0	11		
3	6	500	1	010	8003	20	18	30	0	11		
3	42000		2	0100	5	20	18	65	0	11		
3	22000		2	0100	1	20	18	65	0	11		
2	32000	250	2 1	0100	7 4 6	4	20	18	65	0	11	
4	32000	250	2 1	0100	6 2 7	2	20	18	65	0	11	
6	3	500	250	1 1	010	2 7 4	7	20	18	30	0	11
7	3	500	250	1 1	010	4 6 2	6	20	18	30	0	11
1	2	640		2	0100	3	20	18	65	0	11	
5	4	640		2	0100	3	20	18	65	0	11	
8002	5		2	0100	4	20	18		0	11		
8001	1		2	0100	2	20	18		0	11		
8004	7		1	010	3	20	18		0	11		
8003	6		1	010	3	20	18		0	11		



Approach Grade -- Card Type 11 (Cont.)

3	7	500	1	010	8004	20	18	30	0	11	
4	5	640	2	0100	8002	20	18	65	0	11	
2	1	640	2	0100	8001	20	18	65	0	11	
3	6	500	1	010	8003	20	18	30	0	11	
3	42000		2	0100	5	20	18	65	0	11	
3	22000		2	0100	1	20	18	65	0	11	
2	32000	250	2 1	0100	7 4 6	4	20	18	65	0	11
4	32000	250	2 1	0100	6 2 7	2	20	18	65	0	11
6	3	500	250 1 1	010	2 7 4	7	20	18	30	0	11
7	3	500	250 1 1	010	4 6 2	6	20	18	30	0	11
1	2	640		2 0100	3	20	18	65	0	11	
5	4	640		2 0100	3	20	18	65	0	11	
8002	5			2 0100	4	20	18		0	11	
8001	1			2 0100	2	20	18		0	11	
8004	7			1 010	3	20	18		0	11	
8003	6			1 010	3	20	18		0	11	



Queue Discharge and Start-up Lost Time -- Card Type 11 (Cont.)

3	7	500	1	010	8004	20	18	30	0	11					
4	5	640	2	0100	8002	20	18	65	0	11					
2	1	640	2	0100	8001	20	18	65	0	11					
3	6	500	1	010	8003	20	18	30	0	11					
3	42000	2	0100	5		20	18	65	0	11					
3	22000	2	0100	1		20	18	65	0	11					
2	32000	250	2	1	0100	7	4	6	4	20	18	65	0	11	
4	32000	250	2	1	0100	6	2	7	2	20	18	65	0	11	
6	3	500	250	1	1	010	2	7	4	7	20	18	30	0	11
7	3	500	250	1	1	010	4	6	2	6	20	18	30	0	11
1	2	640	2	0100						20	18	65	0	11	
5	4	640	2	0100						20	18	65	0	11	
8002	5	2	0100							20	18	0	11		
8001	1	2	0100							20	18	0	11		
8004	7	1	010							20	18	0	11		
8003	6	1	010							20	18	0	11		

Queue Discharges and Start-up Lost Time Distribution Characteristic Code

Permitted Movements by Lane -- Card Type 11 (Cont.)

3	7	500	1	010	8004	20	18	30	0	11					
4	5	640	2	0100	8002	20	18	65	0	11					
2	1	640	2	0100	8001	20	18	65	0	11					
3	6	500	1	010	8003	20	18	30	0	11					
3	42000	2	0100	5		20	18	65	0	11					
3	22000	2	0100	1		20	18	65	0	11					
2	32000	250	2	1	0100	7	4	6	4	20	18	65	0	11	
4	32000	250	2	1	0100	6	2	7	2	20	18	65	0	11	
6	3	500	250	1	1	010	2	7	4	7	20	18	30	0	11
7	3	500	250	1	1	010	4	6	2	6	20	18	30	0	11
1	2	640	2	0100	3		20	18	65	0	11				
5	4	640	2	0100	3		20	18	65	0	11				
8002	5	2	0100	4		20	18	0	11						
8001	1	2	0100	2		20	18	0	11						
8004	7	1	010	3		20	18	0	11						
8003	6	1	010	3		20	18	0	11						

Channelization Codes

SHARED LANES ONLY -- NOT NEEDED if turn pockets used!!

Channelization Codes

CODE	MEANING
0 (or blank)	Unchannelized
1	Left turn only
2	Buses only
3	Closed
4	Right turn only
5	Carpool only
6	Carpools and buses only
7	Right turns + right diagonal; right turns + through; also right turns + right diagonal + through if no other lane allows the through movement
8	Left turns + left diagonal; left turns + through; also left turns + left diagonal + through if no other lane allows the through movement
9	All movements permitted by the geometry and adjacent lane
D	Diagonal traffic only
T	Through traffic only

Receiving Nodes -- Card Type 11 (Cont.)

3	7	500	1	010	8004	20	18	30	0	11					
4	5	640	2	0100	8002	20	18	65	0	11					
2	1	640	2	0100	8001	20	18	65	0	11					
3	6	500	1	010	8003	20	18	30	0	11					
3	42000	2	0100	5		20	18	65	0	11					
3	22000	2	0100	1		20	18	65	0	11					
2	32000	250	2	1	0100	7	4	6	4	20	18	65	0	11	
4	32000	250	2	1	0100	6	2	7	2	20	18	65	0	11	
6	3	500	250	1	1	010	2	7	4	7	20	18	30	0	11
7	3	500	250	1	1	010	4	6	2	6	20	18	30	0	11
1	2	640	2	0100	3				3	20	18	65	0	11	
5	4	640	2	0100	3				3	20	18	65	0	11	
8002	5	2	0100	4					4	20	18	0	11		
8001	1	2	0100	2					2	20	18	0	11		
8004	7	1	010	3					3	20	18	0	11		
8003	6	1	010	3					3	20	18	0	11		

Left-Turns

Right-Turns

Throughs

Opposing Left-Turns -- Card Type 11 (Cont.)

3	7	500	1	010	8004			20	18	30	0	11			
4	5	640	2	0100	8002			20	18	65	0	11			
2	1	640	2	0100	8001			20	18	65	0	11			
3	6	500	1	010	8003			20	18	30	0	11			
3	42000	2	0100		5			20	18	65	0	11			
3	22000	2	0100		1			20	18	65	0	11			
2	32000	250	2	1	0100	7	4	6	4	20	18	65	0	11	
4	32000	250	2	1	0100	6	2	7	2	20	18	65	0	11	
6	3	500	250	1	1	010	2	7	4	7	20	18	30	0	11
7	3	500	250	1	1	010	4	6	2	6	20	18	30	0	11
1	2	640	2	0100				3	20	18	65	0	11		
5	4	640	2	0100				3	20	18	65	0	11		
8002	5	2	0100					4	20	18	0	11			
8001	1	2	0100					2	20	18	0	11			
8004	7	1	010					3	20	18	0	11			
8003	6	1	010					3	20	18	0	11			

Upstream node for traffic
opposing left-turn

Mean Values -- Card Type 11 (Cont.)

3	7	500	1	010	8004	20	18	30	0	11					
4	5	640	2	0100	8002	20	18	65	0	11					
2	1	640	2	0100	8001	20	18	65	0	11					
3	6	500	1	010	8003	20	18	30	0	11					
3	42000	2	0100	5		20	18	65	0	11					
3	22000	2	0100	1		20	18	65	0	11					
2	32000	250	2	1	0100	7	4	6	4	20	18	65	0	11	
4	32000	250	2	1	0100	6	2	7	2	20	18	65	0	11	
6	3	500	250	1	1	010	2	7	4	7	20	18	30	0	11
7	3	500	250	1	1	010	4	6	2	6	20	18	30	0	11
1	2	640	2	0100	3		20	18	65	0	11				
5	4	640	2	0100	3		20	18	65	0	11				
8002	5	2	0100	4		20	18		0	11					
8001	1	2	0100	2		20	18		0	11					
8004	7	1	010	3		20	18		0	11					
8003	6	1	010	3		20	18		0	11					

Start-Up Lost Time

Queue Discharge Headway

Link Speeds -- Card Type 11 (Cont.)

3	7 500	1	010	8004			20 18	30	0	11
4	5 640	2	0100	8002			20 18	65	0	11
2	1 640	2	0100	8001			20 18	65	0	11
3	6 500	1	010	8003			20 18	30	0	11
3	42000	2	0100	5			20 18	65	0	11
3	22000	2	0100	1			20 18	65	0	11
2	32000 250	2 1	0100	7 4 6		4	20 18	65	0	11
4	32000 250	2 1	0100	6 2 7		2	20 18	65	0	11
6	3 500 250	1 1	010	2 7 4		7	20 18	30	0	11
7	3 500 250	1 1	010	4 6 2		6	20 18	30	0	11
1	2 640	2	0100	3			20 18	65	0	11
5	4 640	2	0100	3			20 18	65	0	11
8002	5	2	0100	4			20 18	0	0	11
8001	1	2	0100	2			20 18	0	0	11
8004	7	1	010	3			20 18	0	0	11
8003	6	1	010	3			20 18	0	0	11

Desired Free-Flow
Speed (mph)

Fields Most Likely to be Changed

3	7	500	1	010	8004	20	18	30	0	11
4	5	640	2	0100	8002	20	18	65	0	11
2	1	640	2	0100	8001	20	18	65	0	11
3	6	500	1	010	8003	20	18	30	0	11
3	42000	2	0100	5		20	18	65	0	11
3	22000	2	0100	1		20	18	65	0	11
2	32000 250	2 1	0100	7 4 6	4 20	18	65	0	11	
4	32000 250	2 1	0100	6 2 7	2 20	18	65	0	11	
6	3 500 250	1 1	010	2 7 4	7 20	18	30	0	11	
7	3 500 250	1 1	010	4 6 2	6 20	18	30	0	11	
1	2 640	2	0100	3	20	18	65	0	11	
5	4 640	2	0100	3	20	18	65	0	11	
8002	5	2	0100	4	20	18	0	11		
8001	1	2	0100	2	20	18	0	11		
8004	7	1	010	3	20	18	0	11		
8003	6	1	010	3	20	18	0	11		

- Link and Turn Bay Lengths
- Number of Lanes and Bays
- Approach Speeds
- Channelization Codes (possibly)

Lines where most
changes will be
made.

Adding Right-Turn Lane

Example: Add Right-turn lane to NB Approach

3	7	500	1	010	8004			20	18	30	0	11	
4	5	640	2	0100	8002			20	18	65	0	11	
2	1	640	2	0100	8001			20	18	65	0	11	
3	6	500	1	010	8003			20	18	30	0	11	
3	42000		2	0100	5			20	18	65	0	11	
3	22000		2	0100	1			20	18	65	0	11	
2	32000	250	2	1 0100	7	4	6	4	20	18	65	0	11
4	32000	250	2	1 0100	6	2	7	2	20	18	65	0	11
6	3	500	250	1 1 010	2	7	4	7	20	18	30	0	11
7	3	500	250	1 1 010	4	6	2	6	20	18	30	0	11

Adds Right Turn Lane

Right-Turn Bay Length

Adding Dual Left-Turns

Example: Add Left-turn lane to WB Approach

3	7	500	1	010	8004			20	18	30	0	11	
4	5	640	2	0100	8002			20	18	65	0	11	
2	1	640	2	0100	8001			20	18	65	0	11	
3	6	500	1	010	8003			20	18	30	0	11	
3	42000		2	0100	5			20	18	65	0	11	
3	22000		2	0100	1			20	18	65	0	11	
2	32000	250	2	1 0100	7	4	6	4	20	18	65	0	11
4	32000	250	2	1 0100	6	2	7	2	20	18	65	0	11
6	3	500	250	1 1 010	2	7	4	7	20	18	30	0	11
7	3	500	250	1 1 010	4	6	2	6	20	18	30	0	11

Change number of
lanes in left-turn bay

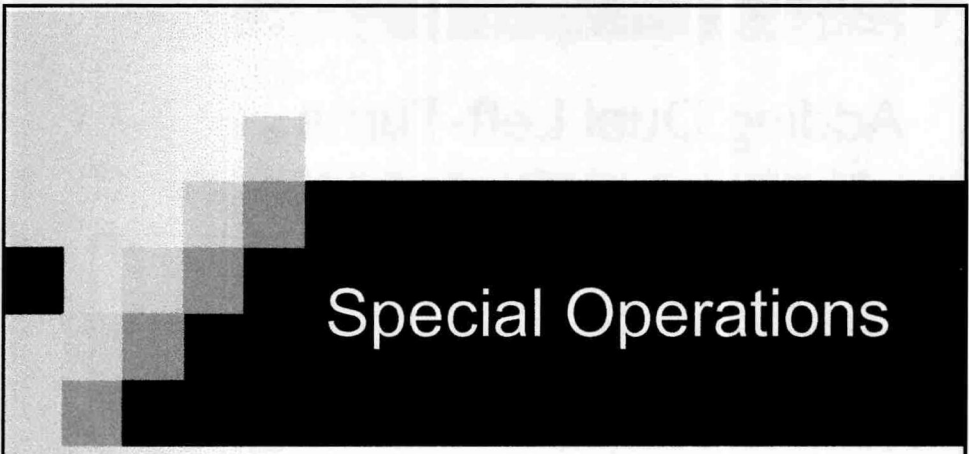
NOTE: Destination link also
need to be changed to
accept dual lefts

ALSO NEED TO CHANGE .sdi FILE TO "PROTECTED ONLY"



Hands-On Practice

- Add right-turn lane to NB approach
- Make dual left-turns for WB/EB approach
- Save as Pract3_Geometry



Special Operations

Diamonds

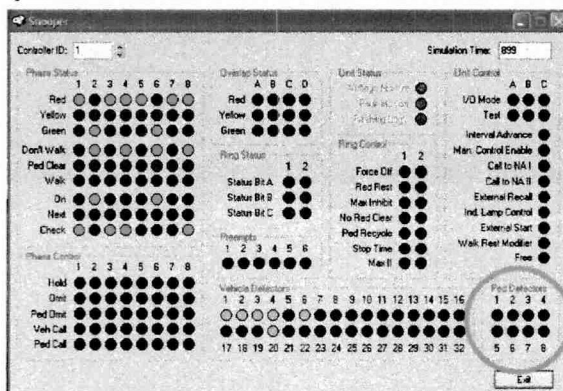
- Set Controller in Diamond mode
- Modify .ini file to correct diamond configuration

```

MappedDetector[13] = SimulationDetector[20]->RealDetector[8]
MappedDetector[14] = SimulationDetector[21]->RealDetector[8]
MappedDetector[15] = SimulationDetector[22]->RealDetector[8]
MappedDetector[16] = SimulationDetector[26]->RealDetector[4]
MappedDetector[17] = SimulationDetector[27]->RealDetector[4]
MappedDetector[18] = SimulationDetector[28]->RealDetector[4]
    
```

Pedestrians

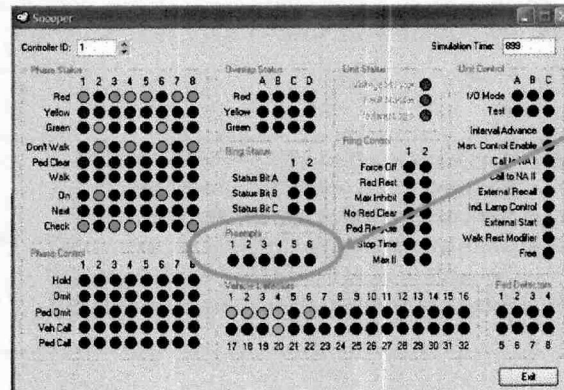
- Use Snooper to manually toggle when pedestrian calls to controller



Click on appropriate *Ped Detector* to place ped call on associated with phase

Preemption

- Use Snooper to manually toggle when preemption to occur



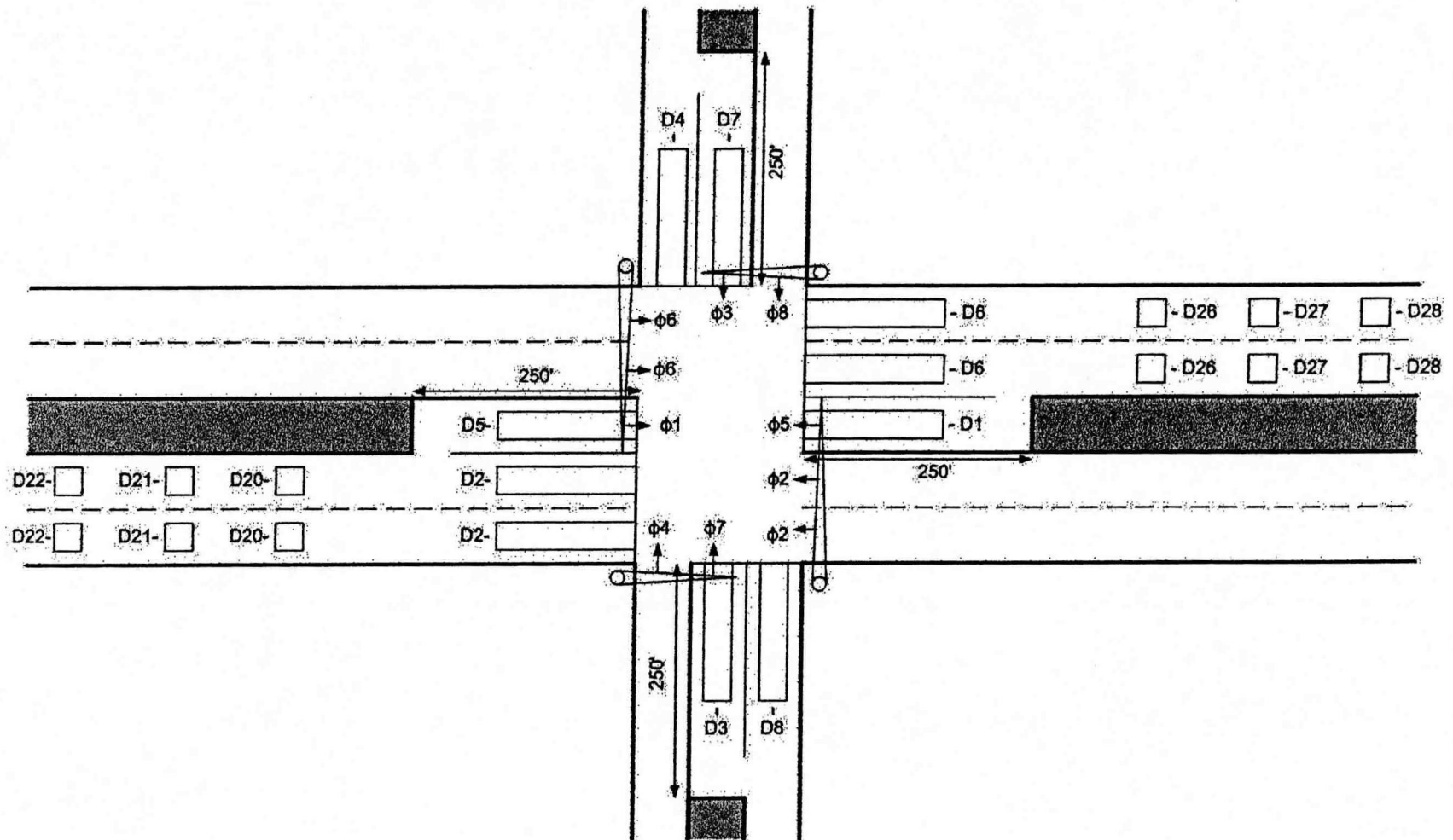
Click on appropriate *Preempts* to place preempt call

Note: High Priority Preempts only

Questions

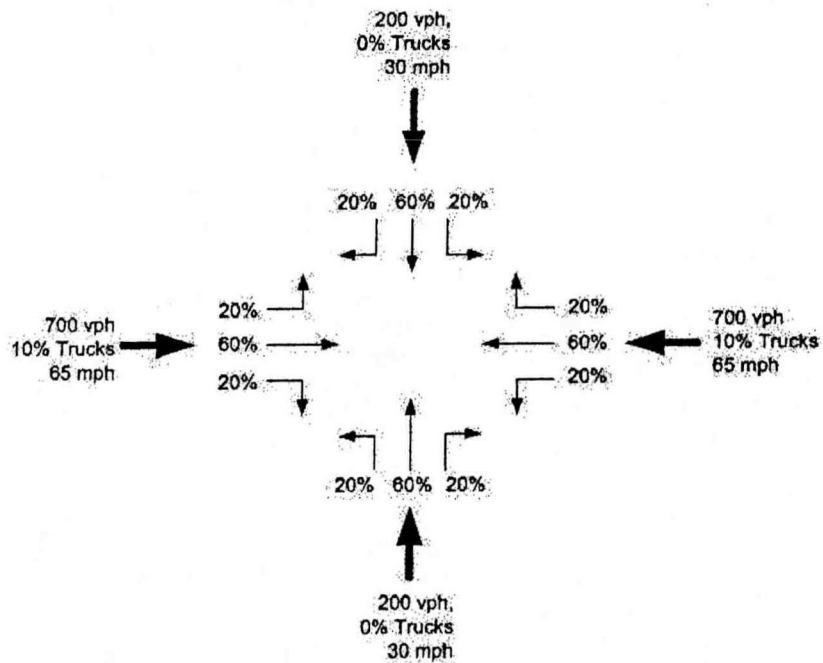
**SCHEMATIC AND
PRINTOUT OF SIMULATION FILE
FOR
STANDARD 4-LEG INTERSECTION**

SCHEMATIC OF EXAMPLE OF STANDARD 4-LEG INTERSECTION WITH MULTI-LOOP DETECTORS



SCHEMATIC OF EXAMPLE OF STANDARD 4-LEG INTERSECTION WITH MULTI-LOOP DETECTORS (CONT.)

APPROACH VOLUME AND TURNING PERCENTAGES



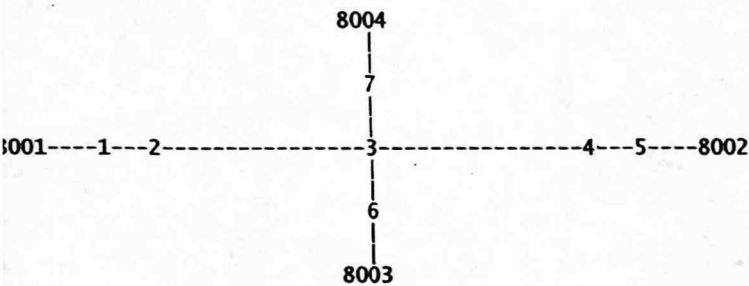
DETECTOR DETAILS

Detector Name	Size	Associated Phase	Operation Mode	Distance From Stop Bar	Function
D1	6'x40'	φ1	Presence	0'	Call & Extend
D2	6'x40'	φ2	Presence	0'	Call & Extend
D3	6'x40'	φ3	Presence	0'	Call & Extend
D4	6'x40'	φ4	Presence	0'	Call & Extend
D5	6'x40'	φ5	Presence	0'	Call & Extend
D6	6'x40'	φ6	Presence	0'	Call & Extend
D7	6'x40'	φ7	Presence	0'	Call & Extend
D8	6'x40'	φ8	Presence	0'	Call & Extend
D20	6'x6'	φ2	Presence	320'	Call & Extend
D21	6'x6'	φ2	Presence	430'	Call & Extend
D22	6'x6'	φ2	Presence	540'	Call & Extend
D26	6'x6'	φ6	Presence	320'	Call & Extend
D27	6'x6'	φ6	Presence	430'	Call & Extend
D28	6'x6'	φ6	Presence	540'	Call & Extend

by TSIS Wed Jan 29 09:27:16 2003 from TNO Version 52

.6 a test configuration for algorithm testing,

k-node diagram is shown below:



2,3) and (3,4) are 2000' long; links (1,2) and (4,5) are 640' long

2 and 4 were included to investigate the effects of relatively intersections (sometime in the future).

78 1 2345678 2 2345678 3 2345678 4 2345678 5 2345678 6 2345678 7 234567

1	0	3	7981 0000	21	3 800	7729	7529
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[illegible]11
11
11
11
11
11

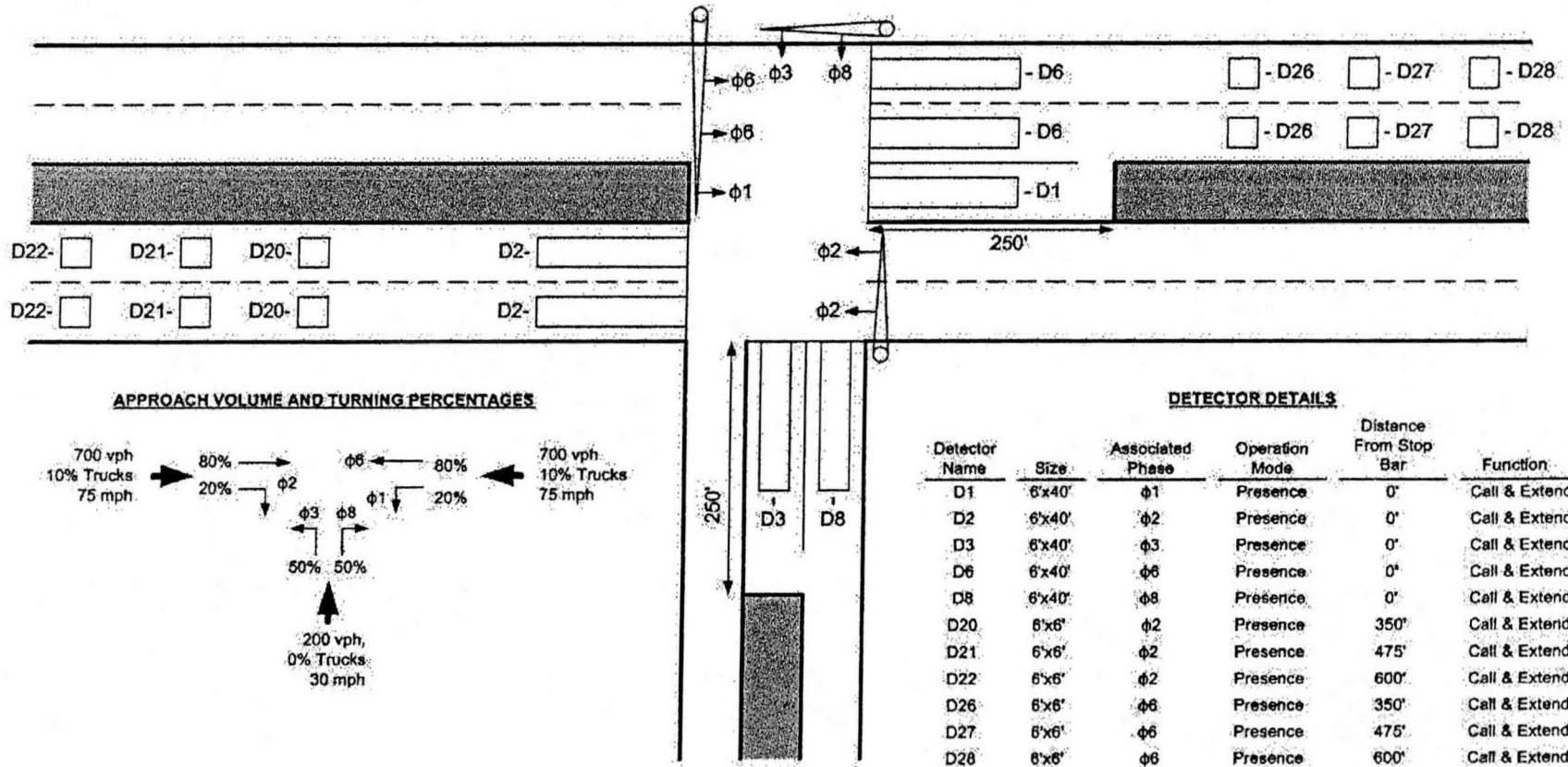
3	8	0	2	400	0
3	1	0	9999	10	0
nd for a programming error in TSIS. Do not remove.					
3	8	3200	26	60	0
3	8	4300	27	60	0
3	8	5400	28	60	0
3	8	0	6	400	0
3	7	0	1	400	0
3	8	3200	20	60	0
3	8	4300	21	60	0

[illegible]

This card is included as a work

**SCHEMATIC AND
PRINTOUT OF SIMULATION FILE
FOR
STANDARD T-INTERSECTION**

SCHEMATIC OF EXAMPLE OF T-INTERSECTION WITH MULTI-LOOP DETECTORS



6
8003

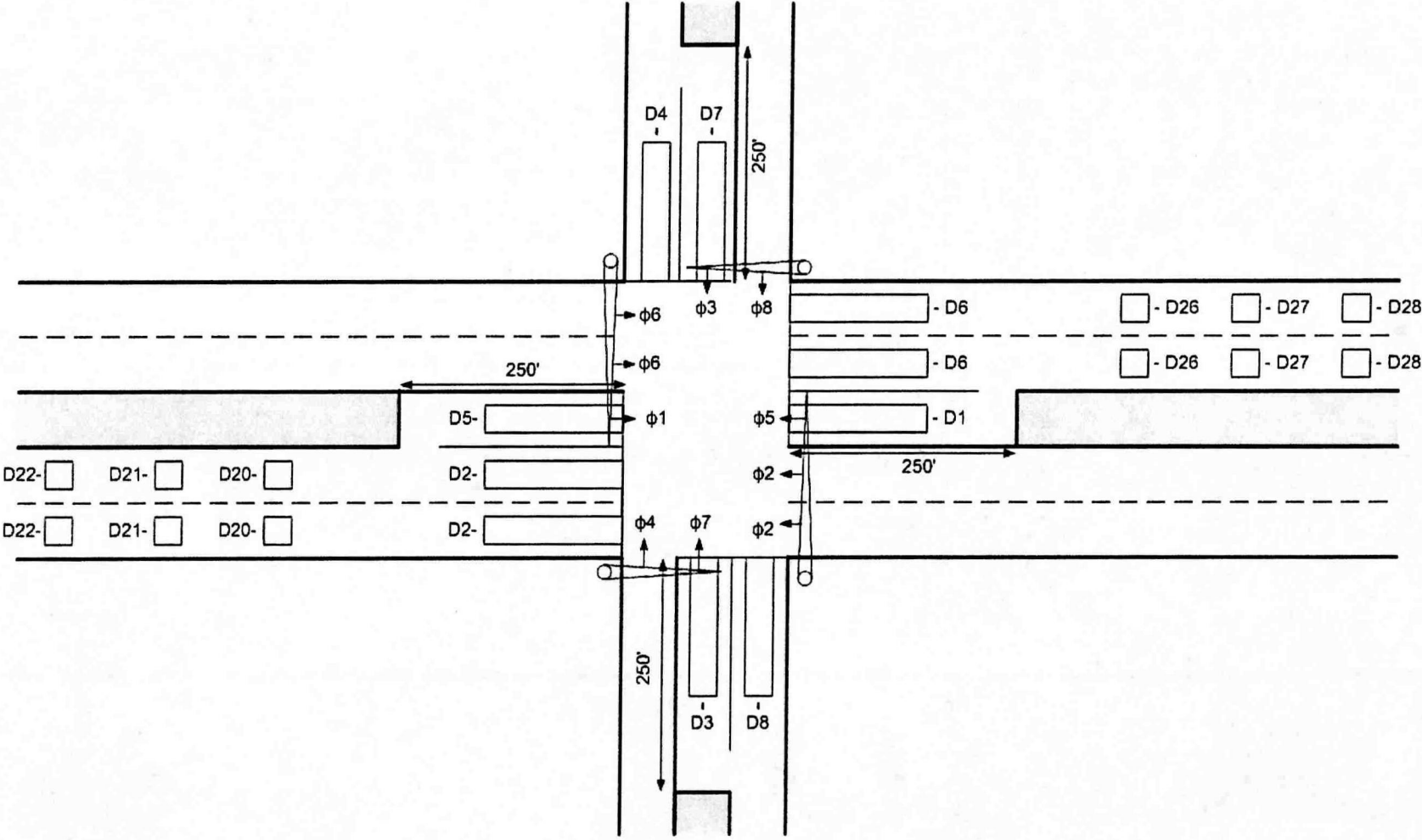
[illegible]

Page 1

**SCHEMATIC AND
PRINTOUT OF SIMULATION FILE
FOR
STANDARD DIAMOND INTERCHANGE**

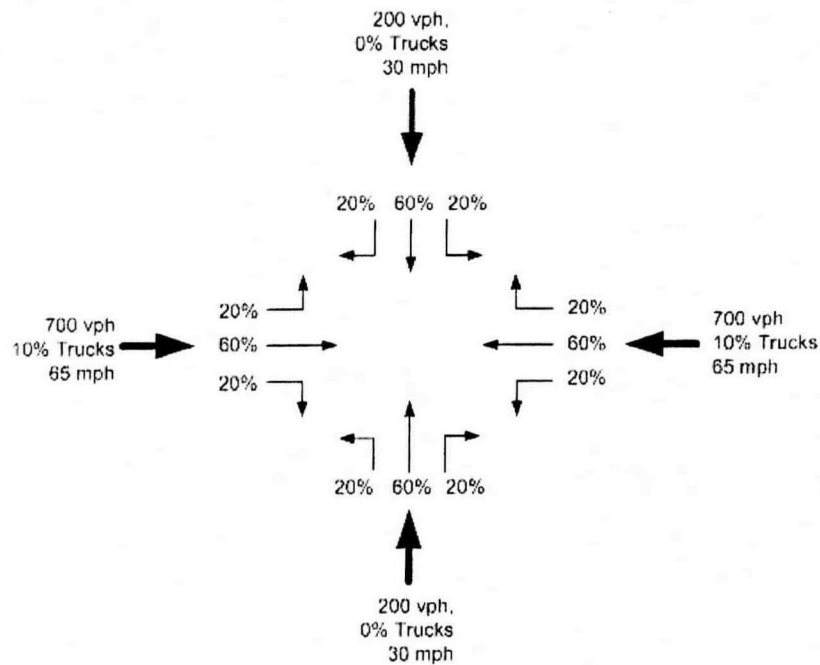
**SCHEMATIC AND
PRINTOUT OF SIMULATION FILE
FOR
STANDARD 4-LEG INTERSECTION**

SCHEMATIC OF EXAMPLE OF STANDARD 4-LEG INTERSECTION WITH MULTI-LOOP DETECTORS



SCHEMATIC OF EXAMPLE OF STANDARD 4-LEG INTERSECTION WITH MULTI-LOOP DETECTORS (CONT.)

APPROACH VOLUME AND TURNING PERCENTAGES



DETECTOR DETAILS

Detector Name	Size	Associated Phase	Operation Mode	Distance From Stop Bar	Function
D1	6'x40'	φ1	Presence	0'	Call & Extend
D2	6'x40'	φ2	Presence	0'	Call & Extend
D3	6'x40'	φ3	Presence	0'	Call & Extend
D4	6'x40'	φ4	Presence	0'	Call & Extend
D5	6'x40'	φ5	Presence	0'	Call & Extend
D6	6'x40'	φ6	Presence	0'	Call & Extend
D7	6'x40'	φ7	Presence	0'	Call & Extend
D8	6'x40'	φ8	Presence	0'	Call & Extend
D20	6'x6'	φ2	Presence	320'	Call & Extend
D21	6'x6'	φ2	Presence	430'	Call & Extend
D22	6'x6'	φ2	Presence	540'	Call & Extend
D26	6'x6'	φ6	Presence	320'	Call & Extend
D27	6'x6'	φ6	Presence	430'	Call & Extend
D28	6'x6'	φ6	Presence	540'	Call & Extend

and 4 were included to investigate the effects of relatively intersections (sometime in the future).

1	2345678	2	2345678	3	2345678	4	2345678	5	2345678	6	2345678	7	2345678	8	2345678	9	2345678	10	2345678	11	2345678	12	2345678	13	2345678	14	2345678	15	2345678	16	2345678	17	2345678	18	2345678	19	2345678	20	2345678	21	2345678	22	2345678	23	2345678	24	2345678	25	2345678	26	2345678	27	2345678	28	2345678	29	2345678	30	2345678	31	2345678	32	2345678	33	2345678	34	2345678	35	2345678	36	2345678	37	2345678	38	2345678	39	2345678	40	2345678	41	2345678	42	2345678	43	2345678	44	2345678	45	2345678	46	2345678	47	2345678	48	2345678	49	2345678	50	2345678	51	2345678	52	2345678	53	2345678	54	2345678	55	2345678	56	2345678	57	2345678	58	2345678	59	2345678	60	2345678	61	2345678	62	2345678	63	2345678	64	2345678	65	2345678	66	2345678	67	2345678	68	2345678	69	2345678	70	2345678	71	2345678	72	2345678	73	2345678	74	2345678	75	2345678	76	2345678	77	2345678	78	2345678	79	2345678	80	2345678	81	2345678	82	2345678	83	2345678	84	2345678	85	2345678	86	2345678	87	2345678	88	2345678	89	2345678	90	2345678	91	2345678	92	2345678	93	2345678	94	2345678	95	2345678	96	2345678	97	2345678	98	2345678	99	2345678	100	2345678	101	2345678	102	2345678	103	2345678	104	2345678	105	2345678	106	2345678	107	2345678	108	2345678	109	2345678	110	2345678	111	2345678	112	2345678	113	2345678	114	2345678	115	2345678	116	2345678	117	2345678	118	2345678	119	2345678	120	2345678	121	2345678	122	2345678	123	2345678	124	2345678	125	2345678	126	2345678	127	2345678	128	2345678	129	2345678	130	2345678	131	2345678	132	2345678	133	2345678	134	2345678	135	2345678	136	2345678	137	2345678	138	2345678	139	2345678	140	2345678	141	2345678	142	2345678	143	2345678	144	2345678	145	2345678	146	2345678	147	2345678	148	2345678	149	2345678	150	2345678	151	2345678	152	2345678	153	2345678	154	2345678	155	2345678	156	2345678	157	2345678	158	2345678	159	2345678	160	2345678	161	2345678	162	2345678	163	2345678	164	2345678	165	2345678	166	2345678	167	2345678	168	2345678	169	2345678	170	2345678	171	2345678	172	2345678	173	2345678	174	2345678	175	2345678	176	2345678	177	2345678	178	2345678	179	2345678	180	2345678	181	2345678	182	2345678	183	2345678	184	2345678	185	2345678	186	2345678	187	2345678	188	2345678	189	2345678	190	2345678	191	2345678	192	2345678	193	2345678	194	2345678	195	2345678	196	2345678	197	2345678	198	2345678	199	2345678	200	2345678	201	2345678	202	2345678	203	2345678	204	2345678	205	2345678	206	2345678	207	2345678	208	2345678	209	2345678	210	2345678	211	2345678	212	2345678	213	2345678	214	2345678	215	2345678	216	2345678	217	2345678	218	2345678	219	2345678	220	2345678	221	2345678	222	2345678	223	2345678	224	2345678	225	2345678	226	2345678	227	2345678	228	2345678	229	2345678	230	2345678	231	2345678	232	2345678	233	2345678	234	2345678	235	2345678	236	2345678	237	2345678	238	2345678	239	2345678	240	2345678	241	2345678	242	2345678	243	2345678	244	2345678	245	2345678	246	2345678	247	2345678	248	2345678	249	2345678	250	2345678	251	2345678	252	2345678	253	2345678	254	2345678	255	2345678	256	2345678	257	2345678	258	2345678	259	2345678	260	2345678	261	2345678	262	2345678	263	2345678	264	2345678	265	2345678	266	2345678	267	2345678	268	2345678	269	2345678	270	2345678	271	2345678	272	2345678	273	2345678	274	2345678	275	2345678	276	2345678	277	2345678	278	2345678	279	2345678	280	2345678	281	2345678	282	2345678	283	2345678	284	2345678	285	2345678	286	2345678	287	2345678	288	2345678	289	2345678	290	2345678	291	2345678	292	2345678	293	2345678	294	2345678	295	2345678	296	2345678	297	2345678	298	2345678	299	2345678	300	2345678	301	2345678	302	2345678	303	2345678	304	2345678	305	2345678	306	2345678	307	2345678	308	2345678	309	2345678	310	2345678	311	2345678	312	2345678	313	2345678	314	2345678	315	2345678	316	2345678	317	2345678	318	2345678	319	2345678	320	2345678	321	2345678	322	2345678	323	2345678	324	2345678	325	2345678	326	2345678	327	2345678	328	2345678	329	2345678	330	2345678	331	2345678	332	2345678	333	2345678	334	2345678	335	2345678	336	2345678	337	2345678	338	2345678	339	2345678	340	2345678	341	2345678	342	2345678	343	2345678	344	2345678	345	2345678	346	2345678	347	2345678	348	2345678	349	2345678	350	2345678	351	2345678	352	2345678	353	2345678	354	2345678	355	2345678	356	2345678	357	2345678	358	2345678	359	2345678	360	2345678	361	2345678	362	2345678	363	2345678	364	2345678	365	2345678	366	2345678	367	2345678	368	2345678	369	2345678	370	2345678	371	2345678	372	2345678	373	2345678	374	2345678	375	2345678	376	2345678	377	2345678	378	2345678	379	2345678	380	2345678	381	2345678	382	2345678	383	2345678	384	2345678	385	2345678	386	2345678	387	2345678	388	2345678	389	2345678	390	2345678	391	2345678	392	2345678	393	2345678	394	2345678	395	2345678	396	2345678	397	2345678	398	2345678	399	2345678	400	2345678	401	2345678	402	2345678	403	2345678	404	2345678	405	2345678	406	2345678	407	2345678	408	2345678	409	2345678	410	2345678	411	2345678	412	2345678	413	2345678	414	2345678	415	2345678	416	2345678	417	2345678	418	2345678	419	2345678	420	2345678	421	2345678	422	2345678	423	2345678	424	2345678	425	2345678	426	2345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3 8      0      2  400  0
3 1      0 9999  10  0
for a programming error in TSIS. Do not remove.
3 8      3200  26  60  0
3 8      4300  27  60  0
3 8      5400  28  60  0
3 8      0      6  400  0
3 7      0      1  400  0
3 8      3200  20  60  0
3 8      4300  21  60  0

```

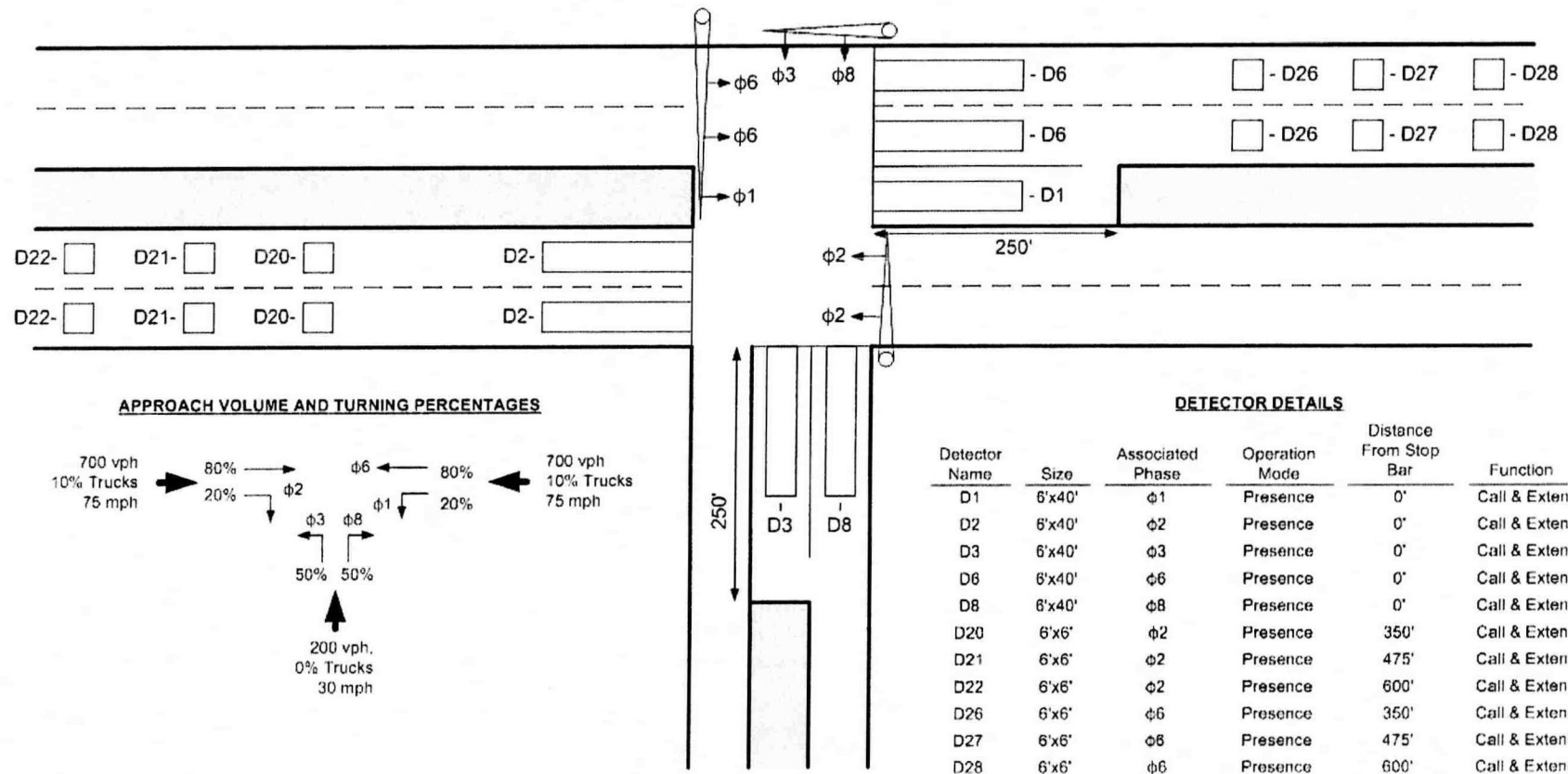
This card is included as a work

8	5400	22	60	0	42
7	0	5	400	0	42
1	0	8	400	0	42
7	0	3	400	0	42
1	0	4	400	0	42
7	0	7	400	0	42
8	0	2	400	0	42

3	6	3	4	3	7	3	0	2	43
200	0	0	100						50
700	10	0	100						50
700	10	0	100						50
200	0	0	100						50
		100					0	0	25
		100					0	0	75
92	95	98	102	105	108	113	121	350	58
								350	58
3440	21800								147
6180	20800								170
0700	20800								195
3440	19800								195
0800	20800								195
1440	20800								195
3440	20800								195
5440	20800								195
6080	20800								195
3440	20300								195
3440	21300								195
0									210

**SCHEMATIC AND
PRINTOUT OF SIMULATION FILE
FOR
STANDARD T-INTERSECTION**

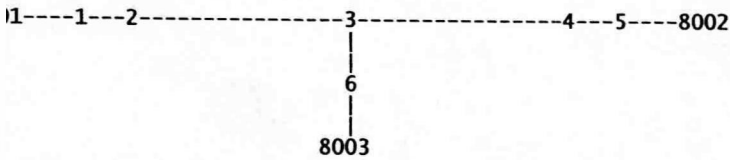
SCHEMATIC OF EXAMPLE OF T-INTERSECTION WITH MULTI-LOOP DETECTORS



y TSIS wed Jan 29 09:27:16 2003 from TNO Version 52

test configuration for algorithm testing,

node diagram is shown below:

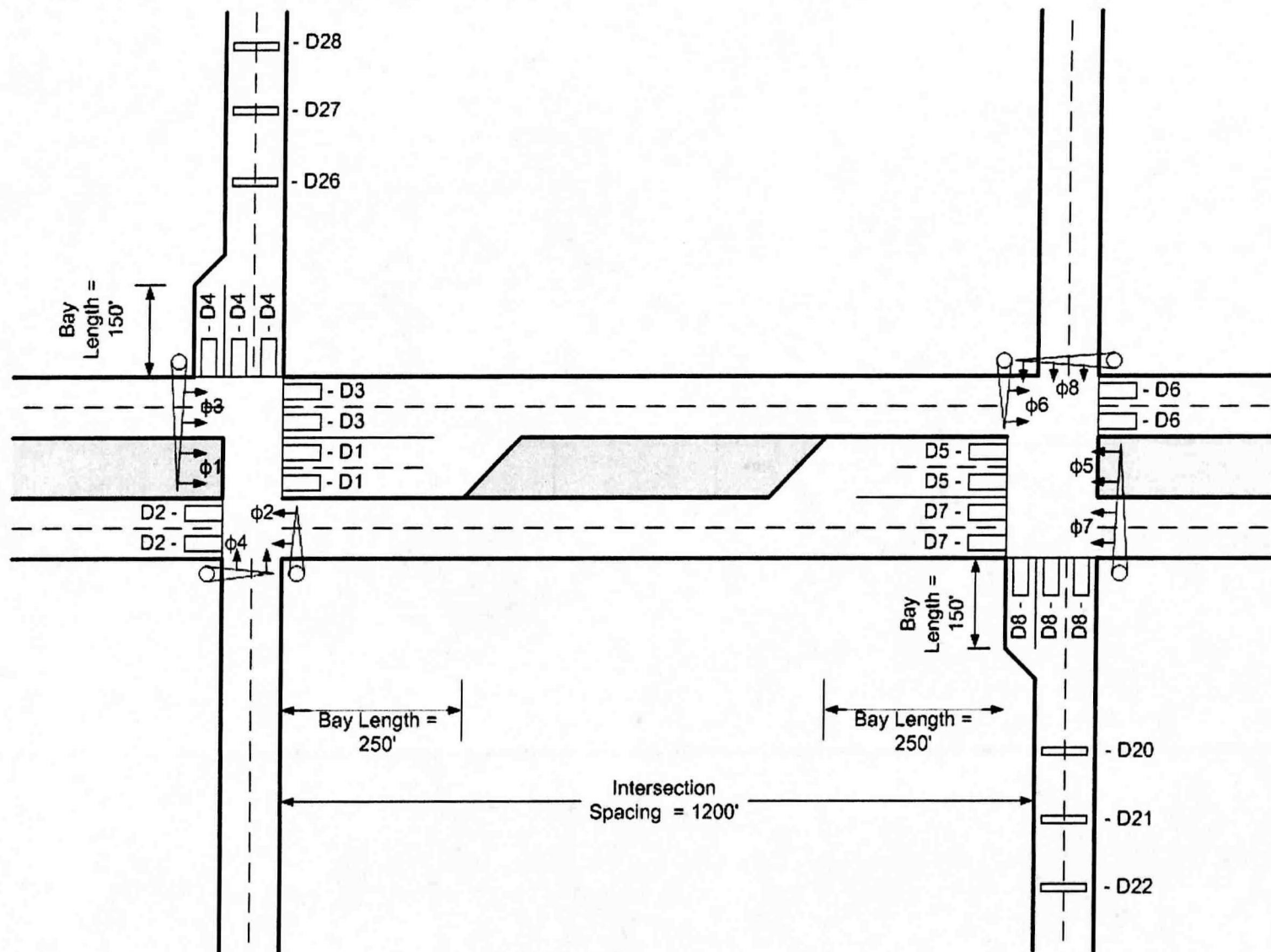


} and (3,4) are 2000' long; links (1,2) and (4,5) are 640' long

and 4 were included to investigate the effects of relatively intersections (sometime in the future).

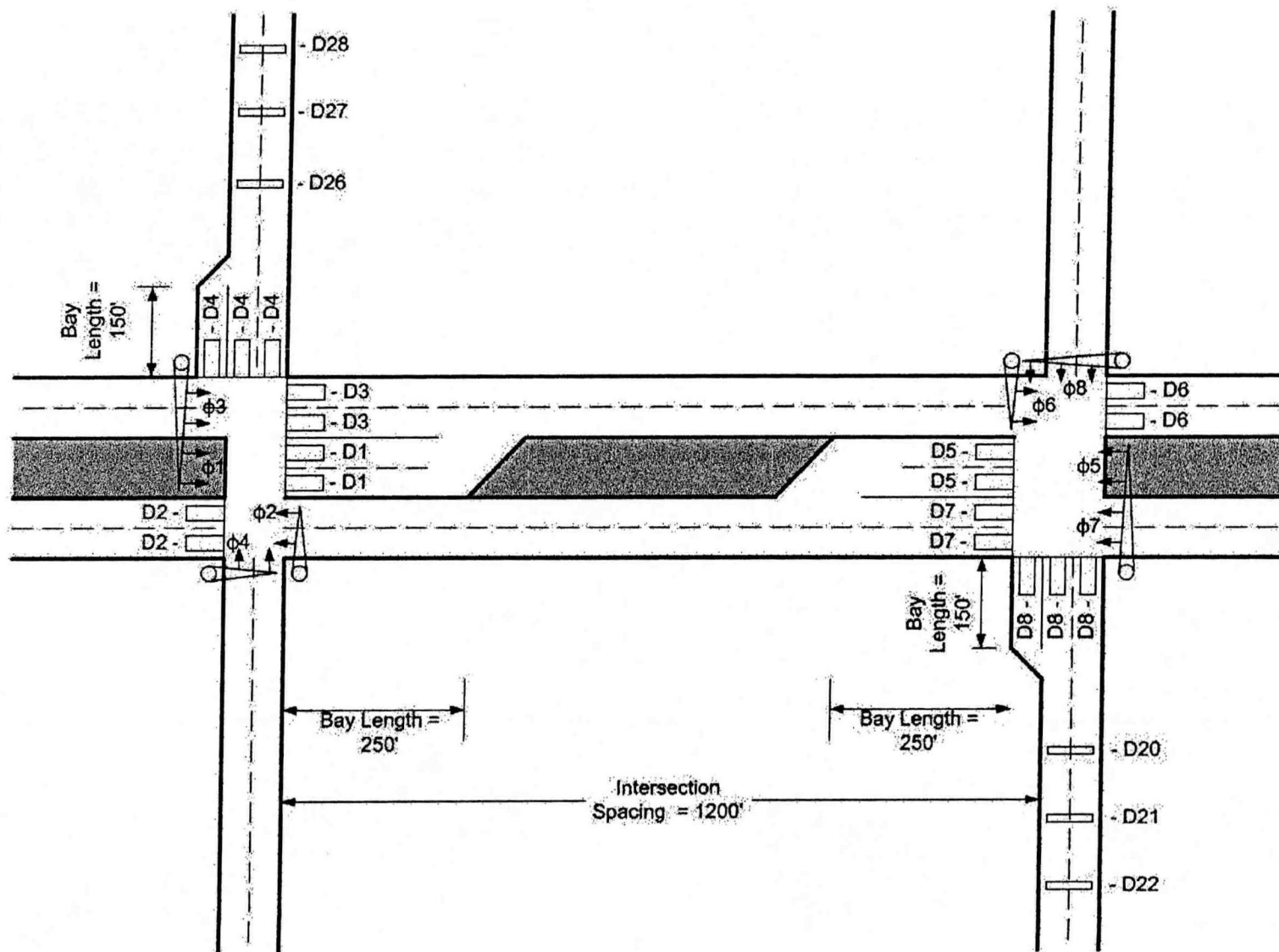
1	2345678	2	2345678	3	2345678	4	2345678	5	2345678	6	2345678	7	2345678	0	1
0	3	7981	0000	21	11	26	0	3	800	7729	7529	0	2		
0	0	60	0	0	0	0	0	1	d60out	20	18	70	0	11	
640	0	0	0	0	0	0	0	1	d60out	20	18	70	0	11	
640	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
500	1	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
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2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
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2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
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2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
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2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
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2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
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2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0	1	d60out	20	18	70	0	11	
2000	2	0	0100	0	0	0	0								

SCHEMATIC OF EXAMPLE OF DIAMOND INTERCHANGE WITH MULTI-LOOP DETECTORS



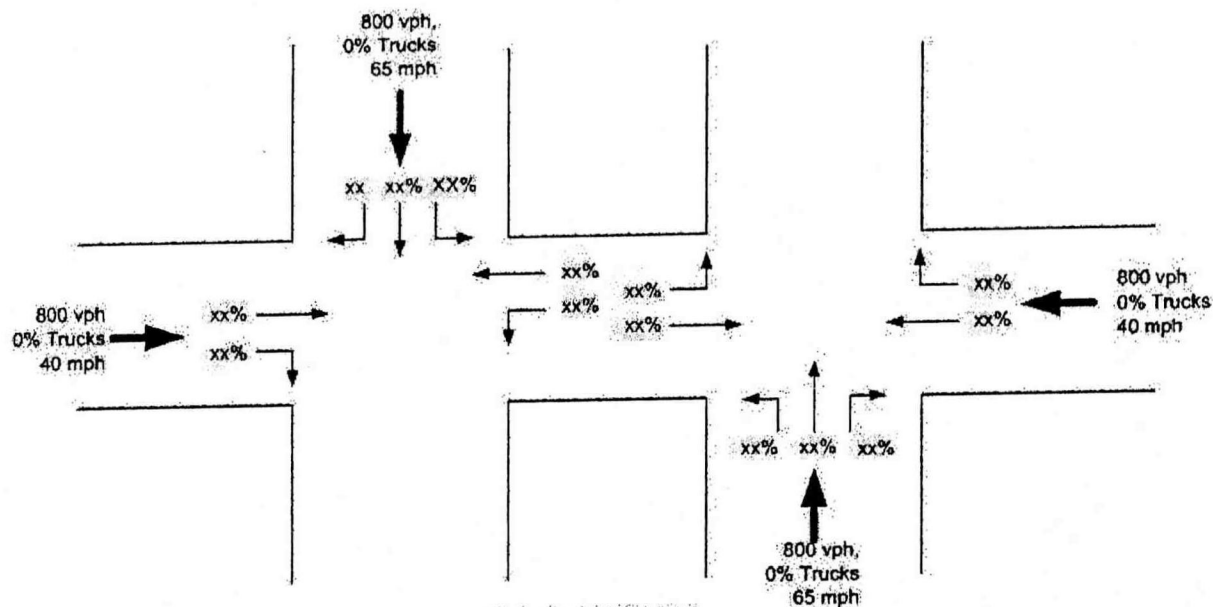
**SCHEMATIC AND
PRINTOUT OF SIMULATION FILE
FOR
STANDARD DIAMOND INTERCHANGE**

SCHEMATIC OF EXAMPLE OF DIAMOND INTERCHANGE WITH MULTI-LOOP DETECTORS



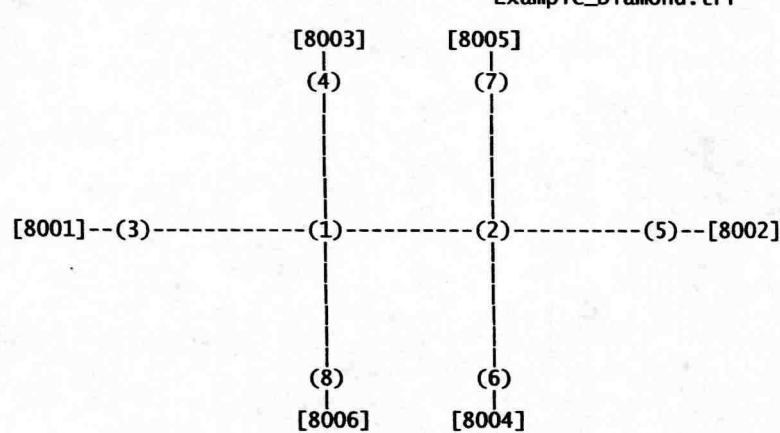
SCHEMATIC OF EXAMPLE OF DIAMOND INTERCHANGE WITH MULTI-LOOP DETECTORS (CONT.)

APPROACH VOLUME AND TURNING PERCENTAGES



DETECTOR DETAILS

Detector Name	Size	Associated Phase	Operation Mode	Distance From Stop Bar	Function
D1	6'x40'	φ1	Presence	0'	Call & Extend
D2	6'x40'	φ2	Presence	0'	Call & Extend
D3	6'x40'	φ3	Presence	0'	Call & Extend
D4	6'x40'	φ4	Presence	0'	Call & Extend
D5	6'x40'	φ5	Presence	0'	Call & Extend
D6	6'x40'	φ6	Presence	0'	Call & Extend
D7	6'x40'	φ7	Presence	0'	Call & Extend
D8	6'x40'	φ8	Presence	0'	Call & Extend
D20	6'x6'	φ8	Presence	320'	Call & Extend
D21	6'x6'	φ8	Presence	430'	Call & Extend
D22	6'x6'	φ8	Presence	540'	Call & Extend
D26	6'x6'	φ4	Presence	320'	Call & Extend
D27	6'x6'	φ4	Presence	430'	Call & Extend
D28	6'x6'	φ4	Presence	540'	Call & Extend



Sunkari	3	7981	06 28	05TTT	31200	7111	7581
0			10000				
60				1			
200 250	2 2	TT	7 5	5	15 15 40 1 11		
600	2	9	8001		15 15 40 1 11		
600	2	TT	8006		15 15 65 11		
200 250	2 2	TT	8 3	3	15 15 40 1 12		
600	2	9	8002		15 15 40 11		
600	2	TT	8005		15 15 65 11		
600	2	7T	2	8	15 15 40 11		
600 150	2 1	7T	2 8	3	15 15 65 0 11		
600	2	7T	1	7	15 15 40 11		
600 150	2 1	78	1 7	5	15 15 65 11		
	2		1		15 15 0 11		
	2		2		15 15 0 11		
	2		1		15 15 0 11		
	2		2		15 15 0 11		
100							21
100							21
100							21
100							21
18001							35
8003							35
28002							35
8004							35
2							35
1							35
							36
							36
							36
							36
							36
							36
67	0	5	400	0			42
12	0	7	400	0			42
67	0	1	400	0			42
12	0	3	400	0			42
1	0	9999	10	0			42
or a							42
ing error in TSIS.							42
8	3200	26	60	0			42
8	4300	27	60	0			42
8	5400	28	60	0			42
8	0	4	400	0			42
12	0	2	400	0			42
12	0	6	400	0			42
1	0	9999	10	0			42
or a							42
ing error in TSIS.							42
8	3200	20	60	0			42
8	4300	21	60	0			42
8	5400	22	60	0			42
9	0	8	400	0			42
1	4	1	2	1	0		2 43
2	5	2	1	2	0		2 43

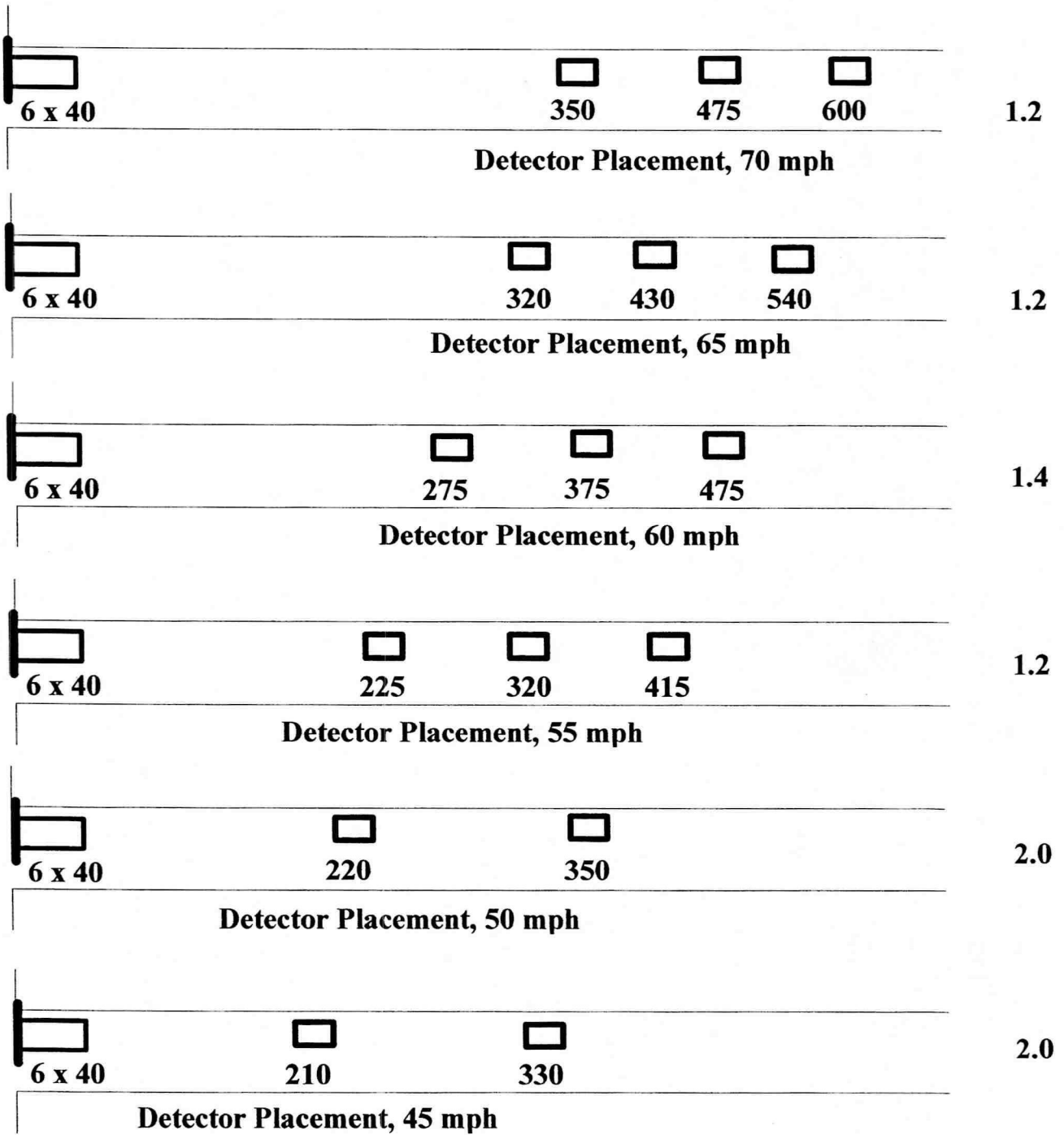
This card is included as a work

This card is included as a work

col77 - 2 to flag

HIGH SPEED DETECTOR LAYOUT

Extension



Link-Node Structure

