Demonstration of Experiments Coordinated Signal Systems (Labs 6 through 7)

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Purdue University

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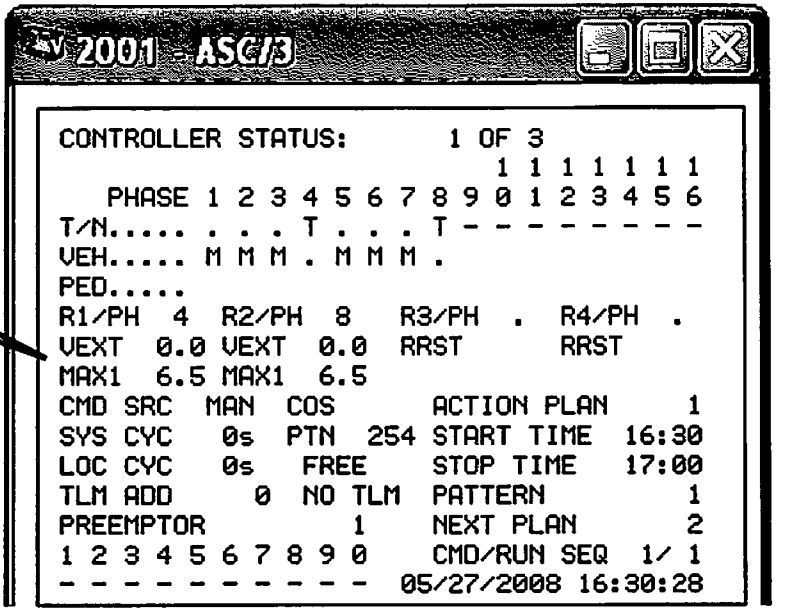
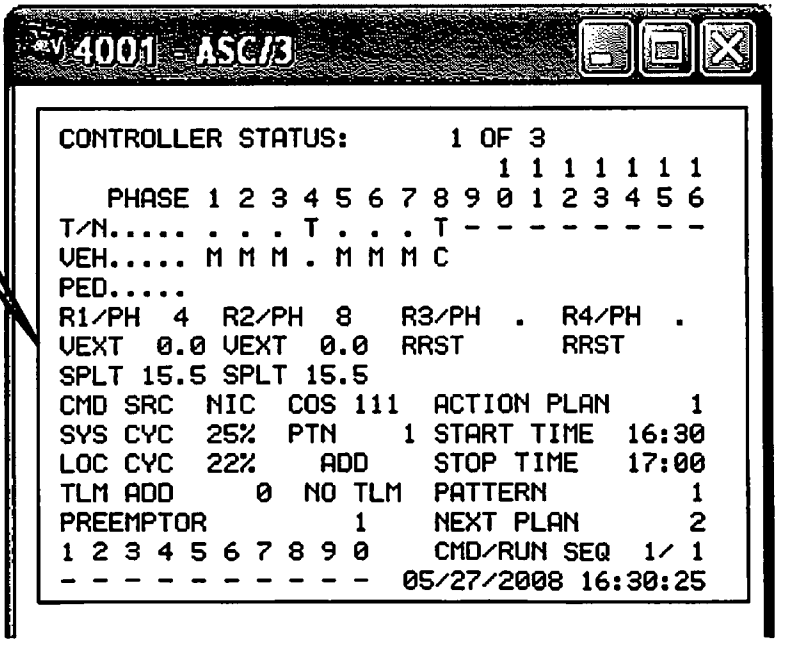
Structure of Laboratory

- Introduction
- Introduction to "System Controls"
- Terms
- Experiments
- Closure: Summary of Key Points Learned





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Parameters impacting capacity

Parameters impacting progression

Experiments

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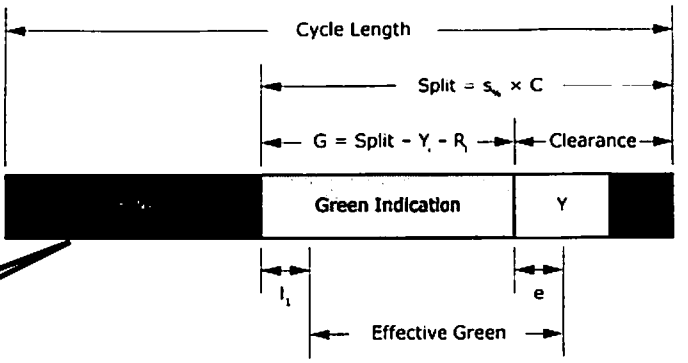
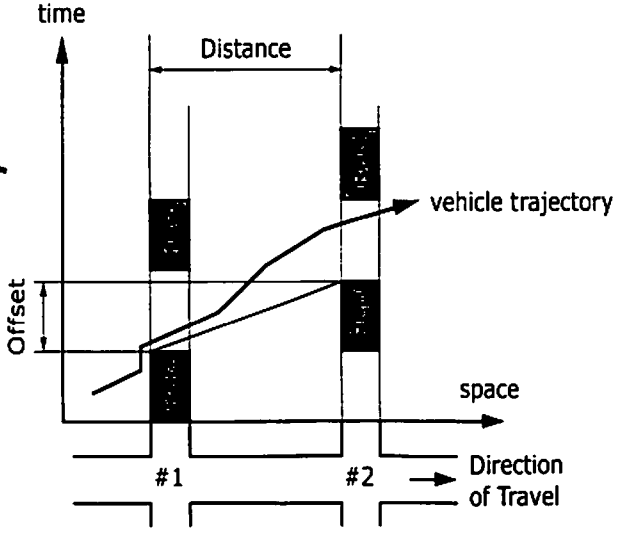
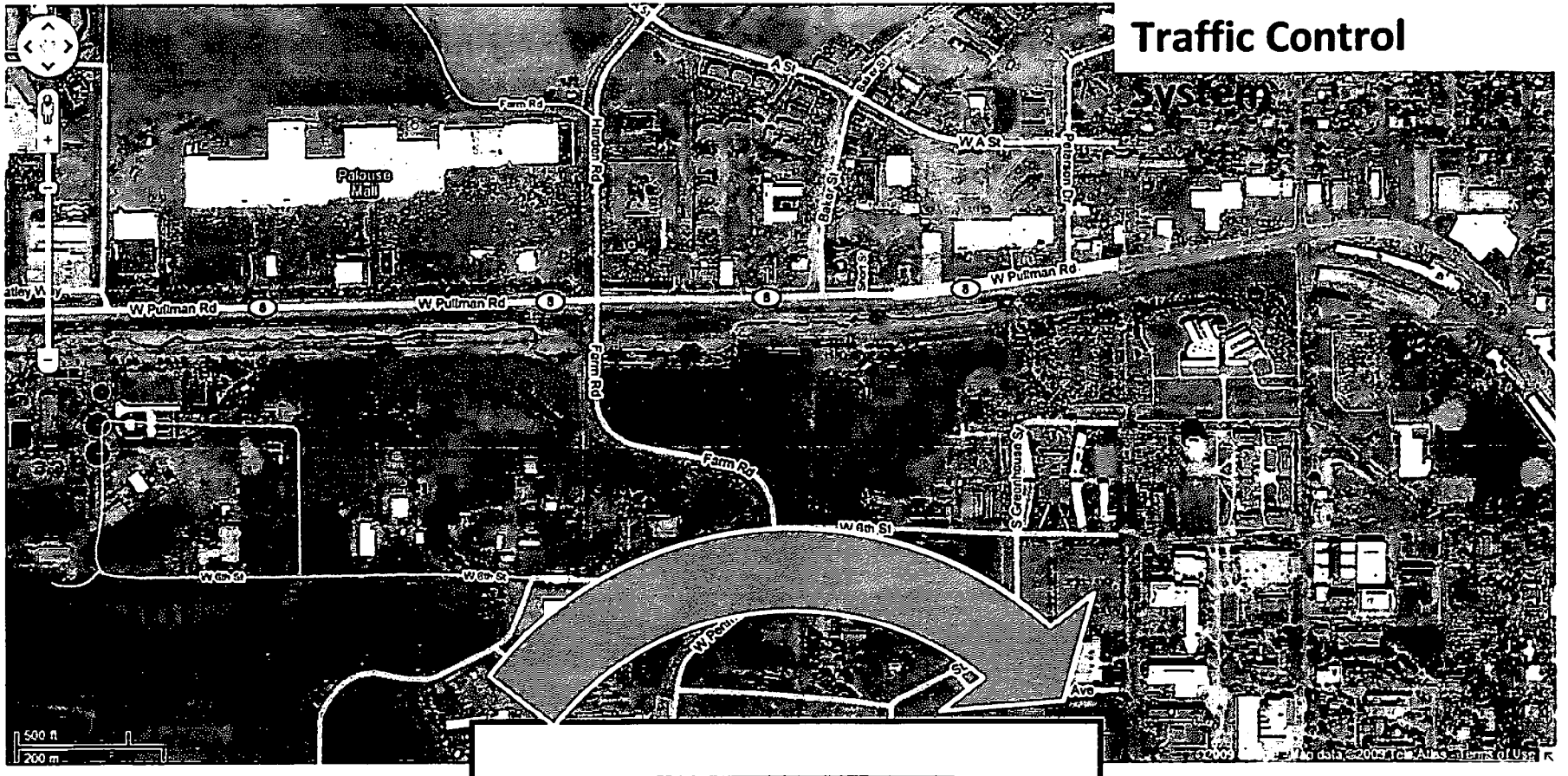
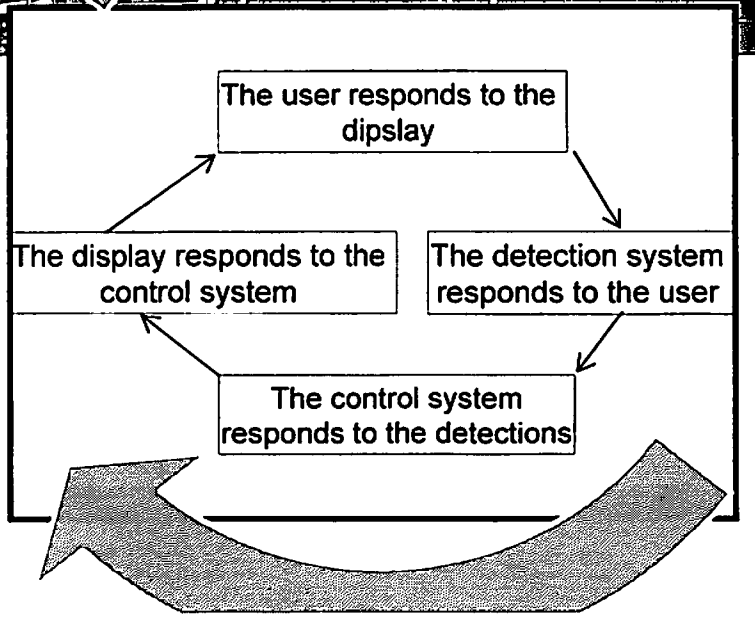




Traffic Control



Coordination must Maintain a background Cycle to facilitate coordination



How does coordination influence system operation

$$d = d_1(PF) + d_2 + d_3$$

$$d_1 = \frac{0.5C\left(1 - g_i/C\right)^2}{1 - \min(1, X_i)\, g_i/C}$$

d: control delay to the lane group, s/veh;
d_1: uniform delay, s/veh;
d_2: incremental delay, s/veh;
d_3: initial queue delay, s/veh;
PF: progression adjustment factor;
X_i: volume to capacity ratio for the lane group i;
C: cycle length, s;
g_i: effective green time for the lane group i, s;

1. Minimize stops

Offset

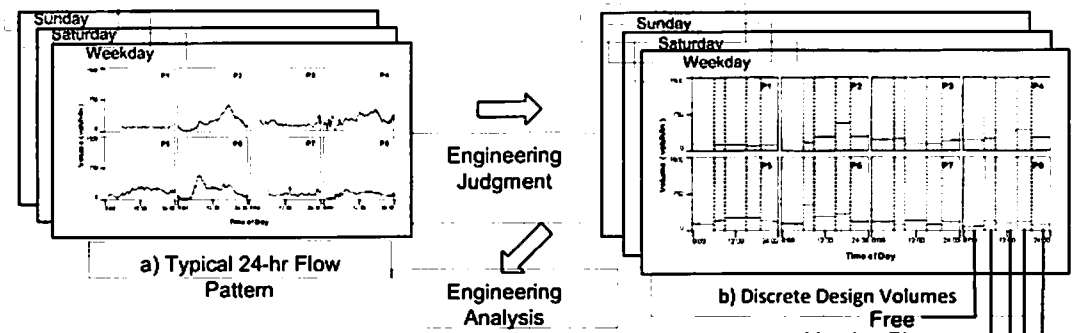
2. Minimize Delay for Vehicles that do stop!

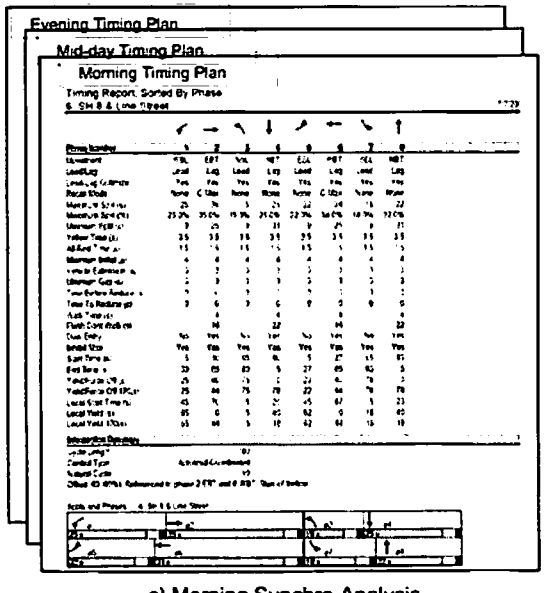
Cycle

3. Provide Sufficient Capacity..

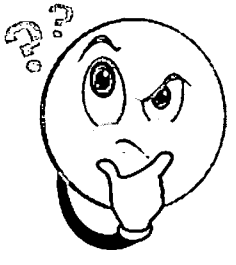
Split

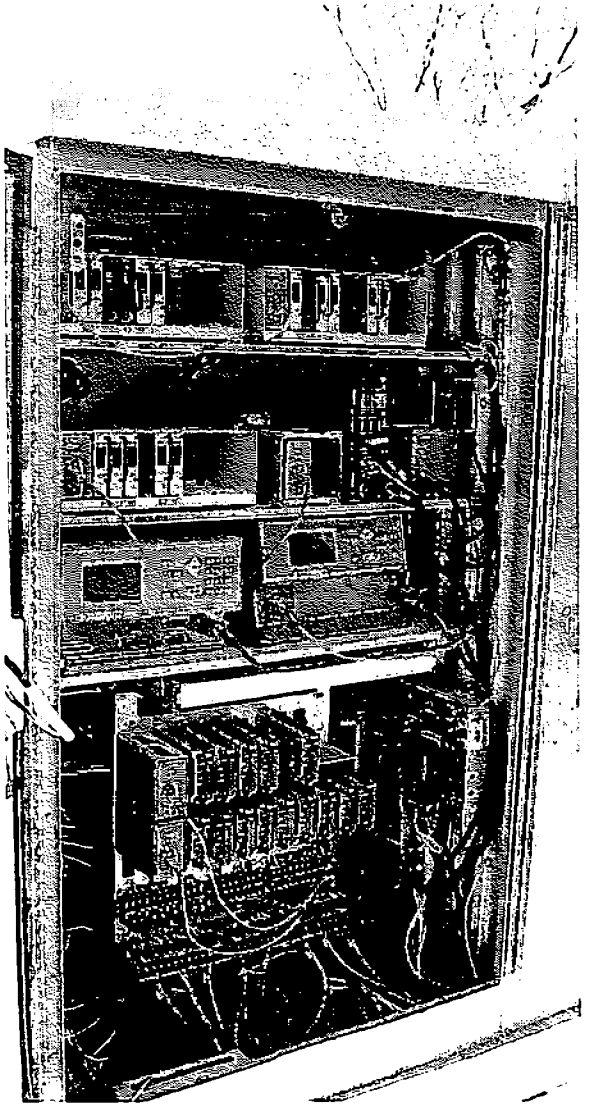
Split, Cycle, and Offset are the main levers for controlling the system..but there is more





c) Morning Synchro Analysis Timing Report

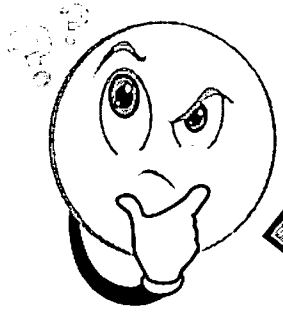


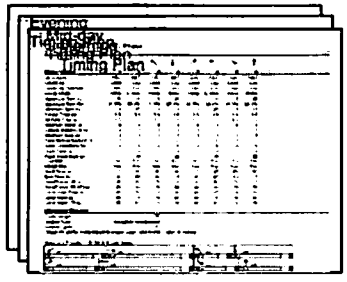


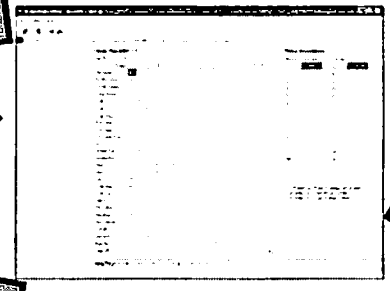
Elements of a Controller Database

	Detectors	Controller	Coordinator	Time Base	Sum
UTDF to NTCIP Direct Mapping	12, Phase	8, Min Green 8, Max Green 8, Walk 8, Ped CLR	3, Cycle 3, Offset	0	50 (19%)
UTDF to NTCIP Mapping With Translation	12, Extend 12, Delay 12, Type	8, Veh. Ext. 8, Yellow 8, Red CLR 8, Dual Entry	6, Reference Phase 1, Reference To	0	75 (28%)
UTDF to NTCIP Mapping with Engineering Judgment	12, Number	8, Phase In Use 8, Ring	3x8, SplitTime 3x8, SplitMode 1, Control Type	0	77 (29%)
[illegible]		[illegible]		[illegible]	[illegible]
Sum	60	96	81	28	265

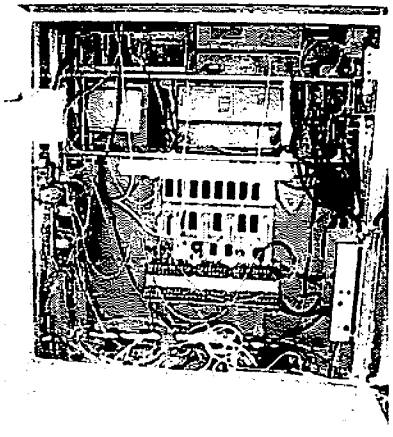
Entire Process

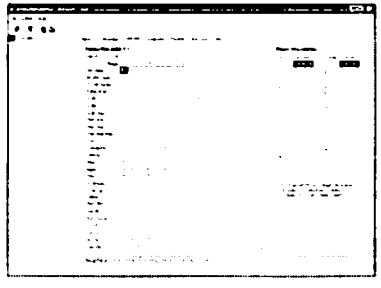






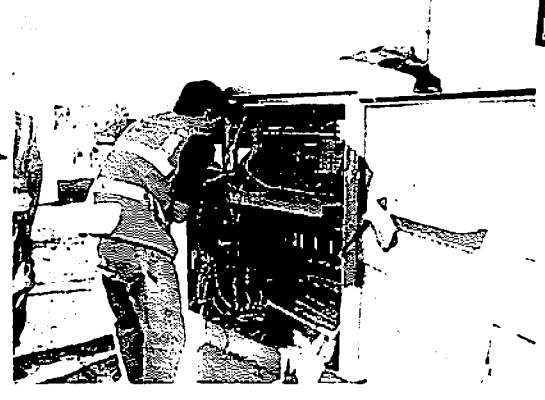
Signal Timing DB





Good Default

Objective of MOST Coordination Experiments



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Closure: Summary of Key Points Learned

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1. Coordination Status Screens
2. Detector Mapping
3. Detector Extension
4. Split Manipulation
5. Split Tuning
6. Split Allocation Strategies
7. Cycle Length Adjustments
8. Offset Adjustments
9. Lead/Lag
10. Capacity Estimation
11. Synchro Mapping

Lab 7

Pulling together the 270-300 parameters necessary to implement a functional 3 plan system

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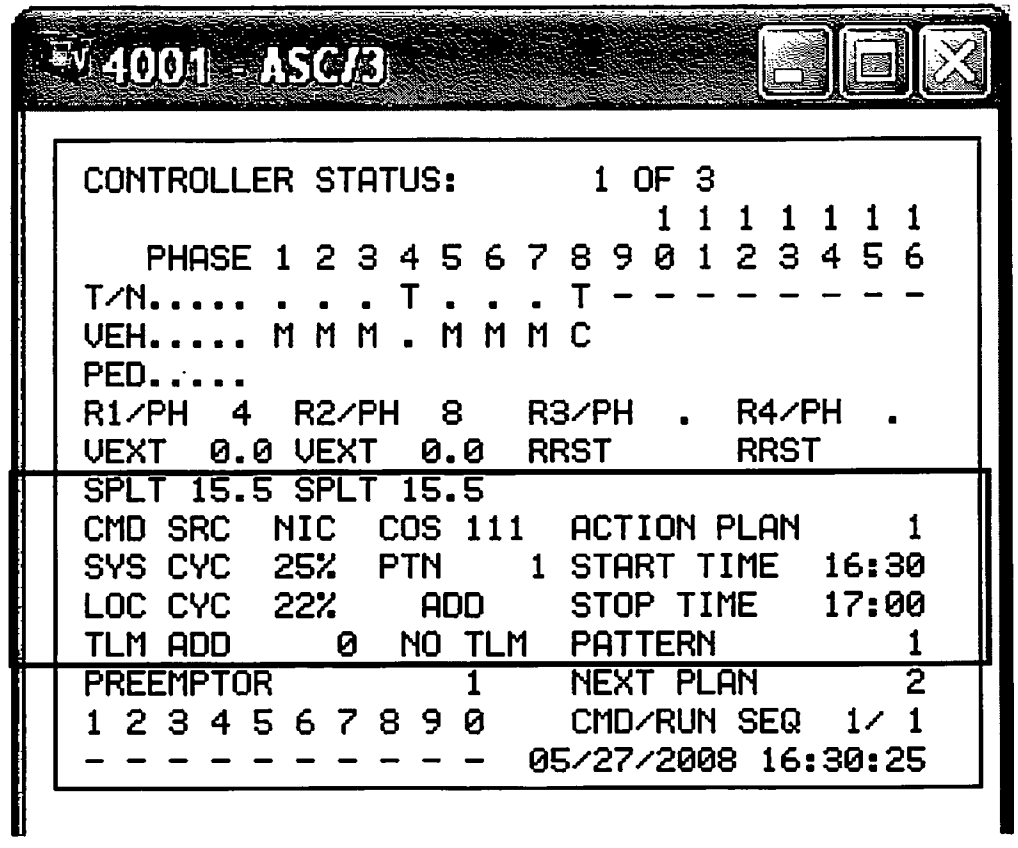

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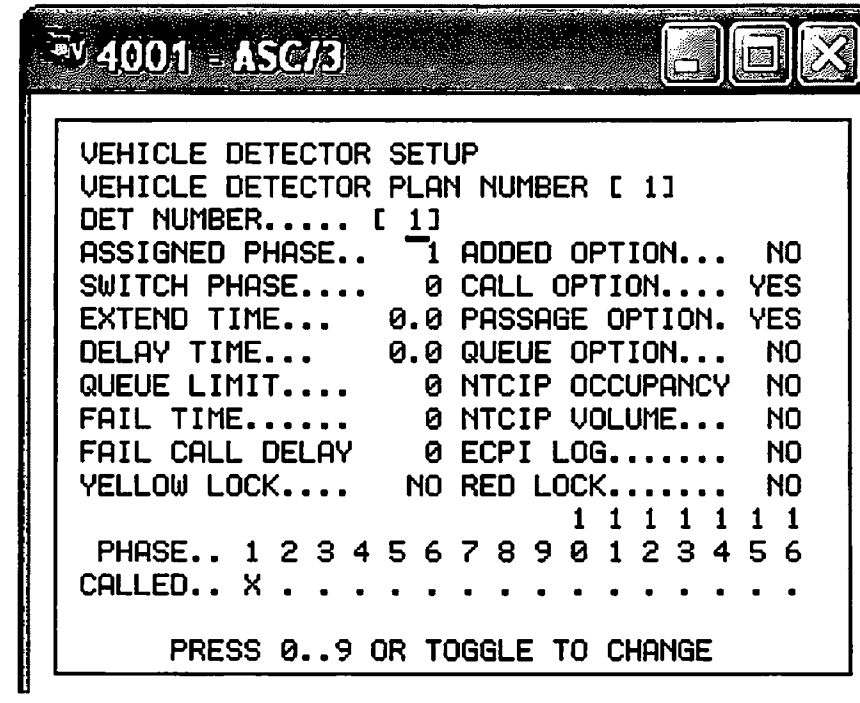

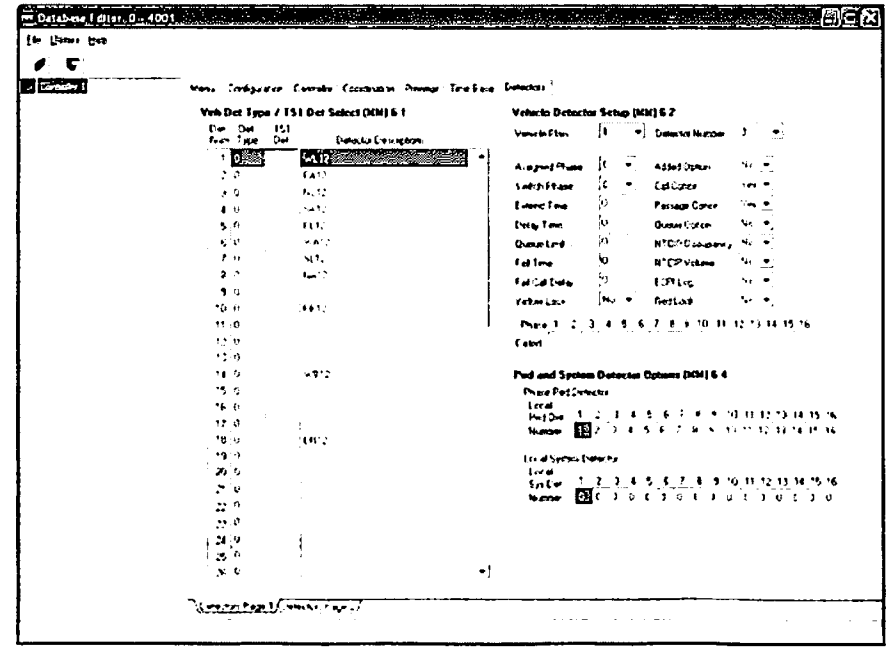

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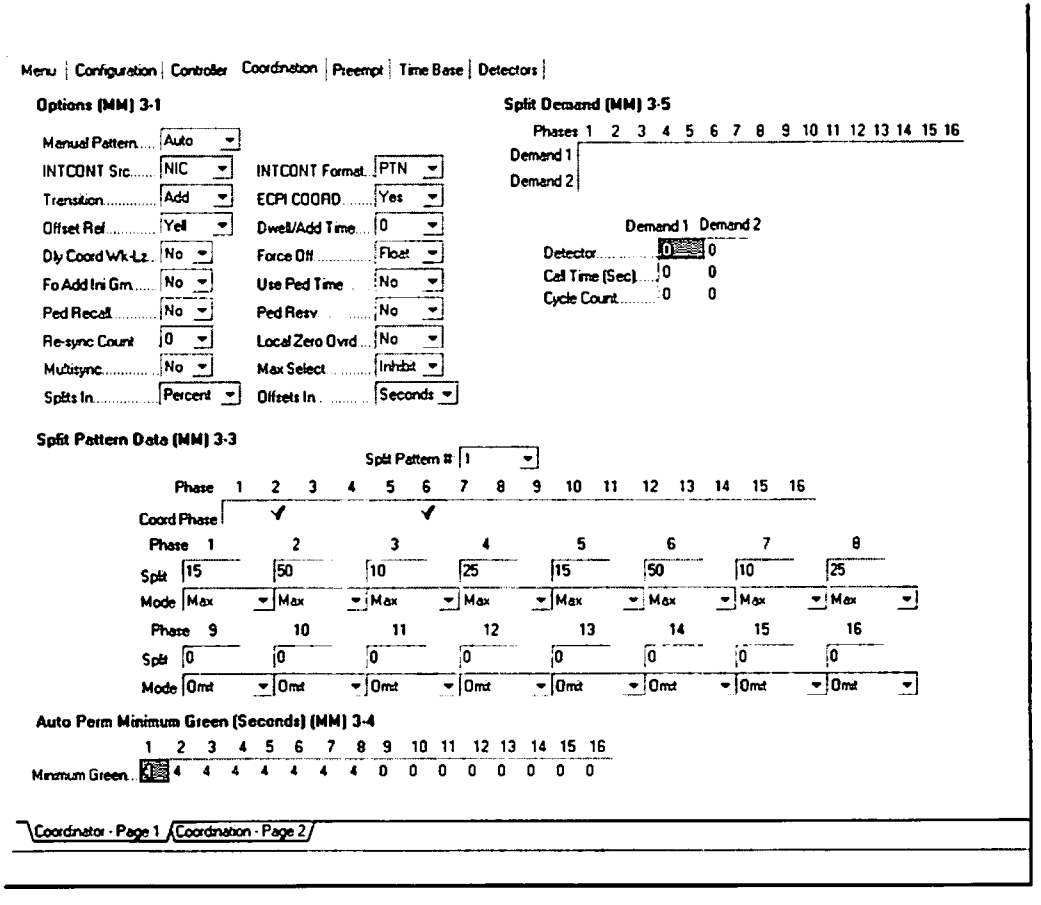

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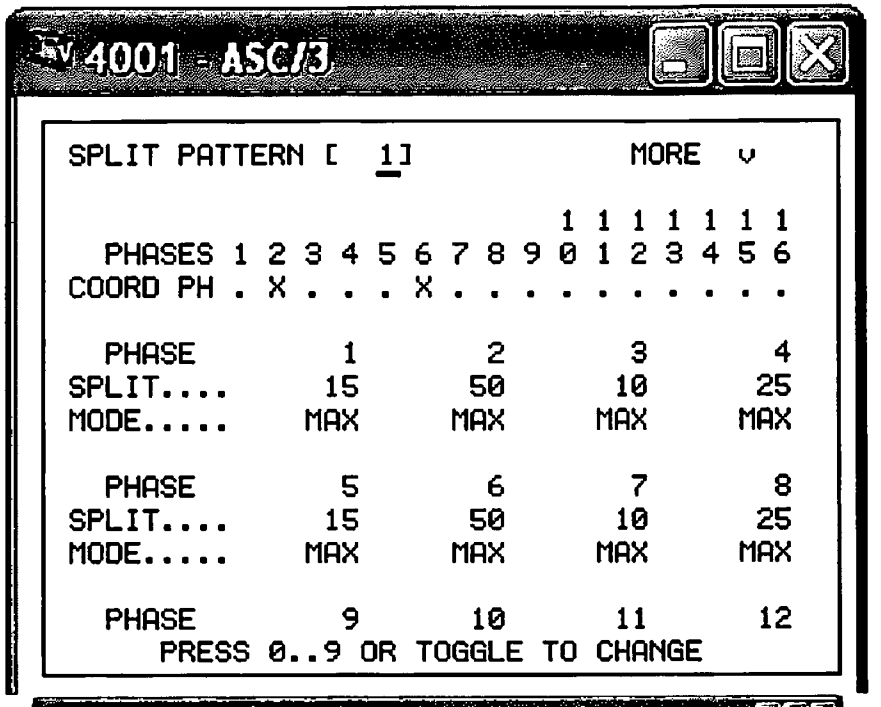

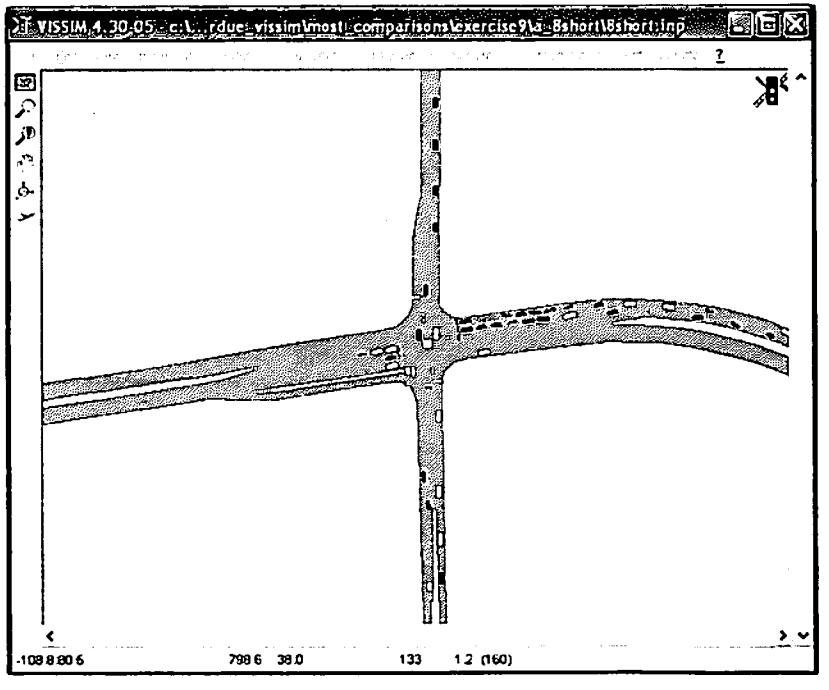

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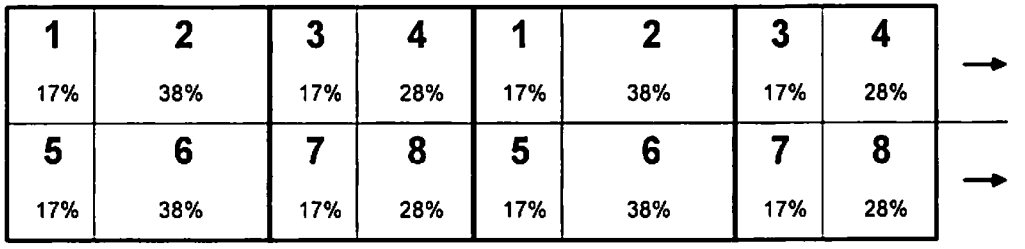
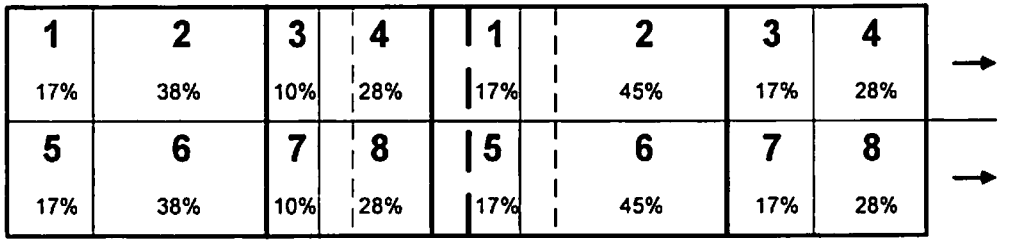
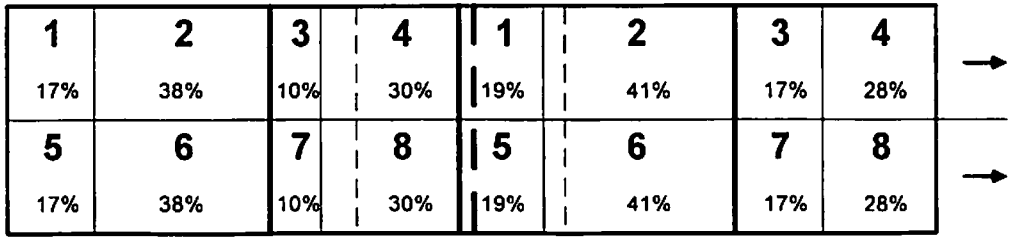


(a) Effective Splits with Maximum Recall



(b) Effective Splits with Floating Force-Offs



(c) Effective Splits with Fixed Force-Offs

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	Controller/ Cycle Length	No. of Vehicles EB Left Turn Pocket	No. of Vehicles WB Left Turn Pocket
During Step 3	2001/120		
	4001/(240)	N/A	N/A
During Step 4	2001/120		
	4001/240		

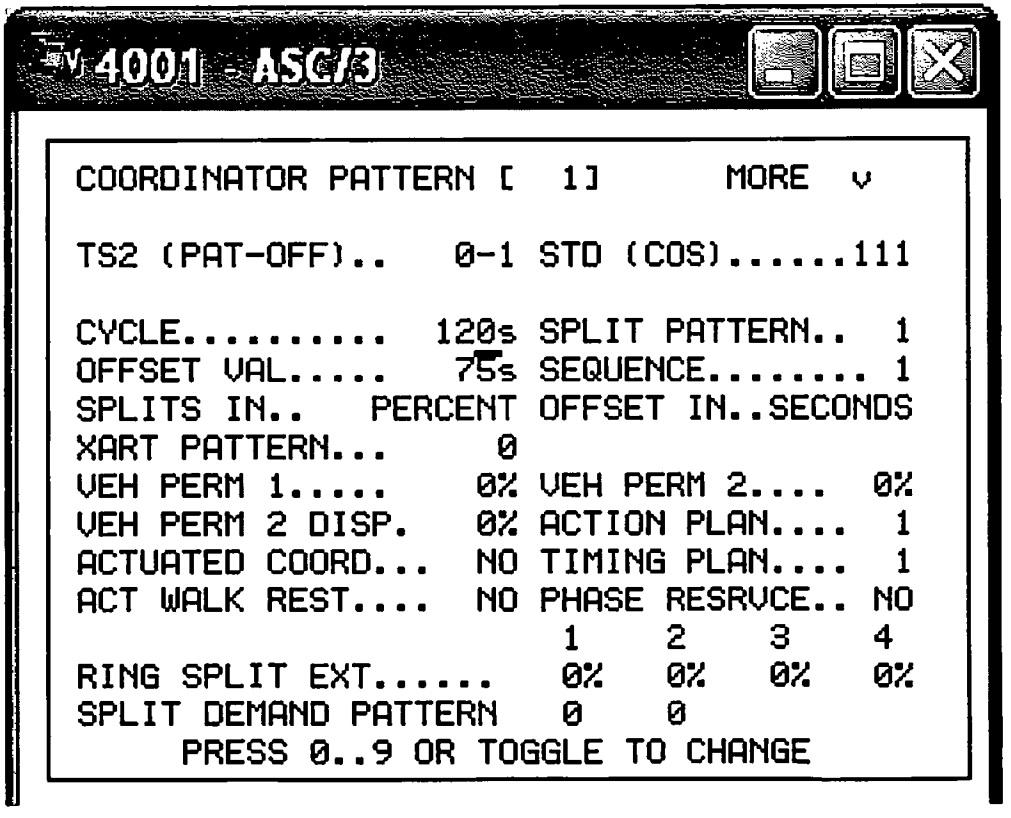

Table 17 Number of vehicles arriving on red in the EB TH Lanes

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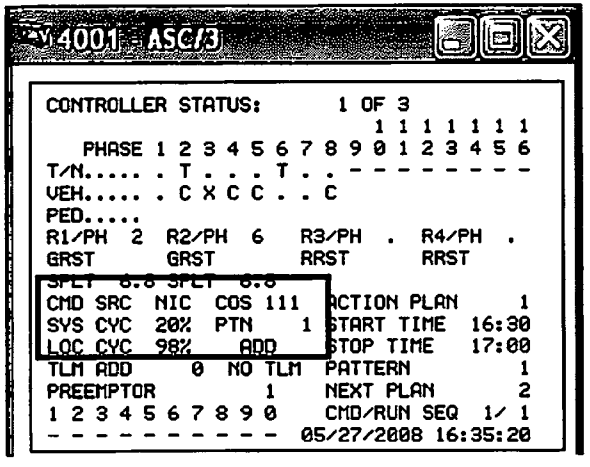
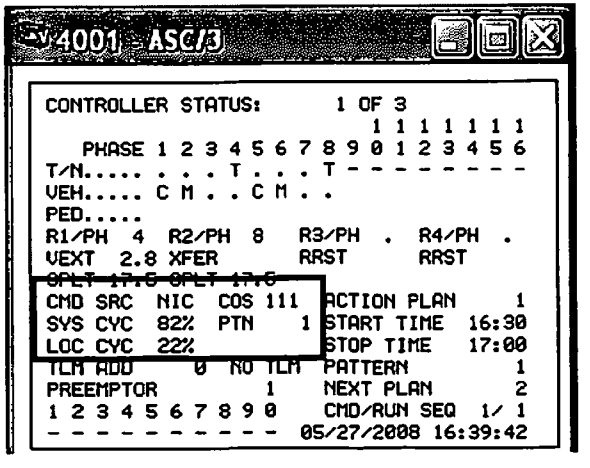
Structure of Laboratory

	Step 4 (around 300s)		Step 5 (around 600s)	
Offset Quality	Bad (20s)	Good	Bad (20s)	Good (60s)
Cycle 1	29	N/A	21	1
Cycle 2	20	N/A	33	4





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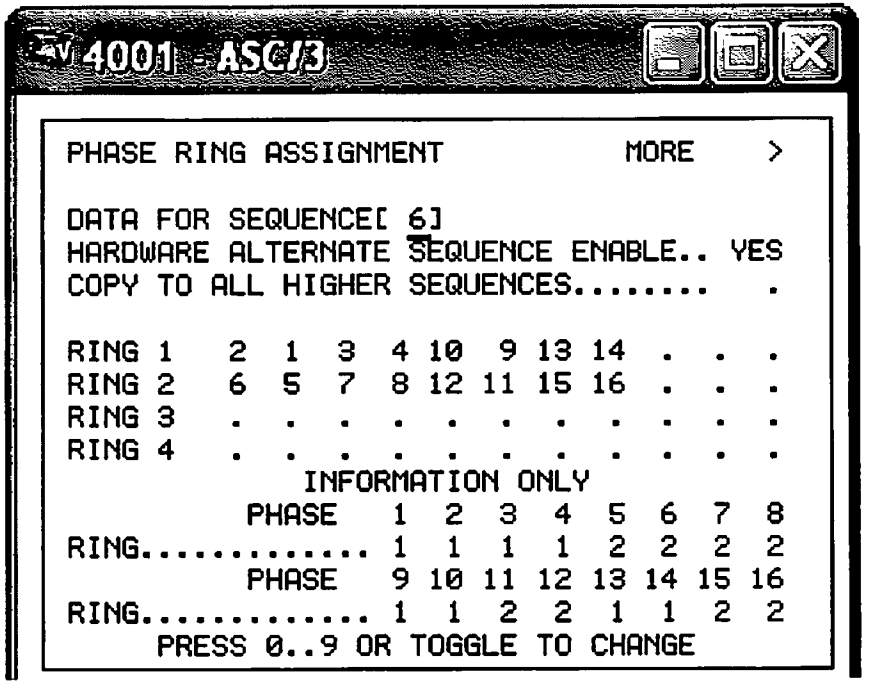

	Step 4		Step 6	
	Lead	Lag	Lead	Lag
Cycle 120		N/A	23	10

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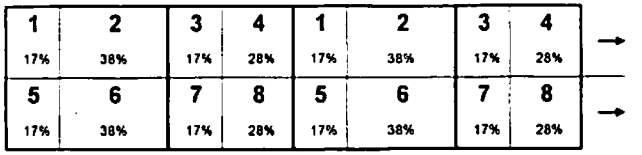
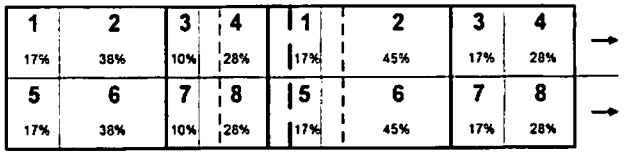
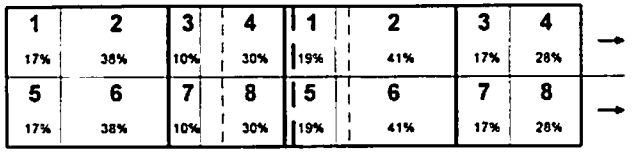


(a) Effective Splits with Maximum Recall

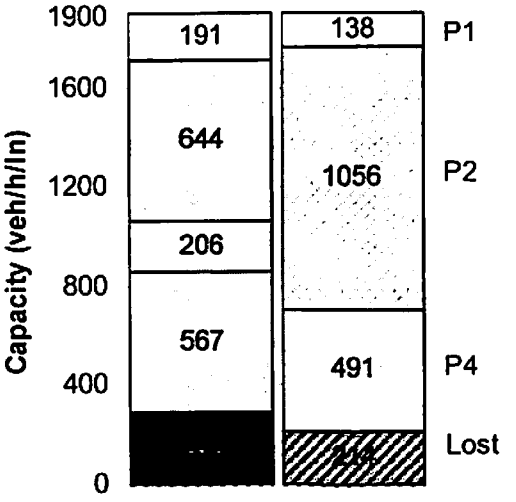


(b) Effective Splits with Floating Force-Offs



(c) Effective Splits with Fixed Force-Offs

Programmed vs. Observed



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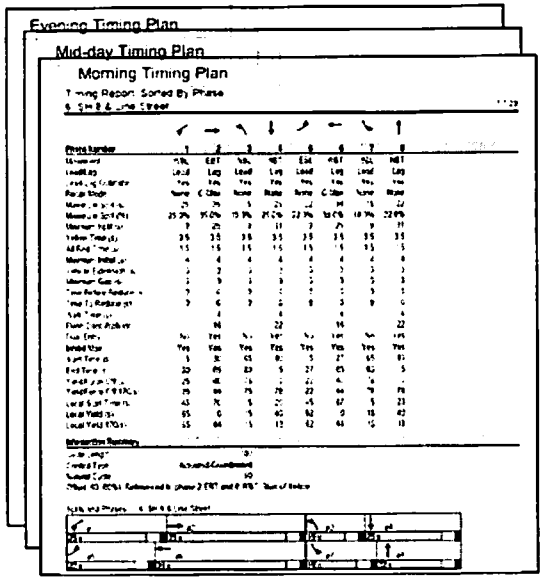

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UTDF to NTCIP Mapping with Engineering Judgment	12, Number	8, Phase In Use 8, Ring	3x8, SplitTime 3x8, SplitMode 1, Control Type	0	77 (29%)
NTCIP Parameters Required but Unidentified in UTDF	0	8, Lock Det. 8, Soft Recall	19	28	63 (24%)
Sum	60	96	81	28	265

- This is more then a direct mapping from a Synchro printout

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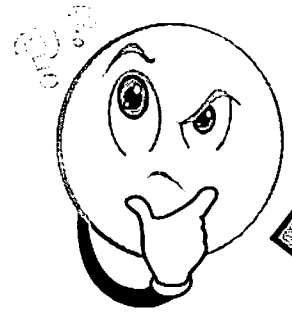
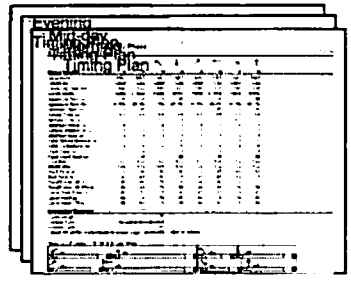
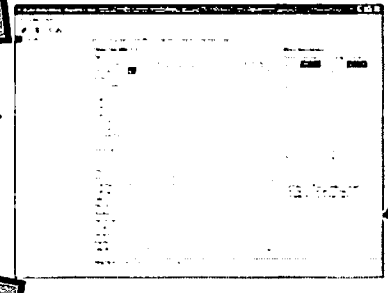
Field Quality Experience .....without the risk







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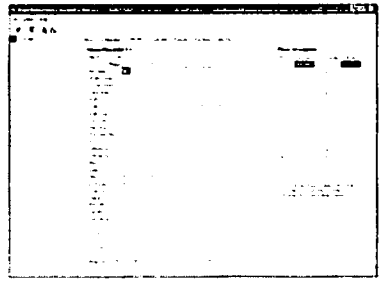

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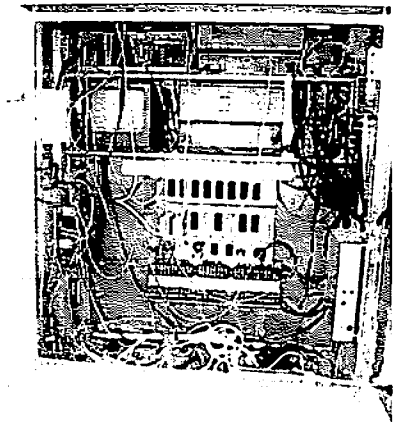

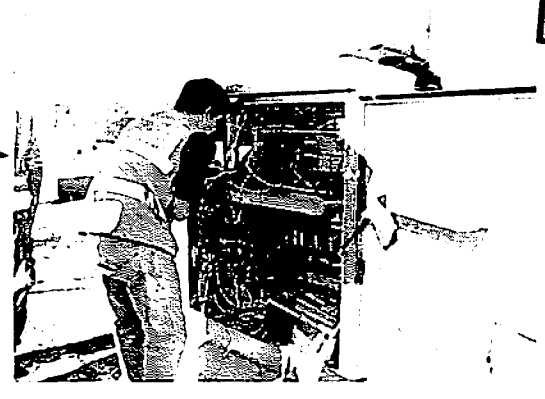

Objective of MOST Coordination Experiments

Overview of MOST: a hands-on approach to signal timing training: Michael Kyte, University of Idaho

Demonstration of MOST simulation tools: Kiel Ova, PTV America

Demonstration of experiments relating to isolated intersections: Michael Kyte, University of Idaho

Demonstration of experiments relating to coordinated systems: Darcy Bullock, Purdue University

Future of software-in-the-loop simulation training and research: Thomas Urbanik, University of Tennessee, Knoxville