

RAMP METERING

PROCEDURE MANUAL ADDENDUM

STATE OF CALIFORNIA
Governor Arnold Schwarzenegger

BUSINESS, TRANSPORTATION AND HOUSING AGENCY
Secretary Sunne Wright McPeak

DEPARTMENT OF TRANSPORTATION
Director Will Kempton

DISTRICT 7
DIVISION OF OPERATIONS
OFFICE OF FREEWAY OPERATIONS

JUNE 2005



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BUSINESS, TRANSPORTATION AND HOUSING AGENCY
DEPARTMENT OF TRANSPORTATION
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RAMP METERING

PROCEDURE MANUAL ADDENDUM



DEPARTMENT OF TRANSPORTATION
DISTRICT 7



DOUG FAILING
DISTRICT DIRECTOR

FRANK QUON
DEPUTY DISTRICT DIRECTOR OF OPERATIONS

MARCO RUANO
OFFICE CHIEF, OFFICE OF FREEWAY OPERATIONS

AFSANEH RAZAVI
BRANCH CHIEF, RAMP METERING BRANCH

JUNE 2005

FOREWORD

Enclosed is an Addendum to District 7 RAMP METERING PROCEDURE MANUAL (RMPM) of 2002. This document was prepared to update ATTACHMENT A and APPENDIX B, which describes the latest SATMS* ramp metering software.

In 2002, when the RMPM was issued, the SATMS software was under development (interim version) and was known as SATMS 2.3. The latest and final version is SATMS 3, which is included in this Addendum.

* **SATMS** is an acronym for **Semi Automatic Traffic Management System**

SATMS-3

Vs

SATMS-1

QUEUE		
Number of Queue	Q1 and Q2 to handle Connector Metering	Q1 only
Queue Priority level	Two levels: higher or lower than SWARM	One level only
Freeway priority	Yes (cancel Queue if MainLine Speed is low)	No
Surface street priority	Yes (rest-in-green if Queue continuously activated for a long time)	No
Start up & Shut down		
Start up Procedure	First_Green, Green, Long_Yellow, and Red	Not really
Shutdown Procedure	Yes	Not really
Enhancement		
Maximum Rate	Dependent on number of veh/green	Independent on number of veh/green
Minimum Green	Settable	Fixed at 2.0 second
Local speed observation	Yes	No
Magnetometer Demand Loop Lock-On	Capable to fix this problem	No
Holiday table	8 holidays	16 holidays
T.O.D table	16 interval	64 interval
Safety Enhancement		
Load Switch Failure Detection	Yes	No
EMS Failure Detection	Yes	No
Check for appropriate values	Yes	No
Front Panel Display		
Display program version and date	Yes	No
Warning for wrong controller ID	Yes	No
Show current signal head color on the LED	Yes	No
Indication for type of Queue activated	Yes	No
Hardwares		
IC	27256	27128
EPROM	412 C only	412 C and old board
Controller ID	Use 412 C DIP Switch	Hardwired at C1 connector

ATTACHMENT A

- RAM MAP
(Page “00XY” & TOD Table)
- LOOP DETECTOR SENSOR LAYOUT SHEET
- AS-BUILTS PLAN

Notes:

- Ramp Metering personnel are **responsible** for the creation, placement and up-keep of these documents (RAM MAP, Loop Detector Sensor Layout Sheet and As-Built plans).
- These documents **must be placed inside every** RMS and VDS cabinet in the District.

SATMS 3.0 RAM Page 0

Date **1/18/2007**

Route **105** Direction **WB** P.M. **R3.30** Location **PRAIRIE / IMPERIAL HWY**
 E. No **E4808** Loc. No. **1808** Line No. **33** Controller No. **3** Engineer **RAFAEL BENITEZ**

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F		"BITS" or "FLAGS"
0	GETADD		DATA	CHARCT	SCTML1	TEMP00	CYLEN	RXSTST	CONT ID 03	FMNL 255	HOLTBL 00	CFTRR	TBCNT2	DATA0A	DATA1A	STATUS	0	
1	"+"		BLKOUT	SPCOUT	SCTML2	TEMP01	DCNTR	TXSTAT	FIRGR 60.0	FLSHR 00		Q1CYTMR	ACKFLG	DATA0B	DATA1B	SIGMSK 00	1	
2	PUTADD		PGADD	MODE	SCTML3	TEMP02	PCNTR	TXINT	PLTYEL 0.0	LASTGR 60			ETBFLG	DATA0C	DATA1C	QFLAG	2	
3	"+"		WDADD	CHARIN	SCTML4	TEMP03	YCENR	INCTR	LNGYEL 3.0	PHYSML 03		GOODML	PADFLG	DATA0D	DATA1D	QSTAT	3	
4	EXINDX		D1	LASTCB	SCTML5	TEMP04	DLETM	BTCK		PHYSOP 00		GOODOS	CARCT1	DETINA	STCHGA	COMM1 0F	4	1 2 3 4
5	"+"		D2	TIMEFX	SCTML6	TEMP05	PLETM	TRCODE	QTHRS 2.0	Q2THRS 0.0		RLPSEL	SPRCNT	DETINB	STCHGB	COMM2 04	5	3
6	HZ30		D3	HR	SCTOS1	TEMP06	GRNTMR	CCHK	MXGRNA 5.0	QON 0.0		MAXRATE	ACKMEM	DETINC	STCHGC	DTCTRA 47	6	1 2 3 7
7	HZ30+1		D4	MIN	SCTOS2	TEMP07	QTMR	XCCHK	MXGRNB 0.0	Q2ON 0.0		QMAXRAT	"+"	DETIND	STCHGD	DTCTRB 00	7	
8	HZ30+2		D5	SEC	SCTOS3	TEMP08	CNTR	GRFLAG	CROCCA 15.0	QOFF 0.0			ENDFG1	BLKTMR	ERRORA 00	DTCTRC 3F	8	1 2 3 4 5 6
9	HZ30+3		D6	YEAR	SCTOS4	TEMP09	TIME	RBPNT1	CROCCB 0.0	Q2OFF 0.0			ENDFG2	GRNFLG	ERRORB 11	DTCTRD	9	1 5
A	HZ30+4		H1	MONTH	SCTOS5	TEMP0A	SOURCE	"+"	CRVOLA 90				XMITFG	EXFLAG	ERRORC	ALTDSE	A	
B	HZ30+5		H2	DAOFO	SCTOS6	TEMP0B	RATE	TBPNT1	CRVOLB 00	MINGRN 2.0			SEND1	TXFLGS	ERRORD 00	LNDMSL	B	
C	TMFLAG		H3	DAOFWK	DWNCNT	BITSTR	MXGRN	"+"	PSELA 01	CRSPEED 35			TSTFLG		ERSETA 00	LNDSSOS	C	
D	BFTMR		H4	DIM	TLANES	CYCLY	PSEL	TBCNT1	PSELB 00	Q1CYGRN 255				DEFLAG	ERSETB 0F	ENBLR	D	1 2 3 4
E	"+"		H5	SSEC	LCNNT	PCC	CRVOL	TBPNT2	RLANES 01	Q1MAXSET 15				STSC	ERSETC 00	SIGFLG	E	
F	MONTR		H6	DAYPTR	WDTGGL	VLTN	CROCC	"+"	GRNHLD 60	RATESTP 02				REFLAG	ERSETD 00	DPERR	F	
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F		

SATMS 3.0 Detector Layout Sheet

Date **1/18/2007**

Route **105** Direction **WB** P.M. **R3.30** Location **PRAIRIE / IMPERIAL HWY**
 E. No. **E4808** Location No. **1808** Line No. **33** Controller No. **3** Engineer **RAFAEL BENITEZ**

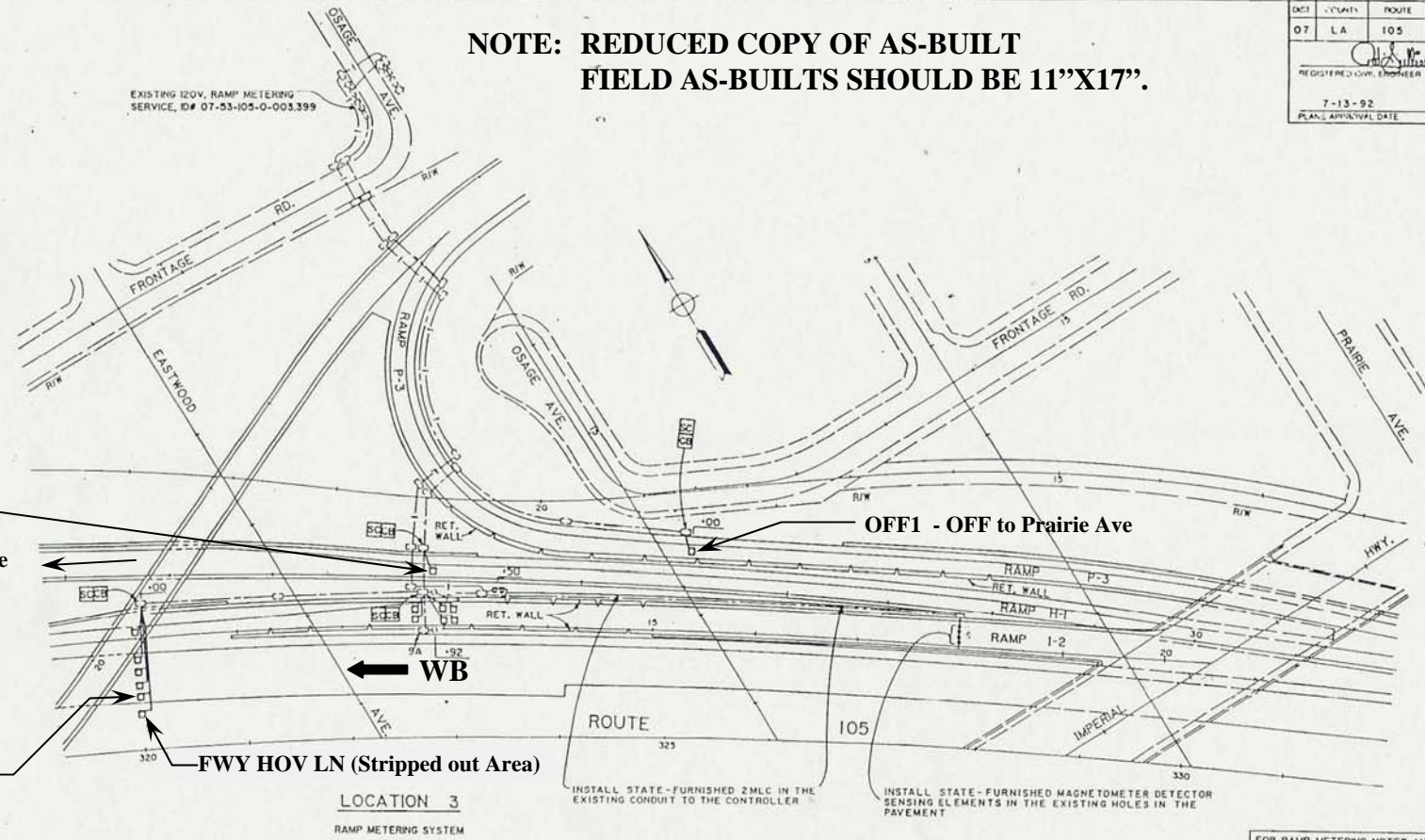
SD1 0F9-1 <input checked="" type="checkbox"/> Descrp ML HOV	HOV 0F8-6 <input checked="" type="checkbox"/>	SD4 0F9-4 <input type="checkbox"/> Descrp HAWTHORNE BL OFF	CD1 0F8-7 <input type="checkbox"/> Descrp	OS3 0F7-3 <input type="checkbox"/>	ML5 0F6-5 <input type="checkbox"/>	ML1 0F6-1 <input checked="" type="checkbox"/>	
SLOT #2	SLOT #4	SLOT #6	SLOT #8	SLOT #10	SLOT #12	SLOT #14	
D1 0F8-1 <input checked="" type="checkbox"/>	Q1 0F8-3 <input checked="" type="checkbox"/>	ON1 0F8-4 <input checked="" type="checkbox"/> PRAIRIE AVE OFF	CD ON 0F8-8 <input type="checkbox"/> Descrp	OS1 0F7-1 <input type="checkbox"/>	OS5 0F7-5 <input type="checkbox"/>	ML3 0F6-3 <input checked="" type="checkbox"/>	
SLOT #1	SLOT #3	SLOT #5	SLOT #7	SLOT #9	SLOT #11	SLOT #13	
P1 0F8-2 <input checked="" type="checkbox"/>	SD3 0F9-3 <input type="checkbox"/> Descrp	OFF1 0F8-5 <input checked="" type="checkbox"/>	CD OFF 0F7-8 <input type="checkbox"/> Descrp	OS2 0F7-2 <input type="checkbox"/>	OS6 0F7-6 <input type="checkbox"/>	ML4 0F6-4 <input type="checkbox"/>	
0F1 1 <input type="checkbox"/> Enable Device 1 2 <input type="checkbox"/> Enable Device 2 0 0		0F6 1 <input checked="" type="checkbox"/> Main Line 1 2 <input checked="" type="checkbox"/> Main Line 2 4 7 3 <input checked="" type="checkbox"/> Main Line 3 4 <input type="checkbox"/> Main Line 4 5 <input type="checkbox"/> Main Line 5 6 <input type="checkbox"/> Main Line 6 7 <input checked="" type="checkbox"/> ML HOV Flag 8 <input type="checkbox"/> Fwy Conn Flag		0F8 1 <input checked="" type="checkbox"/> Demand 2 <input checked="" type="checkbox"/> Passage 3 F 3 <input checked="" type="checkbox"/> Queue 1 4 <input checked="" type="checkbox"/> ON1 5 <input checked="" type="checkbox"/> OFF1 6 <input checked="" type="checkbox"/> Ramp HOV 7 <input type="checkbox"/> CD1 <input type="checkbox"/> 8 <input type="checkbox"/> CD ON <input type="checkbox"/> PRAIRIE OFF		0FB 1 <input type="checkbox"/> ML1 Disabler 2 <input type="checkbox"/> ML2 Disabler 0 0 3 <input type="checkbox"/> ML3 Disabler 4 <input type="checkbox"/> ML4 Disabler 5 <input type="checkbox"/> ML5 Disabler 6 <input type="checkbox"/> ML6 Disabler 7 (Not Used) 8 (Not Used)	
0F4 1 <input checked="" type="checkbox"/> Enable Metering 2 <input checked="" type="checkbox"/> Enable Local Responsive 0 F 3 <input checked="" type="checkbox"/> Enable Q1 Override 4 <input checked="" type="checkbox"/> Enable Q2 or Super Q1 Overr. 5 <input type="checkbox"/> Enable Independent Q2 6 <input type="checkbox"/> Chk ML Speed Before Q-overr. 7 <input type="checkbox"/> Enable Mag. D & P Lock-in		0F7 1 <input type="checkbox"/> Opp Side 1 2 <input type="checkbox"/> Opp Side 2 0 0 3 <input type="checkbox"/> Opp Side 3 4 <input type="checkbox"/> Opp Side 4 5 <input type="checkbox"/> Opp Side 5 6 <input type="checkbox"/> Opp Side 6 7 <input type="checkbox"/> CD2 <input type="checkbox"/> 8 <input type="checkbox"/> CD OFF <input type="checkbox"/>		0F9 1 <input checked="" type="checkbox"/> SD1 ML HOV 2 <input type="checkbox"/> SD2 <input type="checkbox"/> 3 <input type="checkbox"/> SD3 <input type="checkbox"/> 4 <input type="checkbox"/> SD4 <input type="checkbox"/> 5 <input checked="" type="checkbox"/> SD5 HAWTHORNE 6 <input type="checkbox"/> Queue 2 7 <input type="checkbox"/> Pass Vol Count 8 (Not Used)		0FC 1 <input type="checkbox"/> OS1 Disabler 2 <input type="checkbox"/> OS2 Disabler 0 0 3 <input type="checkbox"/> OS3 Disabler 4 <input type="checkbox"/> OS4 Disabler 5 <input type="checkbox"/> OS5 Disabler 6 <input type="checkbox"/> OS6 Disabler 7 (Not Used) 8 (Not Used)	
OD2		OD4		OD6		OD7	
0F5 1 <input type="checkbox"/> Device 1 Flash 2 <input type="checkbox"/> Device 2 Flash 0 4 3 <input checked="" type="checkbox"/> "Meter On" Sign Flash 4 <input type="checkbox"/> Enable Load Switch Monitoring 5 <input type="checkbox"/> Pre-time Red (if no Demand Det) 6 <input type="checkbox"/> Pre-time Green (if no Passage Det) 7 <input type="checkbox"/> Enable Shutdown Top EMS Failure 8 <input type="checkbox"/> Enable Shutdown Bot. EMS Failure		OD3		OD5		OD7	

**NOTE: REDUCED COPY OF AS-BUILT
FIELD AS-BUILTS SHOULD BE 11"X17".**

DATE	PLANS	ROUTE	PROJECT MILES	SHEET NO.	TOTAL SHEETS
07	LA	105	R2.5 / R5.5	58	75

REGISTERED CIVIL ENGINEER
7-13-92
PLANS APPROVAL DATE

PAUL BELL/AM
3002
3-31-96
L.A. COUNTY
CALIFORNIA



LOCATION 3
RAMP METERING SYSTEM

FOR RAMP METERING NOTES AND LEGEND
SEE SHEET E-1

FOR PROJECT NOTES & LEGEND SEE SHEET E-4

**LA-105-WB PM 3.30
AT PRAIRIE/IMPERIAL**

FWY OPS
Traffic Engineer: Rafael Benitez
(213) 897-1666
RAMP METERING SYSTEM
(LOCATION 3)

NOTE: THIS PLAN ACCURATE FOR ELECTRICAL ONLY.

SCALE: F=50' E-3

DESIGNED BY: J. KAWAJOTO
CHECKED BY:
TRAFFIC DESIGN

APPENDIX B
SATMS 3 SOFTWARE
WORKSHOP NOTES*

***This Appendix is the workshop notes of Mr. Liem Phan, TMC Support.**

SATMS-3 Workshop

April 15-17, 2003

Workshop's Objective

- To understand the differences between the original program SATMS-1 and this new program SATMS-3

SATMS-3

Installation Procedure

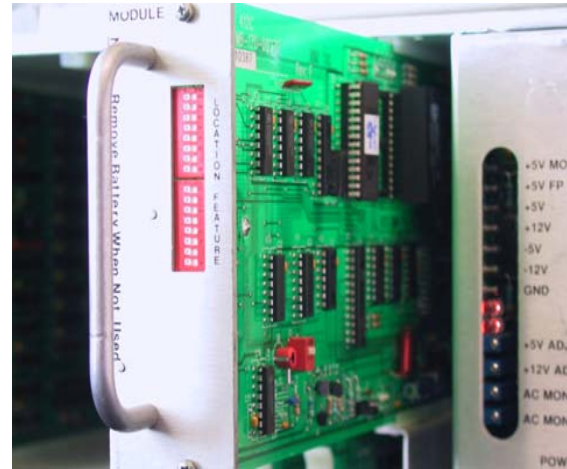
1. Read existing Controller ID which is displayed at address \$280
2. Power down the controller
3. Install new chip & set the Controller ID on dip-switch
4. Power up the Controller: Satms-3 will automatically erase all existing memory
5. Verify Software version (\$3E0) and Controller ID (\$280)
6. Re-enter Controller ID at \$080. Push 'E' to confirm your entry.
7. Setup real time clock and calendar
8. Setup T.O.D and Holiday Tables
9. Enter values at column 8, 9, and F
10. RESET Watch Dog

Note: One should use Field Manual (\$090) to test proper operation of the controller before leaving

SATMS-3 Controller ID & New Chip

EPROM Board

- New chip 27256 at U1
- Controller ID is set at the DIP switch



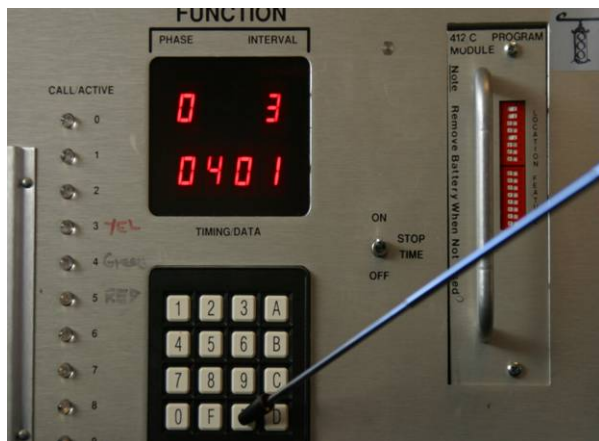
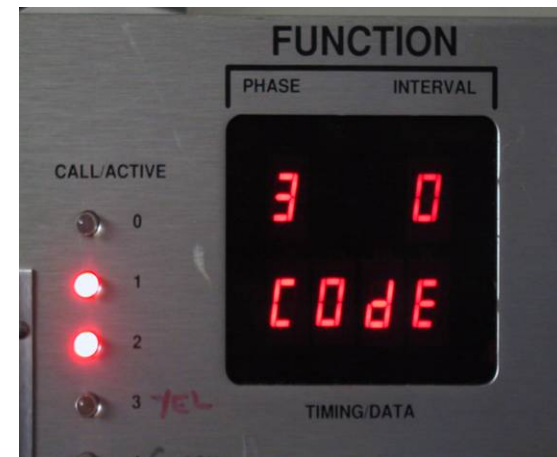
CPU Board & M170/E Board

- The chip 27256 can also be installed on the CPU board
- And the Controller ID is set at the DIP switch on the M/170E board

SATMS-3 Version 3.0

Software Version Identification

- When Power Up the controller, the software version 3.0 is shown for a brief moment
- Software code can also be read at address \$3E0



- Each version has a unique released date. SATMS-3 version 3.0 released date is 04-01-03
- To check the date, just press 'E'

SATMS-3

Controller ID – DIP Switch Settings

Controller Number	DIP Switch Settings	Controller Number	DIP Switch Settings
01	1	11	1, 2, 4
02	2	12	3, 4
03	1, 2	13	1, 3, 4
04	3	14	2, 3, 4
05	1, 3	15	1, 2, 3, 4
06	2, 3	16	5
07	1, 2, 3	17	1, 5
08	4	18	2, 5
09	1, 4	19	1, 2, 5
10	2, 4	20	3, 5

SATMS-3

Controller ID: Verification & Confirmation

- The Controller ID can be verified at address \$280



- The same Controller ID must be re-entered at address \$080 for confirmation
- If (080) & (280) do not match, you will see the effect of Rolling **Alpha-Numeric**

SATMS-3

Start Up & Shut Down	SATMS-3	Vs	SATMS-1
Automatic Start up Sequence	First Green (safety), Green Long Yellow (safety), and Red		N/A
Automatic Shutdown Sequence	Last Green (safety)		N/A

SATMS-3

Automatic Start Up Sequence

1. Black Ball : Meter is off
2. Green Ball :
 - First Green period: between 60 sec to 255 sec, set at address **First Green** (FIRGR) \$081
 - Green Hold period: if applicable
 - Green period: a few seconds of green time
3. Yellow Ball: duration in one-tenth of a second is set at **Long Yellow** (LNGYEL) \$083
4. Red Ball : waiting for Demand call

SATMS-3

Automatic Shutdown Sequence

1. Color Ball : Meter is Operational
2. Green Ball: duration in second is set at address **Last Green** (LASTGR) \$092
3. Black Ball: Meter is off

SATMS-3

Automatic Startup & Shutdown Simplify T.O.D. Table

T.O.D. Table – in SATMS-1

INTV	Time of Day	Rates	Days of the Week						
	(Hrs.)	(Veh/Min)	M	T	W	Th	F	Sa	Su
01	0500	01	X	X	X	X	X		
02	0501	10	X	X	X	X	X		
03	1900	01	X	X	X	X	X		
04	1901	00	X	X	X	X	X		
05	3333								
06									

SATMS-3

Reduces the Number of Intervals

- 1 minute Green at Start Up is replaced by automatic First Green, maximum 255 second
- 1 minute Green at Shutdown is replaced by automatic Last Green, maximum 255 second

INTV	Time of Day (Hrs.)	Rates (Veh/Min)	Days of the Week						
			M	T	W	Th	F	Sa	Su
01	0500	01	X	X	X	X	X		
02	0501	10	X	X	X	X	X		
03	1900	01	X	X	X	X	X		
04	1901	00	X	X	X	X	X		
05	3333								
06									

SATMS-3

T.O.D. Table – in SATMS-3

INTV	Time of Day (Hrs.)	Rates (Veh/Min)	Days of the Week						
			M	T	W	Th	F	Sa	Su
01	0500	10	X	X	X	X	X		
02	1900	00	X	X	X	X	X		
03	3333								
04									
05									
06									

SATMS-3

Traffic Responsive Enhancements

Traffic Responsive Rate	<div style="display: flex; justify-content: space-around;"> SATMS-3 Vs SATMS-1 </div>	
Maximum Rate	Dependent on number of vehicles/green	Independent on number of vehicles/green
TRRATE	Continuously updating status and rate	N/A
Local Speed display	Yes	N/A
Local Occupancy display	Yes	N/A

SATMS-3

RATE – The Metering Rate

- Definition: Metering rate is a total number of Vehicles Per Minute (VPM) that are allowed entering the freeway
- The Metering Rate is entered into the 170 controller by different ways : 1) Manual input, 2) SWARM, 5) Traffic Responsive, and 6) T.O.D. Table
- Every 30 second, the controller selects one of the available rate in the priorities shown in the Rate Hierarchy table

SATMS-3

Rate Hierarchy

1. Highest Level 1: Field Manual
2. 2nd Level : SWARM rate
3. 3rd : PSO (not used)
4. 4th : CORM (not used)
5. 5th : Traffic Responsive Rate
6. 6th : T.O.D. Rate

SATMS-3

MAXRATE – The Maximum Metering Rate

- Unlike SATMS-1, the maximum rate under SATMS-3 is tailored to the chart on the right (for 1 lane metering)
- For multiple metering lanes, the Maximum Rate is the rate shown in the table multiplied by the number of metered lane
- When the selected rate is more than **MAXRATE** - displayed at address \$0B6 – the meter will go to Rest-in-Green

Cycle length Table

TABLE OF CYCLE LENGTH
RELATIVE TO VOLUME OF TRAFFIC

VEH PER GREEN	CYCLE LENGTH (SEC)	RED TIME (SEC)	VEH PER MINUTE	VEH PER 5 MIN.	VEH PER 15 MIN.	VEH PER HOUR (VPH)
1	20.0	18.0	3	15	45	180
1	15.0	13.0	4	20	60	240
1	12.0	10.0	5	25	75	300
1	10.0	8.0	6	30	90	360
1	8.6	6.6	7	35	105	420
1	7.5	5.5	8	40	120	480
1	6.7	4.7	9	45	135	540
1	6.0	4.0	10	50	150	600
1	5.5	3.5	11	55	165	660
1	5.0	3.0	12	60	180	720
1	4.6	2.6	13	65	195	780
1	4.3	2.3	14	70	210	840
1	4.0	2.0	15	75	225	900
2	15.0	11.0	8	40	120	480
2	13.3	9.3	9	45	135	540
2	12.0	8.0	10	50	150	600
2	10.9	6.9	11	55	165	660
2	10.0	6.0	12	60	180	720
2	9.2	5.2	13	65	195	780
2	8.6	4.6	14	70	210	840
2	8.0	4.0	15	75	225	900
2	7.5	3.5	16	80	240	960
2	7.1	3.1	17	85	255	1020
2	6.7	2.7	18	90	270	1080
2	6.3	2.3	19	95	285	1140
2	6.0	2.0	20	100	300	1200
3	13.8	7.8	13	65	195	780
3	12.9	6.9	14	70	210	840
3	12.0	6.0	15	75	225	900
3	11.3	5.3	16	80	240	960
3	10.6	4.6	17	85	255	1020
3	10.0	4.0	18	90	270	1080
3	9.5	3.5	19	95	285	1140
3	9.0	3.0	20	100	300	1200
3	8.6	2.6	21	105	315	1260
3	8.2	2.2	22	110	330	1320
3	7.8	1.8	23	115	345	1380

*Assume green time = 2 seconds/veh, yellow time=2.0 seconds

SATMS-3

TODRATE - Time-Of-Day Metering Rate

- This is the lowest-priority rate; Hence, it is the “fall-back” rate
- The program reads TODRATE from the T.O.D. Table

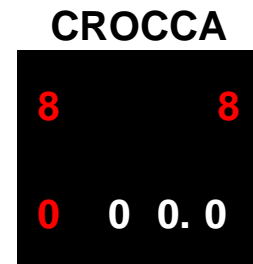
SATMS-3

Traffic Responsive Rate (TRRATE)

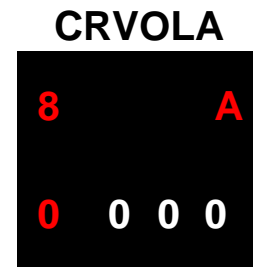
1. Enable TRRATE: set bit 2 of \$0F4



2. Enter the desired **Critical Occupancy** at \$088



3. Enter the desired **Critical Volume** at \$08A



SATMS-3

TRRATE - Traffic Responsive Metering Rate

- When the mainline volume and occupancy are both less than the desired Critical Volume **AND** Critical Occupancy, the controller recommends its own rate TRRATE
- If $TRRATE < TODRATE$: Use **TODRATE**
- If $TRRATE > TODRATE$: Use **TRRATE**
- If $TRRATE > MAXRATE$: **Rest-in-Green**

SATMS-3

Traffic Responsive Rate (TRRATE)

- With SATMS-3, TRRATE is continuously calculated every 30 seconds, and displayed at address **TRRATE** \$3D7



SATMS-3

Local Speed and Occupancy

- Estimated speed on Mainline, Opposite Side, and HOV Ramp are available:
 - \$357 ;Average 3 Min per lane (MPH) on Mainline
 - \$358 ;Average 3 Min per lane (MPH) on Opposite Side
 - \$359 ;Average 3 Min per lane (MPH) on HOV Ramp
- Estimate Occupancy can also be read (in %):
 - \$354 ;Average 1 minute occ mainline in percent (%)
 - \$355 ;Average 1 minute occ opposite side (%)
 - \$356 ;Average 1 minute occ HOV metering lane (%)

SATMS-3

Queue Override Enhancements

Queue-Overrides	SATMS-3	Vs	SATMS-1
Number of Queue	Q1 and Q2 to handle Connector Metering		Q1 only
Queue 1 activated	Can be set for No Action or gradually increment to Maximum Queue Rate or go directly to Rest-In-Green		Cycle Length = 4 seconds regardless of no. of platoon
Q2 activate	Rest-in-Green		N/A
Freeway priority	Yes (cancel Queue if MainLine Speed is low)		N/A
Surface street priority	Yes (rest-in-green if Queue continuously activated for a long time)		N/A
Queue Rate Priority level	Two levels: higher or lower than SWARM		One level only

SATMS-3 Q1 Override

Gradually raise the existing rate to its maximum

1. Enable Q1, and set Q1-Override level
 - Lower than SWARM, set bit 3 of \$0F4
 - Higher than SWARM, set both bit 3 and 4



SATMS-3 Q1 Override

Gradually raise the existing rate to its maximum

2. Enter Q1 Threshold level at \$085

```
QTHRS
8      5
      .
0 0 3.2
```

3. Enter the desired maximum Q1 rate at \$09E (must be less than or equal to the MAXRATE)

```
Q1MAXSET
9      E
      .
0 0 4 5
```

4. Enter the step value called Rate Step or RATESTEP \$09F

```
RATESTEP
9      F
      .
0 0 0 2
```

SATMS-3 Q1 Override

Can be set for NO action, or LIMITED action

2. Big Threshold Level at \$085

QTHRS
8 5
0 2 5. 0

3. Small Maximum Q1

Q1MAXSET
9 E
0 0 1 1

4. Zero Rate Step

RATESTP
9 F
0 0 0 0

SATMS-3 Q1 Override

Can be set for Rest-in-Green

- When Q1 reach its maximum
- And continuously stay at the maximum
- For X number of cycle (each cycle is 30 seconds) set at address \$09D

Q1CYGRN

9 D

0 2 5 5

- Q1 goes to Green Ball - Surface Street Priority

SATMS-3 Q2 Override

Rest-in-Green

1. Enable Q2, set both bit 3,4 of \$0F4
2. For Independent Q2, bit 5 must also be set



SATMS-3 Q2 Override

Rest-in-Green

3. Enter Q2 Threshold level at \$095

Q2THRS
9 5
0 0 2.0

SATMS-3

Q2 Override, Dependent on Q1

When Q2 is activated, and:

- If Q1 has not been activated:
False Q2 activation – No action
- If Q1 is currently ON: Signal goes to Rest-in-Green



SATMS-3

Q2 Override, Independent of Q1

- Don't care Q1 status
- When Q2 is ON, meter is Rest-in-Green

SATMS-3

Queue Override – Freeway Priority

- Cancel Queue Override when mainline speed is less than the **Critical Speed (CRSPEED)** set at address \$09C:

CRSPEED			
9			C
0	0	3	5

- If Queue Overrides have not been activated: they won't be turned ON
- When queue canceled, the meter goes back to normal rate

SATMS-3

Q-Overrides – Rate Hierarchy

- Highest Level 1: Field Manual
- ❖ **Q2 or Super Q1-Override**
 - 2nd Level : SWARM rate
 - 3rd : PSO
 - 4th : CORM
- ❖ **Q1-Override**
 - 5th : Traffic Responsive Rate
 - 6th : T.O.D. Rate

SATMS-3 Safety Enhancements

Safety Enhancement	SATMS-3	Vs	SATMS-1
Load Switch Failure Detection	Yes		N/A
EMS Failure Detection	Yes		N/A
Check for appropriate values	Yes		N/A

SATMS-3

Load Switch Failure Detection

- In the absence of 120 VAC to power the EMS, Shutdown Sequence will start immediately
- All entries at \$0F4 are cleared. The only way to resume metering is to reprogram \$0F4
- To activate this feature, just set bit 4 of COMM2 (\$0F5)
- Make sure this bit is CLEAR for normal ramp metering.



SATMS-3

EMS Failure Detection

- Light bulbs for EMS are continuously monitored during metering. Shutdown sequence will start immediately upon detection of bulb failure
 - To monitor Top part of EMS, set bit 7 of \$0F5
 - To monitor Bottom part of EMS, set bit 8 of \$0F5
- All entries at \$0F4 are cleared. The only way to resume metering is to reprogram \$0F4

SATMS-3

Other Enhancements

Enhancements	SATMS-3	Vs	SATMS-1
Communication Failure (CF) during SWARM	5 minutes extension of SWARM rate		Immediate reversion to TOD rate
Magnetometer Demand Loop Lock-On	Capable to fix this problem		N/A
Minimum Green	Settable		Fixed at 2.0 second
T.O.D table	16 interval		64 interval
Holiday table	8 holidays		16 holidays
LEDs used to indicate signal head color	Yes		No

SATMS-3

Magnetometer Demand Loop

- Problem 1: Magnetometers sometimes provide only a 'spike' reading when a vehicle is present
- Problem 2: Magnetometers also may provide a continuous reading or 'lock up' high
- SATMS-3 can help solve these two problems by setting bit 5 of COMM1 (\$0F4)



SATMS-3 L.E.D. Display

LED	Signal Color
-----	--------------

- | | |
|---|-------------|
| 2 | Last Green |
| 3 | Yellow |
| 4 | Green |
| 5 | Red |
| 7 | First Green |



SATMS-3

Ram Map – Column 8

CTRL-ID

8 0
0 0 1 9

ID Confirmation.
This no. must be matched with actual controller ID set at the DIP switch

FYELL

8 4
0 0 0 0

FIRST YELLOW
The very first Yellow after First Green

Ignored in this version

FIRGR

8 1
0 1 2 0

FIRST GREEN
The very First Green after Black.
60 sec min; 255 sec. Max

QTHRS

8 5
0 0 3 2

Q1 THRESHOLD
The threshold level for Q1 to be activated

PLTYEL

8 2
0 0 2 0

Platoon Yellow
The yellow that precedes RED whenever the Vehicles/Green (PSEL) is 2 or more.
1.0 sec min; 6.0 sec max

MXGRNA

8 6
0 0 5 0

MAXIMUM GREEN A
The maximum time for Green under plan 'A'

LNGYEL

8 3
0 0 5 0

LONG YELLOW
The safety yellow whenever GREEN time is more than 7 sec.
3.0 sec min; 6.0 sec max

MXGRNB

8 7
0 0 0 0

MAXIMUM GREEN B
The maximum time for Green under plan 'B'

SATMS-3

Ram Map - Column 8 (cont'd)

CROCCA

8 8
0 0 0 0

CRITICAL OCC. A (%)
Used for Traffic Responsive
Metering.

PSELA

8 C
0 0 0 1

PLATOON SELECT A
The number of vehicle per
green cycle for plan 'A'

CROCCB

8 9
0 0 0 0

CRITICAL OCC. B (%)
Used for Traffic Responsive
Metering

PSELB

8 D
0 0 0 0

PLATOON SELECT B
The number of vehicle per
green cycle for plan 'B'

CRVOLA

8 A
0 0 0 0

CRITICAL VOLUME A
Used for Traffic Responsive
Metering

RLANES

8 E
0 0 0 1

RAMP LANES
The number of metering lane

CRVOLB

8 B
0 0 0 0

CRITICAL VOLUME B
Used for Traffic Responsive
Metering

GRNHLD

8 F
0 0 6 0

GREEN HOLD
The minimum green time for
Rest-In-Green Queue 2
override, etc

SATMS-3

Ram Map - Column 9

FMNL

9 0
0 2 5 5

FIELD MANUAL RATE
255 - Rate not activated
000 - Black Ball indefinitely
001 - Green Ball indefinitely

PHYSOP

9 4
0 0 0 0

PHYSICAL OPPOSITE SIDES
The number of opposite side mainlanes.

FLSHR

9 1
0 0 0 0

FLASING RED
A value > 0 will flash the red

Q2THRS

9 5
0 0 2.0

Q2 THRESHOLD
The threshold level for Q2 to be activated

LASTGR

9 2
0 0 6 0

LAST GREEN
The last green time before turning the meter to black, or T.R. Rest-in-Black. User input in second

Q1ON

9 6
0 0 0.0

QUEUE 1 ON DELAY
Queue 1 override is delayed up to 25.5 sec. User input in 10ths of a second

PHYSML

9 3
0 0 4 0

PHYSICAL MAINLINES
The number of physical mainlanes.

Q2ON

9 7
0 0 0.0

QUEUE 2 ON DELAY
Queue 1 override is delayed up to 25.5 sec. User input in 10ths of a second

SATMS-3

Ram Map - Column 9 (cont'd)

Q1OFF

9 8
0 0 0.0

QUEUE 1 OFF DELAY
Release of queue 1 override
is delayed up to 25.5 sec.
User input in 10ths of a
second

CRSPEED

9 C
0 0 3 5

CRITICAL SPEED (MPH)
Mainline speed less than this
will terminate all Queue
Overrides

Q2OFF

9 9
0 0 0.0

QUEUE 2 OFF DELAY
Release of queue 1 override
is delayed up to 25.5 sec.
User input in 10ths of a
second

Q1CYGRN

9 D
0 2 5 5

Q1 GREEN CYCLE
The number of 30-seconds
cycle after Q1 reach its
maximum rate, for Q1 to go
green ball

9 A
0 0 0.0

(not used)

Q1MAXSET

9 E
0 0 4 5

Q1 MAXIMUM RATE SET
The desired value of maximum
Q1 rate, must be smaller than
the maximum allowed by the
program

MINGRN

9 B
0 0 2.0

MINIMUM GREEN
The minimum time for
Green. User input in 10th of
a second.

RATESTP

9 F
0 0 0 2

RATE STEP
The number of veh/min
increased by Queue 1 override

SATMS-3

Column 'F'

<p>0F1</p> <p>1 <input type="checkbox"/> Enable Device 1</p> <p>2 <input type="checkbox"/> Enable Device 2</p> <p>0 0</p>	<p>0F6</p> <p>1 <input checked="" type="checkbox"/> Main Line 1</p> <p>2 <input checked="" type="checkbox"/> Main Line 2</p> <p>3 <input checked="" type="checkbox"/> Main Line 3</p> <p>4 <input checked="" type="checkbox"/> Main Line 4</p> <p>5 <input type="checkbox"/> Main Line 5</p> <p>6 <input type="checkbox"/> Main Line 6</p> <p>7 <input type="checkbox"/> ML HOV Flag</p> <p>8 <input type="checkbox"/> Fwy Conn Flag</p> <p>0 F</p>	<p>0F8</p> <p>1 <input checked="" type="checkbox"/> Demand</p> <p>2 <input checked="" type="checkbox"/> Passage</p> <p>3 <input checked="" type="checkbox"/> Queue 1</p> <p>4 <input type="checkbox"/> ON1</p> <p>5 <input type="checkbox"/> OFF1</p> <p>6 <input type="checkbox"/> Ramp HOV</p> <p>7 <input type="checkbox"/> CD1</p> <p>8 <input type="checkbox"/> CD ON</p> <p>0 7</p>
<p>0F4</p> <p>1 <input type="checkbox"/> Enable Metering</p> <p>2 <input type="checkbox"/> Enable Local Responsive</p> <p>3 <input type="checkbox"/> Enable Q1 Override</p> <p>4 <input type="checkbox"/> Enable Q2 or Super Q1 Override</p> <p>5 <input type="checkbox"/> Enable Independent Q2</p> <p>6 <input type="checkbox"/> Check ML Speed Before Q-override</p> <p>7 <input type="checkbox"/> Enable Mag. D & P Lock-in</p> <p>0 0</p>	<p>0F7</p> <p>1 <input type="checkbox"/> Opp Side 1</p> <p>2 <input type="checkbox"/> Opp Side 2</p> <p>3 <input type="checkbox"/> Opp Side 3</p> <p>4 <input type="checkbox"/> Opp Side 4</p> <p>5 <input type="checkbox"/> Opp Side 5</p> <p>6 <input type="checkbox"/> Opp Side 6</p> <p>7 <input type="checkbox"/> CD2</p> <p>8 <input type="checkbox"/> CD OFF</p> <p>0 0</p>	<p>0F9</p> <p>1 <input type="checkbox"/> SD1</p> <p>2 <input type="checkbox"/> SD2</p> <p>3 <input type="checkbox"/> SD3</p> <p>4 <input type="checkbox"/> SD4</p> <p>5 <input type="checkbox"/> SD5</p> <p>6 <input checked="" type="checkbox"/> Queue 2</p> <p>7 <input type="checkbox"/> Pass Vol Count</p> <p>8 (Not Used)</p> <p># 0</p>
<p>0F5</p> <p>1 <input type="checkbox"/> Device 1 Flash</p> <p>2 <input type="checkbox"/> Device 2 Flash</p> <p>3 <input checked="" type="checkbox"/> "Meter On" Sign Flash</p> <p>4 <input type="checkbox"/> Enable Load Switch Monitoring</p> <p>5 <input type="checkbox"/> Pre-time Red (if no Demand Det)</p> <p>6 <input type="checkbox"/> Pre-time Green (if no Passage Det)</p> <p>7 <input type="checkbox"/> Enable Shutdown Top EMS Failure</p> <p>8 <input type="checkbox"/> Enable Shutdown Bot. EMS Failure</p> <p>0 4</p>		

SATMS-3 Base Display

Top Left Segment

- 0** No queues activated
- 1** Q1 is activated
- 2** Q2 is activated
- 3** Both Q1 and Q2 are activated
- 4** Green Hold is in effect
- F** False state: Q2 is activated without Q1 activated first



SATMS-3 Base Display



Top Right Segment

- b** Metering is disabled
- 1** Field Manual Rate is in effect
- 2** SWARM rate is in effect
- 5** TRRATE is in effect
- 6** TODRATE is in effect
- A** Today is Holiday: No metering

SATMS-3 Base Display

Bottom Left Segment

- A** Normal display
- b** Metering shutdown due to bad load switch
- C** Warning: current rate is too small
- d** Metering shutdown due to 'Prepare To Stop' EMS fails
- E** Metering shutdown due to 'Meter On' EMS fails



SATMS-3 Base Display



Bottom Right Segments

- xxx** Metering Rate
- 000** Metering is OFF
- 001** Meter is Rest-in-Green

SATMS-3 Wiring Diagram

WIRING DIAGRAM

