INTRO TRAFFIC 101

What is the purpose of a traffic signal?

What are the parts that make it work?

How do we time a traffic signal?

How do we maintain a traffic signal?
• What is the purpose of a traffic signal?
• Ensure safe and orderly flow of traffic
• Protect pedestrians and vehicles at busy intersections
• Reduce the severity and frequency of accidents between vehicles entering intersections

• Safely and efficiently move traffic!
When Properly Designed and Located:

- Allow for orderly traffic (vehicle and non-motorized) flow.
- Can increase the amount of traffic an intersection is able to handle.
- Can reduce the crash frequency, particularly right-angle crashes.
- Can be coordinated for nearly continuous traffic flow along a given route.
- Can be used to interrupt heavy traffic to permit side traffic to enter or cross a major roadway
What makes a traffic signal work?
Parts

- **Cabinet & Controller Unit (CU)** – Controllers run timings programmed by the agency.

- **Malfunction Management Unit (MMU)** – Also called the conflict monitor, it is the device used to detect and respond to improper and conflicting signals and improper operating voltages in a traffic control system.

- **Load Switch (LS)** – Takes the DC signal from the controller and switches it to AC outputs to be sent to the field.

- **Flasher (FL)** – Similar to a LS in look, it simply provides an AC flashing output that can be transferred to the field.

- **Flash Transfer Relay (FTR)** – Transfers the field indications between either the Load Switch or Flasher. Controlled by the MMU.
Traffic Signal Heads & Hardware

- Housing
- Mounting Hardware
- Pedestrian Pushbuttons
Housing

- **Vehicle and Pedestrian Signals**
  - Aluminum vs. Polycarbonate (MoDOT)
  - LED’s (Light Emitting Diode’s)
- Visors and Backplates
Aluminum / Polycarbonate

- **Aluminum**
  - More expensive
  - Heavier
  - Requires Painting

- **Polycarbonate**
  - Less expensive
  - Weighs Less
  - No painting required (standard colors black, green, yellow)
LED Indications

- 90% power savings over incandescent
- Long life (5 year warranty)
- Fits in standard 8” and 12” Vehicle housing and 9”, 12” and 16” Pedestrian housing
- ITE Specifications (GT1)
Visors and backplates

- **Visors**
  - Reduces sun phantom
  - Cuts off side view
  - Available in Aluminum and Polycarbonate
  - Scoop Visor

- **Backplates**
  - Provides a solid background
  - Available in Aluminum and Polycarbonate
  - Available Louvered (reduces wind load)
Mounting hardware

- Pipe Bracketing
- Span Wire
- Other Mounting Methods
Pipe bracketing

- MoDOT Signal Bracketing
- Side of Post/Pole mount
- 1-1/2” pipe fittings
- Connects to the top and bottom of signal housing
- Bands or bolts with pole plate or hub
Span wire

- Used on temporary signal systems
- Iron or Aluminum
- Hangs from cable over intersection
- Top has wire entrance and balance adjuster
- Bottom connects to a tether for stabilization
Other mounting methods

- “Astro Brac” from Pelco
  - Connects to top and bottom of signal
  - Attached to mast arm by clamp assembly
  - Allows signal raising, lowering or rotation

- CPI Poly Bracketing
  - Yellow or Black
Pedestrian pushbutton

- **Campbell Pushbutton**
  - Solid State
    - Piezo, LED and Audible Tone
  - Round or Rectangle
  - Advisor APS
    - Visual, Tactile and Audible information

- **Teeco Pushbutton**
  - Mechanical
Other Parts

- Pedestrian Poles
- Mast Arm Structures
- Conduit
- Pull boxes
- Wire
- Lighting at Intersection
- Traffic Signal signing
Methods of Detection
Today’s Options

- Preformed Loops & LCD Detectors
- Cut in Place loops
- Video
- Radar
- In Pavement Wireless
Preformed Loop & LCD Detectors
Why Preformed Loops?

- Long term reliability
- Five layers of protection
- The most accurate sensor
- Maintains integrity for the life of the pavement
- Stronger than standard loops
- Manufactured in a controlled environment
- Easy to handle, ship, and install
- Cost effective
• Before that loop leaves Reno it is soaked in Salt Water for three days. The loop is then megged and must exceed 1000 megs.
Why an LCD Detector?
Why an LCD Detector?

Eliminates guess work
- Provides critical information required for proper detector setup

Direct feedback on display
- Allows the accurate setting of frequency and sensitivity
  - Frequency
    - Actual frequency is displayed
    - Optimizes frequency separation
    - Minimizes crosstalk of adjacent loops connected to different detectors
  - Sensitivity
    - Bar Graph allows quick determination of correct sensitivity setting
Why an LCD Detector?

Advanced diagnostics
- Like having a built-in loop analyzer
- Displays inductance and \(-\Delta L/L\) of inductance
- Monitors and logs loop failures
- Audible detect signal

Push button programming
- Long term reliability by eliminating switch contacts
- All programming stored in non-volatile memory

Flexibility
- User specific options can be added with firmware changes
- Easy to upgrade
Video Detection

• The most possible applications
• Easy to install.
  – If conduit is open to the closest pole to the cabinet we can install Terra in one working day.
• Easy maintenance.
  – Only a laptop is required to change detection.
Terra Technology is…

- **Integrated Camera**
  - State-of-the-art dual-core processor
  - Adaptive lighting control

- **Embedded web server access for setup & monitoring via standard Internet web browsers**

- **Streaming MPEG-4 digital video anywhere, anyhow**

- **“3-wires only” installation**
  - Reduced cabling costs
  - Faster, easier installation

- **ClearVision™ faceplate for low maintenance**

- **Now with HD in the Vision Product**
Most Common (Intersection)...
Typical Installation

Contractor to Install

(4) Image Sensors & Brackets ① ② ③ ④
Power Cable to Each Image Sensor (115VAC)
Belden 8281 from Image Sensor to Cabinet
Coaxial and Power Cable Terminations
Radar Detection

• Freeway / Arterial Management
• Stop Bar / Presence Detection
• Advanced Intersection Detection / Queue Management
Radar is consistently accurate in all weather conditions

Radar is unaffected by:

- Rain
- Snow
- Fog
- Wind
- Ice Storms
- Dust Storms
- Changes in Lighting
- Sun Glare
- Shadowing
In-Pavement Wireless

- Detects Vehicle Presence and movement accurately
- Flexible and reliable wireless technology
- Virtually maintenance free
- Stop bar and advance detection
Traffic Signal Cabinets
NEMA

• National Electrical Manufacturers Association
• First Traffic Standard in 1975 (TS1)
• Defines:
  – Definitions
  – Environmental
  – Controller
  – Monitoring
  – Cabinet Architecture
  – Auxiliary Devices
  – Enclosures
Background of TS1

• First cabinet standard issued in 1975
• TS1 set the MINIMUM requirements for safe and effective traffic equipment.
• Defined items such as:
  – Controller Operations (MIN GRN)
  – Controller I/O (Ph. Next, Ph. On)
  – Hardware (Connectors, pin outs, etc.)
Background of TS2

• Approved by NEMA in March 1992
• First major update of the TS1 standard issued in 1975.
• TS2 goes above and beyond TS1 by defining controllers, cabinets, and systems more completely.
Defined by TS2

- Coordination
- Preemption
- Time Base Control
- Automatic Flash Operation
- Cabinet Hardware
- Telemetry Signals
- Detection
- Controller Logging
- Output Monitoring
- AC Power Monitoring
Cabinet Layout

- TS1
- TS2 – Type 1
- TS2 – Type 2
TS2 CABINET CONFIGURATION
• Alarm Inputs & Flash Inputs must be wired to TIO, FOI board “D” connector.
• No CMU data available the controller
TS2 Type 1
• Alarm Inputs & Flash Inputs come in through BIU’s

• MMU is connected to controller to pass flash data
What if I want MMU data and I have a TS1 cabinet???

- Buy a TS2 cabinet!!
- How about a TS2 – Type 2 cabinet modify???
TS2 Type 2

- Remove CMU and install a MMU

- Add an SDLC cable between Controller and MMU

- Option to add a TS2 Detector Rack for full TS2 detectors.
SDLC TECHNOLOGY

• Synchronous Data Link Control
• Unbalanced/Full Duplex
• Point to Point or Multipoint
• 153,600 bps

But what does all this mean?
• **Simplified Cabinet Wiring**
  – 15 wire SDLC bus replaces 171 wire A, B, and C cables

• **Program Verification**
  – Controller and MMU verify each others program every 100msec

• **Redundant MMU Function**
  – A TS2 controller can put the intersection into flash if the MMU fails
• Clearance Time Monitoring
  – The MMU times the interval between conflicting greens and yellow clearance time

• AC Power Monitoring
  – The MMU monitors incoming power for low voltage and brownout conditions

• Logging By Controller
  – Detector Report
  – Events Report
  – MMU Report
TS2 DETECTION UPGRADES

• Makes provisions for 64 detectors
  – The TS1 standard only has 8

• Detector Health Monitoring
  – Normal Operation
  – Watchdog Failure
  – Open Loop
  – Shorted Loop
  – Excessive Change in Inductance

• Failed Detectors
  – TS2 detectors ALWAYS fail on and report failure to the controller
TS2 cabinet components:
Load Switches, Flasher & Flash Transfer Relays

- Downward-compatible with TS1
- TS2 load switch has peak leakage of 10 mA
- TS2 flasher & flash transfer relay operate at 89 VAC
TS2 cabinet components:
Bus Interface Unit (BIU)

- Interfaces detector racks & terminals & facilities to SDLC bus in Type 1 mode
- 15-pin D connector on front panel to SDLC bus
- 64-pin DIN connector to backplane

I/O includes:
- 8 inputs
- 4 opto-isolated inputs
- 24 remappable input/outputs
- 15 outputs
- 4 address select inputs
BIU 1: I/O for most 4-phase intersections: 8 load switches, 4 ped pushbuttons, 2 preempt channels...

BIU 2: Augments BIU 1 with I/O for most 8-phase intersections

BIU 3: Signals used in system applications with remote communication units (RCUs)

BIU 4: Seldom-used I/O signals

BIUs 9-12: 16 detector channels per BIU, for up to 64 detectors per cabinet

BIUs 5-8 & 13-16: Reserved for TS2 & manufacturer use
TS2 cabinet components:

**TS2 Cabinet Power Supply**

- One required per TS2 cabinet with a BIU.
- Four outputs:
  - 24 VDC to drive load switches & BIUs.
  - 12 VDC to drive TS2 detectors.
  - 12 VAC for isolated inputs.
  - 60 Hz timing reference for BIUs.
- LED lamp for each output.
- Fuses for AC power input & power outputs.
CONTROLLER PROGRAMMING
PHASE: Any combination of traffic movements receiving right-of-way simultaneously during one or more intervals

• Vehicular Phases

• Pedestrian Phases
STANDARD NEMA PHASING “QUAD CONFIGURATION”
RING: Consists of one or more sequentially timed, conflicting phases, arranged to time in a pre-established order.

BARRIER: A reference point in the preferred sequence of a multi-ring controller at which all rings are interlocked. Barriers assure there will be no concurrent selection and timing of conflicting phases for traffic movements in different rings. All rings cross the barrier simultaneously to select and time phases on the other side.
STANDARD
NEMA
PHASING
“QUAD
CONFIGURATION”
CONCURRENT GROUPS: All of the phases between two barriers. Typically, they are the left turn and through movements on a single street.

PRIORITY GROUPS: Phase Priority assignment which determines the sequence the controller will follow to service calls.
STANDARD NEMA PHASING “QUAD CONFIGURATION”

RING 1

RING 2

CONCURRENT GROUP

CONCURRENT GROUP

BARRIER

BARRIER

PRIORITY GROUPS

1

2

3

4

5

6

7

8
INTERVAL: Portions of the time Cycle

- VEHICLE MINIMUM GREEN
- PEDESTRIAN WALK
- PEDESTRIAN CLEARANCE
- VEHICLE EXTENSION (PASSAGE)
- MAX GREEN (1, 2, OPTIONAL 3)
- GREEN REST / GREEN TRANSFER
- YELLOW CLEARANCE
- RED CLEARANCE
CONFIGURATION SUBMENU (MAIN MENU - 1)

- RING STRUCTURE
- PHASES IN USE
- EVENT LOGGING
Defines the standard phase sequence

CONTROLLER SEQUENCE

--- PRIORITY ---

1 1 1
1...2...3...4...5...6...7...8...9...0...1...2

R1  1  2| 3  4| 9 10| 0  0  0  0  0  0
R2  5  6| 7  8|11 12| 0  0  0  0  0  0
CG  .  .  .  .  .  .  .  .  .  .  .  .  .  .

R1, R2 = RING 1 AND 2 PHASE ASSIGNMENT.
CG = BARRIER LOCATION BETWEEN CONCURRENT PHASE TIMING GROUPS.

END OF SUBMENU

CONTROLLER SEQUENCE [ 1 ]

> SEQUENCE COMMANDS . HW ALT SEQ ENAB. YES

01 02 03 04 05 06 07 08 09 10 11 12
BC- C C C C C C C C C C C
R1- 1 2 3 4 9 10 13 14 . . .
R2- 5 6 7 8 11 12 15 16 . . .
R3- . . . . . . . .
R4- . . . . . . . .

R1-R4=RING 1-4, DATA ENTRY, PHASES 1-16
BC=BARRIER CONTROL, VALUES: B,C
B=BARRIER MODE
C=COMPATIBILITY MODE
Defines which phases are active in the sequence.
Specifies which controller events will be logged. As the event occurs, a descriptive message is logged along with the date and time of the occurrence.

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRITICAL RFE’S (MMU/TF)</td>
<td></td>
</tr>
<tr>
<td>NON-CRITICAL RFE’S (DET/TEST)</td>
<td></td>
</tr>
<tr>
<td>DETECTOR ERRORS</td>
<td></td>
</tr>
<tr>
<td>COORDINATION ERRORS</td>
<td>X</td>
</tr>
<tr>
<td>MMU FLASH FAULTS</td>
<td></td>
</tr>
<tr>
<td>LOCAL FLASH FAULTS</td>
<td></td>
</tr>
<tr>
<td>PREEMPT</td>
<td>X</td>
</tr>
<tr>
<td>POWER ON/OFF</td>
<td>X</td>
</tr>
<tr>
<td>LOW BATTERY</td>
<td></td>
</tr>
<tr>
<td>SPARE</td>
<td></td>
</tr>
<tr>
<td>ALARM 1</td>
<td></td>
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<tr>
<td>ALARM 2</td>
<td></td>
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<tr>
<td>ALARM 3</td>
<td></td>
</tr>
<tr>
<td>ADDITIONAL SCREEN(S)</td>
<td></td>
</tr>
</tbody>
</table>

**EVENT LOGGING**

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFES (MMU/TF)</td>
<td>YES</td>
</tr>
<tr>
<td>MMU FL FAULTS</td>
<td>YES</td>
</tr>
<tr>
<td>RFES (DET/TEST)</td>
<td>YES</td>
</tr>
<tr>
<td>COORD ERRORS</td>
<td>YES</td>
</tr>
<tr>
<td>PREEMPT</td>
<td>YES</td>
</tr>
<tr>
<td>POWER ON/OFF</td>
<td>YES</td>
</tr>
<tr>
<td>ACCESS</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 1</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 2</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 3</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 4</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 5</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 6</td>
<td>YES</td>
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<tr>
<td>ALARM 7</td>
<td>YES</td>
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<tr>
<td>ALARM 8</td>
<td>YES</td>
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<tr>
<td>ALARM 9</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 10</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 11</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 12</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 13</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 14</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 15</td>
<td>YES</td>
</tr>
<tr>
<td>ALARM 16</td>
<td>YES</td>
</tr>
</tbody>
</table>
CONTROLLER SUBMENU (MAIN MENU - 2)

- TIMING DATA
- RECALL DATA
- OVERLAP DATA
Defines the timing for all basic phase intervals

<table>
<thead>
<tr>
<th>PHASE...</th>
<th>1...2...3...4...5...6...7...8</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIN GRN.</td>
<td>2 2 2 2 2 2 2 2 2</td>
</tr>
<tr>
<td>BIKE GRN</td>
<td>0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>CS MGRN.</td>
<td>0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>WALK....</td>
<td>0 5 0 5 0 5 0 5 0</td>
</tr>
<tr>
<td>PED CLR.</td>
<td>0 7 0 7 0 7 0 7 0</td>
</tr>
<tr>
<td>VEH EXT.</td>
<td>2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0</td>
</tr>
<tr>
<td>VEH EXT2</td>
<td>0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0</td>
</tr>
<tr>
<td>MAX EXT.</td>
<td>0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>MAX1....</td>
<td>35 35 35 35 35 35 35 35</td>
</tr>
<tr>
<td>MAX2....</td>
<td>40 40 40 40 40 40 40 40</td>
</tr>
<tr>
<td>MAX3....</td>
<td>0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>DET MAX.</td>
<td>0 0 0 0 0 0 0 0 0</td>
</tr>
</tbody>
</table>

**END OF SUBMENU**
**GREEN INTERVAL OF AN ACTUATED PHASE WITHOUT VOLUME DENSITY**

- **Start of Green**: Based on the Min. Grn. setting
- **Minimum Green duration**
- **Extensible Period**: This point can occur between Min Grn period and Maximum in effect
- **Extensible Period Termination Point**: Max in effect is based on TOD Manual, or Coord Plan in effect
- **Max 1, 2, or 3**: Max timers do not start timing until there is a Serviceable conflicting call
Volume Density: Variable Initial = seconds per actuation X number of actuations. Actuations Before = number of actuations before time is added to min. green Seconds/Actuation = how much time is added when you start adding Max. Initial = how high the Max initial green is allowed to build
\[ t_0 = \text{Start of phase Green} \]
\[ t_1 = \text{Start of Max Timer} \]
\[ t_0 \text{ and } t_1 \text{ may start simultaneously.} \]

Max Timer start is dependent upon phase being in the Green interval and the registration of an opposing vehicle or pedestrian call.

Vehicle Extension Time (Pre-set Gap) portion of Green interval times concurrently with initial subject to vehicle actuations.
GREEN INTERVAL OF AN ACTUATED PHASE WITH VOLUME DENSITY

Start of Green

Min. Initial time
Duration established
By min. green
Time setting

Minimum
Green
Time

Variable Initial
Termination
Point

Min Grn duration
Added Initial

Variable Initial
Period

Maximum
Initial
Period

Extensible
Period
Termination
Point

Max in effect
Is based on TOD
Manual, or Coord
Plan in effect

Max
1, 2, or 3

Max timers do
Not start timing
Until there is a
Serviceable
conflicting call

This point can
Occur between
Min. Grn. And
Max. Initial period

This is the
Absolute maximum
For the variable
Initial period

TRAFFIC CONTROL
CORPORATION
Defines calls that the controller will place internally (in addition to or in place of calls placed by vehicle / pedestrian detectors).

- Places a call when the phase is not GREEN
- Places a ped call when the phase is not in WALK
- Same as VEHICLE RECALL + keeps the phase GREEN for the MAX time
- Places a call on the phase in the absence of any calls
- Remembers a vehicle call Even after the vehicle has Left the detection zone

---

**Controller Recall Data**

<table>
<thead>
<tr>
<th>Phase:</th>
<th>111</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase........</td>
<td>1 2 3 4 5 6 7 8 9 0 1 2</td>
</tr>
<tr>
<td>Locking Memory</td>
<td>. . . . . . . . . . . .</td>
</tr>
<tr>
<td>Vehicle Recall</td>
<td>. . X . . X . . . .</td>
</tr>
<tr>
<td>Ped Recall.....</td>
<td>X . . X . . . . . .</td>
</tr>
<tr>
<td>Recall to Max.</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>Soft Recall....</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>Don't Rest Here</td>
<td>. . . . . . . . . .</td>
</tr>
<tr>
<td>Ped Dark N/Call</td>
<td>. . . . . . . . . .</td>
</tr>
</tbody>
</table>

End of Submenu
OVERLAP: A traffic movement timed concurrently with one or more phases (parent phases). Typically the yellow and red clearance timing of the overlap is equal to that of the phase terminating the overlap.
ASC/2S Features:
- 12 Phases
- 2 Rings
- 4 Overlaps ***

*** The 12 phases can also be programmed as basic overlaps
ASC/2S Features:
- 12 Phases
- 2 Rings
- 4 Overlaps

*** The 12 phases can also be programmed as basic overlaps
Defines phases that overlaps can time with and any modified overlap operation (e.g. protected/permissive, lag)
COORDINATION
COORDINATION: The control or platooning of traffic to permit a continuous flow of vehicles along a street at a designed speed.
COORDINATION (MM-3)

Establishes a timing plan for the intersection which results in some form of progression in an arterial system.
CYCLE: The time required for one complete revolution of the timing dial or one complete sequence of signal indications.
Offset = A value calculated for vehicle travel time from a reference intersection

Offset = distance between intersections / travel speed

Offset Reference Point = typically start of coordinated phase green interval (user programmable)
TRAVEL TIME = DISTANCE / SPEED
= ((.25 MILES) / (35 MPH)) X (3600 SEC/HR) = 25.71 SEC (round up to 26 SEC)
SPLIT: The portion of the cycle length allocated to each phase in the intersection (green + yellow + red).

Split times can be expressed in percent (%) or seconds (').
100 SEC CYCLE LENGTH

25 second or 25% split (100 second cycle)
COORDINATED PHASES: The traffic movements that will remain green until a fixed point in the cycle in order to maintain an arterial progression or other predictable signal sequence (normally through movement on the main street).
<table>
<thead>
<tr>
<th>COORDINATOR OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPLIT UNITS.. SEC</td>
</tr>
<tr>
<td>OFFSET UNITS. SEC</td>
</tr>
<tr>
<td>INTERCNT FMT. STD</td>
</tr>
<tr>
<td>INTERCNT SRC. NIC</td>
</tr>
<tr>
<td>RESYNC COUNT. 0</td>
</tr>
<tr>
<td>TRANSITION... SMOOTH</td>
</tr>
<tr>
<td>DWELL PERIOD. 0s</td>
</tr>
</tbody>
</table>

FREE ALTERNATE SEQUENCE . . . . . . . .

END OF SUBMENU
Defines specific pattern data for each coordination pattern, including cycle length, phase splits, permissive periods, coordination phases, recalls, and alternate sequence.
PREEMPTION
Railroad / Emergency Preempt sequences “preempt” the normal operation of the controller in order to run a priority sequence.

Bus Preempt sequences also “preempt” the normal operation of the controller, but with a lower priority than a railroad or emergency vehicle preempt.
PREEMPTION: A SPECIAL SIGNAL SEQUENCE FOR THE PURPOSE OF SERVICING SPECIAL TASKS, EMERGENCY VEHICLES AND TRAINS ARE THE MOST WIDELY USED.
EMERGENCY PREEMPTION:
Optical sensors, such as the one shown next to the signal head above, allow emergency vehicles to activate an emergency vehicle preemption by strobing a special light on top of their vehicles.
TRAIN PREEMPTION:
Intersections in close proximity to railroad crossings, such as the one shown in the picture above, go into a railroad preemption sequence when the grade crossing is activated. The most safety crucial interval of railroad preemption (TRACK CLEARANCE) is changing the lights green so motorists can quickly clear the tracks.
TRANSIT SIGNAL PRIORITY

- No interruption of coordination
- No omission of phases
- Minimal time required because of “check-in”, “check-out” operation
- One transit vehicle movement during a cycle
- Re-service prohibited during next cycle
- Modification of phase splits to accommodate transit vehicles
Screen 1 of 3: Defines preempt phases and general options
Defines the active phases and timing for bus preemptors
THE NIC/TOD OPERATION ON THE ASC/2 CONTROLLER IS DIVIDED INTO 2 SEPARATE PROGRAMMING AREAS FOR THE EASE OF USER OPERATION.

THE NIC DATA AREA CONTROLS ONLY THE COORDINATION PLAN.

THE TOD DATA AREA CONTROLS ALL OTHER TOD PROGRAMMING ITEMS (E.G. FLASH, MAX 2-3, RECALL, PHASE OMITs, ALT. VEH. EXT., TYPE 0 DET. DELAY, ALT. SEQUENCE, DET. DIAGNOSTICS, ETC...)
NIC/TOD OPERATION (MAIN MENU - 5)

ALLOWS THE CONTROLLER TO PROGRAM THE TIME AND DATE, WEEK PLANS, YEAR PLANS, HOLIDAYS, COORDINATION PATTERNS AND PHASE OPERATIONS BY TIME OF DAY AND DATE.
Defines the schedule for selecting coordination patterns by time of day

<table>
<thead>
<tr>
<th>STEP</th>
<th>PGM</th>
<th>TIME</th>
<th>PATTERN</th>
<th>OVERRIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
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ADDITIONAL SCREEN(S)
Defines the schedule for selecting alternate controller operation by time of day

(additional steps are on additional screens)
DETECTOR SUBMENU (MAIN MENU - 6)

- TYPE/TIMERS
- PHASE ASSIGNMENT
- CROSS SWITCHING
Defines detector characteristics, timing (delays and extensions), locking detector, and log enable

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<th>EXTEND</th>
<th>DELAY</th>
<th>RESET</th>
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ADDITIONAL SCREEN(S)
Defines which phases are called by each detector.
Defines phases that are called by each detector under the conditions listed on this page.

Phases are called if:

1) The primary assigned phases are not green and the cross switched phase is green.

2) The primary assigned phase is omitted and the cross switched phase is not omitted.
STATUS DISPLAYS
Monitor in controller, coordinator, preemptor status from the display.

Place vehicle, pedestrian, preempt calls through the front panel.

Monitor telemetry communications status.

Monitor detector presence.

View intersection flash conditions.
How do we maintain a traffic signal?
IMSA PM Check List

Vacuum cabinet
Vermin Control
Sealing Cabinet
Replace Cabinet Light Bulb
Test Cabinet Ventilation
Inspect Suppression Devices
Test Cabinet Voltage
Check all Toggle Switches
Check Controller Timings
Update Holiday Plans
Check Back-Up Battery
Check PED Buttons
Loops
Inspect Loop Sealant
Visual Check of all Overhead Devices
Replace Air Filter
Remove Overgrown Vegetation
Replace Duct Seal
Lubricating Locks & Hinges
Test Electrical Outlets
Check Tightness of Connections
Test Cabinet Grounding
Verify Flash Rate
Watch Controller Operation
Check Date & Time on Controller
Conflict Monitor / MMU Test
Check Vehicle Detectors & Inductive
Check Pull Boxes & Splice Locations
Inspect Mast Arm Terminals
Questions???