Run-Away Truck Escape Ramp, A Truckers Safety Net

Presented by:

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CalTrans District 6, Fresno

Run-Away Truck Escape Ramp

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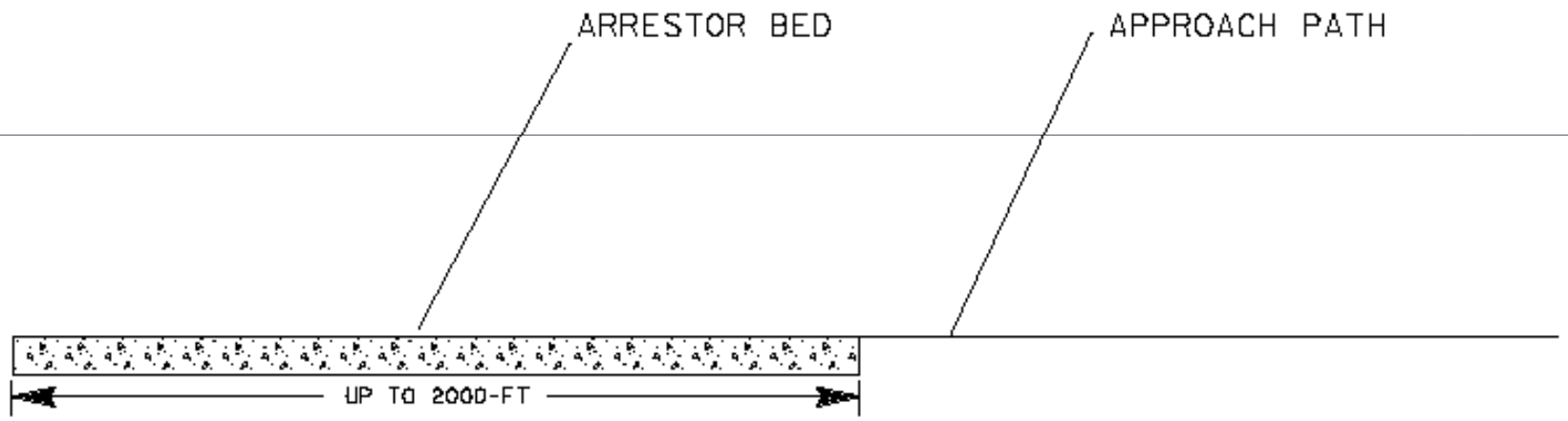
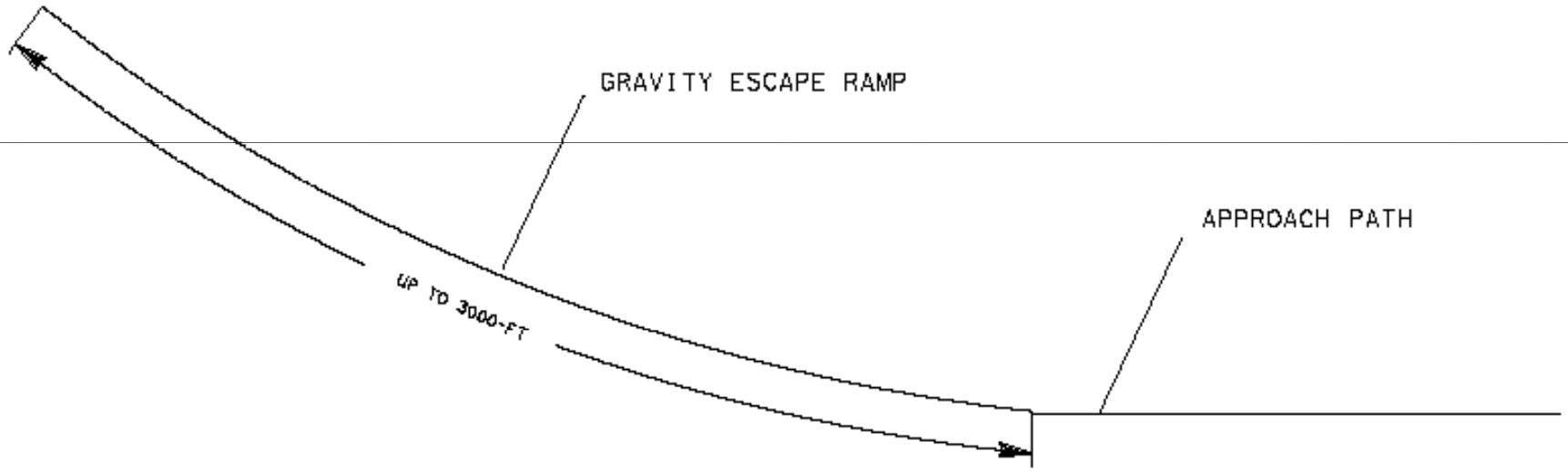
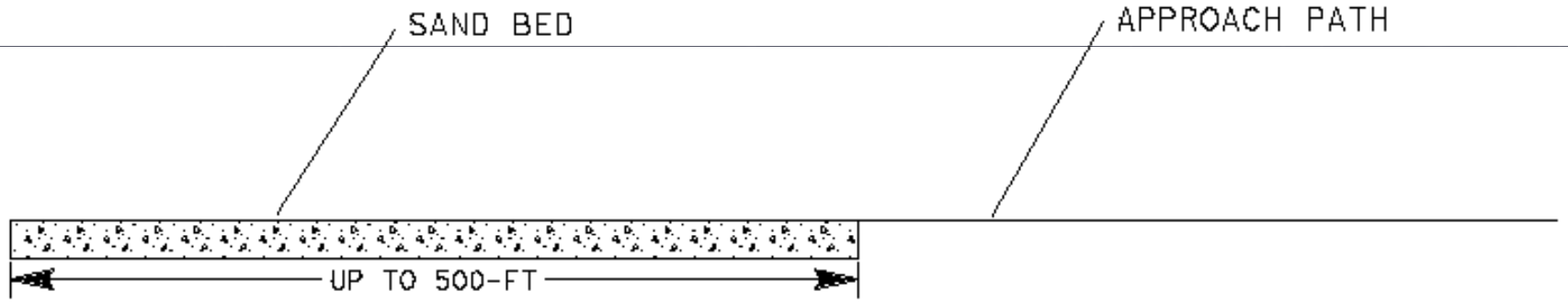
Topic of discussion – This presentation will cover the various systems used to automate the detection and verification of vehicles as they enter the Run-Away Truck Escape ramp.

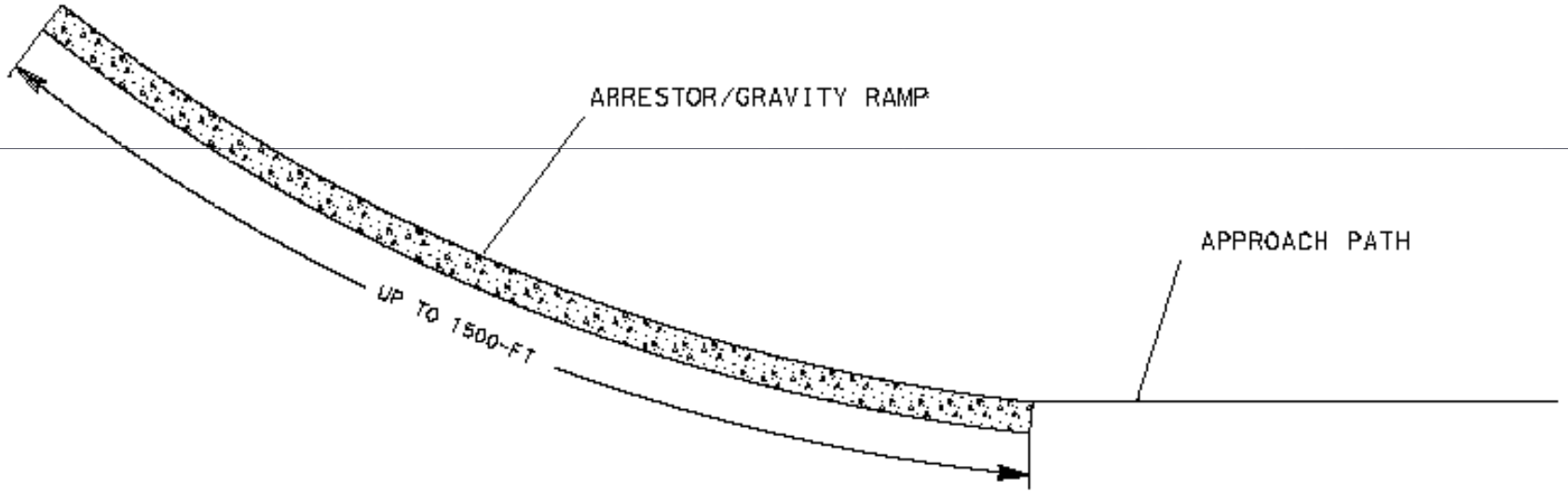
Escape Ramp History

- What is a Run-Away Truck Ramp?
- Types of escape ramps
  - Arrestor bed
  - Gravity escape ramp
  - Sand pile escape ramp


ARRESTOR BED
APPROACH PATH
UP TO 2000-FT


GRAVITY ESCAPE RAMP
APPROACH PATH
UP TO 3000-FT


SAND BED
APPROACH PATH
UP TO 500-FT

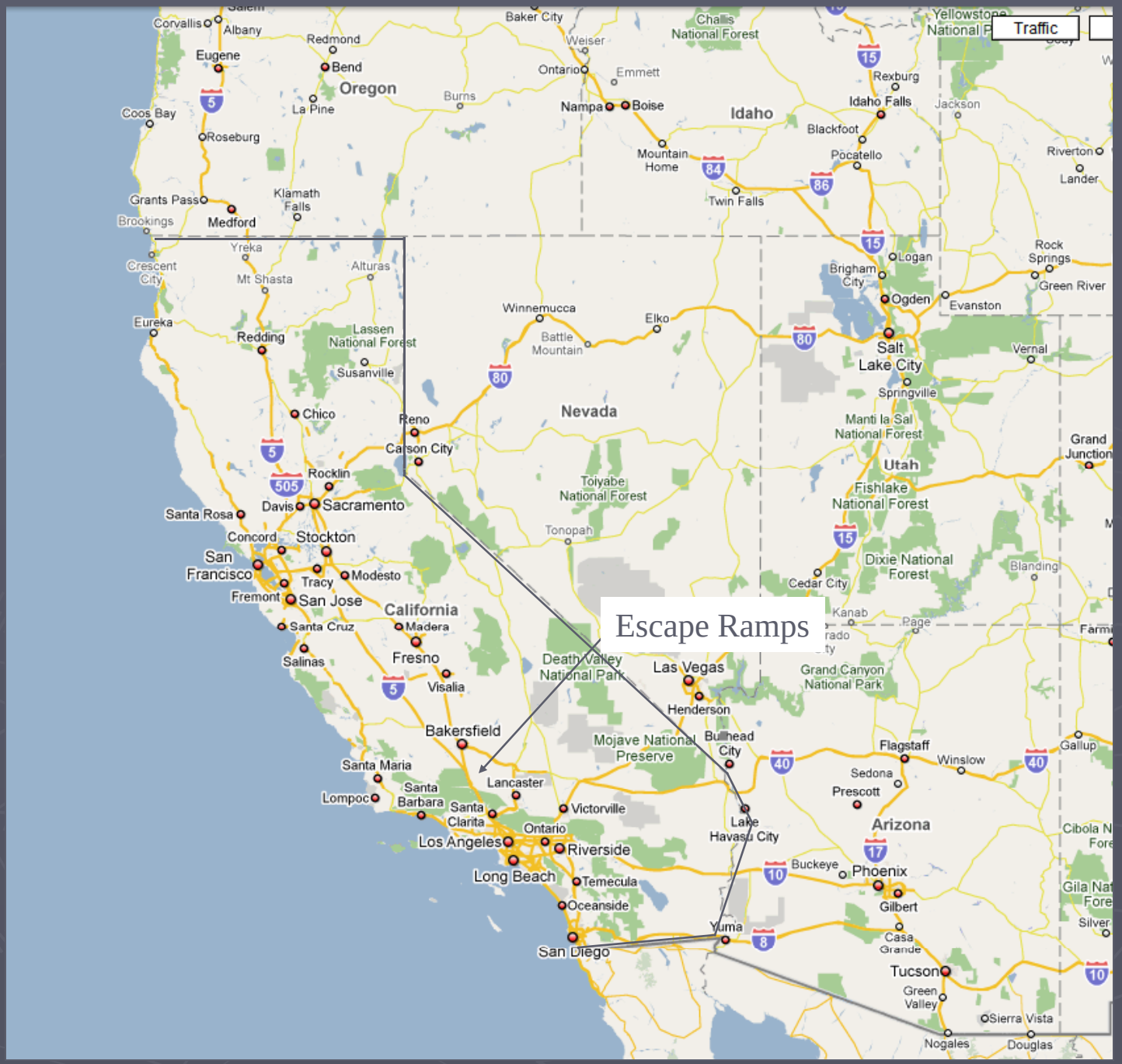

ARRESTOR/GRAVITY RAMP
APPROACH PATH
UP TO 1500-FT

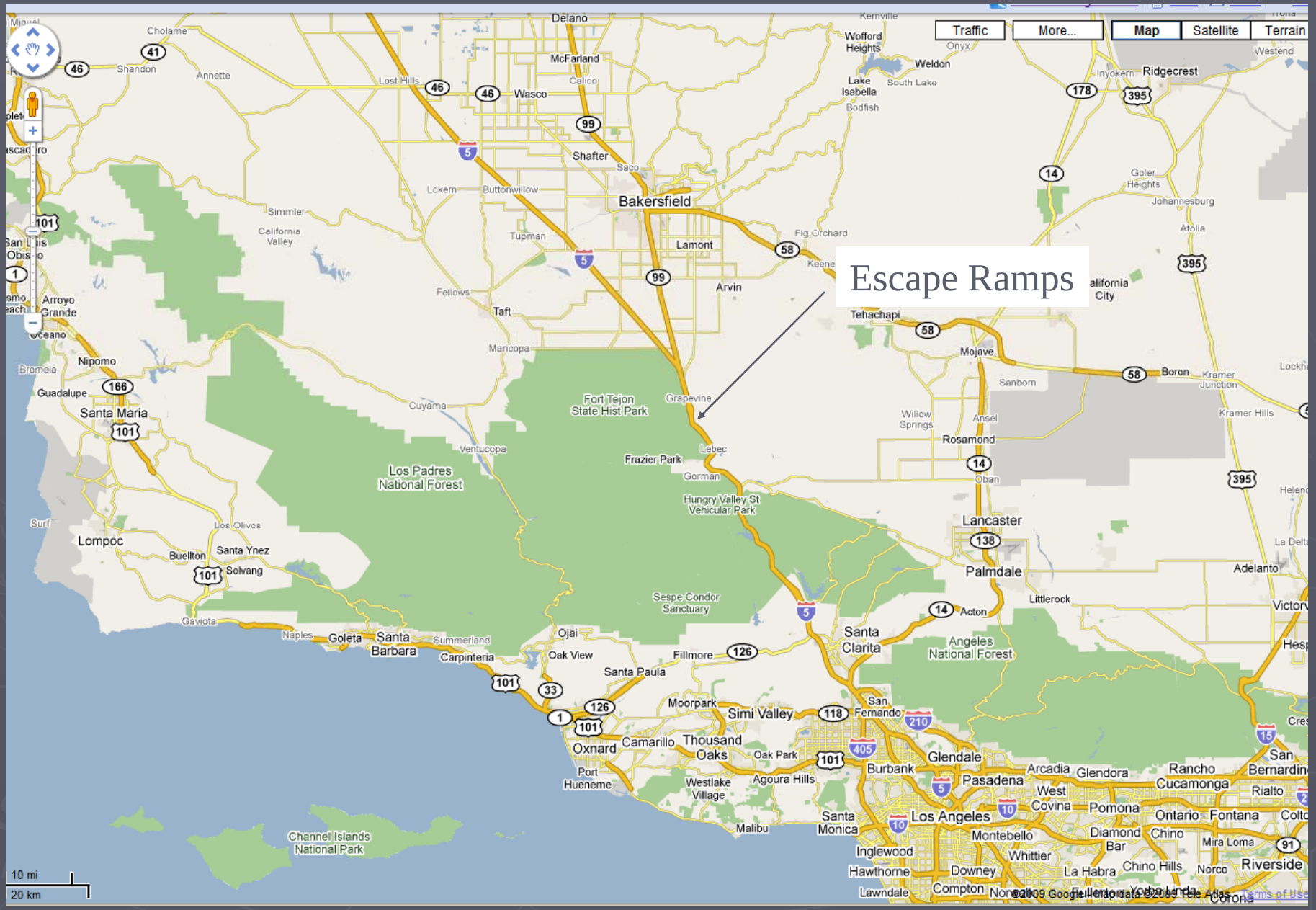
Escape Ramp

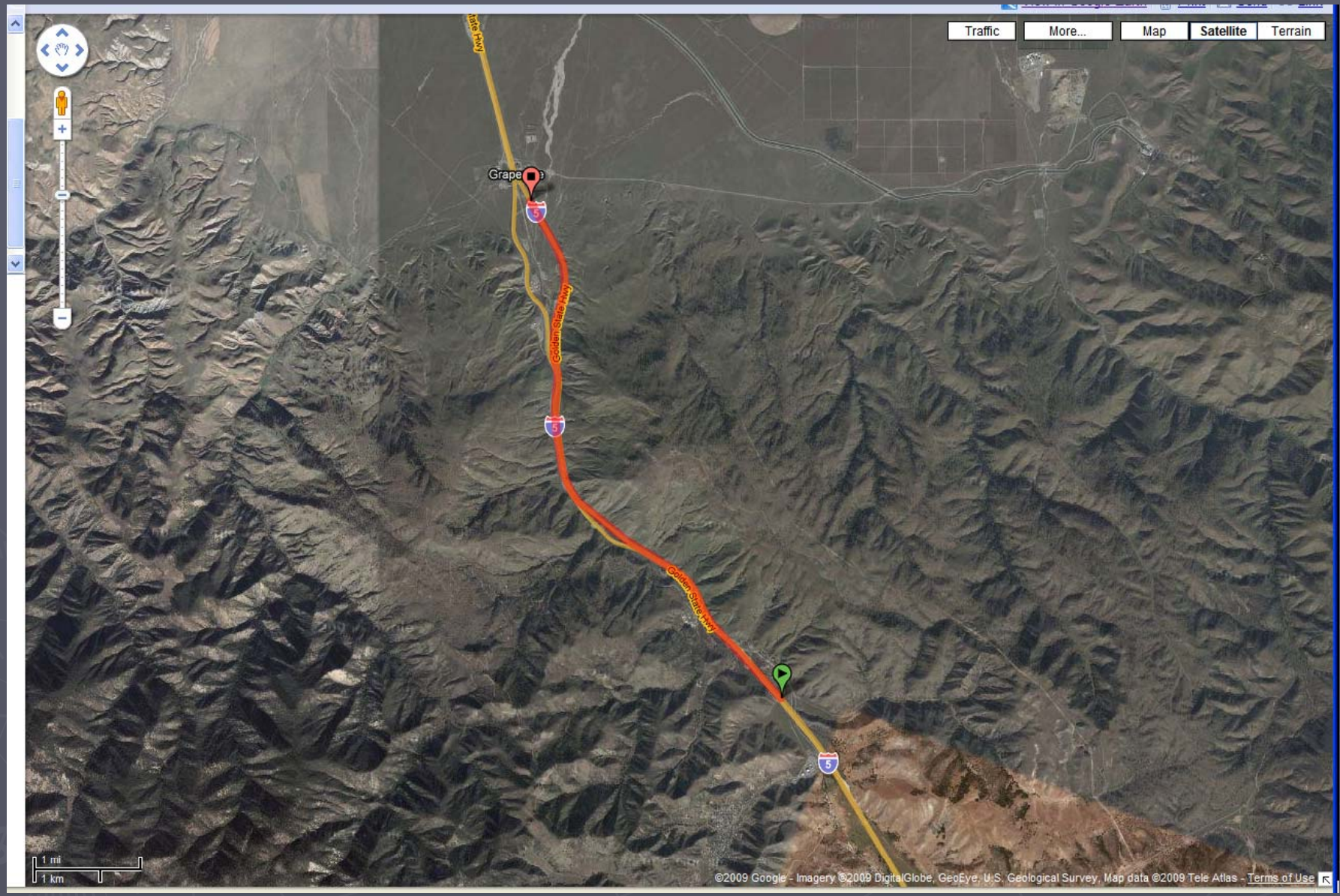
- 1st installed in Castaic, CA – 1956
- 15 total in CA

Escape Ramp

- Located just south of Grapevine Road on NB Interstate 5
- One of the nation's steepest and longest sustained grades on an Interstate with a descending grade of 6% for over 5 miles


Traffic
Escape Ramps
Oregon
California
Nevada
Idaho
Utah
Arizona
Corvallis
Albany
Eugene
Redmond
Bend
Coos Bay
Roseburg
La Pine
Burns
Baker City
Weiser
Ontario
Emmett
Nampa
Boise
Challis National Forest
Rexburg
Idaho Falls
Jackson
Blackfoot
Pocatello
Mountain Home
Twin Falls
Yellowstone National P
Riverton
Lander
Grants Pass
Medford
Klamath Falls
Brookings
Yreka
Crescent City
Mt Shasta
Alturas
Eureka
Redding
Lassen National Forest
Susanville
Winnemucca
Battle Mountain
Elko
Logan
Brigham City
Ogden
Evanston
Rock Springs
Green River
Salt Lake City
Springville
Vernal
Manti la Sal National Forest
Grand Junction
Fishlake National Forest
Toiyabe National Forest
Tonopah
Chico
Reno
Carson City
Rocklin
Davis
Sacramento
Santa Rosa
Concord
Stockton
San Francisco
Tracy
Modesto
Fremont
San Jose
Santa Cruz
Madera
Salinas
Fresno
Visalia
Death Valley National Park
Las Vegas
Henderson
Cedar City
Dixie National Forest
Blanding
Kanab
Page
Grand Canyon National Park
Bakersfield
Mojave National Preserve
Bullhead City
Flagstaff
Winslow
Gallup
Sedona
Prescott
Santa Maria
Lompoc
Santa Barbara
Santa Clarita
Lancaster
Victorville
Lake Havasu City
Los Angeles
Ontario
Riverside
Long Beach
Temecula
Oceanside
Buckeye
Phoenix
Gilbert
Yuma
Casa Grande
San Diego
Tucson
Green Valley
Sierra Vista
Nogales
Douglas
Cibola N
Gila Nat
Silver


Escape Ramps
Traffic
More...
Map
Satellite
Terrain
Bakersfield
Arvin
Lamont
Taft
Tehachapi
Mojave
Rosamond
Lancaster
Palmdale
Santa Maria
Lompoc
Santa Barbara
Oxnard
Camarillo
Thousand Oaks
Simi Valley
Moorpark
Santa Clarita
Los Angeles
Pasadena
Glendale
Burbank
Riverside
San Bernardino
Fort Tejon State Hist Park
Los Padres National Forest
Angeles National Forest
Channel Islands National Park
Sespe Condor Sanctuary
Hungry Valley St Vehicular Park
Frazier Park
Grapevine
10 mi
20 km


Traffic
More...
Map
Satellite
Terrain
Golden State Hwy
Golden State Hwy
1 mi
1 km
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Escape Ramp

- Peak Month Average Daily Traffic (ADT) of 86,000 and an average Truck percentage of 25%.

Escape Ramp

- Ramp usage reported by CHP at about 30-35 times/year.
- What happened before they were installed?
  - Trucks would use whatever resources were available to dissipate large amount of kinetic energy in order to decrease their travel speed. This would include:

Escape Ramp

- Rubbing on the cut-slopes or metal beam guard rails
- Riding out the runaway vehicle until the vehicle slowed-down enough to allow the use of gears to safely slow the vehicle down to a safe stop

The Request

- A request was sent to our group to enable video surveillance of the escape ramps for verification of vehicle entries.
- Existing system consisted of automated EMS activation based on vehicle entry to ramp.

The Request

- Many challenges had to be overcome
  - No communications in the area
  - Nearest Telco service over 3 miles away. Other attempts to install communications had failed.
  - How would video be captured locally at site?
  - How would “trigger” activate video recording?
  - How would the “trigger” work?

Initial Design Ideas

- Full video streaming recording, not just snapshots
- Needed to provide CHP a means of resetting EMS's without waiting for Caltrans maintenance
- Caltrans maintenance needed a way to test the system

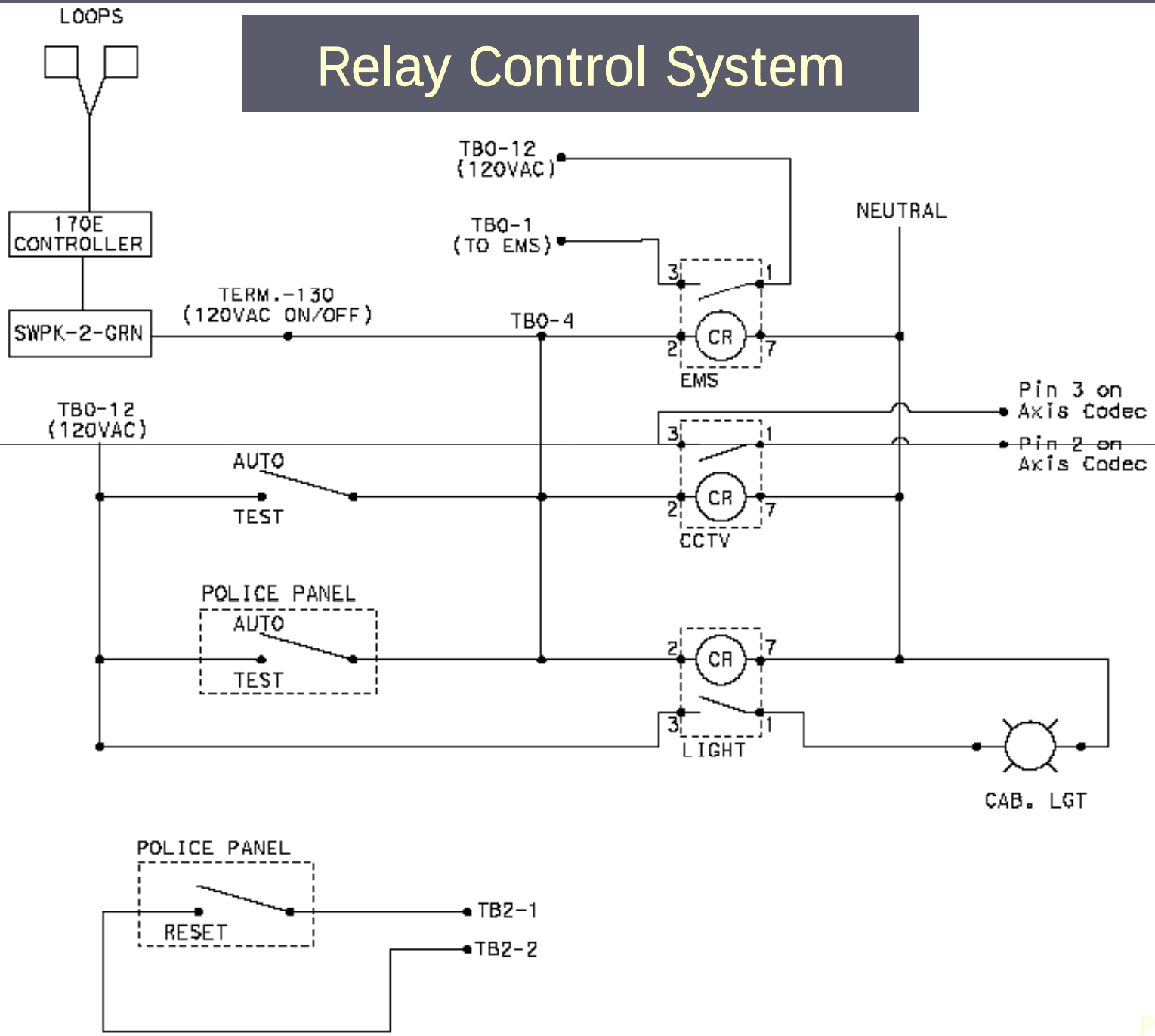
Project Components – Phase I

- 1st phase of project
  - Original budget: $4000 (h/w and s/w)
  - Components used
    - video decoders – Axis 292 decoders
    - Used exiting “ruggedized”
    - Relays, wiring, misc.
    - Existing items: Signal cabinet with 170E Controller; CCTV system

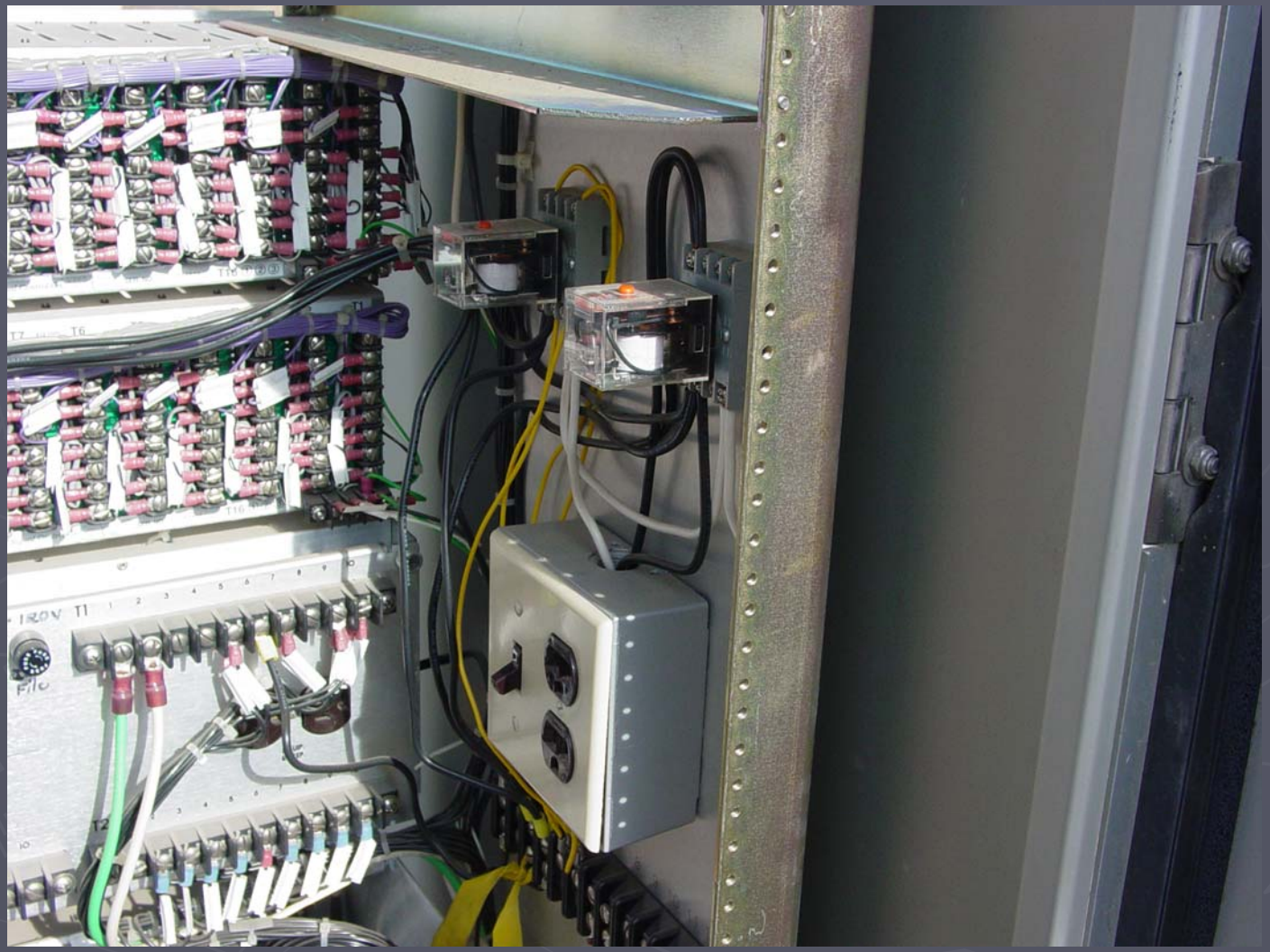

CLOSED
RUNAWAY
TRUCK RAMP
LEFT EXIT 3/4 MILE

LOOPS
170E CONTROLLER
SWPK-2-GRN
TERM.-130
(120VAC ON/OFF)
TB0-4
TB0-1
(TO EMS)
TB0-12
(120VAC)
3
1
2
CR
7
EMS
NEUTRAL

Relay Control System

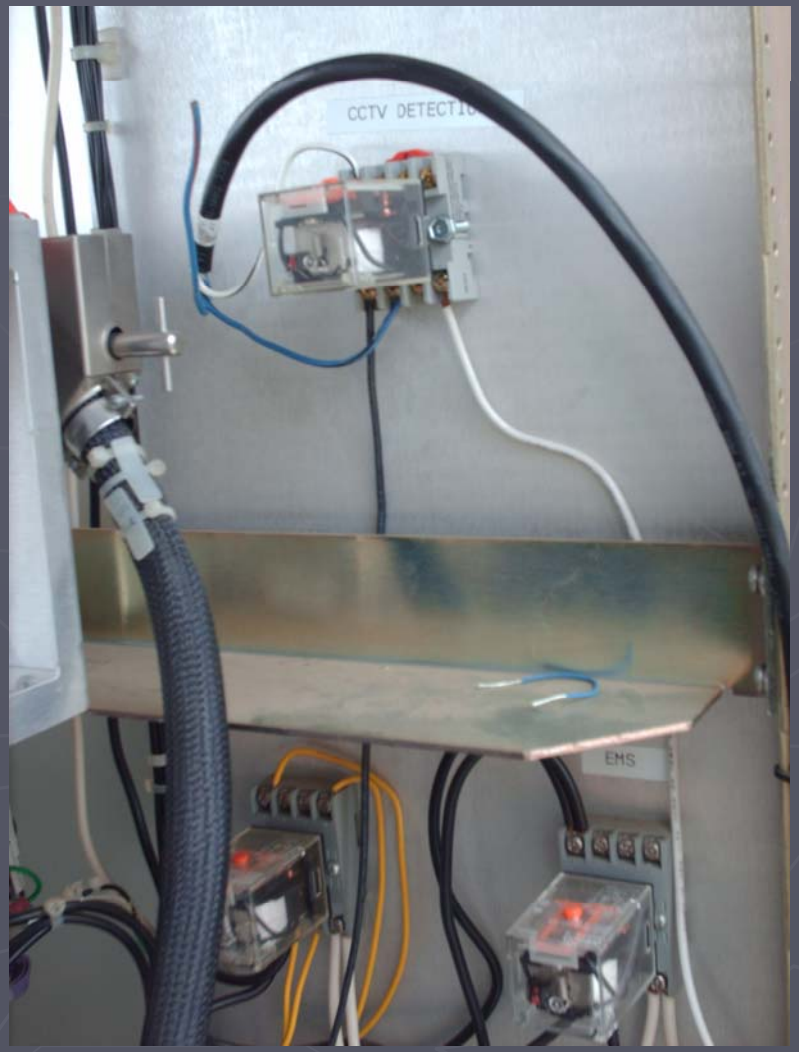


Relay Control System



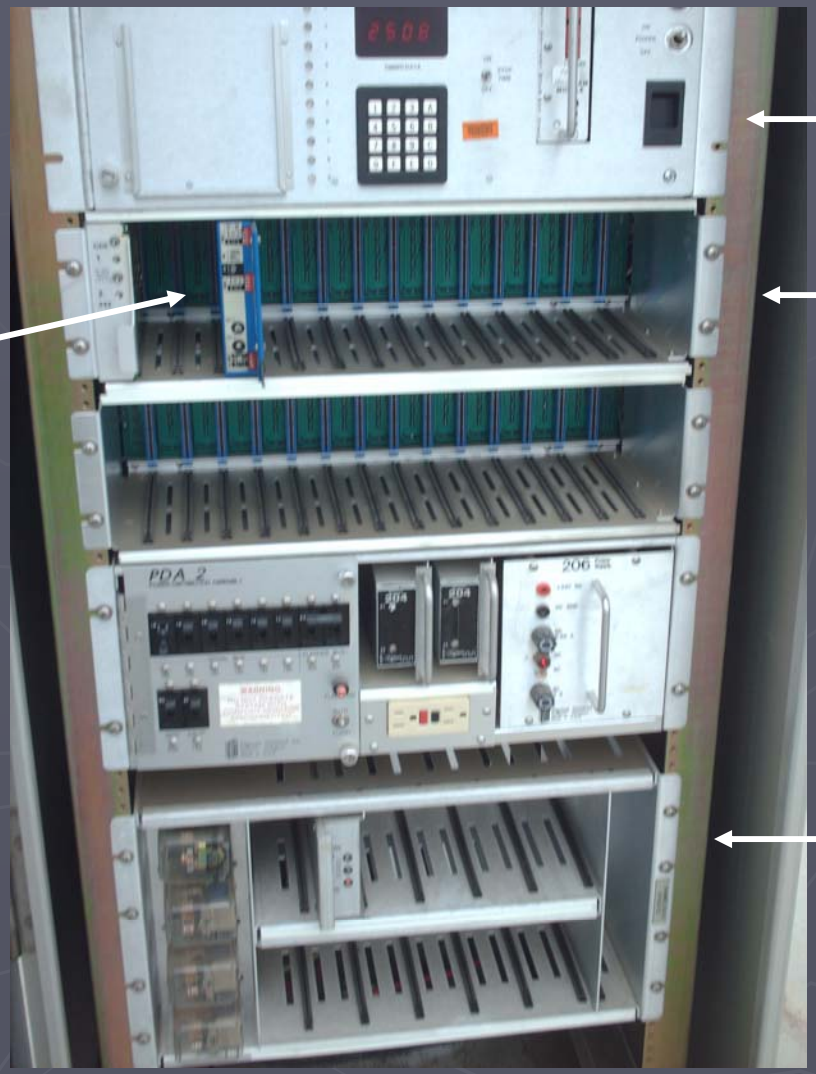
Phase I

Relay Control System



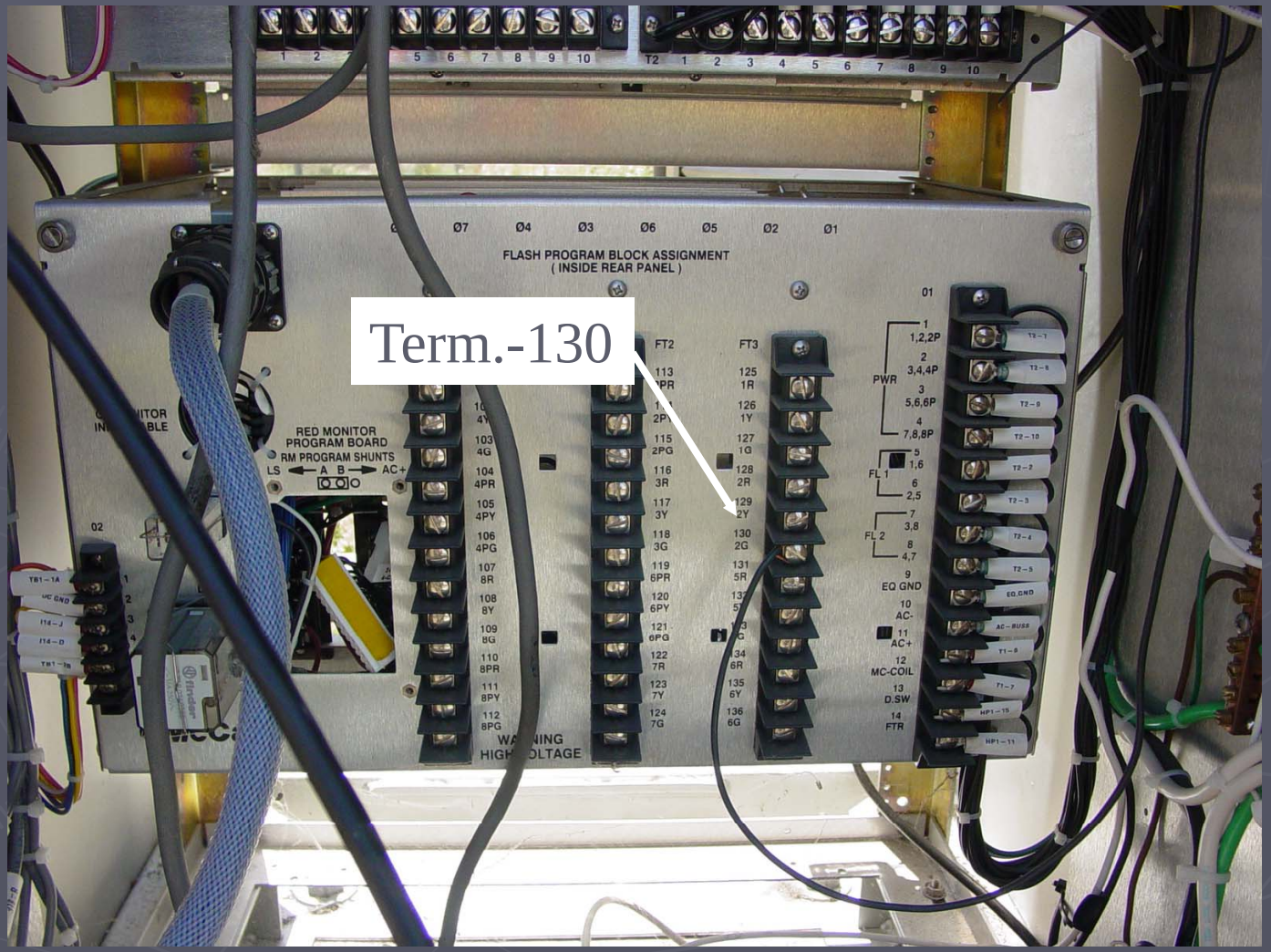
Phase I

Vehicle Detection System



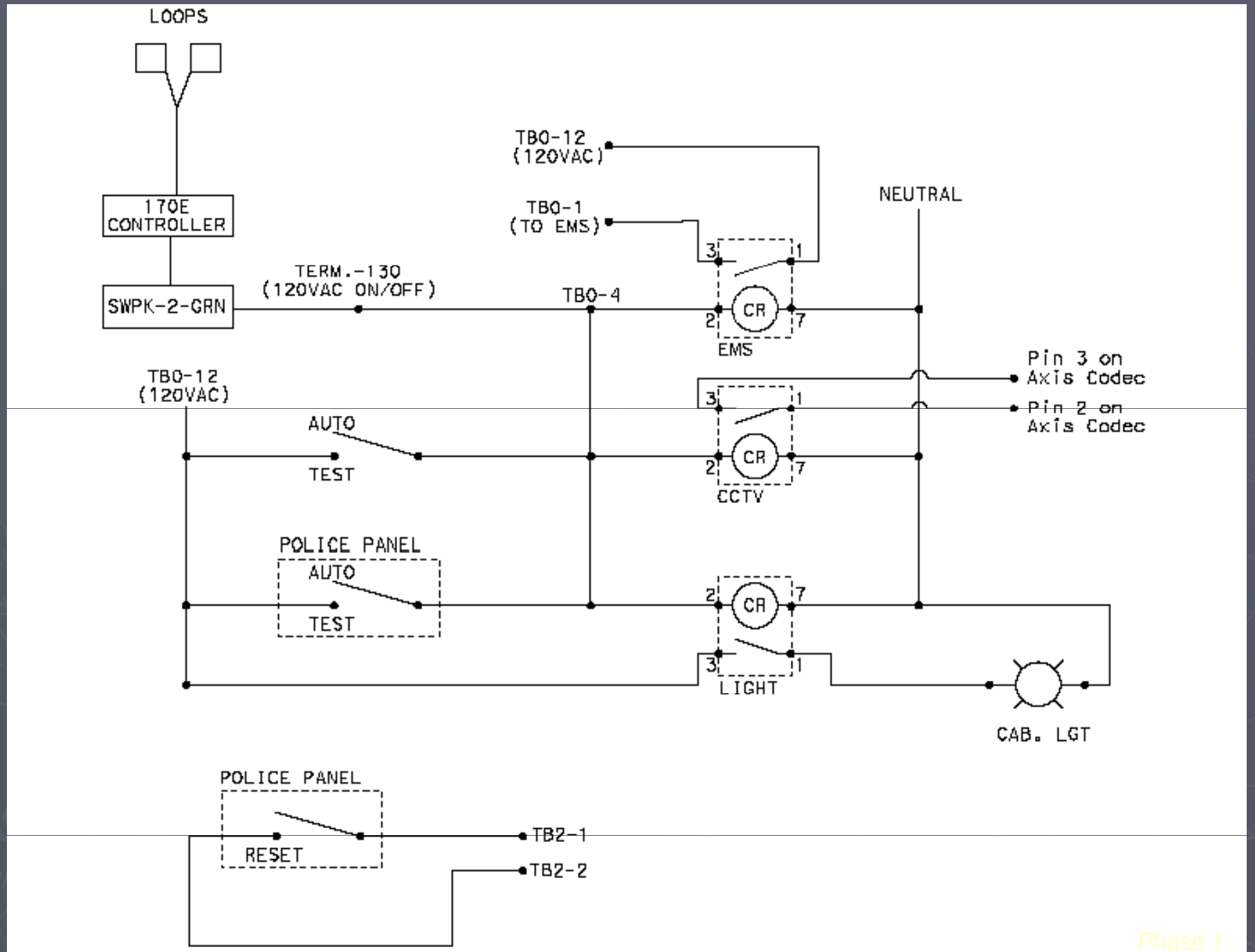
Phase I

Vehicle Detection System



Phase I

System Testing


LOOPS
170E CONTROLLER
SWPK-2-GRN
TERM.-130 (120VAC ON/OFF)
TB0-12 (120VAC)
TB0-1 (TO EMS)
TB0-4
NEUTRAL
3
1
2
CR
7
EMS
Pin 3 on Axis Codec
Pin 2 on Axis Codec
TB0-12 (120VAC)
AUTO
TEST
CCTV
POLICE PANEL
AUTO
TEST
LIGHT
CAB. LGT
POLICE PANEL
RESET
TB2-1
TB2-2

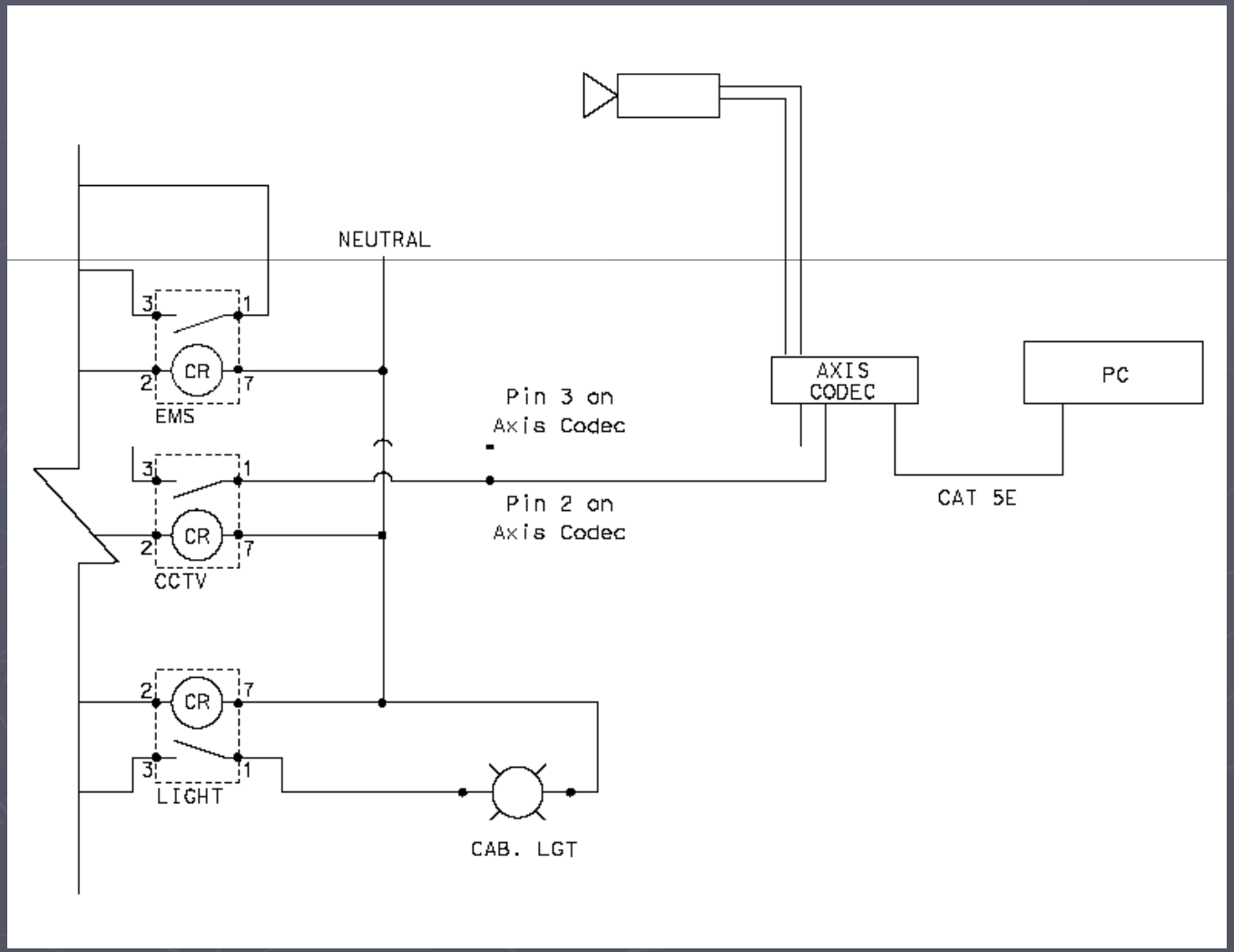
Visual Verification Light

Phase I

Video Verification System

- Axis 241S video encoder
  - Simultaneous Motion JPEG and MPEG-4 streams in resolutions up to 704x576.
  - Built-in motion detection and powerful event management.
- “Ruggedized” computer

Video Verification System

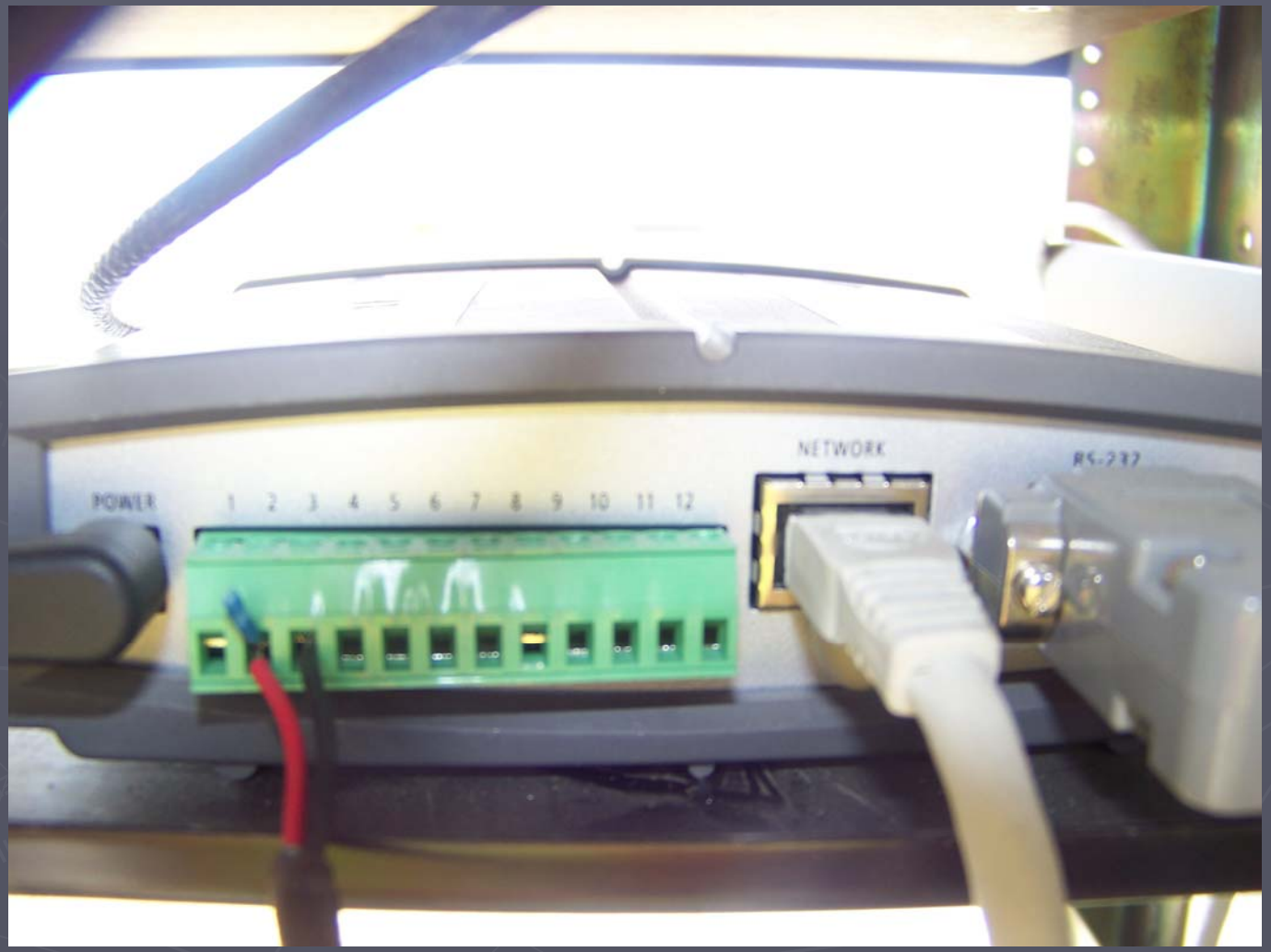


Phase I

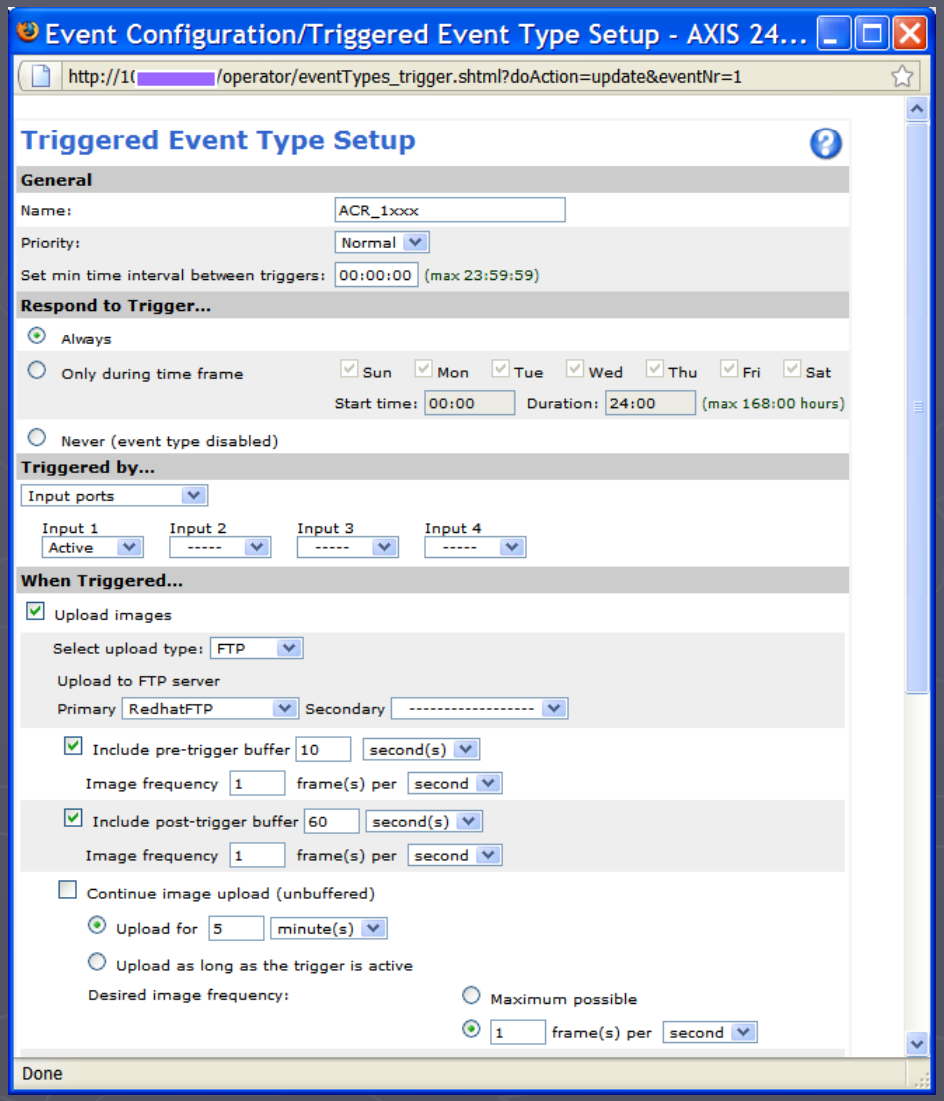
Video Verification System

Phase I

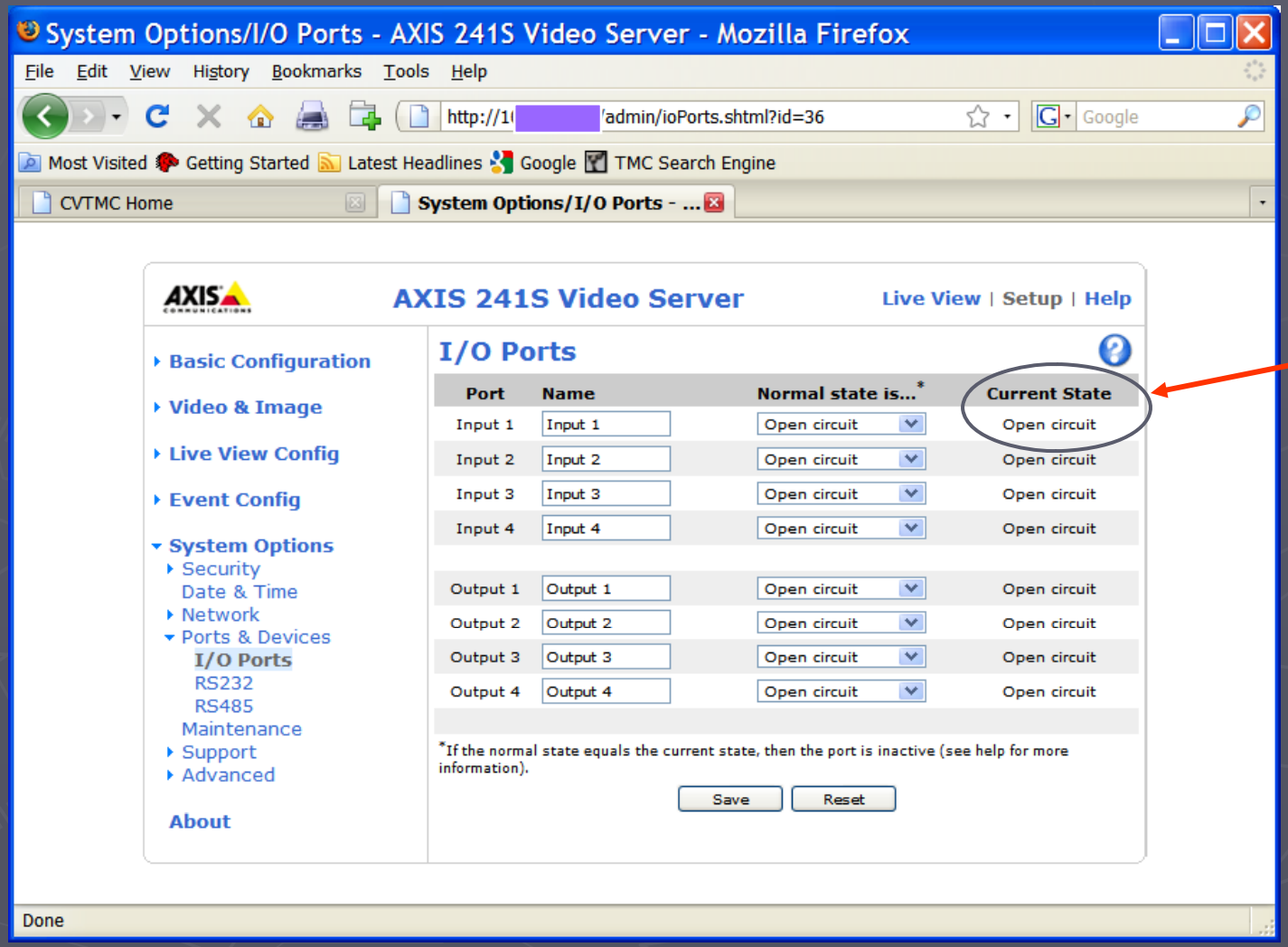
Escape Ramp – Phase I



Escape Ramp – Phase I



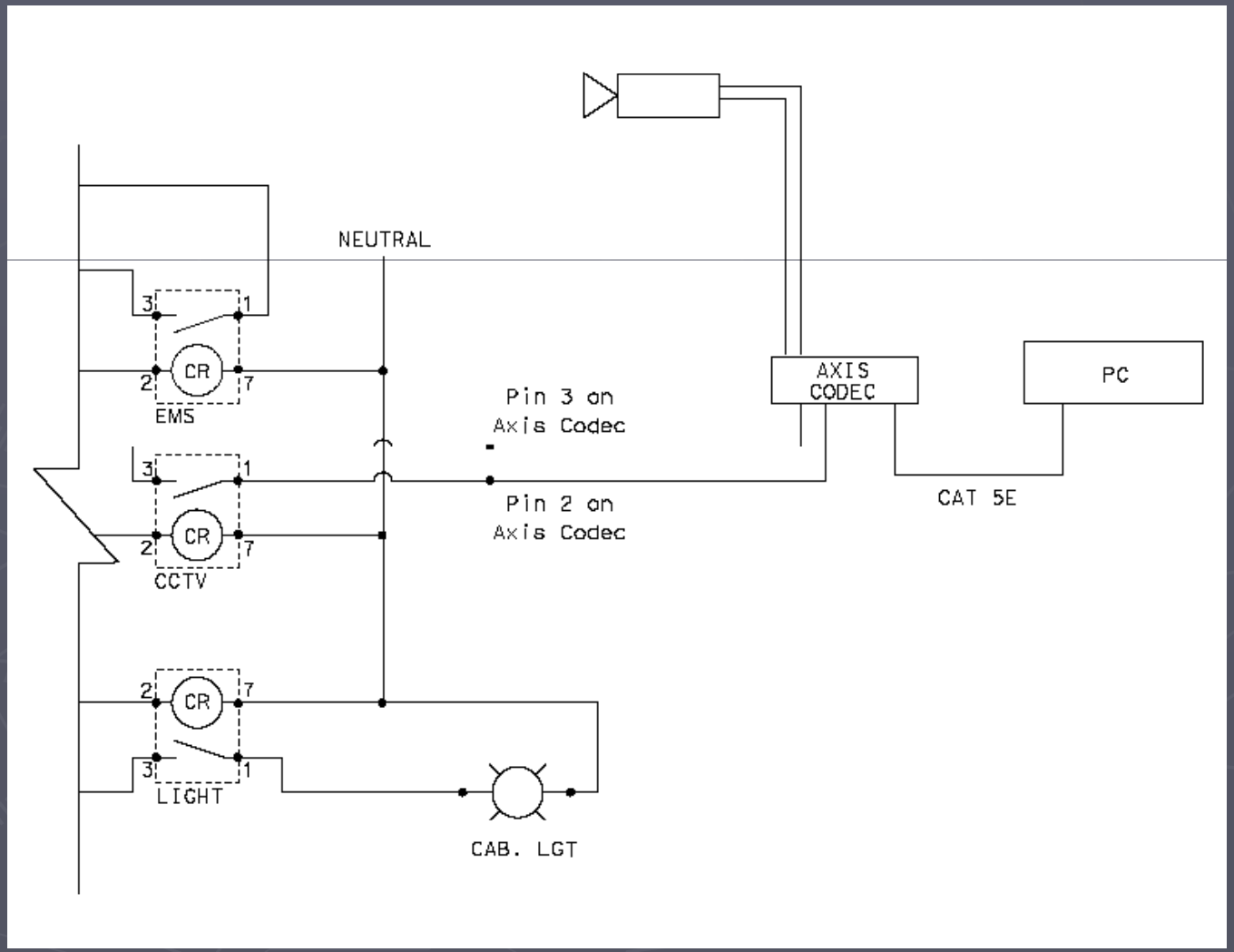
Video Verification System



Normally Opened

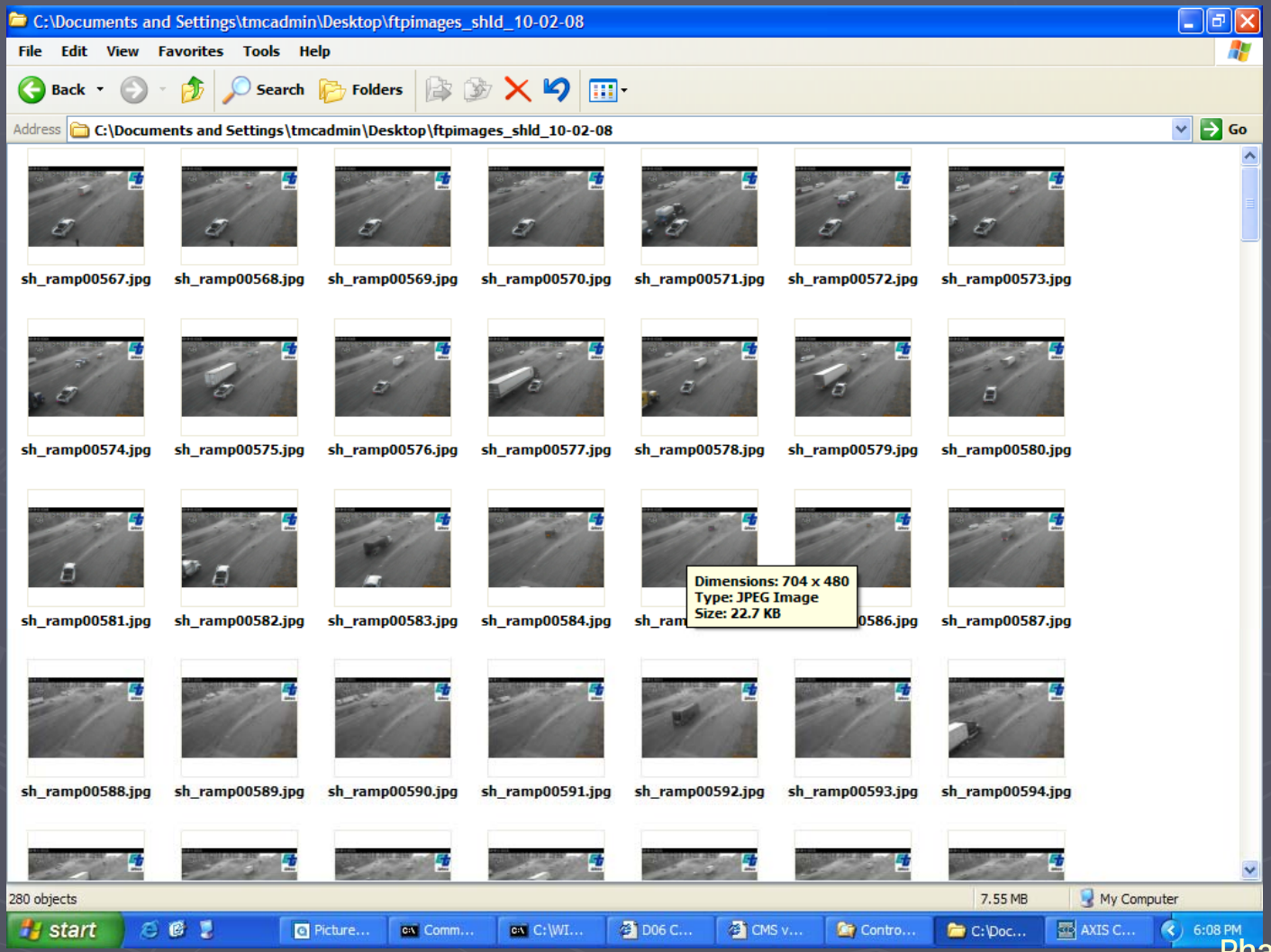
Phase I

Video Verification System



Phase I

Escape Ramp – Phase I



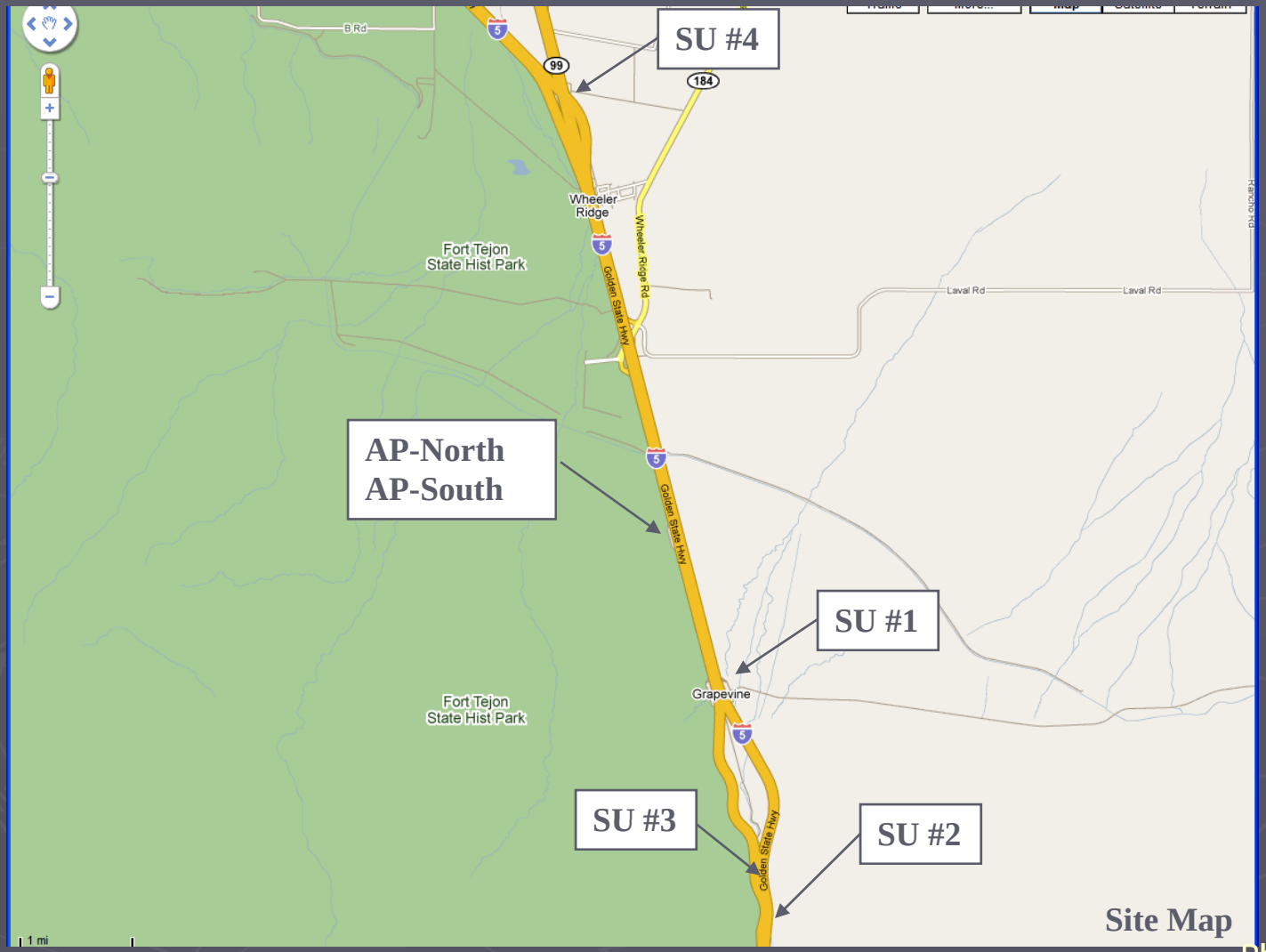
Video Verification System

- Results
  - System worked!!!
  - PC issues - drive space; headless; PC crashes
  - Cameras worked intermittently
  - Needed to drive to site to download video
  - No communications in area

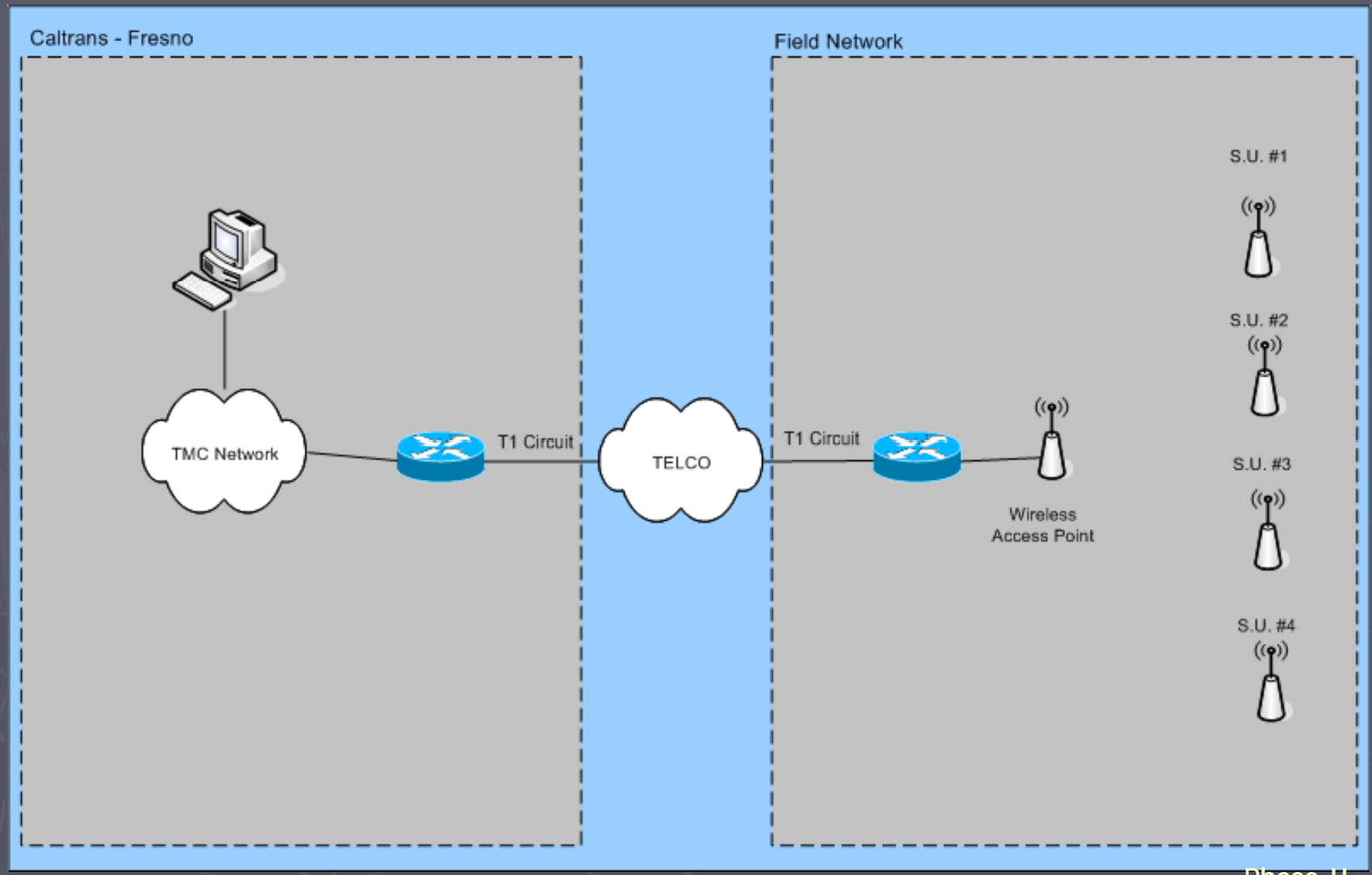
Escape Ramp – Phase II

- 2nd phase of project
  - Minor B Project initiated to replace cameras and enable communications
  - Included upgrading two other CCTV sites
  - Components used
    - Cohu 3960 series cameras
    - video decoders – Axis 292 decoders
    - Existing “ruggedized” pc
    - Axis Camera Recorder software
    - Network switches
    - Trango Broadband point-to-multipoint wireless system

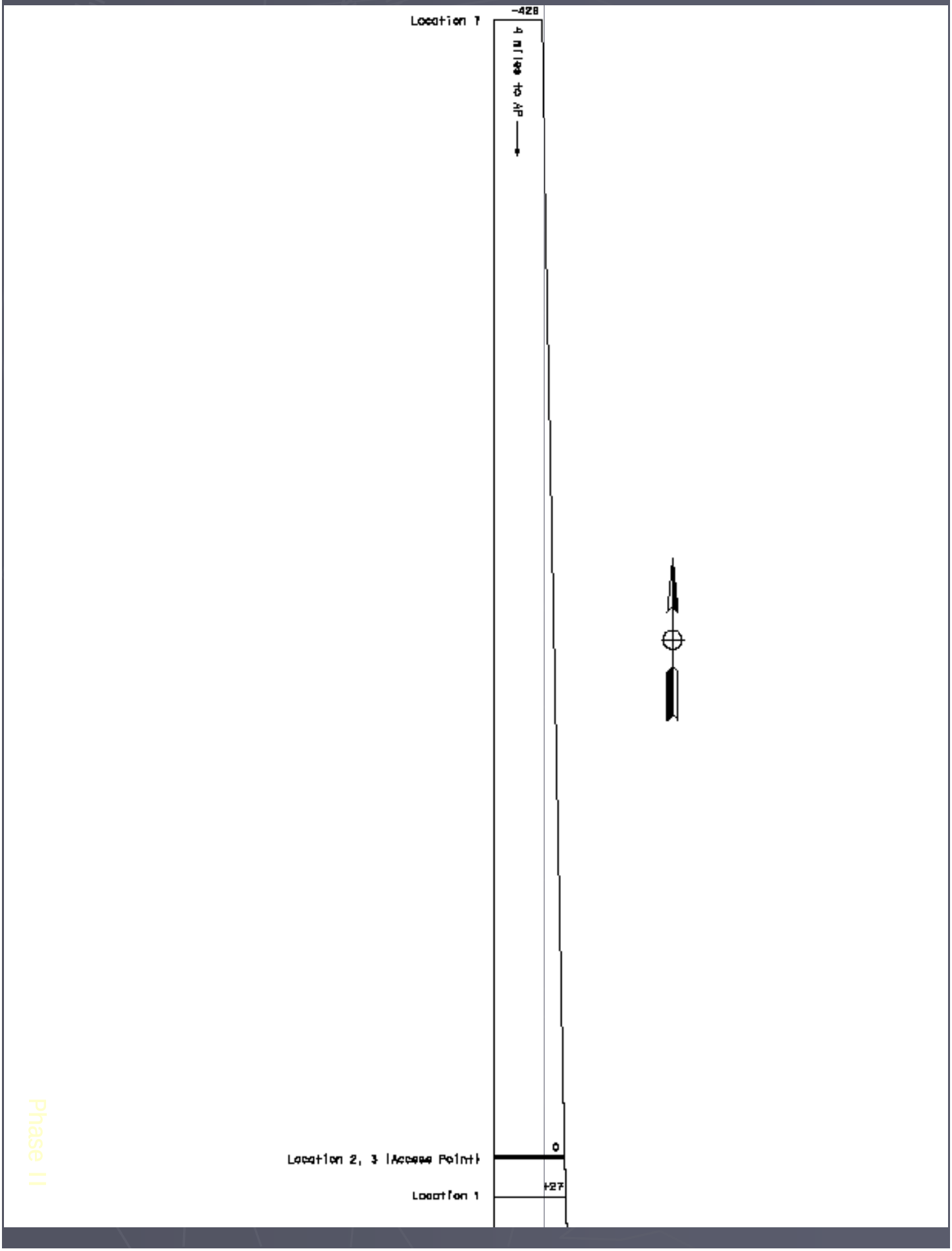
Phase II Site Map



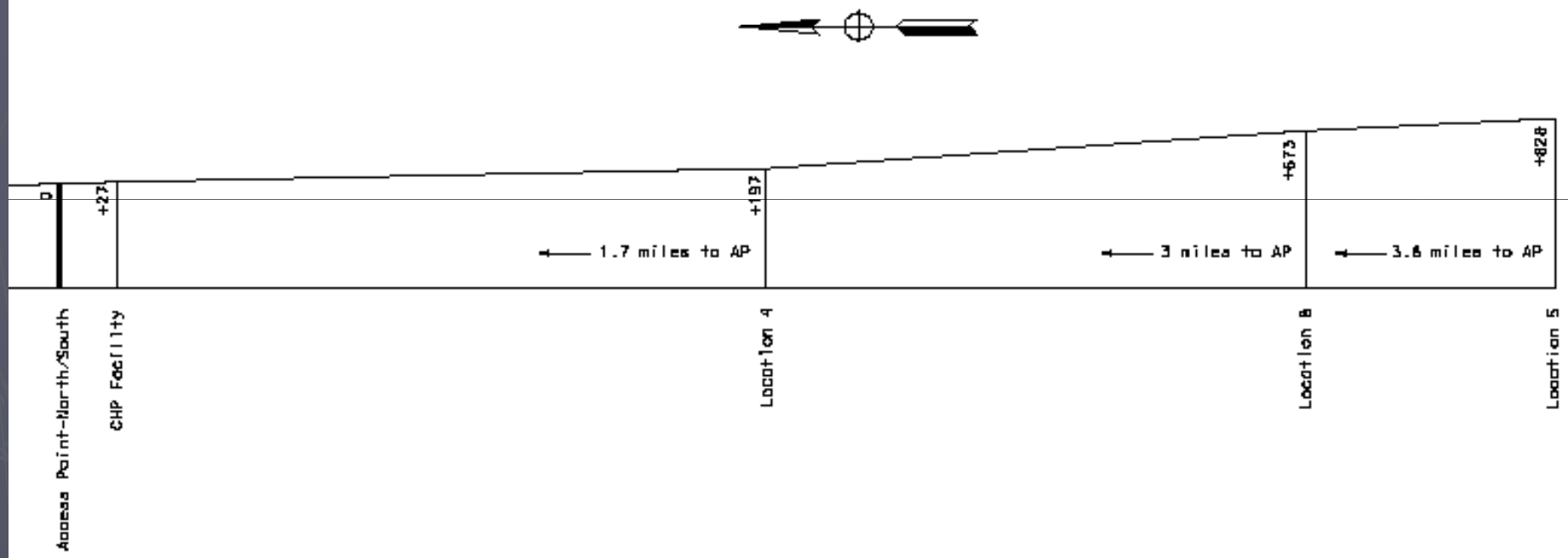
Communications Network



Phase II


Location 1
-428
4 miles to AP
Location 2, 3 (Access Point)
0
+27
Location 1

Phase II



Site	Location	Latitude	Longitutde	Elevation (ft)	Elev. Difference from AP	Distance to AP (miles)
1	CHP Facility			1355	27	0.14
2	Access Point - South - CHP Inspection Facility	34.9626	-118.93872	1328	0	0.00
3	Access Point - North - CHP Inspection Facility	34.9626	-118.93872	1328	0	0.00
4	Subscriber Unit #1 - Grapevine Rd CCTV	34.93931	-118.93066	1525	197	1.70
5	Subscriber Unit #2 - Escape Ramp Shoulder	34.91299	-118.92303	2156	828	3.60
6	Subscriber Unit #3 - Escape Ramp Median	34.92169	-118.92383	2001	673	3.00
7	Subscriber Unit #4 - I-5/Rte 99 IC	35.01839	-118.95508	900	-428	4.00

Phase II

Wireless Network

Phase II

Wireless Network

Phase II

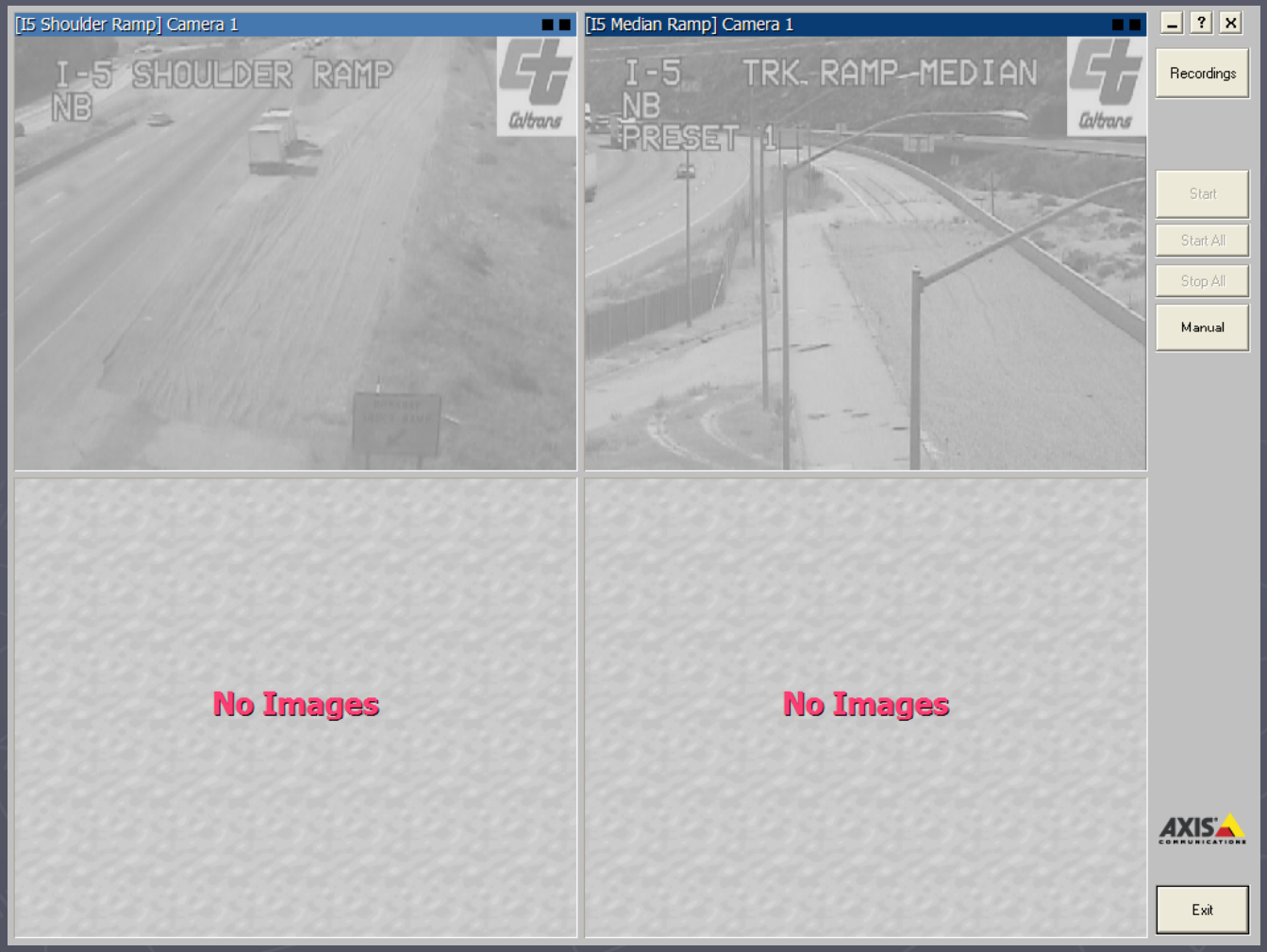
Wireless Network

Escape Ramp – Phase I

Phase I

Cohu 3960 series camera

Video Verification System



•Upgraded to video recording software system by Axis Communications.

Phase II

Escape Ramp – Phase II

- Results
  - Still had issues with drive space; PC would still crash
  - CHP Inspection facility building interfered with RF signal
  - Video could now be downloaded remotely via FTP
  - CHP would not always alert TMC/Caltrans of ramps being used
  - Escape ramp usage verification was cumbersome
  - Video length set to 10 min time frame; FTP download to TMC would take 5-10 min to transfer
  - Video clips automatically generated

Escape Ramp – Phase III

- 3rd phase of project
  - TMC network connection to Caltrans Enterprise network established
  - Alert notification system implemented in TMC
  - Video recording portion change to record remotely from TMC (snapshots only)
  - Results
    - Actual usage of escape ramps is about 60-70 times/year based of alarm notifications
    - Standard Operating Procedure (SOP) issues surfaced

Video Verification System
TMC Computer Room

Phase III

Text Message Alarm in TMC

Phase III

System implemented now what?

- Performance measures
  - What are response times of CHP/Caltrans?
  - Percent of actual truck usage versus car usage
- Implement traffic fines/fees for usage?
- Is current grade of road to steep?
- What other datasets can we acquire?

Future Implementation

- Use a 2070 controller with URMS s/w to measure the speed of vehicles as it they enter ramps
- Add remote reset capabilities using 2070 controller
- Striping at ramp entry point needs to be re-evaluated – false alarms

Run-Away Truck Escape Ramp

- Video clips

Run-Away Truck Escape Ramp

- Questions?