Goals

- “Grassroots” Training
- Pre-Deployment Training
- Lessons Learned
- Case Examples
- Interactive Sessions

Share practical knowledge of ITS components.
## ITS Training Program

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<td>5/27/03</td>
<td>ITS Project Scoping</td>
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</table>
Module 1 – CCTV Systems

... Outline

- Plans, Specifications & Estimates
- Operations
- Maintenance
- National Architecture / Standards

Provide understanding of CCTV features and applications.
FDOT ITS Training Program
Module 1 - CCTV Systems

Schedule

- 9:00 – 12:30  Presentation of Course Materials
- 12:30 – 2:00  Box Lunch / Vendor Demos
- 2:00 – 3:00  Workshop: CCTV Spec Critique
- 3:00 – 3:30  Test on Module 1
- 3:30 – 4:00  Course Evaluation
CCTV Systems

... Purpose and Need

- Monitoring Traffic Conditions
- Incident Verification
- Data Processing
- Security Surveillance

While CCTVs are primarily used for Incident Management, they have a wide variety of other applications.
Monitoring Traffic Conditions

- Operator Knowledge
- Privacy Issues

Operators need to be sensitive to the range of CCTV coverage so as not to violate privacy policies.
CCTVs play an important role in incident verification and dispatching the appropriate emergency services.
Data Processing

- Volume
- Occupancy
- Speed
- Surveillance
- Sharing Data

CCTVs also play an important role in traffic management and traffic engineering studies.
Security Surveillance

Since 9/11, FHWA has placed increased emphasis on surveillance of critical surface transportation facilities.

- Local Streets
- Downtown Areas
- Transit Stations
- Multimodal Facilities
CCTV Benefits

- Travel Delay Savings
- Reduction in Secondary Accidents
- Appropriate / Fast Response
- Proactive Traffic Management

The initial 3-5 minutes are critical in using CCTVs to efficiently manage incidents.
CCTV System

... Incident Management

- DMS Message Verification
- Detour Route Assessment

CCTVs provide a visual traffic management tool in effectively managing traffic detours during a major incident.
CCTV Systems

... Other Applications

- Wide Area Detection
- Ramp Monitoring
- Toll Evasion / Toll Security
- Weight / Inspection Stations
- Railroad Grade Crossings

CCTV cameras can be used to manage railroad grade crossing violations.
The Contractor shall furnish and install CCTV equipment cameras on approved structures as designated by the DOT. CCTV camera locations and mounting heights will be approved by Transportation Management Center (TMC) staff.

The camera assembly shall consist of an outdoor mounting bracket, a dome housing with built-in heater and blower, a dome sunshield, an integral receiver / driver, a tracking system, a camera / lens module and cabling. The outdoor mounting bracket shall be approved by the camera assembly manufacturer and TMC staff. The Contractor shall furnish and install cables as recommended by the manufacturer. Camera set-up activities are considered incidental to the camera assembly …
CCTV Requirements

- Camera Equipment
- Camera Housings
- Lightning Protection
- Camera Locating
- Pole Requirements
CCTV Requirements (continued)

- Resolution
- Electronics / Optics
- Communications Equipment
- Power Supply

CCTV Systems need to be designed in accordance with local needs and conditions.
CCTV Housings

- Standard Enclosures
- Dome Enclosures
Functions of Housings

- Protection
- Vandalism
- Environment

Housing designs should consider the need to make them weather-proof as well as bullet-proof.
Dome Enclosures

- House Pan / Tilt / Zoom Unit
- No Separate Cabinet Needed
- Pressurized vs. Non-Pressurized
- Lowering Devices
- Optical Distortion

Dome enclosures do not require a separate cabinet to house the electronics.
Standard Enclosure

- Encloses Camera Electronics
- Mounts on Pan / Tilt Unit
Environmental Issues

- Darkness / Night
- Rain
- Fog
- Smoke

Environmental issues increase challenges for the operator. A well designed CCTV system will mitigate these challenges.
Pressurized vs. Non-Pressurized

- Inert Gas
- Protects Electronics
- Reduces Dust Particles

Pressurized housing protects the electronics by reducing intrusion of dust particles within the unit.
CCTV Structure Attachments

- Building Mount
- Under Bridge Mount
- Sign Structure Mount
- Traffic Signal Pole Mount

In District 6, a CCTV camera was mounted on top of the City of Miami Police Department Building as part of the I-95 ICS Package “A” contract.
Lightning Protection

- Grounding Rods
- CCTV Protection
- Pole Protection
- Fiber Connections from Camera

Need to install properly rated protectors on all interconnected wiring from the camera to the operator console.
The Pan / Tilt assembly allows for the precise positioning of the camera to view all areas from all sides of the camera.
Pan / Tilt / Zoom Assembly Options

- Presets – 79 to 99
- Variable Speed
- Continuous Rotation - 360°
- Variable Zoom Speed: 0-200°/sec.
- Focus Speed <1.8 sec (end to end)

CCTV specifications need to clearly define the required functions and features.
Terms

• Auto Focus – Lens is automatically set to correct illumination

• Auto Iris – Iris opening is automatically adjusted to allow the correct illumination

• Auto Pan – Camera pans continuously between 2 set positions

• Pan – Camera movement in the horizontal direction
Terms (continued)

- **Pre Set / Pre-position / Privacy Zones** – Segments of the field of view of the camera where the video signal is blanked to prevent from being seen.

- **Tilt** – Camera movement in vertical direction.

- **Zoom** – Changing the effective focal length to allow different fields of view.
Display Resolution

- Match the Source with the Display
- 640 x 480, 800 x 600, 1024 x 768
- 1280 x 1024, 1600 x 1200
- Native Resolution

Industry standard has changed over time.
Horizontal Resolution

- Color – 450 TV lines
- Mono – 550 TV lines
- Color/Mono – 460 TV lines
Picture Element / Imager

- ¼-inch Interline Transfer (IT) Charged Couple Device (CCD)
- 768(H) x 494(V), 380,000 pixels
- 752(H) x 582(V), 440,000 pixels
- 847(H) x 582(V), 490,000 pixels
Dome Assembly Speeds

- **Pan** – Variable, 0.25 - 300°/sec.
- **Autopan** – Variable, 3 - 45°/sec.
- **Tilt** – Variable, 0.25 - 110°/sec.
Power

- Power – 35W to 116W
- Heater Power – 70W
- Surge Protection – Clamped at 6.5 V (Video Level)

Should have some form of in-line current limiting resistor.
Optics

- Optical Zoom – 22x
- Digital Zoom – 8x
- Total Zoom – 176x (22 x 8 = 176)
- Auto Iris – Yes
- Auto Focus – Yes
- Aperture Max – f/1.4 to f/3.0
- Focal Length – 4 to 88 mm
- Zoom – 18x to 22x for Traffic Management Applications
Communications

- Fiber Optics
- Twisted Pair
- RF Wireless

Fiber Optics is typically used when long runs are required; strong signals are needed; and large bandwidth is desired.
Noise Reduction

- Reduction of noise lies in
  - Correct System Design
  - Selection of Equipment
  - Selection of Transmission Systems
# Color vs. Monochrome

<table>
<thead>
<tr>
<th>Color</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advantages</td>
<td>Disadvantages</td>
</tr>
<tr>
<td>Higher Picture Quality</td>
<td>Higher Cost</td>
</tr>
<tr>
<td>Monochrome</td>
<td>Needs Color Monitors</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<td>Advantages</td>
<td>Disadvantages</td>
</tr>
<tr>
<td>Lower Cost</td>
<td>Lower Picture Quality</td>
</tr>
<tr>
<td>Better in Low Light</td>
<td></td>
</tr>
</tbody>
</table>
Color Day / Night Cameras

- Provides the advantages of both the Color and the Monochrome camera technologies
- Color (high picture quality) at adequate light levels
- Low light sensitivity
- Auto switching
Design Criteria
CCTV Location Selection

- Field of View / Spacing
  - Knowledge of Local Traffic Operations
  - Knowledge of Local Conditions

- Clear Zone / Guardrail Requirements
Camera Siting Considerations

- Accident Rates
- Traffic Volumes
- Weaving and Merging Areas
- Visual Obstructions
- Relationship to Detection & DMS
- Roadway Geometry
- Maintenance
- Cost

CCTV siting is a function of both project goals and roadway characteristics..
Field of View / Spacing

- Straight Sections
- Limited Obstructions
- Key Interchanges
- Signs / Overpasses
- Volume
- Accident Rate
- Cost vs. Coverage

High-level interchanges create challenges in the siting of CCTVs to provide adequate coverage.
Types of Coverage

- Continuous (Full) Coverage
- Limited Coverage (Major Interchanges)
- Bridges
Full Coverage

- ½ to 1 mile spacing
- Pan / Tilt / Zoom
- Mounted 35’ to 50’

While full coverage is desirable along urban interstates, partial coverage may be sufficient within non-urbanized sections of District 4.
Limited Coverage

- 2 Cameras
- Key Interchanges
- High Mast Poles (100’)

The I-595 / Sawgrass Expressway Interchange will be a challenge in locating CCTV poles to provide required views of all ramps.
Bridges

- Camera Locations
- Mounting
- Lighting

CCTVs may be attached to existing bridges in monitoring traffic below the structure.
CCTV Structures / Attachments

- Poles
- Sign Structures / Bridges
- Private Buildings / Structures
- Billboards, Cell Towers, etc.

CCTVs attached to cell towers provide an opportunity for wide area views.
Poles

- Standard Height: 35’-50’
- High Mast
- Full Rotation
- Wind Loads
- Existing vs. New Poles

Design of pole foundations need to consider utility conflicts; the need for ground rod grids as well as pole height.
Sign Structures / Bridges

- Existing Structures
- Cost Effective
- No Structural Issues

CCTV units add very little dead load and wind load to existing sign structures.
Private Buildings / Structures

- Buildings
- Billboards
- Cell Towers
- Water Towers
- Toll Plaza Facilities

Smart Routes is responsible for CCTV installation and maintenance outside FDOT ROW.
Cost Decisions

- Camera / Equipment
- New Pole / Foundation
  - Height of Pole
  - Height of Cameras
- Distance between Cameras
- Power Supply
- Communications

Consider life-cycle costs as part of the cost analysis.
## Typical Costs
### Standard Poles

- **Dome Camera Assembly**: $3-$5 K
- **Equipment to Install**: $3-$5 K
- **Modems**: $1-$2 K
- **Poles w/Lowering Device**: $12-$14 K
  - Includes foundation
- **Power**: $1-$2 K
- **Labor**: $8-$10 K
- **Mobilization**: $3-$4 K

**TOTAL**: $31 - $42 K
## Typical Costs
### High Mast Poles

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
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<tr>
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<tr>
<td>Poles w/Lowering Device</td>
<td>$24-$28 K</td>
</tr>
<tr>
<td>- Includes foundation</td>
<td></td>
</tr>
<tr>
<td>Power</td>
<td>$1-$2 K</td>
</tr>
<tr>
<td>Labor</td>
<td>$10-$12 K</td>
</tr>
<tr>
<td>Mobilization</td>
<td>$3-4 K</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>$35 - $58 K</td>
</tr>
</tbody>
</table>
Break
Operations
Describe the chain of events that might occur today if there were a two car non-injury accident along I-95 NB in the left lane during the AM rush hour.
2-Car Accident

- Incident Detected
- 911 Called
- FDOT Responds
- FDOT Notifies FHP
- FHP Responds
- FHP On-site, Requests Assistance
- Tow Trucks, etc. Responds

How long does it take to respond to an incident along the Interstate today?
Time Involved

- Incident Detected
- 911 Called
- FDOT responds
- FDOT Notifies FHP: All within first 5 minutes
- FHP Responds: 10 minutes
- FHP On-site
- FHP Requests Assistance: 5 minutes
- Tow Truck Responds: 20-30 Minutes
- Lane(s) Opened: 20-30 Minutes later
Where might time be saved if CCTVs were in place?
How would the use of CCTVs improve response to the motorists?
Camera Control by Operator

- Selecting Camera Image
- Assign Image to Monitor
- Pan / Tilt / Zoom Camera
- Focus Camera

Joystick control provides the Operator with flexibility in managing the CCTV system.
Monitoring Requirements

- Web Site Interfaces
- Protocols
- GIS Management

DOT Websites provide the Operator with an opportunity to share video images with other agencies and the public.
Web Site Interface

- Agency Developed / Maintained
- Private Developed / Agency Maintained
- Public / Private Partnership

Smart Routes is responsible for the development and maintenance of the traveler information website within SE Florida.
SunGuide Traveler Information Service is about providing people with the right information at the right time to improve the quality and convenience of their trip and the overall performance of the transportation system.

ITS is the umbrella term for the utilization of advanced technologies to increase safety and efficiency. True benefits are gained when various elements are used in combination. These may include:

- Dynamic Message Signs
- Highway Advisory Signs
- Closed-circuit TV cameras
- Ramp-Metering
- Roadway Detectors
- Web sites and E-mail
- Pagers
- On-board computers
- Traffic Kiosks
- Conventional news media outlets

"We need to make the most out of our existing transportation system."

Traffic Management Centers (TMC) -- The nerve center.

TMC is a physical location to monitor traffic conditions, respond to incidents and coordinate ITS programs. A center where information coming in from pavement sensors and cameras can be distributed to motorists in real-time. Law enforcement and emergency services will be at the table and this will allow coordinated...
Camera Service Notice: The Transportation Management Center is currently making minor hardware upgrades to cameras throughout the coverage area. During this time some of the cameras may be temporarily unavailable.

Click on a camera to see a view.

Green cameras contain links to additional information about Rhode Island.

Looking for the future traffic forecast?
Visit RIDOT's Future Traffic Forecast Page.

http://www.tmc.state.ri.us/TrafficCams/LiveCams.asp
The Greater Houston Transportation and Emergency Management Center

Houston TranStar
6322 Old Katy Rd.
Houston, TX 77024
Phone (713) 881-3000
Fax (713) 881-3006

Comments can be e-mailed to www@traffic.tamu.edu

http://traffic.tamu.edu

Copyright © 2002 Houston TranStar, All Rights Reserved.
Choose a camera location by clicking the left mouse button over the desired camera.

Available

Not Available

Ohio: I-275 at I-75

Mile 43.6 on I-275, 16.0 on I-75, located on South side of I-275, West of I-75

North

South

East

West

Reference views only.

http://www.artimis.org

Best viewed with Netscape Navigator at a screen resolution of 1024 x 768.
LIVE cameras

Select view:
- SR 520 midspan
- I-405: NE 80th St
- I-405: NE 8th St
- I-405: NE Park Drive

Images courtesy of Washington State Department of Transportation.

Flow Maps
- Current traffic flows for King and Pierce counties.

Latest Incidents

http://traffic.nwsource.com
Geographical Information System (GIS)

- Map Display System (MDS)
- Computer-assisted information management system of (geo)graphically referenced data
- Two closely integrated databases
  - Spatial (locational, or graphical)
  - Attribute (statistical, or database)
GIS Management

- Tool that acts as TMS backbone
- Operational Philosophy:
  - Multiple Agencies
  - People using the Same Information
- Provides for Proactive Operations
GIS Is Information Management

- Present large amounts of information in a form that is easily assimilated by an Operator
- Quicker response
- Automated pre-programmed response
Video Monitor

- Started with CRT Monitors
Video Wall

- Increase demand for video
- Multiple CRTs organized into a Video Wall

FDOT District 5 TMC Video Wall in Orlando.
Display Technology Improved

- Display Technology improved
- Video Wall concept remained the same
- Operations philosophy remained the same

Houston TranStar TMC Video Wall...
Change in Philosophy

- Different types of information
- Information from different sources

Video Wall becomes an extension of the operators workstation
GIS In Traffic Management

- Camera Selection and Control
- Map Showing Camera Locations
- Pull Down Menus
- Camera Selection based on Congestion

The GIS Map enables the Operator to “drill down” to the appropriate level of detail to effectively manage an incident.
Maintenance

- Cameras
- Poles / Structures
- Monitoring Equipment

Drop-down poles facilitate maintenance and replacement of CCTV units and parts.
Camera Maintenance

- Remove and replace
- Stock spare assemblies
- Factory repair
Pole Maintenance
Mounting Equipment Maintenance
Monitoring Maintenance

- Multi-lamp optical engine
- Median lamp life > 8,000 hrs
- Rear-projection display
Development and implementation of ITS Programs need to be consistent with the National ITS Architecture to be eligible for federal funding.
ITS System Goals

- Increase System Efficiency
- Improve Mobility
- Reduce Fuel Consumption
- Minimize Environmental Cost
- Improve Safety
- Increase Economic Productivity
- Create ITS Market

ITS System goals set the foundation for providing a safe, efficient and well maintained transportation system.
CCTV Market Packages

- ATMS01 Network Surveillance
- ATMS04 Freeway Control
- ATMS05 HOV Lane Management
- ATMS07 Regional Traffic Control
- ATMS08 Incident Management

Market packages are used to plan and implement integrated transportation systems customized to local needs.
National ITS Architecture

Background

The National ITS Architecture provides a common framework for planning, defining, and integrating intelligent transportation systems. It is a mature product that reflects the contributions of a broad cross-section of the ITS community (transportation practitioners, systems engineers, system developers, technology specialists, consultants, etc.) over a nine year period. The architecture defines:

- The functions (e.g., gather traffic information or request a route) that are required for ITS
- The physical entities or subsystems where these functions reside (e.g., the roadside or the vehicle).
- The information flows and data flows that connect these functions and physical subsystems together into an integrated system.

As you navigate through the National ITS Architecture, additional background information is often only a click away. A comprehensive glossary of architecture terms is on the menu and is also linked with the architecture content. If a green highlighted and underlined term marked with an asterisk (*) is unfamiliar to you, click on it to see its definition and links to other related terms. (Note: In browser versions earlier than 4.0, green highlighting of the glossary terms may not be supported. In this case, glossary terms will be highlighted with the same color as the other links.)

If you would prefer a summary document that you can print and read over coffee, a brief document is available that presents the key architecture concepts. A training course provides a more comprehensive look at the National ITS Architecture and the ways in which it can be applied.

Where to Start

There are three ways to navigate through the National ITS Architecture:

1. The hypertext view provides immediate, interconnected access to all the elements of the architecture definition.

http://itsarch.iteris.com/itsarch/index.htm
ITS Standards

- Promotes Interoperability
- Does **Not** Guarantee Interoperability
- Same Level of ITS Service Across Nation

The U.S. DOT ITS Standards Program is working toward the widespread use of standards to encourage the interoperability of ITS systems.
ITS Standards

- TMC to Roadside Interface
- Standard
- Last Update in July 2001

ITS Standards, pertaining to CCTV Systems, are still under development.
Video Surveillance Updates

- 16 Standards that comprise Video Surveillance Application Area
- 9 Published
- 1 Approved
  - Waiting Publication
- 4 Balloted
  - Approval expected Summer 2002
- 2 Under Development
  - Object Definition for Video Switches
  - Transportation Management Protocol
ITS Standards Contacts

- **Mike Schagrin** of the Federal Highway Administration (FHWA), is Manager of the U.S. DOT ITS Standards Program. Telephone: 202-366-2180 E-mail: mike.schagrin@fhwa.dot.gov

- **Bill Jones** is the Technical Director of the U.S. DOT Joint Program Office (JPO). Telephone: 202-366-2128 E-mail: william.s.jones@fhwa.dot.gov

- **Brian Cronin**, of the Federal Transit Administration (FTA), coordinates ITS standards activities relating to transit. Telephone: 202-366-8841 E-mail: brian.cronin@fta.dot.gov

- **Jim Smailes**, of the Federal Railroad Administration (FRA), coordinates ITS standards activities relating to the highway-rail intersections. Telephone: 202-493-6360 E-mail: james.smailes@fra.dot.gov
About ITS Standards

ITS standards are industry-consensus standards that define how system components operate within a consistent framework. The framework is known as the National ITS Architecture. By specifying how systems and components interconnect, the standards promote interoperability.

To expedite deployment of nationally interoperable ITS systems and services, the U.S. DOT supports specific ITS standards initiatives, especially in areas that have significant public benefit.

The ITS Standards Program

The U.S. DOT ITS Standards Program is working toward the widespread use of standards to encourage the interoperability of ITS systems. Through cooperative agreements with five standards development organizations (SDOs), the Standards Program is accelerating development of about 100 non-proprietary, industry-based, consensus ITS standards, and is encouraging public-sector participation in the development process.

The Standards Program is maturing from a primarily standards development program to a standards deployment program by providing technical support. Such support includes providing standard deployment guidelines, training and technical assistance, and disseminating "lessons learned," and deployment experience. In addition, the program is coordinating U.S. ITS standards efforts with international standardization.
Questions?
Lunch Break

• Vendor Demonstrations
  - Vicon
    - Jim LaBatt, Blackhawk Enterprises
  - Cohu
    - Gerry Slosar, Cohu Ind., Electronics Division
Workshop Assignment

CCTV Specification Critique