Gateway Cities
Traffic Signal Synchronization and
Bus Speed Improvement Project
I-5/Telegraph Road Corridor

Consultant’s Briefing Meeting
Siemens Energy & Automation, Inc.
Gardner Transportation Systems
November 12, 2002
I-105/I-5 Telegraph Road Project
Physical Components

ATMS

Control Functions
Traffic signal
CMS
CCTV

IEN

Traffic Signal
Changeable Message Sign
CCTV Camera

Center-to-Center ←→
Field-to-Center ← →

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I-105 Proposed System Architecture

LEGEND
- Hardware Configuration Item
- Software Configuration Item
- Subsystem
I-5/ Telegraph Road Revised System Architecture

Sub-regional TMC

- Corridor Workstation(s)
- TIASS CORRIDOR Server
  - Sub-regional CCTV Manager
  - Sub-regional CMS Manager
  - Data Distribution Manager
  - HAT Manager
  - Sub-regional HAR Manager
- HAT Subsystem
- Data Distribution Subsystem
  - WEB Kiosk
- IEN Subsystem
  - IEN Workstation
  - IEN
- Database
  - Database Manager

Local City Control Site

- IEN Workstation
  - IEN Subsystem
    - IEN
    - CDI
- Local City Workstation(s)
  - Local CCTV Manager
  - Local CMS Manager
  - Local TCS
  - ATMS
    - Local CCTV Manager
    - Local CMS Manager
    - Local TCS
- Signal Subsystem
  - VDS Subsystem
  - Controller Subsystem
- CMS Subsystem
  - Sign
- CCTV Subsystem
  - Cameras
  - Video Monitors

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## Allocation Of Functionality

<table>
<thead>
<tr>
<th></th>
<th>Traffic Control</th>
<th>CCTV Viewing Only</th>
<th>CCTV</th>
<th>CMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commerce</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Downy</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>La Mirada</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Montebello</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pico Rivera</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Santa Fe Springs</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>LA County DPW</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Caltrans D7</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
Local City Control Site (Typical)
I-5/Telegraph Road Proposed Corridor Architecture Stand Alone LCCs

Communication Network for the IEN

County TMC

Sub-Regional TMC

Caltrans CTNet

City of Commerce

City of Downey

City of Santa Fe Springs

County DPW

Field Equipment

Field Equipment

Field Equipment

Field Equipment

Field Equipment

Field Equipment

Field Equipment

Field Equipment

Field Equipment

Field Equipment

Field Equipment

Field Equipment

Field Equipment

Field Equipment

Field Equipment

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Stand Alone LCC
Physical Architecture
Stand Alone LCC System Configuration

IEN Communication Network C2C

FireWall

LAN

Video Display Server (Optional)

Video Projection (Optional)

IEN Workstation

CDI

IEN Client

Communication Equipment

Traffic Signal

CMS

CCTV

Communication Servers

ATMS client workstations

ATMS Applications Server(s)

Database Server

CCTV Server

Gardner Transportation Systems
I-5/Telegraph Road Proposed Corridor Architecture
LCC with Hosting

Communication Network for the IEN

County TMC
County Server

Sub-Regional TMC
Corridor Server

Caltrans CTNet
City of Commerce
Field Equipment
Field Equipment

City of Commerce
Field Equipment
Field Equipment
Field Equipment

City of Downey
Field Equipment
Field Equipment
Field Equipment

City of Santa Fe Springs
Field Equipment
Field Equipment
Field Equipment

County DPW

Montebello
Downey
Pico Rivera
Santa Fe Springs
La Mirada
County

Gardner Transportation Systems
LCC with Hosting
Physical Architecture
LCC with Hosting System Configuration
I-5/Telegraph Road Proposed Corridor
Architecture Client Only

Communication Network for the IEN

- County TMC
- Sub-Regional TMC

Caltrans CTNet
City of Commerce
Field Equipment
Caltrans

City of Downey
Field Equipment
Montebello

City of Santa Fe Springs
Field Equipment
Pico Rivera
Santa Fe Springs

County DPW
Field Equipment
La Mirada
County

Gardner Transportation Systems
Client Only LCC System Configuration
LCC Recommendations
Summary of Meeting Minutes

- All cities, except City of Pico Rivera, were able to identify the potential location of their LCC.
- The City of Pico Rivera stated that they may be able to allocate space in the City Hall or City Yard in the future but did not want to commit to a location just yet.
- Cities do not have resources to staff the LCC’s for a long period of time during the day.
- Most cities will monitor the system on an exception basis, in response to an alarm from the system or during a traffic emergency situation.
- All cities identified a place for the LCC site within existing buildings. The buildings have existing air conditioning and service. It is anticipated that in most cases no upgrade to these in-place systems will be needed.
- All Cities except Downey identified a place for LCC site within an existing office/laboratory. The cities did not express a need to secure the LCC site beyond the security provided for these buildings.
- Most cities identified at least two locations for ATMS workstations – the City Hall and City Yard.
GIS Database Tool
Absia’s Building One

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GIS Database Tool
Absia’s Building One
LCC Recommendations
Commerce and Santa Fe Springs
LCC Recommendations
Downey 2nd Floor
LCC Recommendations
Downey 3rd Floor
LCC Recommendations
La Mirada, Montebello, Pico Rivera
VDS High Level Design Process

- Summarize previously derived Requirements
- Identify Candidate Detection Technologies
- Assess by Comparative Analysis
- Make Recommendations
Candidate Detection Technologies

- Inductive Loop
- Microwave (RTMS)
- Video Image Detection (AutoScope)

- Issues:
  - Equipment Installation
  - Configuration
  - Communications to Central
# Summary of Recommended Choices

## Communication at Site

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Technology</th>
<th>Communication Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>Loops</td>
<td>Twisted-Pair or Fiber</td>
</tr>
<tr>
<td>Stopped Vehicle</td>
<td>VIDS</td>
<td>Twisted Pair or Fiber</td>
</tr>
<tr>
<td>Video (Still)</td>
<td>VIDS</td>
<td>Twisted Pair or Fiber</td>
</tr>
<tr>
<td>Video (Motion)</td>
<td>VIDS</td>
<td>Fiber</td>
</tr>
<tr>
<td>Cost</td>
<td>RTMS</td>
<td>Twisted Pair or Fiber</td>
</tr>
</tbody>
</table>

## No Communication at Site

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Technology</th>
<th>Communication Medium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stopped vehicle</td>
<td>VIDS</td>
<td>CDPD</td>
</tr>
<tr>
<td>Video (Still)</td>
<td>VIDS</td>
<td>CDPD</td>
</tr>
<tr>
<td>Cost</td>
<td>RTMS</td>
<td>CDPD</td>
</tr>
</tbody>
</table>
VDS Location
Advanced Detection and System Detection

- Advanced Detection –
  - Used for traffic operations – traffic responsive operation
  - Data can also be used for measurement of congestion Unless
    - Intersections are far spaced
    - Queues are expected to back-up to the location of advanced detectors

- System Detection
  - Used for collecting congestion data
  - Location needs to represent free flow conditions

- Recommendation For I-5/Telegraph Road
  - Install Advanced Detection at all intersections where detection is required for traffic operations
  - Use Advanced detectors as System detectors unless distance between the intersections warrants mid-block detection and/or data exists to show queue back-up to advanced detector locations
Communications Analysis

- Contents:
  - Field/IEN Network Descriptions
  - Discussion of Video Architectures
  - Requirements Summary
  - Candidate Technology Description
  - Comparative Analysis
  - Recommendations for:
    - Field Communications
    - IEN Communications
CCTV Requirements

• CCTV system should be integrated with ATMS
• The communications system shall support the ability to view and control (Pan, Tilt and Zoom) CCTV cameras.
• Analog: The communications system shall accommodate the standard NTSC bandwidth for video of 4.2 MHz based on a 6 MHz channel spacing for video signals.
• Digital: Either motion JPEG or MPEG formats should be used.
• Control: The control signal, ranging from 300 bps to 9600 bps will be accommodated over a common channel in a multi-dropped environment
CCTV Requirements

• The CCTV interface to the IEN shall support the sharing of full motion video from any of the cameras under the control of the ATMS with jurisdictions in the corridor and elsewhere.

• It shall be possible for all the agencies in the I-5/Telegraph Road Corridor to concurrently view any CCTV image.

• The CCTV interface to the IEN shall support the control of CCTV cameras by other agencies.
Physical Communications Architecture

Layer #3
Sub-Regional TMC

Layer #2
LCC City #1
LCC City #2
LCC City #3

Layer #1
CCTV
Controller
CMS
Field Devices
City #1
Field Devices
City #2
Field Devices
City #3

ATMS Connections
TMC to TMC (IEN) Network

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Video Communication Option #1

City #1
Analog Video Switch

Sub-Regional TMC
Analog Video Switch

City #2
Analog Video Switch

Control (Serial)
Analog Video
Digital Video

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Video Communication Option #2

City #1

Output

Input

Video Server

Sub-Regional TMC

Output

Input

Video Server

City #2

Output

Input

Video Server

Control (Serial)

Analog Video

Digital Video

Encoder

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Video Communication Option #3

City #1
- Video Server
  - Input
  - Output

City #2
- Video Server
  - Input
  - Output

Sub-Regional TMC
- Video Server
  - Input
  - Output

Digital Video

GTS
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## Comparison of Video Architecture Options

<table>
<thead>
<tr>
<th></th>
<th>Option # 1</th>
<th>Option # 2</th>
<th>Option # 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of video available</strong></td>
<td>• Baseband video</td>
<td>• Baseband at TMC</td>
<td>• Digital compressed</td>
</tr>
<tr>
<td></td>
<td>• Digital compressed over IEN</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Switching Logic</strong></td>
<td>• Complex due to protocol</td>
<td>• Video Server distributes video</td>
<td>• Video Server distributes video.</td>
</tr>
<tr>
<td><strong>Scalability</strong></td>
<td>• Not easily scalable</td>
<td>• Moderately scalable</td>
<td>• Very easily scalable</td>
</tr>
<tr>
<td><strong>PTZ Control</strong></td>
<td>• Very responsive, low latency</td>
<td>• Very responsive at local TMC</td>
<td>• Performance impact depending on number of users</td>
</tr>
<tr>
<td></td>
<td>• Added latency via the IEN for other agencies</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>User Access / Security</strong></td>
<td>• Dependent on the video switch</td>
<td>• Controlled at the TMC Video server level</td>
<td>• Very flexible, but needs careful planning</td>
</tr>
</tbody>
</table>
Candidate Technologies

- Cable Based Solutions
  - Twisted Pair
  - Fiber
    - Analog/Sonet/ATM/Ethernet
- Wireless based Solutions
  - Microwave
  - Radio
  - CDPD
- Leased Options
  - Frame Relay ISDN/DSL/T-1 etc.
  - Private Virtual Network
Project Area Expansion

• The original scope of work for I-5/Telegraph included only one arterial- I-5/Telegraph Road and involved following six cities:
  – City of Commerce
  – City of Montebello
  – City of Pico Rivera
  – City of Downey
  – City of Santa Fe Springs
  – City of La Mirada

• County expand the coverage area to include more north south and east west streets and covered two more cities: Whittier and Norwalk
Expanded Project Area
Up-coming Work

• Finalize HLD Report (November)
• Finalize LCC Site Recommendations (November)
• Draft Alternatives Analysis (November)
  – ATMS
  – Communications
• Draft Recommendations (December)
  – ATMS/Detection/Communications
• Draft Conceptual Design (January)
Project Web Page

www.gts.sea.siemens.com

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