GIS in Highway Transportation Management: The I-84 Hartford Project

Presented by:
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What is the I-84 Hartford Project and why is the project needed?

- Bridge Structure Deficiencies
- Traffic and Safety Deficiencies
- Mobility Deficiencies
- Reduce traffic congestion

What are the Goals & Objectives

- Ensure better integration of the interstate with the urban environment
- Maximize public investment in corridor
- Ensure long-term serviceability of corridor
Overview of the Environmental Process
NEPA and CEPA Overview

National Environmental Policy Act (NEPA - 1969)
- A decision-making process for the selection of a transportation improvement

Connecticut Environmental Policy Act (CEPA - 1971)
- A state process that closely follows the intent of NEPA and has similar requirements.
Overview of the Environmental Process

• Define initial set of alternatives
  – Test/evaluate
  – Get input

• Refine alternatives
  – Interchanges
  – Lanes/shoulders
  – Local streets

• Evaluate impacts
  – Traffic
  – Environmental

• Agency and public input throughout
Range of Alternatives Identified

- I-84 on structure
- I-84 at or below grade
- I-84 in tunnel
- Modified interchanges
- Intermodal connections

- 75 alternative combinations presented
- Must satisfy *Purpose & Need Statement*
What are Environmental Resources?

Natural Environment

- Parks and Recreational Areas
- Wildlife and Waterfowl Refuges
- Hydrologic/Water Resources
- Biological Resources
- Endangered Species
- Visual and Aesthetic Characteristics
What are Environmental Resources?

Built Environment
- Transportation
- Land Use
- Communities and Socioeconomic Conditions
- Environmental Justice
- Air Quality
- Noise and Vibration
- Cultural and Historic Resources
- Secondary and Cumulative Effects
- Construction Impacts
- Contamination and Hazardous Materials

All of the above parameters will be evaluated in detail in NEPA/CEPA documentation.
First....A little history.

1820
First....A little history.

1843
First....A little history.

1860

Credit: CHS
First....A little history.

1945

Credit: CHS
First... A little history.

1945
First....A little history.

1960
First....A little history.

1970

“The impact of the I-84 freeway upon the physical environments into which it was introduced has been both dramatic and overwhelming.”
—1970 CTDOT & FHWA
First....A little history.

2006
A Product of its Time.....

2015
Where is the Project?
Approximately from Flatbush Avenue to I-91
I-84 Concerns

- Bridge Structure Deficiencies
- Traffic Operational and Safety Deficiencies
- Mobility Deficiencies
Rating of Current Bridge Elements

National Bridge Inventory Rating

- Very Good (8)
- Good (7)
- Satisfactory (6)
- Fair (5)
- Poor (4)
- Serious (3)
Operational Deficiencies

- Left-hand on- and off-ramps
- Multiple lane drops (“exit only”)
- Weave sections
- 8 full or partial interchanges in less than 3 miles
Traffic Congestion

• 175,000 = daily traffic volume (higher than I-95)
• 6-7 mile traffic jams daily
  – Most congested of Hartford freeways
    (nearly 50% of region’s congestion)
  – Less congestion than I-95, but still a problem
Safety Deficiencies

Accident rate four times the state average
- Narrow shoulder widths
- Nearly two accidents per day
- Significant traffic delays
- Poor pedestrian and bike accessibility on local streets
Community Challenges/Opportunities

- Connectivity between places
- Aesthetics and viewsheds
- Social and economic impact
- Historic preservation
GIS Data Needed

• Bridge Structures
  – National Bridge Inventory

• Environmental Data
  – Wetlands
  – FEMA Floodplains
  – Parks/Recreational
  – Natural and Built environment (planimetrics)

• Traffic Data
  – CTDOT traffic count stations
  – AirSage O-D
  – Skycomp O-D
  – INRIX Travel time data

• 3D HDS Laser Scanning
  – CADD and GIS interoperability

• Land Use/Zoning

• Crash Data

• 2010 Census Demographics
  – Environmental Justice areas

• Pictometry 2D/3D imagery

• Previous Studies’ Data

➢ GIS Data serves as baseline for identification of alternatives and 3D visualization applications
2010 Census – Environmental Justice Areas
Key Constraints Map
Traffic Data

- Traffic Counts
- Field Observations
- Vehicle License Plate Survey
- Travel Time Data – Inrix
- Travel Patterns – Skycomp & AirSage (Origin & Destination)
- Queue Lengths – Skycomp
- Truck Patterns
- Traffic Signal Data
- Accident Data
- Vissim, HCS, TDM
Traffic Counts

• Turning Movement Counts – Peak Periods
• Video Cameras
• Automatic Traffic Recorder (ATR) – 24 hour
  - 105 locations
• Video Cameras
  - 61 locations
Traffic Analysis Study Area
Skycomp – Wide Area Aerial Video (WAV)
INRIX – Travel Time Traffic Data
INRIX – Traffic Congestion “Length”
INRIX – PM Peak Weekday Travel Speeds
Traffic Speeds – AM to PM Peak
AirSage – Travel Patterns

• Provides OD travel patterns based on cell phone data (anonymous)
  – Scaled to represent entire population
• More regional OD travel patterns
• Very useful in calibrating & validating Travel Demand models
Vissim Traffic Modeling
Vissim – Existing LOS (PM Peak)
Synchro Intersection Traffic Modeling

Intersection Level of Service
Existing conditions, PM peak
Crash Rate Map (2014)
Alignments Being Advanced

**Alt. 2: Elevated**
1 alignment (2A)

**Alt. 3: Lowered**
2 alignments (3A and 3B)

**Alt. 4: Tunnel**
1 alignment (4C)
## Interchange Combinations

<table>
<thead>
<tr>
<th>Alternative</th>
<th>West</th>
<th>East</th>
</tr>
</thead>
<tbody>
<tr>
<td>2A: Elevated</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>3A &amp; B: Lowered</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>4C: Tunnel</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
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- 43 combinations further analyzed
3 Tunnel Alignments Considered

- 4A & 4B: Significant property impacts
- One tunnel alignment being advanced (4C)
  - Build on existing footprint
Cost Estimates

Current estimates for the alternatives vary by billions of dollars!
3D Visualization

Existing Conditions

Replaced, I-84 At-grade
3D Visualization

Added bridges
3D Visualization Demo
Next Steps

• Stakeholder and Public Input
  – Considering Crowdsourcing GIS applications
• Continue to Refine Alternatives
• Screen Out Alternatives that are not “Reasonable, Prudent or Practicable”
• Evaluate Impacts
• Select Preferred Alternative
• Obtain Environmental Approvals
• Final Design and Construction
Project Schedule
Conclusions

• NEPA Process works – Needed to identify the Highway Management Strategies
• Stakeholder and Public Input
• Continue to Refine Alternatives
• Screen Out Alternatives that are not “Reasonable, Prudent or Practicable”
• Evaluate Impacts
• Select Preferred Alternative
• Obtain Environmental Approvals
• Final Design and Construction
• GIS Analysis and 3D Visualization are powerful combinations for public input
Questions?

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