3D Model-based Planning-Design-Construction-O&M
Best Practices for Transportation Project Delivery:
Focus on Traffic and Safety for DOTs

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Bio:

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WisDOT Transportation Infrastructure Design
Moving from 2D to Robust 3D Models
Design & Construction Best Practice Workflows: WisDOT SE Freeways

Where we are going

2D CAD Models
Object Features
Objects Not Intelligent
No 3D TIN-DTM Surfaces
Geospatial
Multi Disciplinary 2D Project-based

3D CAD Models
Object Features
Objects Not Intelligent
3D TIN-DTM Surfaces
Geospatial
Multi Disciplinary 3D Project-based

3D CIM Collaboration Models
Intelligent Subassembly Features
Collaborative 3D CIM Databases
3D TIN-DTM-3D Face Surfaces
Geospatial
Collaborative Multi Disciplinary 3D Project-based

3D CIM Integrated Collaboration Models
Intelligent Subassembly Features
Integrated 2D-3D-4D-5D-xD CIM Databases
3D TIN-DTM-3D Face Surfaces
Geospatial
Integrated Collaboration Multi Disciplinary 3D Life-cycle-based

Where we are

ISOLATED

COLLABORATIVE

INTEGRATED
Road & Bridge Design Best Practice Workflows: WisDOT SE Freeways

- Strategic Planning for WisDOT SE Freeways
  “plans are useless but planning is essential”
  - Strategic Goals: Organizational Clarity, Common Shared Vision, Model the Way, Align Objectives, Pull Together, Build Trust, Inspire Passion, Challenge the Process, Enable Others to Act
  - Core Goals: Mobility, Accountability, Preservation, Safety, & Service
Key findings/Best practices for Transportation Infrastructure

- People/Workforce + Organization/Process + Tools/Technologies = Success
- Cost Benefits Analysis/Return on Investment Focus = $, Time, & Quality
- PS&E 3D Model-based Digital Project Delivery = New Workflows
Key findings/Best practices for Transportation Infrastructure

- Have Organizational Strategic Plan for 3D Technologies Implementation
- Manage Change for Disruption to Current/Future Workflows/Dataflows
- Use Best Available Tools & Technologies to Achieve Business Goals
Key findings/Best practices for Transportation Infrastructure

- Management Buy-in with Support for Innovation & Funding of 3T’s (ITEC, IT2, DM, BOS, S&M, 3D, Innovation Committees)
- Reduce Org “Silos of Excellence” Bottlenecks/Poor Workflows/Dataflows
- Encourage Collaboration Between Agencies/Bureaus/Regions/Bus Units
Benefits/Advantages:
- Automate drafting/standards
- Draw efficiently/accurately
- Layout scale model-paper space
- Layout dimensions/text/notes
- Visualize/view drawing
- Layers/attributes/properties
- Vector & raster/custom libraries
- Modify/review to reduce updates
- Link CAE/CAD tools to CADD
- E-construction stakeout
- Organize/access project data

Benefits/Advantages:
- Modify, reuse, & revise in 3D to reduce updates
- 3D geospatial & rapid prototyping shop drawings
- 3D visualizations using walk/drive-through simulations/animations
- GPS stakeout/3D QA-QC
- Subgrade grading/string-less paving using AMG up to 30% savings

Benefits/Advantages:
- Multi-disciplinary collaboration
- Identify/reduce issues earlier by clash detection/resolution
- Reduce redesign, rework, DINs, & CCOs cost savings/avoidance opportunities up to 25%
- Staged-temporary construction
- Constructability analysis
- Optimize/visualize design-construction with VDC-CIM
- Link 3D to 4D & 5D/BOM

Benefits/Advantages:
- Multi-disciplinary collaboration
- Clash detection/resolution to eliminate issues to reduce redesign, DINs & CCOs
- Database lifecycle mgmt for O & M with data warehousing
- PLM link to PDM/CRM/BPM/ERP
- Process/workflows management
- Enterprise LAN + WAN & cloud
- E-design/e-construction use of 3D models/tools with mobile devices

Road & Bridge Design Best Practice Workflows: WisDOT SE Freeways

Where we are

Where we are going

ISOLATED

COLLABORATIVE

INTEGRATED
CIM 3D Modeling: Zoo Interchange
Construction: 2012-2018

- 9 miles of freeway + RRs
- 6 service interchanges
  - North Avenue
  - Watertown Plank Road
  - Bluemound Road
  - 84th Street
  - Greenfield Avenue
  - STH 100
- Major Arterial Roadways
  - STH 100/Mayfair Road
  - Watertown Plank Road
  - Swan Boulevard
  - Glenview Avenue
  - Greenfield Avenue
CIM 3D Modeling: Zoo Interchange
Construction: 2012-2018

- $1.7 b reconstruction of Zoo IC-Corridor
- Handles almost 350,000 avg. vehicles per day in traffic
- Over 15 miles of construction including arterials
- Construction involves 68 bridges including 6 RR structures, 1 system/7 service interchanges, 108 retaining walls, 15 noise walls, 2 box culverts, 115 sign structures & numerous utilities
- Temp. roads/structures to accommodate 2 lanes of traffic during construction
- 3D CIM for all disciplines is deployed throughout Zoo IC Design-Construction
CIM 3D Modeling: Marquette Interchange
Construction: 2004-2008

- $810m reconstruction of Marquette IC
- Handles almost 300,000 avg. vehicles per day
- Marquette IC is a 5-level system interchange
- Marquette IC is over 52 lane miles of construction
- Construction involved, 56 bridges, 30 ramps, 5 miles of retaining walls, and numerous utilities
- Links I-94 (W & S), I-43 (N), & I-794 (E)
- 10,254 page PS&E
- $497.8m Let with Final at $531.9 & CCOs=$34.1m (6.85%)
$294.4m reconstruction of Mitchell IC – part of the 39-mile $1.9b I-94 N-S construction

Handles over 195,000 avg. vehicles per day

Mitchell IC is over 10 miles of construction

Construction involves 3 tunnels, 13 bridges, 1 system/4 service interchanges (including Airport Spur), 29 retaining walls, 7 noise walls, 4 box culverts, 54 sign structures & numerous utilities

Temp. roads/structures to accommodate 2 lanes of traffic during construction

$647.0m Let (to date) with Current Final/Projected $687.0m & CCOs=$40.0m (6.18%)

CBA/ROI involving Contract Change Order Issues:

I-94 Mitchell IC Construction Project-$294.4 m
Mitchell IC, CD Road, 27th St, Airport Spur, College/Grange Aves
Field Issues - $22.2 m or 7.5% (651 of 669 DINs/CCOs) (avg - $33,180)
• GN-General: 30.5% (148-$6.8 m) ($45,674 per issue)
• RD-Roadway/Drainage: 25.5% (66-$5.7 m) ($85,631 per issue)
• WU-Wet Utilities/Drainage: 11.1% (90-$2.4 m) ($27,120 per issue)
• BR-Bridges: 8.0% (114-$1.8 m) ($15,557 per issue)
• NW-Noise Wall: 8.0% (14-$1.8 m) ($125,909 per issue)
• RW-Retaining Wall: 7.7% (78-$1.7 m) ($21,818 per issue)
• EW-Earthwork: 4.5% (17-$1.0 m) ($59,220 per issue)
• EL-Electrical/ITS/FTMS: 2.6% (93-$0.6 m) ($15,557 per issue)
• TR-Traffic: 2.1% (26-$0.5 m) ($18,174 per issue)
• SS-Sign Structures: 0.1% (23-$0.02 m) ($738 per issue)
CBA/ROI involving Contract Change Order Issues (to date):

Zoo IC Construction Project- $446.5 m of 1.7 b total (% - Complete in 2018 as of 03/31/15)
STH 100, Glenview Ave, WTP Rd, Swan Blvd, STH 100/UP RR Bridges, Greenfield Ave, 76th St Bridge, 84th St, Temp Salt Shed, Traffic Mitigation, Advanced Signing, & Int Corridors, Core 1
Field Issues - $12.6 m or 2.8% (1141 DINs/CCOs – avg $7,400) with $4.2m Balancing/Equalizing Mods
Plan Inadequacy Issues - $3.10 m (146 DINs/CCOs – avg $21,200)
• RD-Roadway/Drainage: 34.0% (196-$4.40 m) ($22,300 per issue)
• GN-General: 24.0% (224-$3.10 m) ($13,600 per issue)
• EW-Earthwork: 10.8% (57-$1.40 m) ($24,500 per issue)
• BR-Bridges: 10.8% (89-$1.40 m) ($15,700 per issue)
• WU-Wet Utilities/Drainage: 8.5% (182-$1.10 m) ($5,900 per issue)
• EL-Electrical/ITS/FTMS: 4.8% (131-$0.624 m) ($4,800 per issue)
• TR-Traffic: 4.2% (93-$0.543 m) ($5,800 per issue)
• RW-Retaining Wall: 1.2% (28-$0.152 m) ($5,400 per issue)
• NW-Noise Wall: 0.8% (5-$0.105 m) ($21,000 per issue)
• SS-Sign Structures: 0.6% (16-$0.077 m) ($4,800 per issue)
• SA-Safety: 0.6% (6-$0.073 m) ($12,200 per issue)
• LD-Landscaping: 0.2% (7-$0.026 m) ($3,800 per issue)
• O-Other/Demo: 0.1% (4-$0.017m) ($4,300 per issue)
• Overrun-Underuns/Balancing-Equalizing Mods: 33.3% (108-$4.20 m) ($39,300 per issue)
3D Technologies Implementation Plan-2014 Roadmap

- 3D Models - AMG/AMC Earthworks & Stringless Asphalt/Concrete Paving
- Construction Review
- Design-Construction-Contractor Collaboration
- Field Image Capture/Visualization
- Utility Inspection
- SPAR/GPR
- Field Clash Detection
- Construction LiDAR-Integrated Surveys
- Bluebeam vs Adobe Pro As-builts
- O & M Lifecycle
- Asset Management
- Cloud DPD/DDE
- Mobile Devices-Tablet PCs
- E-Construction
- Traffic & Safety

Wisconsin Department of Transportation
3D Technologies Implementation Plan
WisDOT Project ID: 0667-45-15
CMSC: WO 4.1
Final Report
March, 2013
Submitted to the Wisconsin Department of Transportation

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C3D Technologies/3D Modeling Workflow involving Zoo IC:

Zoo IC Construction Project- $1.7 b total (2007 to Completion in 2018)

• LiDAR and Integrated Survey - Pre-Design Data Collection:
• CIM Project Execution Plan (PXP):
• 3D Modeling – Roads:
• 3D Modeling - Structures:
• 3D Modeling – Utilities:
• 3D Modeling - Traffic:
• 3D Modeling - PI:
• 3D Modeling - Other:
• 3D Modeling QA/QC:
• 3D Modeling e-Construction/3D Rovers (CEC):
• LiDAR and Integrated Survey – Post-Design Data Collection:
• As-built 3D Modeling:
• 3D Modeling Tools
• O-Other:
Automated Infrastructure Planning: SE Freeways Project Prioritization & Sequencing

CIM Applications:
- Decision Matrix for SE Freeways Planning, Prioritizing, & Sequencing Projects
- Web-based SE Freeways Intranet/Extranet GIS Data Warehouse

Tool(s) Used:
- ESRI ArcGIS (7-County 2D File GeoDB GIS Data Warehouse)
- Autodesk C3D (7-County Project Data 3D to 2D)
- Decision Lens (MS Excel Import-Export to-from GIS)

Benefits:
- Strategic Capital Finance Planning, Resource Allocating, & Asset Management Planning
- Customizable Analytical Hierarchical Decision Matrix Weighting of Criteria Fields

Challenges:
- Data Warehousing of Large 7 County Datasets
- Web-based Access of Collaborative SE Freeways GIS DB - Intranet and/or Extranet
Automated Infrastructure Planning: SE Freeways Project Prioritization & Sequencing

SE Freeways Study Segments

55+ miles designed and/or constructed with 218 miles of 273 total miles to be prioritized and sequenced involving freeways in southeast Wisconsin
CIM 3D Modeling: Zoo Interchange Design-grade Survey

3D Survey Integrated Mapping using LiDAR-Static/Mobile/Aerial Scanning with Supplemental RTK GPS/Digital Leveling/TS/UAV Existing Conditions
CIM 3D Modeling: Zoo Interchange Design-grade Survey
CIM 3D Modeling: Zoo Interchange
Design-grade/Post-construction Surveys

Georeferenced Hi-res Digital Images
3D XYZ Return LAS Point Clouds
2D -3D Feature Lines 3D DTM-TINs X-Sections
3D CIM-BIM DSMs
CIM 3D Modeling: Zoo Interchange Design

3D Roads/Drainage/Surfaces
CIM 3D Modeling: Zoo Interchange Design

3D Structures: Bridges, Ret Walls, Noise Walls, Tunnels, Sign Bridges, Other
CIM 3D Modeling: Zoo Interchange Design

3D Utilities-Gas, Steam, Electrical, Comm, Fiber Optic, Tel/Data, CATV/Data, Other
CIM 3D Modeling: Zoo Interchange
Design

3D ITS/FTMS, Lighting, Signs, Signals, Landscaping, Water, San Sewer, Other
CIM 3D Modeling: Zoo Interchange Design

3D Staged Model with Temporary Surfaces, Roads, Drainage, Structures, Other
CIM – Multi-disciplinary Integrated 3D Design

CIM Applications:
- Multi-disciplinary Integrated 3D Design Workflows for Roadway, Structures, Geotech, Utilities, Traffic, S&S, Other
- Clash Detection between Disciplines in Design Reviews

Tool(s) Used:
- Bentley Microstation + In-roads (Design) SS2 / Autodesk C3D 2014
- Bentley Navigator (Clash Detection) / Autodesk Navisworks 2014

Benefits:
- Improved Design & Design-Construction Reviews
- Earlier Detailed Clash Detection-Resolution
- Improved PS&E Production Quality & 3D Model Delivery

Challenges:
- All Design Disciplines Designing in 3D
- Better 3D Modeling SW Tools Needed for Structures & Utilities
CIM 3D Modeling: Zoo Interchange Design

Traffic Applications on the Zoo IC Project

CIM Applications:
- Multi-disciplinary Integrated 3D Design Workflows for Roadway, Structures, Geotech, Utilities, Traffic, S&S, Other

Tool(s) Used:
- VISSIM vs Parametrics for Traffic Modeling
- 3D CIM Visualization Models for Maintenance of Traffic (MOT)
- BIM 360 for Issues and Risks
- Adaptive Signals and Other Innovations

Benefits:
- Improved Design & Design-Construction Reviews
- Improved PS&E Production Quality & 3D Model Delivery
- Earlier Issues Detection-Resolution in Design & Construction

Challenges:
- All Design Disciplines Designing in 3D
- Improved Integration for 3D Modeling SW Tools Needed for Traffic
Brief History of Integrated Corridors in SE Wisconsin

- Integrated corridor efforts began mid 1990’s
- Goal of integrating operations along arterials where multiple jurisdictions owned signals
- Significant efforts to establish a multi-agency corridor
- Collaborative operations by multiple agencies – better in theory than real life
- For the I-94 North-South project, a traffic responsive signal system was implemented
- For the I-94 East-West project, signal timings were provided by DOT to the municipalities
New Approach for Zoo Interchange Reconstruction

• Past experience suggested the need for a new approach to integrated corridors
• Zoo Interchange serves as the hub of the freeway network in the Milwaukee metro area
• Reconstruction would impact over 350,000 motorists per day
• Expanded capacity on several local arterials to address existing capacity constraints
Zoo Interchange

- Gateway to Milwaukee, largest urban center in state of Wisconsin
- Access to the regional medical center, tourism, jobs and education
- Neighborhoods and thriving communities
Zoo Interchange Construction

Significant Challenges

• Core of the interchange – long term closures
• Mainline - keeping traffic moving and Milwaukee open for business
• Railroad bridges – avoiding detours of rail traffic, impacts to freeway operations during construction
• Keep local street system operating
Transportation Management Plan (TMP)

- Staging Decisions
  - Consider 15-minute delay guideline & project schedule constraints to determine:
    - Lane closure time restrictions
    - Temporary bridges or widening
    - Temporary travel lanes or use of shoulder
    - Ramp/road closures
  - Then consider strategies to manage delay
Purpose of ICM

- Direct - address geometric, capacity and safety issues during Zoo Interchange reconstruction
- Indirect – reduce driver frustration, improve perception of DOT and municipal partnerships
- Integrate better traffic management functions within the project area for reconstruction and beyond
Integrated Corridor Management

Key Components

Arterials

- Adaptive traffic signals
- Dynamic message signs
- CCTVs
- Travel time system
Integrated Corridor Management

Adaptive Signal System

SCHEDULE

<table>
<thead>
<tr>
<th>PSE</th>
<th>Let</th>
<th>Begin Construction</th>
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<tbody>
<tr>
<td>1st PS&amp;E</td>
<td>Mar 1, 2013</td>
<td>July 23, 2013</td>
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<tr>
<td>2nd PS&amp;E</td>
<td>Feb 1, 2014</td>
<td>June 23, 2014</td>
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InSync learning segment begins operations in early 2013

New signals installed in fall 2013

LEGEND

- Temporary Signal
- Extensive Signal Work Necessary
- Signal Ownership Transferred to WisDOT
- City of Milwaukee May Operate
- City of Milwaukee
- City of West Allis
- City of Wauwatosa
- City of Brookfield
- City of New Berlin
- Village of West Milwaukee
- Village of Elm Grove
- Waukesha County
- WisDOT
- 1st Tier InSync Signals
- 2nd Tier InSync Signals
- 3rd Tier InSync Signals

Note: Installations in work zones are tentative and will be finalized with the staging schedule.

Zoo Interchange Integrated Corridor Management System
PS&E 1 and 2 Adaptive Signal Installations (2013 and 2014 Construction)

DRAFT
Adaptive Signal System
Learning Segment

- Rhythm Engineering - InSync
- 70+ signalized intersections
- All WisDOT owned signals
- Cost of ~$200k for pilot 6 signals
- Includes an evaluation of operations
- Lessons learned for wider use
Evaluation Scope

Evaluation Measures of Effectiveness

• Travel times
• Intersection stop delay
• Intersection volumes
• Fuel consumption/emissions
Learning Segment

Evaluation Results

Floating Car Travel Time Runs and Bluetooth Travel Times

- Before InSync
- After InSync
- Free Flow @ 40 mph

Travel Time (min)

AM NB | AM SB | MID NB | MID SB | PM NB | PM SB | AM NB | AM SB | MID NB | MID SB | PM NB | PM SB | Sat. NB | Sat. SB

Travel Time Runs

Bluetooth Travel Times
History of Orange Pavement Markings

• Never used before in the United States
• Used before in other countries (Canada, Germany, Holland, Switzerland and New Zealand) in work zones
• Provide color correlation with other work zone devices
Why the Zoo Interchange?

- Lots of lane shifts in project
- Very high Traffic Volumes
- Issues with salt residue on pavement making the white lines blend in during the winter months
- Removal of old markings left scars on the pavement making it hard to distinguish the correct lane lines
- Motorist Confusion on where the travel lane really is
REQUEST FOR EXPERIMENTATION (FHWA)

• FHWA Approval for Experimentation Critically Important!!
  • Experimentation Request submitted on October 20, 2014
  • Approval from FHWA received on November 5, 2014
  • Current experimentation is through June 2016 (for the Core 1 Project)

• Concerns from FHWA:
  • Yellowing of orange marking over time
  • Utilization of Control Sections (one direction of the roadway is orange and the other is white)
  • Semi-Annual reports required
Evaluation Plan for WisDOT

• CCTV Cameras to detect driver reaction/traffic operations
• Dash-cam video footage used
• Continue to evaluate traffic operations, including operations during snow events (plowing and salting)
• Monthly retroreflectivity and color readings taken
• Survey of general public (located on WisDOT website)
• Utilize Fixed Message Warning Signs
Installation Challenges

- Trial and Error
- First orange was put down in early December 2014
- Used on Edgelines and Lanelines
- Utilized Orange Epoxy
- Out of spec (too cold!)
  - Equipment issues
  - Long cure time
  - Not very reflective
  - Poor adhesion
  - Color closely resembled the yellow epoxy
Survey Results (on Original Orange Markings)

• Did the Orange markings:
  • Increase your awareness of being in a work zone?
    • 53.5% Yes
    • 46.5% No
  • Seem more visible than the white pavement markings?
    • 59.7% Yes
    • 40.3% No

• Opinion of the Orange markings

- 23% Needs a lot of improvement
- 31% Needs some improvement
- 18% Good
- 15% Very Good
- 13% Excelent
Survey Results

What times have you traveled the route? (check all that apply)

- Early Morning (12am – 6am)
- Morning (6am – 9am)
- Mid-day (9am – 3pm)
- Afternoon (3pm – 6pm)
- Evening (6pm – 12am)

What weather conditions have you experienced when you traveled the route? (check all that apply)

- Sunrise/Sunset
- Overhead sunshine
- Overcast/Cloudy
- Snowing
- Raining
- Clear night
Lessons Learned So far....

• Issues with color at night with high pressure sodium lighting

• Need to utilize a more fluorescent type of orange to “pop out”
Installation Challenges

- The more fluorescent the orange, the more transparent it becomes.
Results

Measurements with the LTL2000Y from Delta

- White
- Yellow
- Fluorescent Orange (initial)
- Orange (initial)
- Orange (3 months, no traffic)
- Orange (3 months, skip)
- Orange (3 months, edgeline)
- Yellow (initial)
- Yellow (3 months, no traffic)
- White (initial)
- White (3 months, no traffic)
Results

- Orange Pavement Marking

Retro Readings over Time

- Fluorescent Orange (initial)
- Orange (no traffic)
- Orange (skip)
- Orange (edgeline)
- Yellow
- White
Survey Results 2

Opinion on the Fl. Orange used to help you drive safely through the work zone

- Needs lots of improvement: 2.82%
- Needs some improvement: 3.87%
- Good: 17.08%
- Very Good: 34.86%
- Excellent: 24.30%
- I didn’t notice: 17.08%

Did the Fl. Orange increase your awareness of being in a construction zone?

- Yes: 81.49%
- No: 18.51%
Survey Results 2

Which color marking would you prefer to be used in a construction work zone?

- Fl. Orange: 80.50%
- Orange: 14.60%
- White: 4.90%

Do you feel the Fl. Orange is more visible than the white?

- Yes: 90%
- No: 10%
WHAT’S NEXT??

• More fluorescent version (Epoxy) applied in mid March 2015

• Use of orange Waterborne Paint and Tape on Zoo Interchange Project

• $16.50 per gallon for waterborne vs. $65.00 per gallon for epoxy

• Continue evaluation until June 2016

• Providing valuable input back to FHWA

• Additional evaluations performed by the Smart Work Zone Pooled Fund through UW TOPS Lab
CIM 3D Modeling: Zoo Interchange Design

CIM - Visualization & Clash Detection

CIM Applications:
- Digital Project Delivery 3D Model-based PS&E Production + 3D Models (3DAMG Model @Prebid & 3D Ancillary Model @Precon)
- Clash Detection Preformed after 60% & Draft PS&E Reviews

Tool(s) Used:
- Bentley Microstation + In-roads (Design) SS2 / Autodesk C3D 2014
- Bentley Navigator (Clash Detection) / Autodesk Navisworks 2014

Benefits:
- Earlier Detailed Clash Detection-Resolution
- Improved PS&E Production & 3D Model Delivery Pre-bid/Pre-con

Challenges:
- “Rule-based” Clash Detection
- Pre-bid - AMG/Precon - Ancillary 3D Model Delivery Timeframes
CIM 3D Modeling: Zoo Interchange Design

4D/Constructability Analysis

Applications:
- Final design and staging plan development
- Public Involvement

Tool(s) Used:
- Autodesk Navisworks
- Bentley Navigator

Benefits:
- Evaluate staging options
- Evaluate utility relocations

Challenges:
- Requires 3d elements from design
- Requires detailed schedule and durations
- Accuracy of existing surface or utility data
- Design tool or visual aid??
CIM 3D Modeling: Zoo Interchange Design

3D Photorealistic/Augmented Reality/Rendered Model
CIM & Public Involvement Applications

CIM Applications:
- Exhibits & Maps from 3D Engineered Models & GIS for PI
- Renderings & Simulations from 3D Engineered Models for PI

Tool(s) Used:
- Bentley Microstation SS2 / Autodesk C3D 2014 / 3DS Max / RDV Systems / Forum8
- Autodesk 3DS Max

Benefits:
- Improved Renderings & Simulations Directly from 3D Models
- Improved Visualizations for Stakeholders

Challenges:
- Renderings & Simulations 3D Workflows Timeframes
- Better 3D Rapid Modeling Software Tools Needed
CIM 3D Modeling: Zoo Interchange Design

Post-Construction Initiatives:
As-built Record CEC Updating of 3D Model Pilot Project
CIM 3D Modeling: Zoo Interchange Construction

3D Engineered Models in Construction-SE Freeways/Region

CIM to Field Issues Tracking
CIM 3D Modeling: Zoo Interchange Construction

3D Engineered Models in Construction-SE Freeways/Region
CIM 3D Modeling: Zoo Interchange Construction

CIM – BIM Field 360

CIM Applications:
- Collaboration Using Autodesk BIM Field 360, Glue, & Buzzsaw
- Construction Issues Management + Design-Construction Reviews

Tool(s) Used:
- Autodesk BIM Field 360, Glue, & Buzzsaw (Pilot)
- Office & Field Mobile Devices (Pilot)

Benefits:
- Improved Issues & Risks Tracking & Notification
- Improved Design-Construction (PSE) Reviews
- Improved Constructability (Schedule/Costs) Reviews
- Improved Construction Collaboration & Coordination

Challenges:
- Mobile Devices Hardware (iOS Apple vs MS Win Office Tablets)
- Software Applications (Apple vs 32-bit MS Windows software)
Intelligent Vehicles + Sensor Technologies + Intelligent Roads with Automated 3D Design

- Driverless Vehicles
- Machine-Controlled UAV
- Traffic Operations
- UAV Accident Monitoring
- Lane, Distance, Time Compression