INTELLIGENT TRANSPORTATION SYSTEM STANDARDS DEVELOPMENT

Presenter: Therese Polum, PE (MN, KS) Associate SRF Consulting Group, Inc.
Kansas DOT starting to deploy significant ITS projects.

Project designers had to develop project specific standards for each individual PS&E.

Kansas DOT noticed the results of the time and effort put into this task by each individual project designer.
- Development of rural DMS and CCTV PS&E.

- Need to provide designers a standard set of ITS specifications and details as a building block to ITS design.

- Near future encompassed an increase of ITS deployments throughout the state, both rural and urban.
THE GOAL

- Provide designers with a standard set of specification and details.
- Specifically these standards are to be:
  - Easily inserted into PS&E packages
  - Editable for project specific items and future updates
- Project included:
  - Details
  - Specifications
  - Typical ITS Unit Cost List
  - ITS Average Bid Tabulations
  - ITS Design Principals (best practice)
  - Structural Evaluation Report
1. Data Gathering
2. Research Previous KDOT Plan Sets
3. Research Other DOT Plan Sets
4. Organize Information & Data
5. Research "Design Best Practices"
6. Evaluate Preferred Standard
7. Develop & Organize CADD Files
8. Evaluate Agency Requirements
9. Overall Documentation
DATA GATHERING

- Details and Specifications
  - Obtain details and specifications that have been used in past Kansas DOT ITS PS&E’s to establish specification outline.
  - No consistency in CADD file format.

- ITS Unit Cost List, Average Bid Tabs, Design Best Practices
  - Gather information from past Kansas DOT ITS PS&E’s and from correspondence from past projects.
PROCESS

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RESEARCH PAST PLAN SETS

- ITS on State Highway I-70 (Vanus)
- Wichita TMC Final Deployment (Telvent, PB, Iteris)
- ITS on State Highway US-69 Johnson County (KHA)
- ITS on State Highway K-10 and K-7 Johnson County (KHA)
- Salina Area DMS (SRF)
- AMBER Alert DMS and CCTV (SRF)
- Wichita TMC Test Project (Telvnet)
- I-635 ITS Project (KHA)
- I-70 Corridor - Speedway ITS Deployment (KHA)
PROCESS

Data Gathering

Research Previous KDOT Plan Sets

Organize Information & Data

Research “Design Best Practices”

Evaluate Preferred Standard

Research Other DOT Plan Sets

Evaluate Agency Requirements

Develop & Organize CADD Files

Overall Documentation
RESEARCH OTHER DOT PLAN SETS
PROCESS

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EVALUATE AGENCY REQUIREMENTS

- AASHTO
- ANSI
- ASTM
- FHWA
- TIA/EIA
- NEMA
- NFPA
- NTCIP

Equipment and manufacturing Vendors
Product data sheets
PROCESS

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RESEARCH DESIGN BEST PRACTICE

- DMS Placement
- CCTV Placement
- Clear Zone
- Guardrail Use
- Concrete Barrier Use
- Cross-Sections
- Ditch Profiles
- Sight Lines
PROCESS

Data Gathering

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Evaluate Preferred Standard

Develop & Organize CADD Files

Overall Documentation
NOW WHAT?

Resource:
Circuit Diagram
http://xkcd.com/730/
Xkcd A Webcomic of Romance, Sarcasm, Math, and Language
ORGANIZE PROJECT

- Organize details – what do we have and what is missing?
- Organize specifications – what do we have and what is missing?
- Recognize unique characteristics to the state of Kansas.
- Recognize that these are living documents, allow room for technology updates.
PROCESS

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STANDARD DETAILS

- Original List – 14 details
  - Legend and abbreviations
  - General notes
  - Cable, conduit, and device legend
  - Typical 334C and 334S cabinet details
  - ITS conduit structural attachment detail
  - DMS orientation detail
  - Pull box detail
  - Splice vault detail
  - Lighting suppression detail
  - Detector pole detail
  - Field power supply detail
  - Electrical service diagrams
  - Typical power arrangement
  - ITS Example Plan Sheet

- Today’s List – 28 details

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STANDARD DETAILS – CABINET DETAIL
2009 TO PRESENT
Equipment specifications were found to need updates to reflect current code requirements and current technology requirements.

Duplicate specifications were removed, including items that are covered in the Kansas Standard Specifications for Road and Bridge Construction.
HDPE Conduit Example

July 2010 example:
Non Metallic Conduit
Install HDPE Conduit according to the manufacturer’s instruction. All HDPE conduit and materials shall have a minimum SDR of 11 and be compliant with ASTM D3035

December 2011 example:
Non Metallic Conduit/HDPE Conduit
Install HDPE conduit according to the manufacturer’s instructions. All HDPE conduit and materials shall have a minimum SDR of 11 and be compliant with ATSM D3035.
All non-metallic conduits shall be color-coded red for electrical cables, green for communication cable and fiber optic cable, and black for the spare conduits. All conduit and fittings shall be listed by UL, and conform to NEC standards.
EQUIPMENT SPECIFICATIONS

HDPE Conduit Example

Current 2014 example:
Non Metallic Conduit/HDPE Conduit
Provide HDPE conduit that is schedule 80 and UL listed.
Provide color coded conduit as required for installation location. KDOT installation area: provide red for electrical cables, green conduit for communication and fiber optic cable, and black conduit for spare. KC Scout Installation area: provide yellow conduit for electrical cables, blue conduit for communication and fiber optic cables, and black conduit for spare. Install HDPE conduit according to manufacturer’s instruction.
PROCESS

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MICROSTATION

- KDOT Graphics Certified File and ITS Cell Library

CONTRACTOR TO INSTALL APPROXIMATE 20' OF CONDUIT BETWEEN EXISTING POWER SERVICE PER WESTAR ENERGY REQUIREMENTS. WESTAR ENERGY TO THE COST OF THIS SEGMENT OF CONDUIT SHALL BE CONSIDERED INCIDENTAL INSTALLATION OF THE POWER SERVICE.
- **Kansas DOT ITS Workspace Development**
  - Level library for ITS.
  - CADconform feature table.
  - Final deliverables are all KDOT Graphics Certified.

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PROCESS

Data Gathering

Organize Information & Data

Evaluate Preferred Standard

Research Previous KDOT Plan Sets

Research “Design Best Practices”

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Research Other DOT Plan Sets

Evaluate Agency Requirements

Overall Documentation
PRODUCT

- ITS Standard Details – Microstation and PDF.
- ITS Standard Specifications – Microstation and PDF.
- Typical ITS Unit Costs – spreadsheet.
- Structural Evaluation Report.
- Process to track and produce updates as necessary.
# ITS Unit Costs

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ITS Design Principals (best practice)

1. Design DMS signs to handle future color TMW.
2. Separate power and communication cables into their own junction boxes.
3. Utilize DCTP free-pivoting M-64s, for traffic sign system and landscape placement.
4. Refer to ITS Standard Design Manuals for future color TMW.
5. Refer to ITS Standard Design Manuals for future color TMW.
6. Verify with Road Design on what future projects will be taking place in the area.
7. Check with Traffic Engineering on TMW placement with respect to traffic signs.
8. Route conduits and pole pull boxes a minimum of 22” from roadway edge line to assist future sign post installations.
9. Make sure long bridge rail have expansion joints to TMW conduit to work. Refer to Limited Time.
10. Make sure the name for the correct locations on the correct signs to prevent confusion and take into account clear zone distances and guardrails.
11. Design DMS signs in clear zone distances and guardrails to eliminate clear zone.
12. Design DMS signs to eliminate clear zone distances and guardrails to eliminate clear zone.
13. Design DMS signs to eliminate clear zone distances and guardrails.
14. Design DMS signs to eliminate clear zone distances and guardrails.
DMS SUPPORT STRUCTURE EVALUATION

May 3, 2011

Ms. Shari Hillard, P.E.
Kansas Department of Transportation
Eisenhower State Office Building
700 S.W. Harrison
Topeka, KS 66603

SUBJECT: KDOT ITS Standards Project, 160 KA-1188-02
DMS Support Structure Evaluation

Dear Ms. Hillard:

In conformance with our proposal dated November 4, 2010 we are pleased to present this evaluation of the new DMS support structures.

Scope of Work

SRP’s scope of work for Task 3.1 included the following items:

- Evaluate the current two-post DMS support structure utilized by KDOT.
- Evaluate static breakaway support structures.
- Evaluate a butterfly support structure.

Investigation

We considered five different DMS unit manufacturers when evaluating the structural supports. These DMS were chosen as a representation of the most common DMS in use around the country that are of similar display size as the current Addco DMS used by KDOT, which is also included. The variation in sign case dimensions and weights are shown in the table below. Structural details of each are included in Appendix A.

<table>
<thead>
<tr>
<th>Sign manufacturer</th>
<th>Model</th>
<th>External Case Dimensions</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive</td>
<td>AX2700-27X108-4BA</td>
<td>25.6&quot; x 7&quot; x 1.1&quot;</td>
<td>1320 lbs</td>
</tr>
<tr>
<td>Addco</td>
<td>13x5 SRFM SD Box/2</td>
<td>21&quot; x 11.5&quot; x 7.6&quot; x 1.0&quot;</td>
<td>1080 lbs</td>
</tr>
<tr>
<td>Polytroon</td>
<td>Vanguard VF-2455-27x09-06-X</td>
<td>21&quot; x 6&quot; x 7&quot; x 3/16&quot; x 1.3&quot;</td>
<td>1600 lbs</td>
</tr>
<tr>
<td>LEDSTAR</td>
<td>55-27x09 Variable Message Sign</td>
<td>20.8 x 8.8 x 0.8 x 3/4&quot; x 1.1&quot; x 1/2&quot;</td>
<td>1650 lbs</td>
</tr>
<tr>
<td>Skylines</td>
<td>LEDVMSL-3-18P-25x59-1</td>
<td>22.6 x 8.8 x 1&quot; x 1/16&quot; x 1.8 x 1/4&quot;</td>
<td>2770 lbs</td>
</tr>
</tbody>
</table>

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How are standard updates recognized and handled?

- Design engineer notes updates as they arise.
- Design engineer notifies Kansas DOT ITS engineer.
- Kansas DOT ITS engineer reviews updates.
- Updates (approved and not approved) are tracked on a spreadsheet and a “red line” PDF tracking updates is created.
- As appropriate, standards updates are released.
- Release includes a ”red line” PDF of changes along with final PDF and Microstation files.
UPDATES

Gary Covey: emails 3/11/2013

KCC Scout: 12, 2, 3 and 19.4

Translutes language with addressing the three vendors Wexora, TransSuite, Omniscied (see emails from Gary Covey).

Shari: email tracked changes 3/11/2013

Warranty information: 26.8.10

Lighten this up a bit. Verification not required. Shari deleted the stringent requirements; see tracked changes. (read 23.2 to adjust if necessary to match Shari's updates)

Shari: email 3/12/2013

Mounting Transformers - Nema Enclosures: multiple

Need something in the specifications and the details to make transformer mounting consistent. Two options 1. mounting on a cabinet, 2. mounting in a separate box. Shari is interested in mounting on the cabinet to eliminate creating additional obstacles, need to look at weight. Shari said weight is an issue, need to investigate transformer weight. Mark Sommerhauser is interested in 1 beam support if a cabinet was used to enclose the transformer-if so does 1 beam need to be set in concrete or just driven into ground (Shari)?

Shari: email and this was also brought up in the past 3/12/2013

Mounting Transformers: 8.2 and ITS-DDD

Shari would like a step-down transformer enclosures mounting detail. This issue has come up on many scout jobs. Add text to 8.2 and add detail drawing to ITS-DDD. See photos from MV form Wichita jobs.

Shari: email and phone 3/12/2013

CCTV Detail: ITS-D13

Address the safety concern to assure placement of lowering device handhole and pole mounted cabinet are not below the camera "lowering zone". See redlines on detail D13

Mark Sommerhauser: email 3/14/2013

Rack elevation drawings: 26.8.12

Rack elevation drawings should include a front and back drawing when applicable (meaning when there are two door front and back). Rack elevation drawings should include a summary information. Example: 534 cabinet with xx by xx outside dimensions and a 15" rack with xxU slots for mounting equipment. Also - these drawings should be to scale 1 provide a clear picture the size difference in cabinet size and rack space between 334 ground mounted cabinets and 3 pole mounted cabinets.
Many Thanks to the Project Team and Support Resources

- Leslie Spencer Fowler - KDOT
- Shari Hilliard - KDOT
- Jonathan Mushock – KDOT
- Abe Rezayazdi – KDOT
- Carmen Bakarich - KDOT
- Steven Baalman - KDOT
- Robert Bidwell - KDOT
- Bill Kritikos - KDOT
- Tom Hein - KDOT
- Dale Holsey – KDOT
- Lee Ann Legge – KDOT
- Karen Peterson - KDOT
- Cathy Jones – KC Scout
- Mark Sommerhauser – KC Scout
- Gary Covey – KC Scout
- Multiple Vendors and Manufactures
- John Kissinger - KHA
- Tyler Wiles – formerly KHA
- Andrew Reid - formerly KHA
- Charles Miller - HNTB
- Matt Volz - formerly SRF
- Mark Gallagher – SRF
- Steve McHenry - SRF
- Zach Hanson – SRF
- Therese Polum - SRF
Thank you

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SRF Consulting Group