

Kansas Department of Transportation Achieves Near- and Long-Term Strategic Benefits

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CADconform Case Study

CADconform improves accuracy of maps in daily workflow; allows standards-conformed map data to be imported directly into GIS systems for strategic planning and disaster preparedness

In a recent presentation to executive staff, Kansas Department of Transportation (KDOT), Assistant Manager of Cartography Fred Holthaus provided some interesting points about the details of map making. He said, "The last issue of our official state map had more than 69,000 individual elements on it and the front cover alone had 17,000. Each one of those elements represents a possibility to make a drafting standards mistake. CADconform eliminates 100 percent of those possibilities."

And that particular map is just one of nearly 1,000 unique maps that the Kansas Cartography/GIS Unit (C/GIS) is responsible for maintaining and producing. Kansas C/GIS has been using Altiva Software's CADconform since June 2002. As such, they have reaped the daily, near-term benefits of using CADconform, which includes reduced time and effort to produce maps that conform 100% to their CAD standards – a level of quality humanly impossible before the adoption of CADconform.

But the assurance of accurate, standards-conformed maps have also allowed them to realize long-term strategic value for all of KDOT and the other state and federal agencies that depend on the mission-critical data and information that they gather, produce, maintain and provide.



For Kansas DOT, CADconform is a critical component for meeting new federal government requirements resulting from problems during evacuations for hurricanes Katrina and Rita in 2005.

Case Study – Quick Look

CADConform at Kansas DOT:

- ▲ Improves Drafting Efficiency
- ▲ Improves Communication of Information
- ▲ Enables Data Re-use for Access to Additional ROIs
- ▲ Facilitates Federal Compliance
- ▲ Eases CAD Administration
- ▲ Simplifies V7 to V8 Migration

As a result of using CADconform, data and information previously locked into a map can now be used with confidence as direct input into the state's geospatial information system (GIS), a critical tool for analysis and planning by numerous government agencies and the state legislature.

Life Before CADconform

When creating maps, a cartographer typically works with a defined set of elements that represent the items on a map, for example, roads, highways, bridges, cities, rivers, railroad tracks and so on.

Cartography groups typically develop a set of standards to define these elements so that each unique element will be represented consistently on a map – critical for avoiding

confusing communication errors. For example, a state highway will be represented by a line of a certain size, weight and color, and a river will be represented by a line of a different size, weight and color. Each unique element that you want to place on a map must have a unique set of attributes to properly define it.

Before CADconform, Kansas C/GIS had a written standards document that defined elements for the following:

- ▲ Official state map, 326 elements
- ▲ City maps, 185 elements
- ▲ County maps, 282 elements
- ▲ Interchange drawings, 101 elements
- ▲ Connecting links, 47 elements

That's 941 elements, each with multiple attributes, for 5 different categories of maps, for the almost 1,000 unique maps produced by Kansas C/GIS!

Each cartographer was responsible for reading, correctly interpreting, and properly implementing these standards on the maps that he or she worked on. Then the quality control person, who also had to read, interpret, and understand the standards, would manually review printed maps for accuracy as best as possible.

Holthaus, whose chief responsibilities include quality control, explains, "Before CADconform, almost all reviewing and checking was done using plotted paper maps that were marked up and returned to the cartographer for correction. There was just no way, no mechanism, to check every element on each and every map file – it was humanly impossible to assure 100% accuracy."

The Switch to CADconform

Kansas C/GIS actually first began using CADconform in June 2002 to help their MicroStation® users in the conversion from version 7 (V7) to

version 8 (V8). As MicroStation® users know, the move from V7 to V8 represented a significant step change in file structure and capability. Kansas C/GIS doubted the consistency of the V7 map files, had encountered some corrupt elements within the files, and dreaded the conversion to V8 – until the unit learned about CADconform.



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"It was recognized by many in the industry that V7 files could become rather unstable over time," explains Altiva Software CTO Piers Porter. "While the user community was looking forward to the arrival of V8, many are still dreading the pains of converting to the new file format." Kansas C/GIS Technical Support Administrator Danny Bahre was able to easily implement the existing written Kansas C/GIS standards into feature tables of CADconform, then went to work using the CADconform Check/Fix feature to correct the V7 drawings.

Bahre explains, "Using CADconform, it took only about 1 hour to check and fix an entire city map and only about 3 hours to check and fix each of the county maps – something that would have taken days manually, with little hope of achieving the same 100% accuracy of CADconform."

"A really important aspect was the ability of CADconform to locate and delete corrupt elements in the V7 drawings. Those corrupt elements would have caused some serious problems in the conversion to V8. Without CADconform, we wouldn't have been able to find them, so we wouldn't have been able to fix them. After the clean-up with CADconform, the conversion to MicroStation® V8 was straightforward."

After using CADconform to quickly bring the map files into conformance with the unit's standards, Kansas C/GIS was also able to project them, that is, match the map files with coordinates on the Earth's surface. This task was a critical step in preparing the map files for initial use in the GIS.

Life After Implementing CADconform

A great deal of data and information from multiple sources goes into a map. For example, information from strip maps, which track general road features such as width and surface material, city boundaries, which change as a result of annexation or new city ordinances, and plans for new roads and developments. Each time these changes are approved, maps go through extensive updates.

Each time a Kansas DOT cartographer updates a map, he or she uses the CADconform drawing menus, which contain every element required, defined per the standards, to easily select and place elements on the map file. Then the cartographer runs the CADconform Check/Fix option to ensure the map conforms 100% to the Kansas C/GIS standards.

Overview of the Kansas Cartography/GIS Unit

As its name indicates, the Kansas Cartography/GIS Unit (C/GIS) has two major areas of responsibility for the state of Kansas:

- ▲ **Cartography.** A staff of 8 cartographers uses CADconform on their drafting workstations to design, develop, maintain and produce the official state map, 105 county maps, and 627 city maps, along with various others, such as route mileage, railroad, bike, and other special purpose maps, numbering close to 1,000 total unique maps.
- ▲ **GIS (Geospatial Information Systems).** A staff of 8 application developers researches, designs, develops, deploys and supports this system.

A GIS (also called geographical information systems) is a network of computer hardware, software, people, processes and massive amounts of data – for example, geography, spatial relationships, road characteristic and capacity, population, statistics such as usage and crashes, and much more – for the purpose of collecting, processing, analyzing and presenting data linked to a specific location on the Earth's surface.

Who Uses Kansas C/GIS Outputs?

The question really is "who doesn't use Kansas C/GIS outputs?" These outputs include the myriad of maps listed above as well as the enhanced maps and associated data produced from the GIS.

The traditional maps are used by citizens, tourists, and businesses to navigate the roads of Kansas.

The traditional maps along with GIS output, which are essentially maps with layers of additional data and information, are critical tools used by local, state and federal government agencies for all analysis and planning, including activities such as building, roadway and economic development and emergency planning for events such as evacuations for terrorist attacks and natural disasters.

Finally, as an expanded part of their quality control process, either Holthaus or Bahre run the CADconform Certify option which places the tamper-proof electronic seal on the standards-conformed drawing. This provides a visible assurance of 100% conformance to CAD standards. After completion of this process, the updated version of the map is printed and published to the KDOT website (www.ksdot.org).

Benefits of Using CADconform

More Accurate Output in Less Time

Since implementing CADconform in 2002, Kansas C/GIS has been able to produce more accurate maps in less time. Before using CADconform, Kansas C/GIS relied on cartographers and reviewers to read, interpret, and apply nearly 1,000 elements for multiple types of almost 1,000 unique maps. This cognitively daunting, labor-intensive task took hours, sometime days, and one could never ensure that a map conformed 100% to the CAD standards – it was simply, humanly impossible.

With CADconform, the standards-conformed elements are built right into the drawing menus that the cartographers use to create and update maps. Then cartographers run the Check/Fix option themselves. So CADconform empowers the original drafter – the best qualified person to make corrections – to properly and easily correct any non-standard elements as part of their regular workflow.

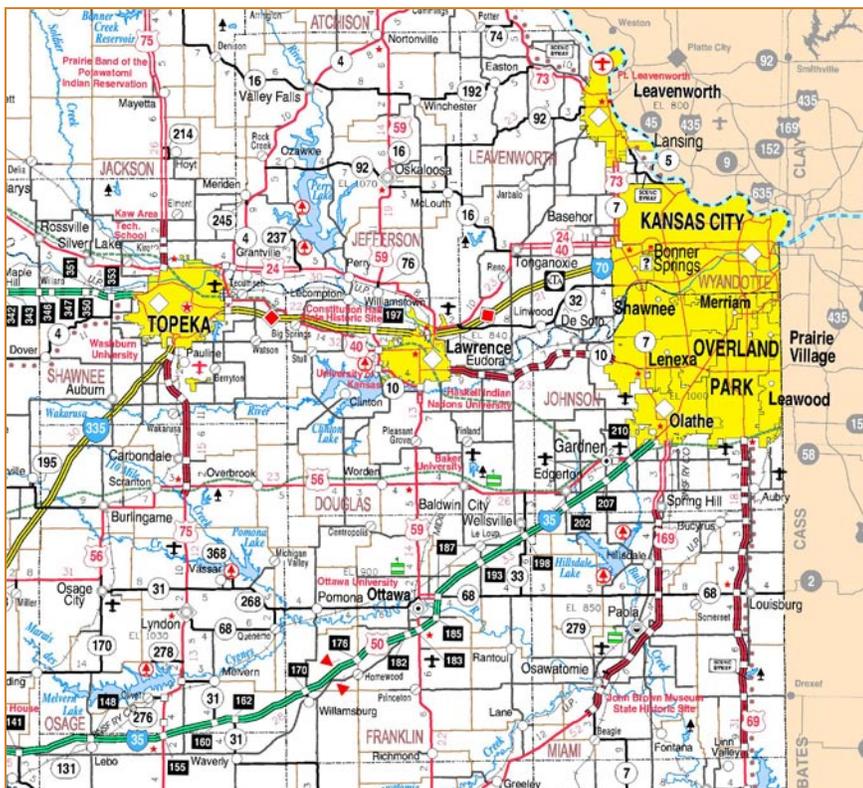
Then Kansas C/GIS uses CADconform again to perform a quick, final quality check (because cartographers run the Check/Fix option first, this check literally takes just seconds per drawing) and apply the CADconform tamper-proof electronic seal, a customizable, visible assurance of standards conformance that was not previously possible.

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Holthaus explains, “Because CADconform uses advanced software technology to automatically assure our drawings comply to our drafting standards, our staff is now free to focus on the important engineering checks that require human intervention – for example, changes in highway route numbers, alignments, and other features like section, township, and range numbering. CADconform has boosted the efficiency and credibility of our group, and has finally given us the ability to extend the use of our data to our GIS systems.”

Ease of Use, Low Maintenance

With existing standards easily imported, CADconform becomes a seamless, reliable part of the drafting process. Kansas C/GIS Manager Brian Logan comments, “As a manager, I can confirm what an asset CADconform is to our organization. It provides an extremely valuable



A sample portion of the official state map of Kansas produced by the C/GIS Unit. CADconform enables the C/GIS Unit to confirm that every element on this map – all text, line weights, colors, symbols, etc. – conform 100% to the Unit’s defined CAD standards.

service that does exactly what it says it does. Our cartographers and management never want to go back to life before CADconform.”

“At Altiva, we know that CAD administrators have a demanding daily grind with the administrative and technical details of managing both the workflow and technology of a CAD group,” explains Porter. “In designing CADconform, we’ve kept the architecture extremely light on the network and easy to use and administer through a single streamlined interface, unlike the multiple, confusing components of some of our competitor products.”

Bahre provides technical support and maintenance of the Kansas C/GIS network, administers the CADconform standards, and is the “help desk” to the cartographers for all of the software products used by the Kansas C/GIS Unit. He concurs that the ease of use and low maintenance add to the bottom line value of CADconform. “It’s very easy to maintain; it takes care of itself,” Bahre stated.

Strategic Value of Using CADconform

“Organizations are more and more aware that data is a mission-critical asset, key to achieving business goals and establishing competitive advantages,” explains Altiva Software CEO Philip Hurlston. “CADconform empowers groups to assure 100% conformance to CAD standards, and then use that standards-conformed data to differentiate themselves in the market. CAD data without conformance to standards has a greatly diminished value.”

By using CADconform, Kansas C/GIS has also been able to capitalize on the standardized data and information now contained in their maps. Logan explains, "The maps we produce represent a compilation of valuable source data, for example, the geometry or line work of the roads. Before we had CADconform, that data was essentially locked into the maps with no ability to further re-use this critical asset. With the standardized data provided using CADconform, the data from those maps now serves as reliable input to our GIS, enabling Kansas C/GIS to manage data and information like the valuable assets that they are."

Business Drivers

Two key factors drive the need for standardized data and the type of advanced information processing being performed at Kansas C/GIS.

Governments' drive to foster collaboration and improve efficiency

Today, improved collaboration and efficiency is a persistent goal for any organization, whether private sector or government agency. However, the state and local governments in Kansas have formalized their efforts under a program called the Kansas Collaborative.



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Kansas Governor Kathleen Sebelius and the Kansas Association of Counties, later joined by the League of Kansas Municipalities, were the primary driving forces behind the creation of the Kansas Collaborative. The goal of this program is to bring government agencies and employees together to share data, knowledge, and experience to identify potential cost saving opportunities across and among government agencies, then to implement the changes required to realize those savings. The first project under this program saved more than \$2 million for state and county governments.

The maps and information in the GIS systems maintained by the Kansas C/GIS Unit are critical to the analysis and planning of many state and local agencies. CADconform fosters the type of reliable re-use of data and information that will help achieve the kinds of collaboration and cost-savings hoping to be achieved through the Kansas Collaborative.

Federal government requirements for safety and security

Federal government requirements include directives from groups such as the U.S. Department of Transportation's Federal Highway Administration (FHWA) and the U.S. Department of Homeland Security.

The FHWA requires that state DOTs track information about usage and crashes for specific locations on not only interstate highways running through a state, but also on local connector roads and such. This type of information is used to identify and mitigate problem areas and fund repair and expansion projects.

The Department of Homeland Security, which includes the Federal Emergency Management Agency (FEMA), requires data and information for roadways and bridges, for information surface type, current condition, and maximum capacity. The state DOTs have been required to track this data for the interstate system and state highways, but after recent disasters such as Hurricane Katrina, Homeland Security is now requiring that this information be collected for local roads as well.



The Kansas C/GIS Unit created a custom graphic for the CADconform tamper-proof electronic seal, which is used as visual assurance of 100% conformance to CAD standards.

Logan explains that this information will enable federal, state and local authorities to provide additional safe, effective evacuation routes on local roads, in addition to interstates, to help in evacuations like those for Hurricanes Katrina in the New Orleans area and Rita in the Houston area. He explains that for government agencies to safely and confidently announce evacuation routes on local roads, they must have current, accurate capacity data to ensure the safety of the people traveling those routes.

Once again, the conformance to standards provided by CADconform facilitates the process of data re-use from maps to GIS, helping to ensure that government agencies have the most up-to-date, accurate information for making better decisions.

Follow-up

Members of the Kansas Department of Transportation Cartography/GIS Unit who were interviewed for this case study are also available for your follow-up questions and discussion. To view maps produced by Kansas C/GIS, visit their website at www.ksdot.org.

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