# Smarter Bridges Podcast Transcript

**VP:** Hello and welcome to this IBM Decision Management podcast. I’m Vijay Pandiarajan with IBM and I have Dr. Brian Metrovich, Associate Professor of Civil Engineering at Case Western Reserve University joining me to talk about Smarter Bridges. Brian, welcome!

**BM:** Vijay, it’s good to be here.

**VP:** So Brian, we’ve had a few instances of bridges being in the news lately - the Minnesota bridge collapse in 2007 comes to mind. Can you talk a little more about that and how your recent research project can help?

**BM:** Certainly. What we’ve had are a couple of large bridge failures in the past decade - some that the news media is aware of and many others went under the radar. But there’s another problem such as the Hoan Bridge in Milwaukee in the year 2000. In that bridge in particular, it failed in a very brittle manner. Since my expertise is in the fracture and fatigue of steel bridges, I was really drawn to developing some sort of solution that can detect and anticipate these kinds of bridge failures.

And so, we were involved in a project with IBM with Michael Schwitters and Paul Giangarra and we dubbed it the Smarter Bridges project where we developed a system, which will allow us to integrate data from a variety of sensor systems and develop easy to use rules for analysis of that data. And that comes from the fact that we want to start putting sensors on these bridges. The problem is that there’s a lot of data that results from that and we to figure out ways to come up with solutions to handling and analyzing that data. The system we developed was a Commercial Off The Shelf or COTS system. The goal was to build a system that could predict fatigue performance based on fracture mechanics principles and we want to use data from the sensors to do that type of analysis.

**VP:** So what were the key challenges that this project solved?

**BM:** Well, one of the major problems is the handling of massive amounts of data. We developed this system then, to collect, transmit and store that data in an efficient manner. And that also allowed for reexamining the data in the future as needed. Now, our interest was on fatigue damage and this is really caused by a truck moving across the bridge. After millions of trucks cross a bridge, the fatigue damage that accumulates ultimately causes the crack to grow and fail. We used WebSphere Business Events (WBE) to develop some rules based algorithms, which were able to capture or define a particular load cycle. And once we defined a load cycle, we were able to relate all the sensor data that was related to that load cycle for a particular site. This is really a step forward in how we do fatigue damage and assessment on a bridge structure. This allowed us, in particular, to use principles of fracture mechanics and this is a step forward in the prognostics of bridges. As new sensors are developed, they can easily be included in this system because ultimately its just adding an extra line of input into what we’re calculating. So its very expandable and as new sensors give us new insight to what’s going on, we can improve the accuracy of our predictions.

**VP:** So do you see this going forward? What’s next for Smarter Bridges?

**BM:** Well, one of the things we would look at is how we can expand it … the initial project looked at one particular site on a bridge and what its fatigue damage was – consider that as one stiffener damage. In reality was want to scale things up, we want to look at not only that one location, but what’s happening on that same girder on other locations on the bridge. And then we can scale it up a bit more and see what’s happening on adjacent girders on the bridge. Then see if it has the same damage or different damage occurring between those two girders. We can scale it up even more, for instance on the same highway we have the same basic traffic that’s moving from one bridge to the next. So there’s a comparison in the load that’s occurring between the two bridges. The system allows us to do that type of comparison – so it allows us to see if there is damage occurring on one bridge and see if there’s similar damage occurring on the adjacent bridge. As new sensors give us new insight into what’s going on, we can improve the accuracy of our predictions.

**VP:** Other than bridges, can we apply this technology to solve other problems?

**BM:** We’re looking at the idea of structural health monitoring in general. So there’s a pattern that exists – the pattern is that you put sensors on a structure, you record that data and transmit it, you store it and analyze it and you look for predictions of future results. So this basic pattern can apply to a variety of civil infrastructures. You’ve got new wind turbines that are coming online. Ship structures actually are very similar to bridges and the types of loading schemes that they’re going to have and the resulting fatigue problems that they encounter. Bridges come to mind as well, sorry, buildings come to mind as well. In buildings, particularly if some larger events, say earthquake types of events where sensors could ultimately give us information about what happened to the structure. So there’s a large number of ways we can apply this technology to things outside of just this bridge problem that we’ve basically worked with.

The advantage is that we’ve already developed the framework for such a system with the Smarter Bridges project and so its really just changing the rules that we write in WBE rather than the IT infrastructure that’s already been developed.

**VP:** That’s great Brian, thank you for the quick insight into your research today and you can get all the details of Brian’s research in the March issue of the IBM Journal for Research and Development. Brian thanks for your time today.

**BM:** Thanks for having me.