

# Quality Matters

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from the Quality Assurance Branch (QAB) of Highway Design



**Wetherington Blvd. Florence, KY**

Courtesy of Viox & Viox

## INVEST in your Project

What makes a transportation project sustainable? The goal of sustainability can be described with what's called the triple bottom line. It is the capacity to endure, considering the principles of Social, Environmental, and Economic effects. Measuring them examines how well basic social and economic (current and future) needs are met and how responsibly natural resources are used on a project.

[INVEST](#) is a voluntary program that encourages transportation agencies to integrate sustainability into their projects and programs through self-assessment and guidance. The program also provides the tools to quantifiably measure a project's sustainability. These tools help designers use sustainability when making decisions with multifaceted considerations. INVEST allows

project teams to quantify, consider, and balance project sustainability trade-offs when designing a project.

In addition to a project development (PD) module, there are also modules for system planning and operations/maintenance decisions. Each INVEST module utilizes criteria to examine the project in depth. The PD module is for the evaluation of

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projects, from early project planning through construction, and consists of multiple scorecards designed to recognize the varying scope, scale, and context of projects across the country. With the inclusion of a customizable scorecard, the tool is highly adaptable.

KYTC enlisted the Kentucky Transportation Center (KTC) to investigate project development sustainability practices. KTC reviewed several sustainability metrics and found INVEST to be very practical and beneficial to project decisions. KTC noted that Kentucky was well poised to use INVEST based on the Department's background with Context Sensitive Design.

To illustrate this, KTC conducted [three project case studies](#) where INVEST was used to score the final design. In all three cases KYTC earned scores meriting INVEST's Bronze Achievement level. While this may lead some to think that Kentucky is outside the need

for such an evaluation, in reality there are still many criteria of INVEST that KYTC could learn from. The case studies illustrated that Kentucky excelled within principles of Context Sensitive Design but within project specific sustainability features.

In another example, just to the north of us, the Ohio Department of Transportation (ODOT) used INVEST on the largest project in their history. During Phase I and II of the [George V. Voinovich Bridge](#) in Cleveland, ODOT used the INVEST program to score and see how sustainable its preliminary design was. The Phase I received a score of 59, which earned it a gold level rating and confirmed the project was meeting its goals. The success of the Phase I inspired ODOT to require INVEST in project development during Phase II, the design-build (DB) contract. The sustainability plan was used in the selection of the DB team. The contractor

committed to achieving 95 INVEST points, 47 over what was required by the Request for Proposals scope. The final design achieved a platinum rating and doing so at 19 million dollars below the engineer's estimate.

INVEST is a great tool that helps an agency strive towards establishing sustainable policies and procedures that can raise the bar for projects and programs. More information about the program and case examples can be found on [FHWA's INVEST website](#).

by: [Anthony Norman](#)



## CatStrong

CatStrong is a cost saving solution invented to reinforce damaged or aging concrete structures. This product was developed by a team led by Dr. Issam Harik, Program Manager at the Kentucky Transportation Center. The greatest appeal of CatStrong is its ability to increase the life of a concrete structure at a low cost.

The use of CatStrong to extend the life of a concrete structure can be compared to KYTC's efforts to maintain its asphalt and concrete pavements. When an area of pavement degrades faster than the remainder of the roadway, we patch that location rather than pave the entire corridor to maximize the life of the pavement on that corridor.

When a substantial portion of a structure is in good shape, but one portion suffers from spalling concrete and damaged reinforcing

steel, CatStrong may be a good solution to repair those beams rather than replace the entire structure.

The images above show the application of CatStrong on a deteriorating bridge project. The first image shows the condition of a bridge on KY 81 in McLean County when Dr. Harik and his team arrived. They started by removing loose concrete and sand blasting reinforcing steel. They then formed and placed concrete to re-establish the existing cross-section of the beam. Finally they [applied CatStrong panels](#) to compensate for sectional loss of the reinforcing steel due to rust. In many cases, when CatStrong is applied, the new loading can actually surpass the original design loading.

Dr. Harik says "once the structural member section is built back to its original shape, we

make a paste from a two-part resin and spread it on the surface. Then we press CatStrong into it, add another layer of paste over it and that's it. Once applied, it will gain [80% of its strength](#) within 24 hours."

While it is possible to re-establish the original cross-section without use of CatStrong, the structural integrity will not be improved without adding more reinforcement. In some situations when damage to the beam is isolated, such as that caused by a collision of an overly tall vehicle, a short length of added reinforcing steel to such a small area will not add the necessary tensile strength. However, CatStrong is an easy-to-install solution to bandage that damaged gap in reinforcement making the existing beam capable of carrying design loads once again.

by: [Shawn Russell](#)

# Post-Construction Reviews Return

After a two year dormant period, the Quality Assurance Branch (QAB) is excited to announce that Post Construction Reviews (PCR) are up and running once again! This program provides valuable information about what worked and what didn't work on a project by organizing an open discussion forum that includes the project design team, construction staff, and even the project contractor. Designers can learn more about why field staff needed to make changes to the original design and construction staff can gain insight into the reasons behind the elements of the design.

Bob Jones, the new PCR coordinator, begins the process by identifying projects to review. He looks for projects that provide the most opportunity for discussion. These tend

to be large projects that are at least nearly 90% complete and with sizeable change order activity; however, noteworthy smaller projects may also be considered. He then seeks input and recommendations from each District about the list and ultimately chooses a few from that district to review.

Change orders are typically used as a starting point for discussion, but issues that were resolved without a change order are also very important to discuss. It is important to note that these discussions are never intended to single out anyone, but rather are intended to identify issues and solutions so everyone can learn and grow from these experiences. As such, the PCR is a critical link between Construction and Design to ensure that lessons learned during construction of the project are not lost.

It is the job of the PCR coordinator to facilitate each project review meeting, promote discussion, gather all pertinent information, and generate a Post Construction Review Fact Sheet. The purpose of the Fact Sheet is to provide information in an organized and concise way for those that participated. This information is also documented in a Lessons Learned Database which can be accessed to look at statewide or regional issues and trends.

It is also common for issues that affect policy, standards, or awareness come up in the meetings. Many are carried forward for KYTC management to consider. Some of these issues are also chosen to be highlighted in QAB's Quality Matters newsletter so a wider audience can learn.

by: [Bob Jones](#)

## How Safe Will Your Road Be?

### *Measuring Highway Safety*

Many highway improvement projects are developed to address an existing safety problem. The problem area may involve crashes at an intersection, series of driveways, sharp curve, or blind spot. Typically, on existing roads, designers examine records about specific crash locations, frequency, and types. They'll discuss different strategies to improve the situation and then decide on a preferred solution.

It is unusual for a designer or project manager to make geometric decisions with a quantifiable prediction of how safety will vary as an input; however, now there is a tool to help quantify the impact on safety. The [Interactive Highway Safety Design Model \(IHSDM\)](#) is based on data compiled in the [Highway Safety Manual](#). There are six pieces or modules that are a part of the IHSDM. Each module serves a different purpose; this article will touch on two that directly affect design projects.

The Crash Prediction Module (CPM) estimates the frequency of crashes expected on a roadway based on its geometric design and traffic characteristics. This module can be used for most types of road, freeway, and ramp designs. One potential use of the CPM is to screen different roadway design elements or groups of elements. It will show the relative safety performance of

design alternatives which can then be used to develop decisions that balance safety and cost-effectiveness.

For example, the Arizona Department of Transportation (ADOT) employed this type of predictive analysis to select a cost-effective safety solution for a 25-mile stretch of undivided two-lane rural road. The analysis resulted in a benefit-to-cost ratio of lives and injuries saved per dollar invested for three design alternatives: widening the shoulders to five feet, widening the shoulders to eight feet, and super elevation improvements. Based on the analysis outcome, ADOT found that the five-foot shoulder would provide the greatest safety benefit per dollar spent.

The Intersection Review Module performs a diagnostic review to systematically evaluate an intersection design for typical safety concerns. It will also offer possible treatments to address those concerns. This can be used for an existing intersection or one being proposed.

The IHSDM software is [free to download](#) from FHWA. To learn more about using the software, there is a web-based training hosted by the National Highway Institute called [Using IHSDM](#).

by: [Brent Sweger](#)

## Upcoming Training:

■ **2016 KSPE Annual Convention**  
4/13/2016 - 4/15/2016  
Louisville – KEC

■ **InRoads II**  
4/26/2016 - 4/29/2016  
Frankfort – KEC

■ **MicroStation/InRoads TBD**  
5/10/2016 - 5/13/2016  
Frankfort – KEC

■ **MicroStation/InRoads TBD**  
6/7/2016 - 6/10/2016  
Frankfort – KEC

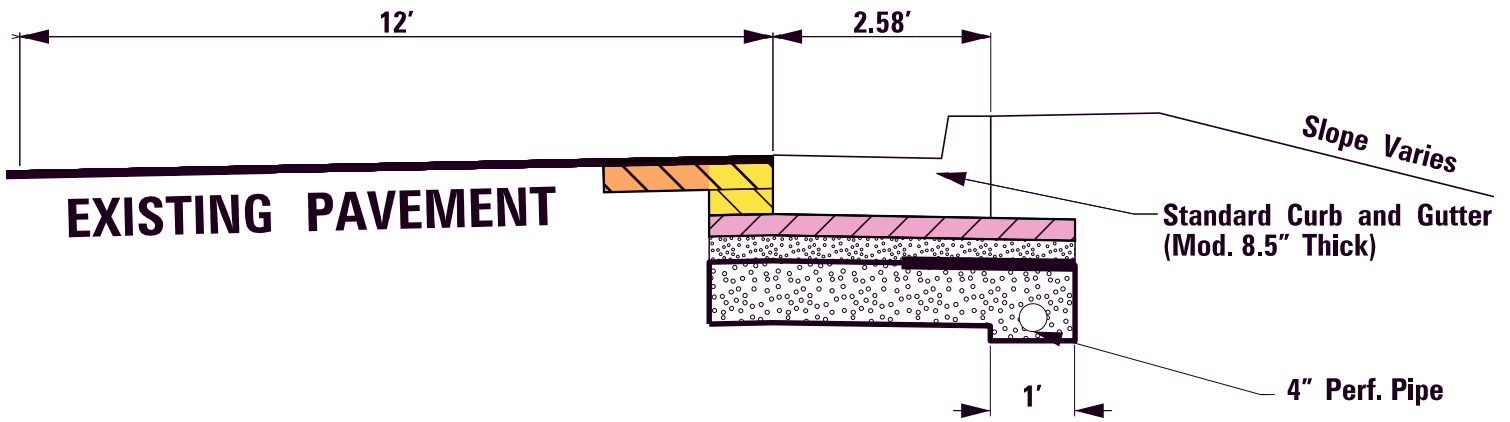
■ **Traffic Impact Study Review Training presented by KTC**  
4/27/2016 - 4/28/2016  
Frankfort – KYTC

■ **Safety Inspection of In-Service Bridge presented by NHI**  
6/6/2016 - 6/17/2016  
Frankfort – KYTC

■ **2016 ACEC-KY/FHWA/KYTC Partnering Conference**  
9/6/2016 - 9/8/2016

*KYTC employees should contact **Kevin Martin** for all classes.*

*Consultants will only need to contact **Kevin Martin** if the class is held at KYTC. Otherwise consultants should contact the [Kentucky Engineering Center](#).*



## Can the contractor really build as shown?

The key to constructability is visualizing the steps a contractor will take to construct what he or she sees on the plans. Often equipment limitations can be overlooked during the design phase. For example, the above illustration shows a typical from a plan set adding curb and gutter to an existing roadway. Placing asphalt base below and adjacent to the curb and gutter as shown is not feasible because the width shown to pave is narrower than the width of standard paving and compaction equipment.

A less complicated and more constructable solution would be to eliminate the lift of asphalt base under the curb and gutter (see pink highlight in above diagram) and place the curb and gutter directly on crushed stone base (CSB) by increasing overall depth of CSB. Once curb and gutter is placed concrete trench (23314EC) paid by the linear foot (see yellow highlight) can be used to fill the void left between the face of existing pavement and gutter in lieu of the asphalt base shown. The top of the concrete trench should be placed

lower than the gutter line to allow for the overlay of asphalt surface. In instances where there is a curb, the edge key can typically be eliminated (orange highlight). Compaction would be greatly improved over use of asphalt base for such a narrow width.

Don't hesitate to ask your nearest construction professional about any part of your design. They are guaranteed to have an opinion that will either reinforce the quality of the current design or suggest ways to build it easier.

by: [Mike Spain](#)

### VISIT OUR WEBSITE



**BOB JONES, PE PLS**, is the new Post Construction Review Coordinator in the Quality Assurance Branch. He is a graduate of the University of Kentucky with a Bachelor of Science in Civil Engineering. He has over 30 years of experience in the civil engineering field. Over this time his responsibilities included project design and construction management roles. Prior to accepting this position, he was a long time employee of the KY Abandoned Mine Lands Program which is responsible for reclamation projects in the eastern and western Kentucky coal fields. Bob also worked on a variety of projects for HMB Professional Engineers for a few years. His previous work experience will allow him to him to effectively assume the role of the Post Construction Review Coordinator. If you would like to contact him, email: [bob.jones@ky.gov](mailto:bob.jones@ky.gov)

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