

A Practitioner's Perspective on Flexible Design

JAMES O. BREWER

*Engineering Manager–State Road Office
Kansas Department of Transportation
9th Floor, Docking State Office Building
915 Harrison
Topeka, KS 66612-1568
jbrewer@ksdot.org*

ABSTRACT

This paper presents the author's opinion on the current topic of flexibility in design. It is based on his experience of 32 years as a practitioner in the field of transportation engineering.

Recently there has been much discussion about the term "flexibility in design." Some have attempted to place design professionals in either a "pro" or "con" group. I'll let you decide for yourself if I fit in one or both of the groups.

DECISIONS TO BE MADE ARE THE HEART OF FLEXIBILITY

We don't have all the answers and can't even imagine all the questions. We live in a changing society and yet many expectations of our customers have not changed. They still expect safe and efficient travel. The design professional is faced with a multitude of input, demands, constraints and mandates, some of which are competing, if not direct opposites. For example, we have "smart growth" (which could be considered "no growth") on one hand and full economic development with unlimited growth on the other.

There are groups and individuals who have single-issue agendas, with little flexibility in their position. Some have been instrumental in passing laws that strengthen their position.

We have those who are advancing "social engineering" issues in conjunction with transportation projects.

These issues are before us at a time when transportation use is up (2.5 trillion miles traveled annually) and when transportation has been instrumental in providing the United States with an unequaled quality of life.

Secretary Rodney Slater said earlier this year that one in seven jobs in our economy is transportation related.

These are exciting times for the transportation professional in helping solve the issues that affect us all.

There are some factors and considerations affecting design that I would like to discuss with you.

It is my hope today to bring some reminders to those of you engaged in the practice of roadway design. For the rest of the audience I would like to introduce to you a few factors and considerations affecting the modern design process.

The following are some statistics concerning highway safety:

- 42,000 people die on America's roads each year.
- Over 3 million are injured in traffic accidents each year.
- Traffic accidents are the leading cause of death of Americans 6–28 years old.
- Traffic accidents cause more permanent disabling injuries than any other type of accident.
- Traffic accidents cost American society over \$159 billion each year.
- Urban streets have almost twice the fatality rate as interstates.
- The declining fatality rate is attributed mainly to improved roadways.
- Kansans list safety as top priority.

It is a very unpleasant part of our job to view the bodies and see the damage caused by accidents. At that point, the appropriateness of the design is often discussed, but flexibility is not an issue.

I saw a cartoon recently that illustrates in a humorous fashion some of the driver characteristics we are faced with today that affect driver safety. It pictured a wrecked car with ambulances on the way and an emergency worker trying to pry the driver out of the car. The driver is still on his cell phone and tells the listener: "Hold for a minute, I hear someone at the door."

Mobility is another factor affecting design. Today's drivers expect the following:

- Smooth roads and streets,
- Reduced congestion,
- Little or no inconvenience due to traffic operations,
- Limited inconvenience and time during construction projects, and
- Enhanced access to destination points.

Environmental and cultural considerations are important in today's design process. We are concerned with:

- Air Quality,
- Noise,
- History,
- Archeology,
- Water Quality,
- Environmental Justice,
- Hazardous Waste, and
- Threatened and Endangered Species.

I recall a careless contractor excavating into a prohibited site of Native American archeology. This should not have happened.

I also recall explaining to an elderly man that we must take his home to avoid killing a milkweed plant that was an endangered species. He did not think I was very flexible.

Professional conduct is a factor that is important to all ethical engineers, who are aware that:

- Engineers are guided by a code of ethics.
- The first canon is to hold paramount the safety, health, and welfare of the public.
- The courts hold engineers to a “standard of care” in their performance.

I know of cases where engineers have refused to sign or seal plans.

In one case this was due to a substandard sight distance design. It was brought about by orders to reduce design time by avoiding a new right-of-way.

In another case, the substandard design was a narrow roadway with reduced clear zone. The design was brought about by the belief that this constrained design would deter drivers from using the road.

Public involvement is good and should be early in the project development and should be ongoing. Some things we have learned are:

- The public expects more opportunities for input.
- Special interest/advocacy individuals and groups sometimes dominate.
- “Public at large” often does not participate; therefore, the real “community values” are not known.
- Elected officials may try to overly influence the final design.

I know of no other profession so open and responsive to public input as that of the design professional. Can you imagine doctors or lawyers asking the public to provide input into their work? How about a public meeting to discuss the merits of a surgery or trial?

We have found that most Kansans want roadway improvements and they want them on time (or sooner) and on budget.

A newspaper article on Kansas US-169 is representative of much public input today. It stated that, “Two persons died Tuesday night on an infamous stretch of US-169 while making a U-turn near Paola, Kansas.”

It also quoted a local official who said, “How can they (KDOT) conscientiously live with the fact that people will die until they work through that process? It doesn’t matter what caused the accident. We’ve got a highway that needs critical response and that warrants immediate response, not two years from now.”

What is being said here is that two years is too long a time to design and let to construction a project to upgrade a two-lane roadway to a four-lane road. Never mind that the project is 20 miles long.

LEGAL LIABILITY IS A CONSIDERATION

In Kansas, as well as some other states, the design should meet the prevailing criteria and practice.

Don’t let fear of lawsuits dictate the design. Use a reasonable standard of care and professional actions. Don’t be afraid of lawyers, but don’t give them anything.

Some of our colleagues make a living testifying that we did something wrong.

I have to testify in several lawsuits, but *never* because of overdesign.

We have discussed the following factors and considerations:

- Safety,
- Mobility,

- Environmental/Cultural Aspects,
- Professional Conduct,
- Public Involvement, and
- Legal Liability.

These six are but a *few* of the factors and considerations facing the design professional today. I could discuss many others, such as property rights, older drivers, the Americans with Disabilities Act, value engineering, maintenance, human factors, budgets, aesthetics, constructability, livable communities, political aspects, risk management, traffic accommodation during construction, pedestrians/bicyclists, and the list goes on.

“Flexibility in design” and “context sensitive design” may be new terms, but are not new actions. They have been practiced for years. The main disagreement might come from someone who didn’t get what they wanted. Flexibility should be a normal way of doing business.

The following are a few KDOT geometric flexibility examples. There are instances of flexibility other than geometric that are exercised routinely.

- Reduced median width on a suburban arterial to avoid historic property and wetlands.
- Reduced reconstructed interchange geometrics in suburban location to minimize right-of-way impacts.
- Cancelled projects in the concept phase when need or scope was not confirmed.

Design is an art as well as a science. There is more than one way to design a project. Therefore, I believe that flexibility is absolutely necessary for the design professional to do the job. However, it is apparent to me that flexibility in design *cannot be viewed as merely a reduction in standards*. Neither should it be viewed as a compromise strategy to try to “sell” a project. Rather, flexibility should be only one factor of many that may surround any given design.

We would hope that all stakeholders would have general agreement (or at least informed consent). However, after all the input and tradeoffs are considered, and as the designer considers the factors involved along with the pressure to be more “flexible,” a question often asked is, “Who decides if appropriate flexibility has taken place?”

I submit to you that the decision should be made by the agency responsible for the roadway. Whatever your agency decides to build, I support your decision if you assume responsibility for your actions.

Flexibility is necessary for the knowledgeable design professional to do the job. However, flexibility must be accomplished within reasonable bounds of good engineering practice to a standard of care expected by the public to accomplish the purpose and need of the project.

Perhaps the “Give ’Em a Brake” campaign should apply to designers as well as construction workers.