

# Informal Discussion on Systems Building for Bridges

The closing portion of the final session of the workshop was devoted to an informal discussion of the means through which the goals of the workshop could be realized. The comments of the participants are presented below.

## Robert G. Bartlett

One of the leaders in the prefabrication or systems building of bridges has been the military. Many who have served with the U.S. Corps of Engineers are familiar with the Bailey or timber trusses, the steel treadway, and the pedestrian bridges. Perhaps Jim Bolton would comment on some of the work that he is engaged in and what the outlook is for systems building and packaging structures by the military.

## James R. Bolton

One of the major things that we are concerned with is tolerances. Tolerance really becomes a problem in bridges that are assembled, disassembled, and reassembled continually. The tighter the tolerance is, the more inspection required and the more cost involved. We are becoming more concerned with the weight of structures. The emphasis right now, at least in my field, which is mobility, is on lightweight aluminum structures. Steel is used more for conventional types of bridges. Concrete structures, that is, precast, post-tensioned structures, have never been suitable to our particular needs.

## Robert G. Bartlett

Most bridges that are erected will not be moved from one location to another. Therefore, the ability to disassemble, transport, and reassemble a bridge at a new site is important only to the military. However, the fact was cited that military bridge erection is generally accomplished by unskilled labor, and any bridge system would do well to consider this point.

Many of the workshop discussions were free ranging as they should have been. We must now pull the main points together so that we can determine where we go from here. We have said that the European contractual system is one that we should explore and that we should obtain acceptance of a concept of designing, manufacturing,

and building under one jurisdiction. It is known in this country as the turnkey operation. It is now practiced with regard to buildings, and there is no reason why it cannot be practiced with regard to bridge structures. That may mean challenging some of the philosophic bases of the industry. But why not say it more positively: The industry will change if the change is for the better.

The question, then, is, Can we move in this area? And a second related question is, What about performance specifications? Some of the performance specifications issued by the U. S. Department of Housing and Urban Development for housing have been so precise and detailed that they are more like a manual or a cookbook on how to put something together. They eliminated the innovation and creativity of industry. There should be competition, not just price competition, but performance competition and time competition. Those are the things that will make for better progress in the future.

Related to them, of course, is user acceptance. Arthur Anderson revealed that acceptance has been obtained from logging companies for the design and installation of their bridges in the northwest United States. When you are dealing with one industry, you can gain acceptance of this type of system very readily. Too often, governments must segment the industry and review projects in the design, the specifications, the manufacturing, and the production. Sometimes you wonder why the state agency is not also the contractor because, if it wants to limit all of the steps, there is no real place for the competition that has made industry as productive and successful as it has been. The Federal Highway Administration sets the standards and the policies, and the state highway departments through AASHO have to accept those principles and concepts. Therefore, if this system is ever to gain any acceptance or respect within the industry, it must first be accepted by the Federal Highway Administration because we are primarily addressing ourselves to the field of highway bridges.

Another item, and a very valid item, in tooling up for the industrial production of components is market aggregation, which means simply that, if you could guarantee a certain volume, you could amortize the tooling up of a production within the industry and therefore have it become a spread-cost item. Tooling up for a given project or a couple of projects is prohibitively costly unless the volume is great enough to warrant it. We do not like to talk about government subsidies, but maybe they are necessary to "prime the pump." To harness industrial capabilities requires that industry be given the profit incentive. At least some sort of financial inducement is needed to undertake something new. The public will benefit in turn because the taxpayers have to pay for the bridges.

The AASHO Bridge Committee is a very key and influential group that has to accept the principle and encourage further developments of this concept of bridge building. It has been suggested that, at a meeting of the Bridge Committee, there should be some presentation of the highlights of this workshop. This could start new thinking and discussion and the necessary process of accommodation and education. I am sure that we will get the cooperation of this key committee.

I think there has to be distribution of the workshop proceedings to others who did not attend. We have to get this information to the building contractors so that they understand what has to be done and can prepare to accept their responsibilities. It must also go to manufacturing plants, to designers, and to various professional agencies. It has also been suggested that there should be a conference open to more contractors, more designers, more material suppliers, and the like. At that conference, papers would be presented or by that time some demonstration project might be observed or commented on in more detail as to its practicability to the problems that were encountered. In this category, the demonstration project of the Virginia Highway Research Council might indeed be a very effective one to be reported on.

Donald W. Pfeifer

I think the most important item is that the proceedings of this conference be presented to the regional meeting of AASHO.

Simon Kirshen

I think we ought to start right in the drafting room with the standard widths of road lanes, the standard shoulder width on the inside and the standard shoulder width on the outside. The local roads have 24-, 32-, or 40-ft widths with sidewalks. Therefore, we know what the general width of bridges will be. Why then can we not have standard spans? The state highway department can then say to its consultants and to the designers in the drafting room, "Here is the type of bridge, and here is the spacing." Are we going to use a steel beam, aluminum beam, wood beam, or precast, prestressed concrete? Knowing that, you will now know what the slab is. For a simple span, if the weight of the superstructure is known, the abutment can be designed because the dead load is known, and the live load is determined from the length of the span. What about the foundation? Is it going to pay to excavate a little bit more to reach good material and not use piles, or is the poor material so deep that it is better to use piles? Whenever a consultant does a job for a highway department, he has to record his computation and check his computation. If bridge A is the same as bridge B, the consultant should not be required to submit another set of figures. This concept has to be sold to 50 different people, the bridge engineers from each one of the states, each one with inherent likes and dislikes, but that is where we have to start.

Robert G. Bartlett

That is going to take a lot of education prior to acceptance because for a long time we have placed a great deal of attention on factors of safety and the like. No one is readily going to give up that opportunity to review and to check calculations before construction.

Harold B. Elsasser

It seems to me that the specifications for the design requirements and the construction requirements should be adequately coordinated. Some states apparently have a mechanism by which they encourage the designers and state personnel and contractors to exchange ideas on mutual construction problems.

Robert G. Bartlett

This is a very good point. For example, we now have a standing committee in Pennsylvania of design consultants, contractors, and highway officials that meet on a regular basis to review items such as taper on interchange ramps, standards on bridge arches, and culverts. A lot of this information has been segregated, and we have to bring it together. If we are ever going to follow the European contractual system, we have to start talking together and understanding one another's points of view clearly. That is not to say that this is not being done, but I think that it must be accelerated.

Summary

The comments of the workshop participants were directed toward future actions that would encourage the systems building of bridges. The basic need is for user acceptance, in this case by officials and engineers in the federal and state governments. Such acceptance will result in specifications amenable to systems construction, in market aggregation, and, perhaps, in an evaluation of the turnkey or European system of contract administration, all of which would foster the creative atmosphere so essential to progress. The goals of the workshop can best be gained through the education of highway officials regarding the concepts, capabilities, and advantages of the systems approach. It is hoped that these proceedings will serve that purpose.