aesthetics in structures

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Aesthetics of any kind is so subjective that we probably should have some ground rules before starting a discussion. There is truth to the cliché "Beauty is in the eye of the beholder." If you say something is beautiful, there is no guarantee at all that your listeners will agree. One hippopotamus looks beautiful to another hippopotamus. What is beautiful to you depends entirely on your taste.

During the Great Depression, there was the feeling that limited highway and bridge budgets could not afford aesthetic considerations. That situation has changed, and aesthetics has now become a design prerequisite for any kind of public structure. If it is worth building, it is agreed now that it is worth building aesthetically for it may endure a hundred years or so.

We still have, however, those who feel that it costs more to give attention to aesthetics. I get irritated when someone asks, "How much extra did it cost to make it attractive?" My answer is, Compared to what? The question assumes that there must have been some other cheaper, starkly plain, utilitarian design that would also have been satisfactory.

We should not try to put a price tag on aesthetics. A design that does not properly consider aesthetics is an acceptable solution to a design problem. How much extra does it cost to design a good-looking structure? In most cases the answer should be, Nothing. As proof that many engineers find it impossible to think aesthetically, the Federal Highway Administration sent out a questionnaire on June 5, 1972, that included a question on the cost of aesthetics and what percentage that was of the total cost. With due respect for the alleged superior intelligence in Washington, I think that is silly.

Let us realize that aesthetics is one of the prime design requirements ranking right along with adequate load capacity and safe geometrics. You should not seek to save a few dollars by skimping on the aesthetics any more than you would skimp on the load capacity. In facing a design problem, we start with the assumption that, as we design each part or as we lay out the whole, we are seeking to make everything look as good as we can.

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Of course, we now find ourselves right back where we started. Each of us has a different picture of what is good-looking. Back around the turn of the century, making a bridge look good meant adding fancy decorations, spires, big pylons, fancy benches built into the rail, or statuary on the rail posts. During that period, we also loaded our houses with jigsawed frills and decorations. That is not what I am talking about. Only on rare occasions do we put decoration on the structures. I am talking about a clean, simple, well-proportioned design. It may not be easy, but neither is it expensive. It is a matter of having everything fit and look well together so that the overall effect is pleasing.

The remainder of this paper does not concern huge or monumental bridges but the small, garden-variety stream crossings and separation structures and what can be done with them. Those small bridges really present greater aesthetic problems because one has so little to work with.

PIERS AND BENTS

First, let us consider what is going to hold up the bridge. Of course, there is nothing wrong with round or square columns or piers. But consider how much extra interest can get into a structure by using other shapes, for instance, tapered or wishbone columns. In creating new types, though, one should consider that special shapes cost more to form. If you can arrange to use the special forms several times on one job or on subsequent jobs, then the extra cost of making the special design will be minimized to the point that it becomes practical. We have already had some of our contractors renting and swapping column forms, and we hope to encourage a lot more of that. To do so, it is necessary to develop form shapes that can be easily adapted to various heights and widths.

Of course, columns must be the right size. If they are too small, they look like toothpicks. If they are to big, they look like feet on a St. Bernard puppy. You must consider how they look from all angles. Thin wall piers will practically disappear when looked at from the end and give one an odd, uncomfortable feeling of having inadequate support. The intangible feeling of rightness or comfort is an essential part of an aesthetic design.

If the height of the structure varies, you can use a sort of a golf-tee pier that can be raised or lowered and still retain its similarity. If there are going to be substantial width variations, a pier can be used that has a center panel or stripe running up the face that can be made wider or narrower.

As the columns get wider and taller, shadow, texture, or color can be used to break up the large flat faces and to make the columns more interesting. But you should consider carefully who will be able to see them. If the only person who can see the effort is the motorist who is going by at 70 mph, you might as well forget it. To benefit him, you have to apply your efforts to the end view of the piers so he can see them as he approaches. However, if there are people who live nearby and can see the piers every time they look out at the freeway, it will pay to make them attractive.

Special designs can be used to ensure that the supports and the superstructure are a pleasant combination. That was accomplished in our Old Miramar Road overcrossing just north of San Diego (Fig. 1).

Tall piers can be sculptured or they can be quite plain depending on the surroundings and the desired effect. In rustic settings the thin plain look is often desirable. The Caspar Creek Bridge (Fig. 2) on the California coast is one example. Another well-known example is the Europa Bridge at Innsbruck. If piers are high and have to be wide at the top, an attractive flare with a bit of sculpturing can be added. Some of the pier designs that look best are rather scaleless. In other words, you can build them 250 ft high on a grand scale for an 8-lane freeway or build them only 50 ft high close down over a creek for a 2-lane highway.

GENERAL CONFIGURATION

Sometimes the overall configuration of a bridge can be a problem. Through the years, tastes have changed. Years ago people did not worry too much about what a bridge looked like. At first bridges saved time that would have been spent fording the

creek or waiting for a ferry or driving miles around. Later, bridges were considered to be monuments, either to their designers or to the politicians who claimed sponsorship. During this period the idea was to make them so big and overpowering that people would be impressed. Now bridges are designed so that people do not even notice that the bridge is there. When people cannot remember seeing a bridge, then you have succeeded. The basic principle is to make a structure compatible with its surroundings.

In California we have tried about every form of superstructure. We build mostly concrete box girders because they are cheaper than anything else. The most obvious form is a square-cornered rectangular box. It has a certain unattractive utilitarian appearance, so we have sloped the sides to decrease the apparent depth effect. Then we built some with round bottoms—one continuous curve clear across like a shallow bathtub (Fig. 3). They are expensive to build, however, and there are other forms easier to build that look just as good. For instance, if you slope the sides and then use large-radius fillets on the corners, you get almost all the advantages of the bathtub shape without the cost. All of these things help to make the superstructure look thinner. Most of our present-day box girders are prestressed, which in general takes about 25 percent out of their depth and makes them thinner and better looking.

There is one comparatively small touch that can be given where the superstructure meets the abutment to make a design more dynamic. The normal thing is to bring the girders into an abutment that has a vertical face (Fig. 4, top). We have been doing it for years; it is neat, but it does not say much. Now, try sloping the face of the abutment back at the bottom (Fig. 4, bottom). It need not be the whole abutment; it can be just a facia pilaster on each end. The span has a take-off point and seems to leap across. I think that one sloping line can do a lot for the structure, and it really takes very little extra effort.

RAILINGS

Railings are the visible part of the normal bridge and, in the past, represented the only place where a designer thought he could express his individuality. As a result we got some pretty fancy railings—designs, lamp posts, sometimes even benches where one could sit and watch the cars go by. Unfortunately, they were very costly, and many of them were not strong enough to stop a speeding bicycle. Now the principal function of a rail is to keep vehicles on bridges. Today, the chief complaint about railings is that they are too high and they obstruct the view. People want protection, but they also want to see. Each year cars get closer to the ground, and providing both a view and protection is harder and harder to do.

Because it saves fenders and prevents a lot of minor accidents, we are using the sloped-face or New Jersey rail on bridges and also as a center divider on bridges and closely spaced roadways. A car hitting that railing at a flat angle will be redirected without being damaged at all.

The railings still offer the designer some opportunity for individual design such as breaking up the smooth face with some interesting form or texture or a limited use of color. The end treatment of a rail is always a problem. We strive for something that looks good but that will not act as a battering ram should a vehicle run into it. Some sort of a bent-down or ramp-like treatment seems the best so far even though in certain cases a car might hit it on one side, run up onto it, and flip over.

It pains the aesthetically minded designer, who has tried to build a beautiful bridge, when we have to add a fence on each side to keep both young and old irresponsible people from dropping things on the cars passing underneath.

PEDESTRIAN STRUCTURES

We wrestled with the problem of pedestrian structures for a long time. Those bridges are narrow and should appear to be light and airy. Some of the early ones looked horrible, but they were utilitarian and worked in spite of their looks.

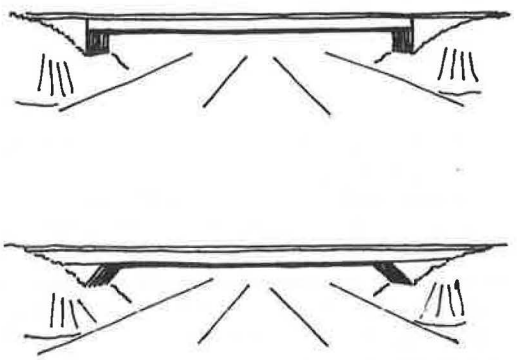
At first, we used stairways as access, but they could not accommodate shopping carts, baby strollers, and bicycles. Then we used ramps, but long straight ramps are not very attractive. Now we use a simple spiral, which can look very light and attractive when it is tastefully done.

Figure 1. Miramar Road overcrossing near San Diego.

Figure 2. Bridge over Caspar Creek ravine near the ocean.

Figure 3. Superstructure with continuous curve from edge to edge.

Figure 4. More dynamic design created by sloping front faces of abutments.



But, as with some bridges, we have to put a cage over the walkway, and we have been striving for some way to build a good-looking cage. The conventional approach to use heavy pipes and fittings as supports looks very institutional. We are developing a light wishbone support, and we hope it will look better. You have to round the upper corners of the cage and leave the center of the top open or the kids will climb up and walk across on top of the cage and use it as a trampoline.

WALLS

In connection with building structures, we must frequently build walls that are sometimes high and long. A huge face of concrete is unattractive and hard to hide. We have tried a number of things: striping, texturing, and checkerboarding; we have even built in recesses for planting (to the horror of the safety experts). But the cheapest, simplest, and satisfactory approach is just to use a few abstract designs scattered along to break up the big concrete faces.

SLOPE PAVING

Although not strictly a structural element, slope paving used around a bridge is certainly a factor in its design and appearance. The early tendencies were to pave the

slopes entirely. That is costly and has a sterile appearance. Planting along the edges and leaving recesses in the paving for planting helped some. Next we pulled the paving in until it was right under the structure drip lines. Precast blocks and slabs and fancy textures were used, but still it was expensive and looked contrived.

Then we asked, What is it for, and why do we need it? Actually its function is to preserve the slope and prevent the earth from washing or slipping out from under the abutments. But for that, you do not need a lot of slope paving. So we went to a minimum of slope paving (we call it a bib) and paved only that portion of the slope in front of the abutment generally not reached by the sun and not suitable for plants. The rest of the area is used for planting. The appearance is much better than anything we have tried so far.