

A RATING SYSTEM FOR THE ESTHETICS OF BRIDGES

by

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(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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SUMMARY

There is a need for a tangible way to evaluate the esthetic or visual characteristics of bridges. This report describes such a method based on a numerical experiential rating scale of -10 to +10. Negative values represent unpleasurable responses; positive values, pleasurable ones.

Using the rating method proposed, seven kinds of bridges are evaluated. Their esthetic rating numbers range from a low of -3.6 to a high of +5.3.

This definable way of measuring esthetics provides engineers a means of calculating the appearance of a bridge along with its other engineering aspects.

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INTRODUCTION

Because of their importance, bridges are subject to very careful analysis. To determine their strength, a great deal of mathematical calculations are employed. From these calculations, bridges are routinely rated as to their load-carrying capabilities. Cost also is a subject for concern and it too is determined by mathematical computation. In recent years, other concerns as environmental impact and historical importance have been subjected to quantitative analysis. The seemingly subjective aspect of the historical importance of a bridge has been brought under a systematic rating system by Howard Newlon.⁽¹⁾

The appearance, or esthetics, of a bridge is still another of its important qualities. Bridges are seen by millions of people, sometimes for many centuries. Their importance as part of the landscape is undeniable. Songs, poems, and stories are written of the beauty of bridges. Institutions, communities, and organizations often award prizes or accord honors for the most beautiful bridges. Even great nations pridefully single out their fine bridges as landmarks of note. Yet with all the attention that many people place on the appearance of bridges, bridge engineers often place a very low priority on bridge esthetics, particularly for the non-monumental ones. It is the intention of this report to offer a simple, workable, and general system for the quantitative evaluation of the esthetics of bridges so that such structures can be judged on a definable basis. A bridge can then be evaluated on its esthetic merits by a rating number, much as its strength can be. By this process, it is hoped to encourage designers to upgrade their concern for the appearance of bridges.

Now, each person sees a bridge in his or her way. One may like it or dislike it based on one's own particular perceptions. There is no defined standard of judgment. The construction of a new bridge may prompt both favorable and unfavorable comments concerning its appearance — comments that often end up as letters to a local newspaper. Even when a select group of jurors evaluate a bridge for the awarding of a prize, there may be disagreement. Clearly, some general method of rating the esthetics of a bridge should be helpful to the bridge designer by enabling him to design a structure with confidence that it will be pleasing.

SOME COMMENTS ON ESTHETIC THEORY

There are hundreds of books and thousands of articles on the subject of esthetics. They deal with a wide range of subjects as painting, sculpture, music, architecture, and even philosophy. In the realm of bridge esthetics, there are relatively few. Some recent and significant literature on bridges is listed in references 2-11. Reference 12 is a treatise on the esthetics of buildings placed on the list because much of what pertains to buildings holds for bridges as well. In preparation is a reference manual on the esthetic design of highway bridges that is directed specifically to bridge engineers. It is being written by Paul Harbeson of Philadelphia, Pennsylvania, under the auspices of the Federal Highway Administration.

Prior to discussing the appearance of a bridge, some general comments on esthetics must be made. Adages as "Every man to his own taste" and "Beauty is in the eye of the beholder" are commonly used to rationalize any or all esthetic judgments of an object. Although there is some truth to these statements, the subject of esthetics does have some definable bounds. Philosophers as far back as Plato have pondered esthetics and given it substance. The experience of pleasure is at the heart of esthetics. It is not purely sensuous pleasure as eating a delicious dessert, or intellectual pleasure as in comprehending an elegant mathematical derivation, but somewhere in between. The pleasure may be immediate as in seeing a colorful sunset, or it may take contemplation and understanding as in seeing an abstract painting by Picasso. Even in the case of an immediate pleasure response, a deeper understanding or perception of the subject can add to the esthetic pleasure. Thus it is that "beauty" is both in the object and in the mind of the observer.

The word "beauty" is used reservedly as it does not fully explain the esthetic perception. A better word is "experiential", as it encompasses not only the object but also the viewer.

Another comment on esthetics that must be made is that the esthetic experience is relative. Whereas one might find a daisy pleasing, a rose is even more pleasing. For the establishment of any sort of esthetic rating system there must, therefore, be a standard with which to compare the thing being noted.

In this report, a numerical rating system is used to represent the esthetic experience of viewing a bridge. A value of +10 is designated as being the most pleasurable of experiences. A +10 visual experience for a bridge is of the same intensity as the most visually pleasurable experience one knows. As an example, it may be the sight of a golden sun setting in a sky radiant with color or a peaceful hamlet nestled in a green mountain valley.

A value of -10 is designated as being the most visually repulsive of experiences. For example, it may be equivalent to the sight of rotten garbage scattered over a sidewalk, or a mass of slimy slugs slithering on a kitchen table.

A value of zero is designated as being esthetically neutral; neither pleasing nor displeasing.

A rating of an object may, therefore, have a twenty-point spread, with values anywhere between -10 and +10 depending on the degree of esthetic satisfaction derived from it. Positive values represent experiential sensations that make you feel good and negative values sensations that make you feel bad.

HOW TO LOOK AT A BRIDGE

Ideally, a bridge should be seen at firsthand from many different angles; at close hand and from afar; in bright sunlight and in subdued light; in winter and in summer. A fair appraisal of a bridge cannot be made from a single photograph or from a fast moving vehicle. Regrettably, most juries that select bridges for esthetic awards must do so on the basis of photographs alone. Obviously, photographs can be deceptive as only the best views, often enhanced with special camera lenses or film, are generally taken. A classic example of photographic deception is that of the Salginatobel Bridge in the Alps of Switzerland. This highly acclaimed bridge by Robert Maillart is almost always seen in photographs from a distance as a breathtaking arch leaping over the deep gorge below. However, when seen from the roadway approach, it appears nothing more than a simple narrow little bridge with absolutely no distinction. Deck bridges, in contrast to through bridges, are vulnerable in this respect in that one sees almost nothing of the bridge when passing over it.

So it is that a bridge should be seen as a piece of sculpture "in-the-round" from all angles, including from underneath, and not just in elevation. Of course, few people have the time to spend hours traversing and studying a bridge from all positions and under a variety of light and seasonal conditions. As a minimum, an observer should witness a bridge from three locations; namely, (1) from a distance where the overall elevation can be seen in conjunction with its site, (2) from underneath slightly to one side at close enough range to see the details of construction, and (3) from the roadway, either on foot or in a slowly moving vehicle.

In trying to understand the esthetics of a bridge, it is helpful to be familiar with some of the generally agreed upon principles that a pleasing bridge should incorporate. (See references 3-11.) Sensitivity to such aspects as form, proportion, balance, harmony, contrast, scale, color, texture, and expression of purpose enable a person to "see" a bridge in depth and judge it properly and critically. In addition to the bridge itself, the surrounding site affects the visual judgment of the structure. There is an interplay of the site and structure that must be taken into account.

Indeed, one could spend a lifetime studying the many aspects of esthetics and still not fully comprehend it all. Engineers, preoccupied with many other problems, need a simple workable system of esthetic determination. For that reason, the following system is proposed. Although it may be flawed in detail, it is believed to be generally valid for its intended application.

In rating the esthetics of a bridge, four basic features are to be evaluated. These are (1) the bridge as a whole, (2) the site and the relation of the bridge to the site, (3) details of the bridge, and (4) the uniqueness of the bridge or its special features.

The aspect of uniqueness is often overlooked in formal theories of esthetics, but it is nonetheless an important determinant in the experiencing of an object. A fresh new look elevates the level of experiential sensations, and this in turn affects one's perception of what is seen. In effect, feature 4 is treated as a bonus or penalty factor, depending on whether the special qualities are pleasing or displeasing. If no special qualities are apparent, a neutral zero rating can be assigned.

The four basic features listed do not all rate equal importance. The exact weighting of each may be subject to some judgmental variation. However, the following weighting factors are used in this report.

1. Overall bridge, 50%
2. Site, 20%
3. Details, 20%
4. Uniqueness, 10%

CASE STUDIES

To illustrate the method of numerically rating the esthetics of bridges, seven representative bridges have been selected as case studies. The numerical ratings are those of the author and are based on his studied reactions.

Bridge No. 1 — Metal truss bridge on Rte. 653 over the Southern Railroad in Nelson County, Virginia. Constructed in 1882. See Figure 1.

1. Comments on the appearance of the bridge as a whole.

The structure is relatively short, high, and narrow, which gives it a rather ungraceful, gangling appearance. The truss members are relatively light and thin, which is pleasing, but the floor beams appear quite heavy in contrast, which is not pleasing.

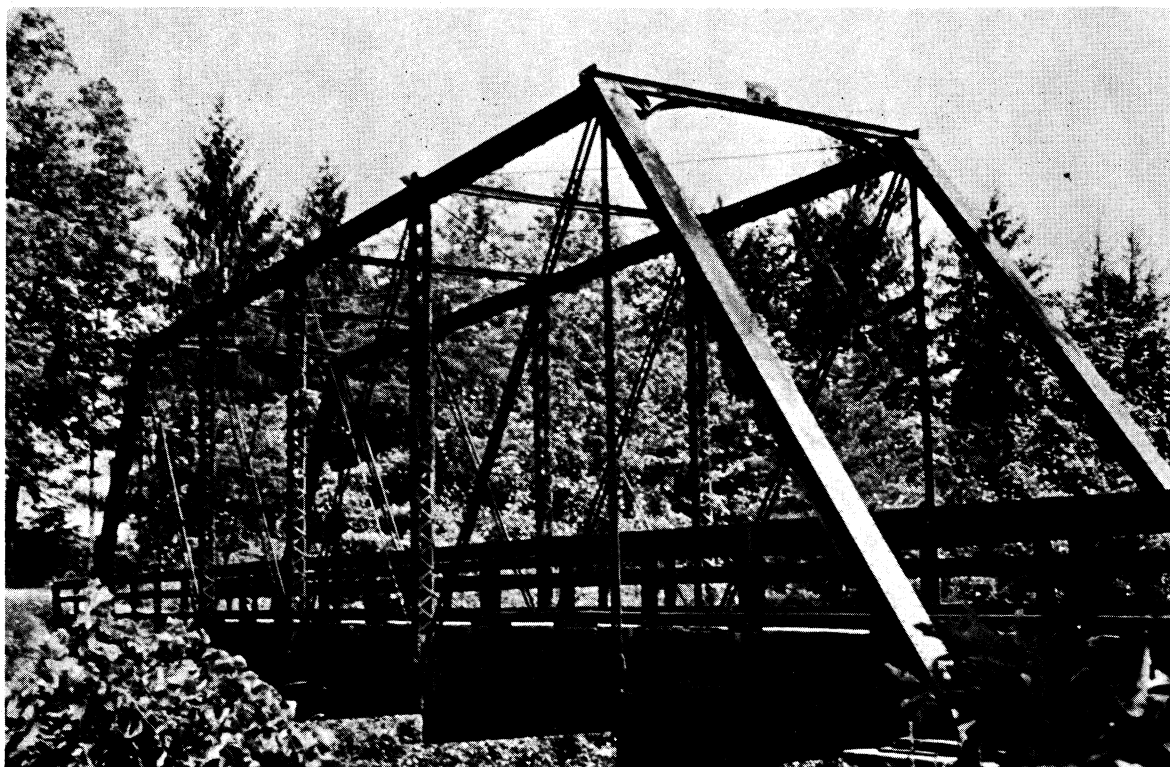


Figure 1. Bridge No. 1 — esthetic rating -0.7.

The bridge is painted black, a color suggesting sombreness.

Overall, the visual impression is not favorable, mostly because of the awkward proportions of the structure. On a pleasure scale of -10 to +10, the overview of the bridge rates about a -2.

2. Comments on the site and the relation of the bridge to the site.

The bridge is sited over a relatively narrow and deep railroad cut. Woods lie on one side of the structure and an open field on the other. Aside from the railroad tracks, the general site is moderately pleasant, as landscapes go.

In connection with the relationship of a bridge to the site, esthetically one looks either for a sense of harmony or a dramatic contrast. This particular bridge ostentatiously sticks out from its surroundings, carrying a strong sense of man's presence in this rural landscape. Generally, harmony is more pleasing than contrast; however, in this case contrast is not objectionable.

On balance, mostly on the influence of the landscape, the rating for this category is +2.

3. Comments on the details of the bridge.

Except for slightly decorative portal bracing, the details of this structure are basically utilitarian. Exposed eyebar connections, riveted truss members, and simple wooden guardrails are accepted for what they are, and are neither pleasing nor displeasing. The most unattractive detail is the black asphalt surfacing of the bridge deck.

Details are thus given a neutral rating of zero.

4. Comments on the uniqueness of the bridge or its special features.

This truss bridge stands out as being something from another age. It is in truth listed on the National Register of Historic Places, although it is not necessary to know this fact in seeing it as being different from most other highway bridges. Because of the relative rarity of this bridge type, it attracts the eye and stimulates a special visual experience.

This feature elicits a +1 on the rating scale.

The composite rating for bridge no. 1 is arrived at as follows:

<u>Aspect of Bridge</u>	<u>Rating</u>	<u>Weighting Factor</u>		<u>Value</u>
Overall	-2	x 0.5	=	-1.0
Site	+1	x 0.2	=	+0.2
Details	0	x 0.2	=	0
Uniqueness	+1	x 0.1	=	+0.1
TOTAL				-0.7

The conclusion is that this structure, rated as objectively as possible, is not a "beautiful" bridge, in that it has a negative rating. Nor is it a terribly "ugly" bridge, in that its rating is only slightly below zero. Many may view this old bridge and see it as highly interesting, but "interesting" and "pleasing" are not the same responses and it is only the "pleasing" experience that is being evaluated here.

Bridge No. 2 — The Lee Bridge on Rte. 1 over the James River
in the city of Richmond, Virginia. Constructed
in 1936. See Figure 2.

1. The bridge as a whole.

In itself, an arch bridge of any kind is a dramatic and natural structural form as the arch seems to literally leap across space. In the Lee Bridge, the multiple arch forms, relatively light and open, rhythmically leap from pier to pier over the great distance of the river. The piers, in contrast, appear massive, solid, and firmly planted in the riverbed.

The bridge is all of one material, reinforced concrete, which gives its components a sense of harmony and unity.

Overall, the visual image is quite pleasing, rating a value of +4.



Figure 2. Bridge No. 2 — esthetic rating +2.7.

2. Site and relation of the bridge to the site.

The site is visually dominated by the James River, over which the bridge passes at a moderately high level. At the two ends of the bridge, there is the urban development of the city of Richmond consisting of the usual mix of buildings and roads. Near the center of the river is a small, vegetated, relatively unpopulated island on which several bridge piers rest.

In general, the bridge relates well to its surroundings, with the arch spans appearing to "skip" over the expanse of the river. Geometrically, the long, straight deck relates to the linear patterns of the buildings on shore. The one

unrelated aspect is the lack of recognition of the island at mid-river. The bridge continues over water and land in the same way, not differentiating between the two.

However, because of the generally scenic aspects of the river set against a skyline of tall buildings, this esthetic feature rates a +3.

3. Details of the bridge.

Close up, there are both pleasing and displeasing details. The balustrade along the sidewalk is a conspicuous esthetic element. Pedestrian stairs in cast concrete leading from the sidewalk to the ground also show a sculptured quality. Under the deck, where most of the structure is seen, the members are done in a straightforward manner and are neither pleasing or displeasing.

The displeasing aspect lies primarily in the condition of the exposed concrete, which shows evidence of deterioration and staining.

On balance, details rate a neutral zero.

4. Uniqueness or special features of the bridge.

Although popular about fifty years ago, concrete arch bridges of this type are no longer being built and many are being razed as being functionally obsolete. Thus, this bridge may be considered somewhat special, as would any man-made object almost a half century old.

Its rating in this category is +1.

In summary, the composite esthetic rating for bridge no. 2 is determined as follows:

<u>Aspect of Bridge</u>	<u>Rating</u>	<u>Weighting Factor</u>		<u>Value</u>
Overall	+4	x 0.5	=	+2.0
Site	+3	x 0.2	=	+0.6
Details	0	x 0.2	=	0
Uniqueness	+1	x 0.1	=	<u>+0.1</u>
TOTAL				+2.7

Thus it can be concluded that the Lee Bridge is moderately pleasing visually, although not breathtaking. Perhaps the same conclusion can be reached intuitively, but the rating system proposed offers a rational basis for evaluating, comparing, and ranking many different bridges. This ability should become evident as the additional structures in this report are rated.

Bridge No. 3 — The Robert Opie Norris, Jr. Bridge on Rte. 3 over the Rappahannock River between Lancaster and Middlesex Counties, Virginia. Constructed in 1957. See Figure 3.

1. The bridge as a whole.

Seen in total, this structure appears to be at least three different bridges joined together to cross the river. The main central portion is a heavy steel truss structure, while the side spans are several types of steel girders. To make matters worse, there are several different kinds of piers, particularly for the side spans.

The lack of visual harmony of the many forms seriously detracts from its esthetic appeal, placing it in a negative rating category of -1.

2. Site and relation of the bridge to the site.

The vision of almost any bridge spanning a wide body of water is captivating and sets the adrenaline flowing. This long bridge over the Rappahannock River is no exception.

Where the bridge touches the relatively unpopulated land, the embankments are nicely done with grass and riprap making for an attractive transition.

An unfortunate relationship is the presence of electrical transmission towers in the river quite close to the bridge. The purity of the structure standing boldly and alone in the water is hurt by their presence.

All things considered, a +2 is given for the site and the relation of the bridge to the site.

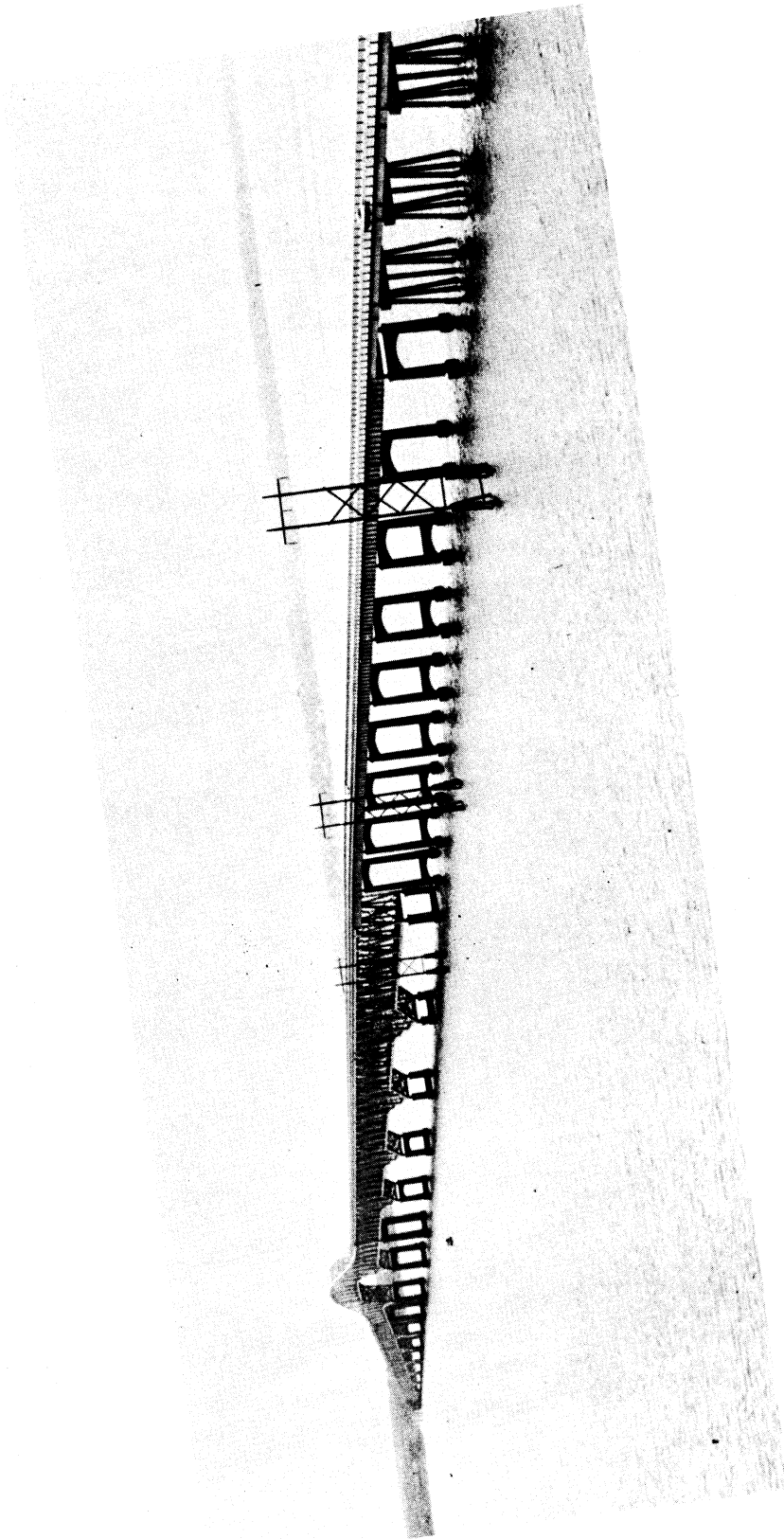


Figure 3. Bridge No. 3 - esthetic rating +0.2.

3. Details of the bridge.

Here again, the details of the rails, structural connections, and bearings come across as being neutral esthetically. The shape of the piers under the truss portion of the bridge shows a pleasing regard for form, but the pile clusters under the girder portion are displeasing by their clutter.

On average, these details rate a zero.

4. Uniqueness or special features of the bridge.

A long bridge of this type is not a sight seen everyday by most people. Whereas a short bridge can easily be ignored, there is no ignoring this bridge visually, when either on or off the structure.

Therefore, as a visual experience on its own it rates a +3.

The composite esthetic rating for bridge no. 3 is as follows:

<u>Aspect of Bridge</u>	<u>Rating</u>	<u>Weighting Factor</u>		<u>Value</u>
Overall	-1	x 0.5	=	-0.5
Site	+2	x 0.2	=	+0.4
Details	0	x 0.2	=	0
Uniqueness	+3	x 0.1	=	<u>+0.3</u>
TOTAL				+0.2

The net rating of +0.2, being very close to a neutral value of zero, indicates that this bridge is neither beautiful nor ugly. While it has some pleasing features, it has nearly equally displeasing ones. It may be called impressive by virtue of its size, but it is no beauty contest winner.

Bridge No. 4 — Bridge on Rte. I-64 over Rte. 780 in Albemarle
County, Virginia. Constructed in 1969. See
Figure 4.

1. The bridge as a whole.

These twin bridges of concrete are plain and simple. The bridge does its job in a direct and obvious way, with girders resting on pier caps that in turn rest on pier columns. It is relatively short in span and generally symmetrical, so there is nothing especially notable to catch the eye. The structure neither attracts nor repels visually. Indeed, most people driving by the bridge probably take little note of it.

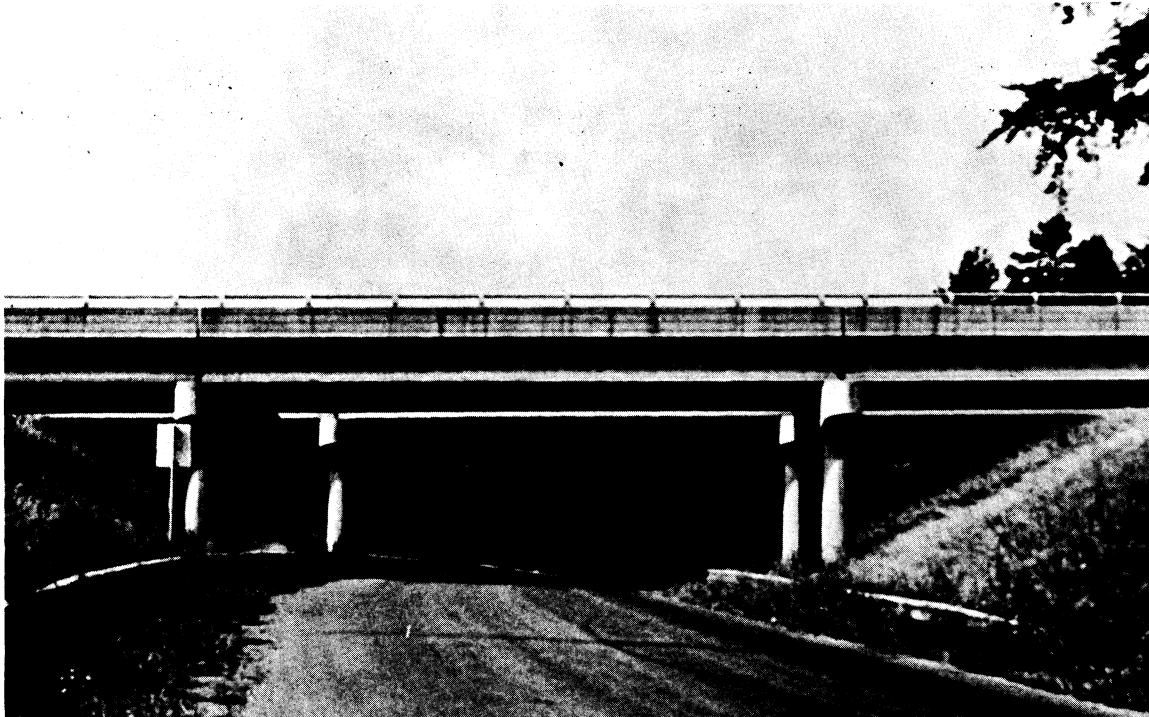


Figure 4. Bridge No. 4 — esthetic rating +0.2.

Esthetically the bridge rates a zero.

2. Site and relation of the bridge to the site.

The site of the bridge is rural in a setting of trees and grass. The structure spans a narrow cut with the piers flanking the roadway below. These piers visually serve to define the roadway.

The bridge deck joins the top of the embankments in a straightforward manner; it is seen as a direct solution to the problem of getting the roadway across the cut.

In conclusion, the bridge relates reasonably well to the site entitling it to a rating of +1.

3. Details of the bridge.

The elements of this simple bridge are all clearly seen. These are the handrail, parapet, girders, piers, abutments, deck, and bracing. The concrete surface is its natural gray, with no special texturing. Two apparent concessions to esthetic details are the rounding of the ends of the pier cap that reflects the curvature of the round pier columns and the horizontal grooves on the parapet face that emphasize the horizontality of the bridge.

However, the other details, being basically utilitarian in design, appear as what they are and rate a neutral zero.

4. Uniqueness or special features of the bridge.

The design of this bridge is a standard one and thousands of others of this type may be seen throughout the country. As there are no special features, its rating here is also zero.

The composite rating for bridge no. 4 is as follows:

<u>Aspect of Bridge</u>	<u>Rating</u>	<u>Weighting Factor</u>		<u>Value</u>
Overall	0	x 0.5	=	0
Site	+1	x 0.2	=	+0.2
Details	0	x 0.2	=	0
Uniqueness	0	x 0.1	=	0
TOTAL				+0.2

Bridge no. 4 is thus a rather ordinary bridge, utilitarian and neutral in appearance. There are those who believe that bridges, except for certain monumental ones, should be neutral and unobtrusive in appearance; so it may actually be desirable to have bridges with a zero (or near zero) esthetic rating under some circumstances.

Bridge No. 5 — Flyover bridge over Rte. 258 and Coliseum Drive in the city of Hampton, Virginia.
Constructed in 1974. See Figure 5.



Figure 5. Bridge No. 5 — esthetic rating +3.7.

1. The bridge as a whole.

This bridge, actually a long, curved ramp of reinforced concrete, has very pleasing lines by virtue of its horizontal curve. The curvature is enhanced by the clean box configuration revealing only smooth side and bottom surfaces. The deck overhangs the box girder a small distance, visually making the depth of the structure less than it would be otherwise. The single circular columns support the structure along the curve in a simple and pleasing manner.

Seeing this bridge evokes a clear sense of pleasure that qualifies it esthetically for a rating of +5. Had this structure been a complete bridge and not just a ramp (in a sense only half a bridge), its rating would have been higher.

2. Site and relation of the bridge to the site.

The bridge is located in a heavily traveled commercial area. Although there are some trees, shrubs, and grass near the bridge, the site is dominated by roadways and parking lots. In this confusion, this cleanly shaped bridge stands apart and serves to improve the visual environment at that location.

This category rates a +2.

3. Details of the bridge.

An attempt was made to treat the details of this bridge as cleanly as the overall form of the structure. The piers meet the ground and the box girder cleanly and directly. The vertical faces of the box girders slope slightly so as to slenderize the girder. The superstructure joins the ground firmly with the use of solid abutment walls.

Unfortunately, there are blemishes in the finish concrete that are noticeable at close range. However, despite the minor flaws, the details rate a +3 with regard to esthetic pleasure.

4. Uniqueness or special features of the bridge.

All too few bridges are built with as much attention to appearance as was this one. Due to a combination of factors, such as the curvature, the pleasing appearance from below as well as from the side, and the nice way the piers are handled, this structure stands out from most others. Because of these special features, this aspect rates a +2.

The following is the composite rating for bridge no. 5.

<u>Aspect of Bridge</u>	<u>Rating</u>	<u>Weighting Factor</u>		<u>Value</u>
Overall	+5	x 0.5	=	+2.5
Site	+2	x 0.2	=	+0.4
Details	+3	x 0.2	=	+0.6
Uniqueness	+2	x 0.1	=	<u>+0.2</u>
TOTAL				+3.7

It is improbable that man will ever design a bridge as beautiful as a sunset with a maximum pleasure rating of +10. However, by the standards set in this report, a composite esthetic rating of +3.7 is rather good. Although this rating may be considered better than average, it should not be taken as an ideal as higher ratings are possible.

Bridge No. 6 — Private bridge on Mount's Bay Road over Kingsmill Creek in "Kingsmill on the James" development in James City County, Virginia. Constructed in 1975. See Figure 6.

1. The bridge as a whole.

The first sight of this bridge captures the eyes and makes the heart beat faster. The overall proportions of span, depth, and height are in very good relation to one another. The delta shaped steel legs have a pleasing rhythm through repetition both longitudinally and transversely. The band of parapet concrete accents the low horizontality of the bridge and provides a strong visual element spanning the water.

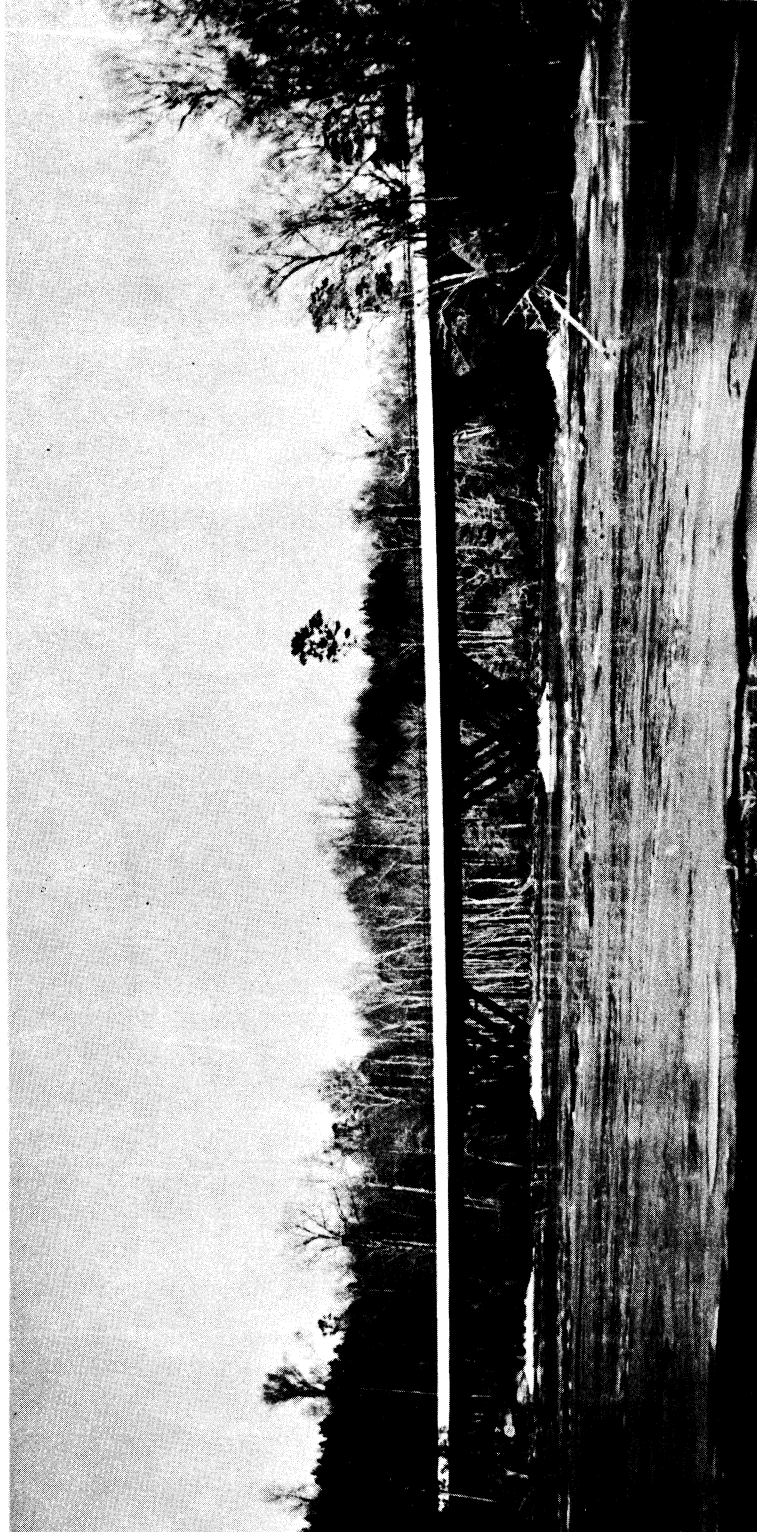


Figure 6. Bridge No. 6 — esthetic rating +5.3.

The bridge colors are well chosen and in harmony with each other, the steel being natural rust and the concrete tan.

The bridge deserves a rating in this category of +6.

2. Site and relation of the bridge to the site.

The site is a semi-wildwood area with a moderately wide creek flowing into the James River nearby. The site in itself is natural and quite pleasing. The bridge provides a linear "high-tech" contrast to the organic randomness of nature. Yet, there is a harmony of color, with the natural rust and earthy tan of the bridge blending with the hues of the natural surroundings.

The rating in this category is also a +6.

3. Details of the bridge.

From the foundations to the rails, the details are generally pleasing. Smooth transitional curves are used in the foundation supporting the legs and in the delta portion of the rigid frame. The handrails are light and not overly conspicuous.

Two details, however, are rather ordinary. They are the end abutments and the underside of the deck, which is of open steel construction.

These two features are not highly visible to the casual observer, so the net rating for details remains high at +4.

4. Uniqueness or special features of the bridge.

In recent years, a number of delta leg bridges have been built, but they are still the exception rather than the standard. The special feature of this bridge is the very happy marriage of the attractive bridge design to the attractive site.

For this feature, a rating of +3 is given.

The composite esthetic rating of bridge no. 5 is as follows:

<u>Aspect of Bridge</u>	<u>Rating</u>	<u>Weighting Factor</u>		<u>Value</u>
Overall	+6	x 0.5	=	+3.0
Site	+6	x 0.2	=	+1.2
Details	+4	x 0.2	=	+0.8
Uniqueness	+3	x 0.1	=	+0.3
TOTAL				+5.3

Any value above +5 may be considered an exceptionally high rating. An independent confirmation of the attractiveness of this bridge is the fact that in 1977 the American Institute of Steel Construction selected this structure for its prize bridge award in the short span category. This award is based primarily on esthetics.

The six bridges illustrated thus far are all highway structures located in Virginia. Of the six, the best one esthetically is bridge no. 6 with a rating of +5.3 and the worst one is bridge no. 1 with a rating of -0.7. The other four, falling between these two values, represent the general range of most highway bridges in Virginia.

To illustrate a bridge with a high negative rating, a railway bridge located in a state outside of Virginia is next described. To avoid possible hostile repercussions, its exact location is not revealed.

Bridge No. 7. See Figure 7.

1. The bridge as a whole.

This old steel structure is not a pleasant vision. Its design features are chaotic, with one pier being a braced steel frame and another an irregular block of concrete. The multiple spans consist of girders of different depths and visually unrelated.

Making the bridge even more unsightly is its depressing black coat of paint.

The bridge as a whole is given a rating of -4 as its lack of eye appeal actually turns one away.



Figure 7. Bridge No. 7 — esthetic rating -3.6.

2. Site and relation of the bridge to the site.

The site of the bridge is little better than the bridge itself as it is a rather run-down commercial and industrial area. Poles and signs, some of which are not even plumb, surround the structure.

In one sense, the bridge harmonizes with its surroundings; both are confusing and unappealing. Whereas some sites can enhance the attractiveness of a bridge, this site serves to compound the grossness of the structure.

The site rates a value of -3.

3. Details of the bridge.

This bridge is loaded with bothersome details. The connections are awkward where the girders of different depths meet. There are small knee braces on one side of the main span that make no esthetic or engineering sense. The jog in the concrete abutment looks almost like an afterthought. The black paint on the steel is peeling badly.

The details rate a -4.

4. Uniqueness or special features of the bridge.

In regard to bridge no. 6, the combination of attractive site and attractive bridge caused it to gain points. In contrast, for bridge no. 7, the combination of unattractive site and unattractive bridge causes it to lose points. Many girder bridges do exist, but few, if any, are as repulsive as this one.

A negative value of -2 is thus given here.

In summary, the following gives the composite rating for bridge no. 7.

<u>Aspect of Bridge</u>	<u>Rating</u>	<u>Weighting Factor</u>		<u>Value</u>
Overall	-4	x 0.5	=	-2.0
Site	-3	x 0.2	=	-0.6
Details	-4	x 0.2	=	-0.8
Uniqueness	-2	x 0.1	=	<u>-0.2</u>
TOTAL				-3.6

Any bridge with a value below -3 may rightly be considered ugly. This particular bridge may, in fact, be one of the ugliest bridges in the country. Several large ugly bridges are cited in reference 13 (one of the Guinness book of records) on pages 35 and 36 under the heading "The Ugliest Bridges". The more well known of these include the Williamsburg suspension bridge in New York City, the Sciotoville continuous steel truss bridge over the Ohio River in Sciotoville, Ohio, and the old Landsdowne steel cantilever bridge over the Indus River at Sukkur, India.

So it is that bridges can have both positive and negative esthetic ratings.

CONCLUSIONS

From an inspection of the case studies presented, it can be seen that the esthetic rating system described is not difficult to apply. To be sure, the method in part is subjective, and different people viewing a bridge may ascribe different levels of pleasure to various aspects of it. However, by forcing one to concentrate on the four specific aspects of the structure — namely (1) the bridge as a whole, (2) the site and the relation of the bridge to the site, (3) details of the bridge, and (4) its unique or special features — it is believed that a much greater degree of consistency can be had than by just rating the bridge with no guidelines.

The method described is kept as simple as possible for ease of application and for adaptability to all types of bridges. Should there be a need for many people to make a statistical evaluation of a specific bridge, the bridge features can be more fully and explicitly listed, along with appropriate weighting factors. Different people will react somewhat differently to the appearance of a bridge, but by codifying what is seen as measured against a close-ended numerical scale (as -10 to +10), the differences can be minimized and a consensus can be had.

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