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4.1 Design Excellence

To achieve design excellence, one should be:

1. Creative and aesthetic
2. Analytical
3. Technical and practical

Science, technology, art and economy are the prerequisites for design excellence. Where one or more of these aspects is flawed or not fully considered during design, the final design will probably be flawed, in some cases with distressing results.

The Tacoma Narrows Bridge is an example of technology and art without sufficient science on wind dynamics, which caused the bridge to collapse.

A Rib-Arch Bridge in Ohio was built with science and art but without technology. Numerous deck joints, poor concrete and deicing salts deteriorated the spandrel columns beyond repair, thus causing the bridge to be demolished.

There are many examples of bridges built with science and technology but without art. Just look around.



4.2 Aesthetic Guidelines

Primary Features:

- Superstructure Type and Shape
- Abutment Type and Shape
- Pier Type and Shape
- Lines and Grades

Secondary Features:

- Railing
- Architectural Etchings
- Color

Consider the following guidelines when designing structures:

1. Clear structural system
2. Good proportions in 3 dimensions
3. Good order - lines & edges
4. Integration into the environment/landscape
5. Choice of materials
6. Coloring - soft colors (Chapter 9 for approved colors)
7. Lighting
8. Simplicity of shape
9. Recognizable flow of forces

Consider the bridge shape, relative to the form and function at the location. Use a structural shape that blends with its surroundings. The aesthetic impact is the effect made on the viewer by every aspect of a bridge in its totality and in its individual parts. The designer makes an aesthetic decision as well as a structural decision when sizing a girder or locating a pier.

The structure lines should be flowing and simple. Do not clutter up the structure with distractive elements. If light standards are required, place them in line with the piers, so the vertical lines blend. Keep girder stiffeners on the outside face of exterior girders at abutments and piers only. If pedestrian fencing is required, consider cathedral post shapes, or a shape that blends.



Consider focal points on the structure to attract the viewer such that other features are less noticeable. This can be achieved with shadow lines. Consider concrete stains to create color lines or patterns to attract the viewer. Stains tend to penetrate and are more durable than paints and surface finishes.

Formliners are an inexpensive way to provide features of relief in concrete. They have been used on concrete walls or parapets to depict historic scenes or artistic designs. They break up the solid, blank wall appearance. Formliners have also been used to provide aesthetic form to abutments and piers. Form details should be terminated 1'-0" below low water or ground elevations where they will not be visible. Formliners are relatively inexpensive if they can be reused. The designer should detail the required structural shapes and then allow the contractor some flexibility to adjust the size to accommodate form liners. An extra 5 cubic yards of concrete can offset the cost of wasting formliner if they need to be cut. Formliners are not reusable if they must be cut, so right angle shapes work best. Where there are sloping lines, provide an optional construction joint allowing the contractor to extend the formliner above the slope. See Standard for Formliner Details for standard patterns that should be detailed on structures so that contractors can reuse their forms. Variations of the pattern should be accepted on projects in order to promote competition from suppliers.

There are some situations where single use formliners may be more economical than reusable liners. This should be discussed with the suppliers if there are some questions. It is better to allow the contractor flexibility to choose the best formliner material.

Look at nature for examples of proportions of elements such as trees, etc. The span to depth ratio of the structure should be proportional. The number and spacing of piers should be proportional to the height unless there are other features to avoid. Pier shapes should also be proportional. Hammerhead piers need adequate column heights as an example.

See Standard for Formliner Details.



4.3 Levels of Aesthetics

The Regional Office should establish one of the following levels of aesthetics and indicate it on the Structure Survey Report. This will help the structures designer decide what level of effort and possible types of aesthetics treatments to consider. If Level 2 or greater is indicated, the Regional Office personnel needs to suggest any particular requirements such as railing type, pier shape, special form liners, color, etc. in the comments area of the Structure Survey Report. Specify on the Structure Survey Report whether anti-graffiti coating is required. Areas normally requiring the coating are readily accessible to people with moderate to low levels of activity. High traffic areas or areas with continuous activity would not be as vulnerable to graffiti.

The preliminary plan should incorporate all the agreed upon aesthetic treatments so that final design can proceed efficiently. These details would be developed mutually between the preliminary bridge designer and the Regional Office.

1. Level One: A general structure designed with standard structure details. This would apply in rural areas and urban areas with industrial development.
2. Level Two: Consists of cosmetic improvements to conventional Department structure types, such as the use of color stains/paints, texturing surfaces, modifications to fascia walls and beams or more pleasing shapes for columns. This would apply where there needs to be less visual impact from roadway structures.
3. Level Three: Emphasize full integration of efficiency, economy and elegance in structure components and the structure as a whole. Consider structure systems that are pleasing such as shaped piers, integral caps and smooth superstructure lines. These structures would need to harmonize with the surrounding buildings and/or the existing landscape.
4. Level Four: Provide overall aesthetics at the site with the structure incorporating level three requirements. The structure would need to blend with the surrounding terrain and landscaping treatment would be required for the total appearance.



4.4 References

1. *"Bridge Aesthetics Around the World"*, Transportation Research Board, Washington, D.C., 1991.
2. *"Esthetics in Concrete Bridge Design"*, American Concrete Institute, Detroit, Michigan, 1990.
3. *"Aesthetic Guidelines for Bridge Design"*, Minnesota Dept. of Transportation, 1995.