Spanning Elements

A major symbol of the interstate highway system is the bridge, overpass or underpass. The standardization of the construction process and the selection of the material have produced a visual sameness in the design of the spanning element. The German philosopher Schopenhauer remarked, that the conflict between gravity and rigidity is the sole aesthetic material of architecture. When this concept is applied to the design of bridges, a greater emphasis on the sculptural aspects of bridge design would be in evidence. The structural behavioral aspects of bridge design have been well proven along the roadway. However, the bridge represents more than just a resolution to an equation, it is an articulation within the landscape. The bridge can be seen as a landmark, denoting place and defining space. If the expression of sculptural and functional form can be integrated within the design of the bridge, the expressive content of the roadway can be increased.

This section on spanning elements is intended to bring the idea of form to the nebulous world of supporting columns, beams, abutments and approaches. The unity of the structural system must be preserved throughout the span of the bridge. The traditional post and lintel solution can be expanded far beyond the current vocabulary of form. In long span situations, two
different structural systems can be made to work as one. In small span conditions, it is desirable to have the structural system express the visual and behavioral relationship of span and support. The continuity of the roadway must also be expressed within the continuity of the bridge member. The project ideas contained in this section stress the connection of the horizontal bridge to the vertical support. Through the use of a variety of geometric forms, the bridges and their support systems become identifiable artifacts along the route.

One area that is suggested is the bridge as part of the roadway lighting system. By integrating lighting elements into guardrails, horizontal beams, abutments or columnar supports, each bridge will take on the nighttime character of a gate or portal. This will increase driver awareness of the three-dimensional movement of the automobile.

While the bridge is often seen as an obstruction to the visual continuity of the roadway, its silhouette can be shape to be particularly responsive to the surrounding context. Blending or accentuating a particular bridge form with the landscape can create a larger awareness of the aesthetic content of the landscape and the unique meaning of the highway located within it.
Spanning Element

Object: Bridge Support

The highway bridge is designed to meet the functional requirement of spanning from point A to point B in the most direct manner. This intent is well met by the interstate bridge as it meets that goal head-on. The primary difficulty is that in a majority of cases, the bridge sacrifices the aesthetic form for function alone. To this end, the American bridge lacks the larger visual appeal of its European counterpart. While the same functional requirements of a spanning element must be met, the European bridge designer is able to integrate an aesthetic that glorifies the nature of span through an articulation of material, structural principle and sculptural aesthetic. The economic constraints, based on current research, appear to be equal. Therefore the emphasis on expediency and economic consid-
erations prevalent in American bridge design could be modified to accept a greater artistic latitude with the material, structural principle and sculptural aesthetic.

In this scheme, the relationship between the roadway and the bridge is standard, the main difference being in the bridge supports. The uniformity of the rectangular box support or the circular column support is replaced with a spherical form. The sphere is intended to generate a sculptural aesthetic apart from that of the norm and as a result increase driver awareness of the differences between bridges. This method was employed quite effectively on the Merritt Parkway in Connecticut where each bridge has certain unique sculptural features.
Spanning Element

Object: Bridge Support

A two lane bridge structure will have a different solution than that of a four lane or even a single lane bridge. Specifically, the load transfer requirements and the structural behaviour of the structural element can be articulated in a manner different from that of a multi-span arrangement. In the work of the Swiss engineer Robert Maillart, concrete supports are curved into the horizontal spanning element to create a smooth and fluid visual aesthetic.

In a recent bridge project by the Chicago, Illinois, architect Myron Goldsmith, even greater design latitude may be achieved through the curving of the roadbed element over the spanned distance. In this scheme, Goldsmith uses cables of
various lengths anchored into the hillside that in themselves take on a visual quality apart from the supported structure.

In this design, a triangulated support system is employed to increase the sense of gate as the vehicle passes through the defined opening. Set on a diagonal or perpendicular to the roadbed, the bridge support system modifies the more accepted practice of uniformity of support. Built of reinforced concrete, the bridge supports can be textured or colored to visually mesh with the surrounding area. Through the modification of scale, roadbed elevation and manipulation of the ornamentation, tremendous variation on the bridge support theme may be achieved.
Spanning Element

Object: Bridge Support

Along the national interstate highway system, certain bridges, viaducts, tunnels and passways have developed their own unique identity based on the quality of their respective designs. The Verrezzano Narrows Bridge, The Golden Gate Bridge, The Brooklyn Bridge, The Chesapeake Tunnel and the Florida Keys Highway are but a few of those respected designs.

Through close inspection, those bridges met the function and technical aspects of the design requirement while at the same time imparting a formal design aesthetic. They appear to be unlike any other bridge design and yet offer an interpretation that extends the meaning of bridge. In this scheme, the bridge support system emulates that of a Doric column from a Greek
temple. While this design may not be appropriate in all areas of the nation, the antebellum South and the Eastern part of the country would find the design quite acceptable.

Formed from reinforced concrete, these gigantic columns add a historic or cultural framework to the highway corridor. While the column style may vary, variation in the bridge structure may also respond to cultural or historic factors.
Spanning Element

Object: Bridge Support

The repetitive quality or sameness that appears to be the liet-motif of our national highway system is at the heart of the problem. It is projected that within the next twenty five years, 50 to 60 percent of our current highway system will have to be rebuilt or modernized to accommodate the increase in traffic flow. The bridges are a part of the national highway infrastructure and therefore suffer a similar problem. The economic cost associated with re-construction is enormous.

It has been demonstrated both in this country and in Europe that the cost of introducing a unique identity to a bridge support system is very slight compared to the larger cost of reconstruction. The revitalization and rebuilding of the infrastructure is
critical to the continued economic growth of the country. In order to maintain and even improve the American way of life, the population will become ever more dependent on an efficient transportation system.

In this scheme, paired reinforced concrete columns act as planar elements supporting the bridge. Specific attention is given to the connection of the columns to the underside of the bridge in order to visually separate the elements. This articulation heightens the difference between the sculptural quality of the column and the horizontality of the bridge.
Spanning Element

Object: **Bridge Support**

The bridge, historically, has always had as its primary purpose to cross natural depressions in the landscape. The emphasis on the techno-material aspects of bridge design left little room for a bridge aesthetic to express itself other than that expressed by the functional form. Currently, bridge design has been taken over by highly efficient computer programs that can generate a complete set of drawings once the basic load and span parameters are introduced. Unfortunately the program cannot respond to the specifics of sculptural form or aesthetics. The art component in bridge design need not change the entire bridge form or even threaten the computer generated solution. As shown in this scheme, a uniform bridge element can be supported by a variety of supports.
To reproduce the same form over and over generates a sameness that permeates our culture. The use of the cylindrical and undifferentiated column support with no capital or base suggests that a functional minimalism is at work rather than a concern for the quality of our environment. The expediency of technology has made the highway designer dependent on formula and not on the holistic image. This proposal attempts to modify the traditional concept of column by changing the formal proportions and methods of connection between the elements.
Spanning Element

Object: Bridge Support

In many urban interchanges, the motorist drives through a forest of trees in the shape of bridge support columns. These columns respond to the gravity load requirements of the spans they respectively support and have little to do with the visual enhancement of the driving experience. The position role of vertical elements, such as columns or bridge abutments, is an important asset in designing the highway. The motorist, confronted with long distances, loses contact with the threedimensional world passing by. Passing under bridge supports is one means of developing a greater awareness of the threedimensional aspects of the roadway. By considering more than just the pure functional aspects of supporting the bridge, the highway designer can utilize the vertical elements to create the
sense of movement and space. By responding to both the functional and spatial requirements, supports may be placed in a variety of ways. Bridges on the diagonal alternating with bridges perpendicular to the highway can produce a rhythm or pattern of three-dimensionality. By increasing the width of the column beyond that required for stability can enhance the visual sense of movement.

In this scheme, over-scaled columns are placed in pairs to create a gateway to the highway beyond the bridge. The movement from one bridge gate to another establishes a spatial pattern and enhances the driver's awareness of the third dimension. The increased alertness of the driver will provide for greater highway safety as well as an appreciation for the sense of change in space.
Spanning Element

Object: Bridge Support

The interstate highway bridge is designed to connect two opposing sides of the highway together. The differences being one of position, elevation, form or direction. One of the great potentials of the highway bridge is that it does not need to connect equally to both sides of the road. In this sense, a difference in elevation between one lane and another could be taken into consideration in the design of the structure and the connecting roadbeds. A difference in orientation as demonstrated in this design is also a possibility. The spanning road approaches the highway from two different directions. Each direction is treated as a single bridge so that the overall effect is a series of spans at different angles and elevations to the flow of traffic.
The breakdown in the traditional perpendicularly seen on most roadways is at the heart of this design. In addition, the use of large scale column capitals, shafts and bases set at various angles to the bridge structure offer visual change to the passing motorist. These columns would be painted in a variety of colors that could be selected by local artists or design aesthetic boards concerned about the quality of the roadway environment.
Spanning Element

Object: Bridge Support

The urban highway bridge connecting the center to the highway system must be seen as part of a much larger design issue. The form of the city is not simply that dictated by the functional transportation requirements, but in conjunction with the aesthetic shape and form of the city. An industrial district may be seen as characterless even though the individual buildings may be competently design and landscaped. The low structures, surrounded by cars are often dotted over a flat landscape. While the view from the highway is considered to be important, both its advertising and its scenic value, the identity of the area is usually handled by large and ugly signs. It would be far more effective to open up the roadway so that approaches can be made legible and the bridges far more distinctive.
The urban core represents similar design concerns for the highway designer. The simple solution of placing a bridge from one edge to another avoids the design problem. In this scheme, a recessed highway passes under several bridges. By integrating lighting and a part of the visual aesthetic, the bridges take on a more distinctive quality. The large spherical supports accentuate the gravity connection while at the same time providing illumination for the roadway below. The shape of the column can be derived from the architecture of the city or from the regional culture. Roads, bridges, approaches and ramps are not simply unpleasant necessities to be maintained and kept as neat as economically possible. Roads, dams, bridges, pylons, quarries and cooling towers are magnificent objects if well shaped. They are big enough and meaningful enough to take their aesthetic and formal place in the landscape. They are part of our culture and explain the technological heritage of our civilization.
Spanning Element

Object: Bridge Support

Where our American landscape used to move artists, it now more often moves cars, trucks, buses and motorcycles. One of the purposes of urban design is to allow it to move both and, in addition, accommodate all our vast new construction in an aesthetically pleasing and harmonious manner. Urban design is a matter of arranging material objects and therefore it is a plastic art, concerned with how things look as well as how they operate. From this viewpoint, beauty in the cities must not be an afterthought, it is a necessity. The horizontal emphasis of the roadway and the bridge introduce a compositional element into the fabric of the city that is frequently overlooked. A bridge, a highway, ramps and underpasses must be considered as city furnishings, each with its own identity and sense of place. This
clarity of character can help in orienting the motorist to the city.

Through this approach, the architecture of the city is expressed through its street furnishings.

This bridge design scheme reflects the extension of the urban grid by creating a unique bridge form for each street above. A passing motorist can quickly identify a particular area of the city through the character of the bridge and support mechanism. By using super-graphics in combination with shaped columns, the highway designer is able to develop a modulated visual sequence.
Spanning Element

Object: Bridge Support

Whether located in the urban core, a residential district or in the open countryside, the highway is a symbol of cultural history. The style of the roadway reflects a specific time and place in the development of the highway system. The patterns created by the highway reflect a changing attitude about the value of the landscape. The automobile is now the predominant means of passenger transportation in this country. The interchanges between the various transportation systems represent a major problem in highway design. While design methods for alleviating highway congestion exist, pre-existent patterns of usage retard or even prohibit their introduction. The retention of highway forms and furnishings is therefore a design limitation but also represents a major challenge. The bridge and its
support mechanism must be re-evaluated along these lines of thinking. A bridge, situated in the country, may have a greater design latitude because of greater area available for construction. The urban bridge has far more design constraints due to existing traffic patterns, time and economic limitations as well as area restrictions. This proposal is designed around a modular prefabricated bridge system manufacture from factory cast reinforced concrete. Systems such as this can be introduced into the highway infrastructure with a minimum of disruption.

Using small scale interlocking pieces, properly connected to an existing foundation, a prefabricated bridge system could fundamentally alter the bridge aesthetic while at the same time reducing the overall unit cost. This approach moves away from the more traditional custom construction procedures while maintaining a high degree of design flexibility.
Spanning Element

Object: Single Pole Suspension Bridge

The role of the material is important to the nature of the spanning element. A single span requires a different support system, reduced material and gravity load transfer compared to a multiple span bridge system. This difference may be articu-
lated in a variety of ways.

One particular way is to use a single pole suspension system with a cable stayed bridge support system. The appropriateness of this type of system depends on the span requirements in terms of distance, gravity load support, soil conditions for foundations and environmental constraints affecting the immediate area. The single mast provides a focal object for the driver and contributes to the overall aesthetic of the roadway as a major sculptural element. The suspension cables, in contrast to the horizontal bridge element create a diaphanous web over the roadway which can act as a visual screen for the surrounding area.