

arch 384

essay

crossing the divide

Millie Roy
#20177968
Winter 2006

Divisions, whether they are physical or metaphysical, are a constant factor in our daily lives. One notices them and struggles to overcome them. These separations are universally experienced, especially those of the physical kind. Architects and engineers often deal with these physical divisions by building bridges, pathways and walkways to connect spaces with ease. The 2006 Steel Structures Education Foundation competition “Crossing the Divide” asked its competitors to “...conceptualize, and realize in detail, a small, single span structure of simple program.” The result is a union of elements which exploit the steel assembly for both structural and aesthetic purposes.

The process of design is dependent on both precedent and initiative; one must know what came before them to know what to do next. Imagining a bridge is no exception; different influences, in both the aesthetic and structural realms allow the designer to focus their work to complete certain tasks. Precedent and initiative also comes into play when designing for a specific site. The site has a history which provides a context to one’s design. In addition, the initiative of the design must compliment the site and improve the experience of the site. For my own site, a portion of Toronto’s waterfront cultural hub, Harbourfront, I felt a pedestrian bridge was needed as its iconography would add to the rich history of the site as well as adding a much needed route of circulation. The tradition of the bridge would complement the site. There is also a functional need for such a passageway. A contemporary design would also fit it with the dynamic nature of Harbourfront, a hub for the arts and culture in Toronto. These points are all aspects of my reasoning to place a bridge in that area.

The bridge is a common program, one which dates back from the man’s earliest attempts to cross considerable physical distances. As Micheal Golia states, “The earliest primitive bridges, formed from beams, stones, and ropes, evolved into more complex structures fashioned by highly intuitive, often anonymous hands.”¹ These simple pathways became more elaborate, from the Roman masonry single arch bridges to Renaissance inhabited pathways to the elaborate steel constructions which dominated

¹ Quote taken from ‘The Geometry of Bridges’:
<http://www.cis.yale.edu/ynhti/curriculum/units/2001/5/01.05.09.x.html>

the late 19th and 20th centuries up until today.² A great deal of development has occurred on a structure with one simple purpose; the passage of one point to another.

A bridge must not only provide a pathway for people but play the role of a landmark as it contributes to the aesthetic nature of the site in which it is built. Both the functional use of the bridge and the materials dictate both the structural elements and the aesthetic composition of the piece. A simple river crossing upon a log has transformed into complicated steel and glass structures which work in both tension and compression. A shift in which materials are used created a shift in the type of structures that were made. Beforehand, bridges consisted of compression elements to be affective structures and efficient in the use of developed technology at the time. These bridges were often made of masonry and wood. In modern day, although the basic principals of usage have not changed, the need for longevity and to accommodate larger spans has demanded more of bridges. Thus, steel and glass have been implemented as the primary materials as well as concrete decking or steel sandwich panels are used for the base. In the entire process of designing my bridge, the materials of glass and steel dictated every component of its functional purpose and aesthetic appeal.



Image 1 – Personal Photograph



Image 2 – Personal Photograph

The site I chose to use for my steel pedestrian bridge is located in between the Power Plan, a contemporary art gallery and the York Quay Centre, a building which houses cafes, art studios and a gallery. There are several reasons for choosing this site. One, the pedestrian

bridge would create another, more obvious pathway from one building to the other. The lack of a discernible connection to both buildings were sufficient initiative to create the passage way and link both buildings. In addition, the programs of both buildings accommodate

² Taken from ‘The Geometry of Bridges’
<http://www.cis.yale.edu/ynhti/curriculum/units/2001/5/01.05.09.x.html>

the decking and the abutments of the bridge. The programmatic circulation also allows for a clear flow from the patio on the deck of the York Quay Centre to a landing of a set of staircases located in the Power Plant Gallery. This ease of movement, from one building to the other, creates a precedent for an extension of this circulation.



Image 3 – Personal Photograph

Also, by offering unrivalled views to the harbor and the lake, the bridge compliments the past and present purpose of Harbourfront; to engage the urban population using the lake front and its landscape as a public and cultural space.



Image 4 – Personal Photograph

Lastly, the need for an aesthetic landmark in this area of Harbourfront would enrich the pedestrian experience of

the site. Pedestrians have a different tactile experience in terms of materials; as they travel from white steel and stone tile for steel and glass overhangs with a concrete deck. Pedestrians whom are walking underneath or around the area will have a discernible milestone to use for finding their direction or to use as a meeting place. I feel the site can use the bridge as an improvement in circulation and as a familiar sight, this allowing it to be a functional and attractive reference point.

Much of the structure, the construction details and the use of materials were influenced by other pedestrian bridges and steel structures. As an undergraduate architecture student, I feel my knowledge is extremely limited when designing completely original and realistic working construction details. Therefore, I turn to previous work done by architects and engineers to set a standard and a precedent to allow me to develop a design initiative. Several works involving use of steel and glass helped in imagining a detail which has a minimalist design and uses steel efficiently in its tensile capabilities.



Image 5 – Source i

My initial approach for this project was to design one detail and repeat it along the span. Many pedestrian bridges use this approach, the most famous being the Millennium Bridge by Foster and Partners and ARUP. Used as a pathway to the Tate Modern, a significant gallery for temporary

art from a major part of London, it has become a major public space and a celebrated feat of architecture and engineering. The result of collaboration between Norman Foster, an architect, Sir Antony Caro, a sculptor and Arup and Partners, an engineering firm, the multi-disciplinary approach allowed for three elements to come into play:

“A long span bridge, as needed to cross the Thames at this point, is a pure expression of engineering structure. A city centre footbridge, however, is equally about people and the environment - a piece of public architecture. When considering a link between Tate Modern and St. Paul's Cathedral another element is vital: the pure sense of physical form that drives a sculptor. “³

This quote changed my perspective on the process of design of such a bridge. Rather than simply creating a design which works structurally, a synthesis of an architectural aesthetic with a sound structure was required. The precedent of a multi-faceted approach

³ Taken from ‘The Millennium Bridge’: <http://www.arup.com/MillenniumBridge/>



Image 6 – Source ii

around cables which are attached to two solid abutments for support. Transverse arms which are clamped onto these cables support the deck. All of these components allow the bridge to comprise of a modular detail which is then repeated along the span of the bridge.⁴

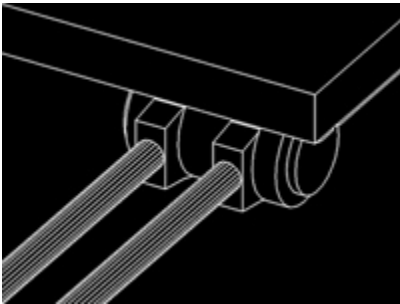


Image 7 – Image of Competition Entry

When I first began my research for the steel pedestrian bridge, I immediately began researching the Millennium Bridge as I felt it has two characteristics I wanted to capture in my design: the use of a repeated detail and an open, airy deck which offers unrivalled views to the landscape. The detail as one element, constructed of HSS steel sections bolted together. Upon these steel sections, cable attachments are bolted onto strategic points to allow the steel rods to be threaded along the HSS sections. This allows tensile forces to help the steel sections to remain upright and to become intimate with the concrete decking. The bridge I designed does not offer a full 360 view of the surrounding area however it does leave the south side open. This allows a view of the Toronto harbor and the horizon of Lake Ontario which connects the viewer to the landscape and allows a different view of the lake that the view offered at ground level.

⁴ Taken from ‘The Millennium Bridge’: <http://www.arup.com/MillenniumBridge/>



Image 8 – Source iii.

that are held in steel brackets. These glass treads are linked to paired rods by bosses which also support a curved, glass-clad balustrade.⁵ The glass and steel both catch and reflect interior light in the store becoming an effective showpiece; “...a lustrous, sparkling jewel at the heart of the store.”⁶ The beautiful and delicate nature of the stair set a precedent for my aesthetic approach to the bridge and initiated the use of steel rods and glass as major components of the design.

The clean aesthetic of patterned glass and slender steel rods is something I strived to implement in my bridge. The connection detail of glass knobs instead of glass spiders or steel connections were used when I imposed a glass panel upon the upper most HSS steel member. Glass knobs are attached to a stainless steel connection; much like the glass knobs which support the treads as well as the glass panels on the balustrade. Only the use of brackets to support the knobs and the context of the stair allow it to differ. In addition, the use of slender steel rods inspired my use of slender cables being wrapped along the profile of the detail. I wanted to achieve the same structural support yet remain subtle and unobtrusive.

⁵ Taken from ‘Contemporary Staircases’ by Catherine Slessor

⁶ Taken from ‘Contemporary Staircases’ by Catherine Slessor



Image 8 – Source iv.

system. These HSS steel members work in tension to create a barrier of rods between the bridge and the area below. The HSS steel details are bolted together and are



Image 9 – Source iv.

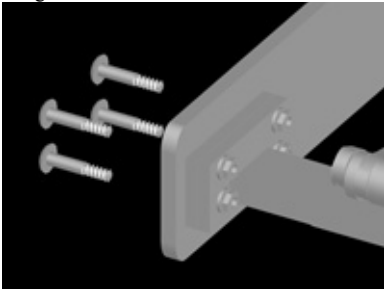


Image 10 – Rendering of Competition Entry

entered in the competition. I was inspired to use HSS steel members as I felt their lightness would follow my intention to partially enclose the open area around the deck. I also wanted to create a steel support system which used tensile cables; this would support my idea to create a modular detail as tension would allow the detail to remain in its place. Tension bolts are used to connect the HSS members in the Luminous Veil; I mimicked this when designing the connection detail

A significant civic work for Toronto, the Luminous Veil is another exemplary work using steel. Used as a suicide barrier for the Bloor Street Viaduct, this steel structure has also become a public space; a walkway overlooks onto by HSS steel support

repeated at an interval to create a support system. The barrier is also a landmark; both functionally, as it prevent suicide attempts off of the Bloor Viaduct and aesthetically, as it create a screen of light along a prominent feature of the Toronto landscape.⁷ Its significant role on its site and the use of a HSS steel support system fueled my imagination and allowed my design to focus on structure and aesthetic appeal.

The use of a HSS steel support system with tensile cables is another significant influence on the design I

⁷ Taken from ‘Steel: Fun is in the Details: The Luminous Veil’ : http://www.architecture.uwaterloo.ca/faculty_projects/terri/steel/veil.html

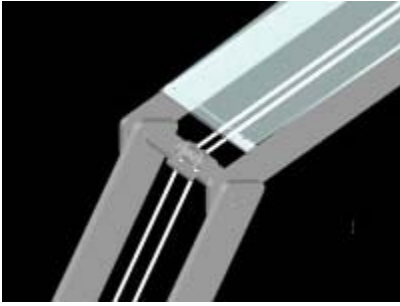


Image 11: Rendering of Competition Entry

site, much like the Luminous Veil and its relationship to its site. Therefore, I feel the bridge I designed could become a landmark of sorts for its site.

for the steel members in my bridge. The placement of my pedestrian bridge allow creates a public space with unobstructed views out to the landscape often draws visitors and the enrichment of the experience of the site by allowing it to be seen from a different perspective. The bridge becomes significant to the

From simple river crossings to immense spans, measuring in hundreds of meters, bridges play a significant role in allowing us to negotiate the physical divisions we encounter in our daily lives. As bridges hold a significant place in both architecture and engineering, one must look at both the structural and aesthetic elements of such a work. In examining these elements, the designer often needs to examine what preceded him when making those first few steps forward. As a result, the process of designing a bridge becomes one of precedent and initiative; when examining the works of the past, one finds the momentum to build upon the ideas these works present and further develop them. Also, one must study the history of the site to ensure that one's design will compliment the past as well as the present. When approaching my site, the void between the Power Plant and the York Quay Centre, I felt I needed to create a contemporary design which fit the aesthetic of both buildings, functioned as an alternate route of circulation to both buildings and served as a landmark within the area. I also felt that my bridge should present unobstructed views to the harbor and Lake Ontario as it fit with the purpose of Harbourfront. To achieve these goals, I examined three works of modern steel construction: The Millennium Bridge by Foster and Partners, a glass and steel stair located in the David and Joan shoe store by Eva Jiricna and The Luminous Veil by Dereck Revington Studio. All three established a precedent in terms of steel detailing, creating a functional structure and using glass and steel for a

sleek and clean style. I feel that the Steel Structures Education Foundation Competition presents a design solution that requires an innovative approach to the familiar. The participant is asked to draw from a long tradition of steel construction to design something new. It is then one realizes that the process of design requires one to think both in the past and in the present.

image sources

Source i:

http://www.dcs.shef.ac.uk/~lucia/big_photos/London/MillenniumBridge8_150505.jpg

Source ii:

<http://www.ukexpert.co.uk/photopost/showphoto.php?photo=11725&size=big>

Source iii.

http://www.ejal.com/PAGES/2_3_1.html

Source iv:

http://www.architecture.uwaterloo.ca/faculty_projects/terri/steel/veil.html

bibilography

- 1) Golia, Michael “The Geometry of Bridges”
<http://www.yale.edu/ynhti/curriculum/units/2001/5/01.05.09.x.html>

- 2) The Millennium Bridge
<http://www.arup.com/MillenniumBridge/>

- 3) Slessor, Catherine “Contemporary Staircases” London: Octopus Publishing Group, 2000 p.54

- 4) Meyer Boake, Terri “Steel Case Study Project Gallery: Luminous Veil – Prince Edward Viaduct”
http://www.architecture.uwaterloo.ca/faculty_projects/terri/steel/veil.html