

GALT MARKET & PLACE

An Illustrated Essay by Boian Dabov

“Tensegrity describes a structural-relationship principle in which structural shape is guaranteed by the finitely closed, comprehensively continuous, tensional behaviors of the system and not by the discontinuous and exclusively local compressional member behaviors.¹”

- Buckminster Fuller

“...The State is a creation of nature, and [...] man is by nature a political animal.²”

- Aristotle

INTRODUCTION

The ongoing urban renewal occurring within the town of Galt has been a long delayed but necessary process. A latent sense of disintegration within the cultural identity of the city can be observed, as a result of an urban architecture that subverts the social/political processes from the public realm. Urban design has instead been dominated by fragmented community relationships, propagated by our now unavoidable dependence on automobiles. Public spaces are undeniably important for the development of effective interactions between individuals and groups living in a given community, therefore it is important for future public environments in the city of Cambridge to engage in the creation of urban architecture designed for democratic social interactions.

In redefine the core urban identity into a more effective place for the community activities, the opportunity for architectural intervention presented itself through the typology of the market. As part of the Association of Collegiate Schools of Architecture (ACSA) and the American Institute of Steel Construction (AISC) annual student steel competition, I submitted my proposal for an adaptive market place in the downtown Galt, one of three heritage centres in the city of Cambridge, Ontario. As part of the open category (category II), the site and program that I defined were influenced by my current thesis studies regarding public urban spaces in the town of Galt.

The Galt Market Place is a proposed urban market structure with the goal of supporting the development of public urban spaces within the city of Cambridge, Ontario (Fig. 1). In the historic core of the town of Galt, the official centre of the city of Cambridge, people from various cultures pass through the downtown centre, yet few of these people are able to gather and sustain their experience in the city, learning and connecting with its urban and architectural heritage. The Galt Night Market presents the opportunity for a new program to be added to the existing open spaces of the city; its parking lots.

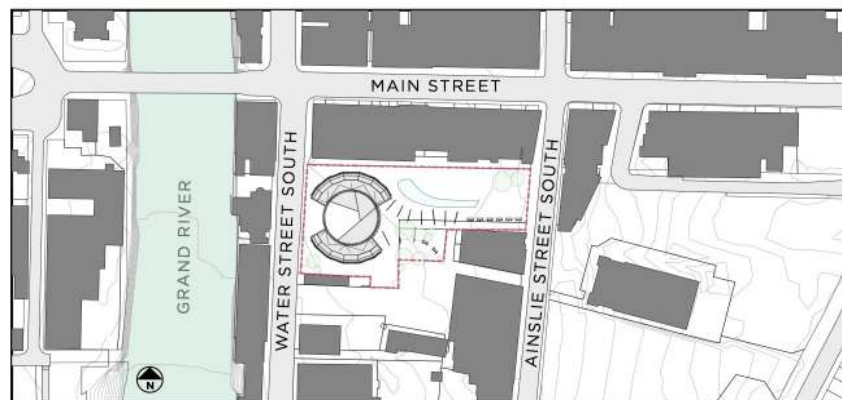


Fig. 1 – Site Context Plan of Galt Market Place, Cambridge, ON.

¹ R. Buckminster Fuller, *Synergetics: Explorations in the Geometry of Thinking* (Macmillan Publishing Co., 1975), 34.

² Aristotle, *Politics* (New York: Random House Inc., 1943), Book I, 1253.A2.

Structural steel members are used in the design of the complex so that maximum span can be achieved. Curved steel members compose the main frame of the two market buildings. These support compression forces from the roof, but in order to allow for a clear span at the interior edge of the building, a cable system is used in suspension to support the interior side of the building. The interior therefore can have the benefit of being an open air, yet covered public space that can be fully opened and occupied in suitable weather. During winter, the sliding curtain wall panels on the interior protect the market from unsuitable environments.



Fig. 2 – View of courtyard and rotating roof structure of the Galt Market Place.

The roof structure also allows for various configurations for different events (Fig. 2). From partially to fully covered, the moving steel roof along with the use of tensional integrity for the market structure allow for a unique building that aims to provide a space for the local community.

PROJECT DESCRIPTION

The goal of the project was to explore and apply contemporary steel construction techniques to the typology of public food markets. The project was inspired from my studies on public urban spaces in post-industrial cities, in which the market place presents itself as the ideal programmatic intervention, acting as an urban development catalyst for underused public spaces. As part of the Open Category criteria for the 2013 ACSA/AISC Steel Competition, the Galt Market Place attempted to create an efficiently organized array of market stalls that would allow for the introduction of secondary program, adding to the market's public presence. This was accomplished by expanding on the form of typical market stalls, which in the most basic form provide a surface and/or enclosure to accommodate the exchange of products. A parti was developed, consisting of two parallel strings of individual market stalls arranged around a shared common space. The final program consisted of 20 vendor stalls, 2 washrooms, a storage room, an information desk, and an outdoor seating area. The outdoor seating area is the central armature around which both structure and circulation were designed. The seating area also functions as a public events space whenever the market is not operational or during special occasions. The circular seating/event space provides a throughway between the two main vendor enclosures, connecting the Galt Market Place to the core of the city and its famous heritage landmarks. Furthermore, the seating/events area is covered with a series of 3 stacked roof planes. These roof assemblies have integrated lighting, as well as motored bearing system (Fig. 3) capable of rotating the 3 roof planes into various configurations, which can be optimized for seating and tables, performance, and informal public use. These secondary programs are capable of integrating directly with the city and its immediate urban community, by virtue of responding to the needs of market's users. The open space surrounded by the vendor structures defines a latent threshold, through the physical forms tracing out and designating it as public space. This space becomes synonymous with the market, thanks to its proximal location to the stalls, and as such, becomes a vehicle for public interaction. Because of its pedestrian oriented design, the market will encourage members of the community to participate in this public market, and will provide a new shared space that is simultaneously a part of the city while being apart from the city. This distinction inherited by the design parti allows for the building program to be experienced, not simply as another series of privately owned spaces, but instead as a program that through its design, is able to introduce a sense of public ownership to the site. By providing and supporting a dedicated zone for

community interaction, the private spaces of the local households are given a counterpoint through a truly public infrastructure, that is able to expand our use of public space beyond the networks of streets that supplant the needs of pedestrians for those of automobiles.

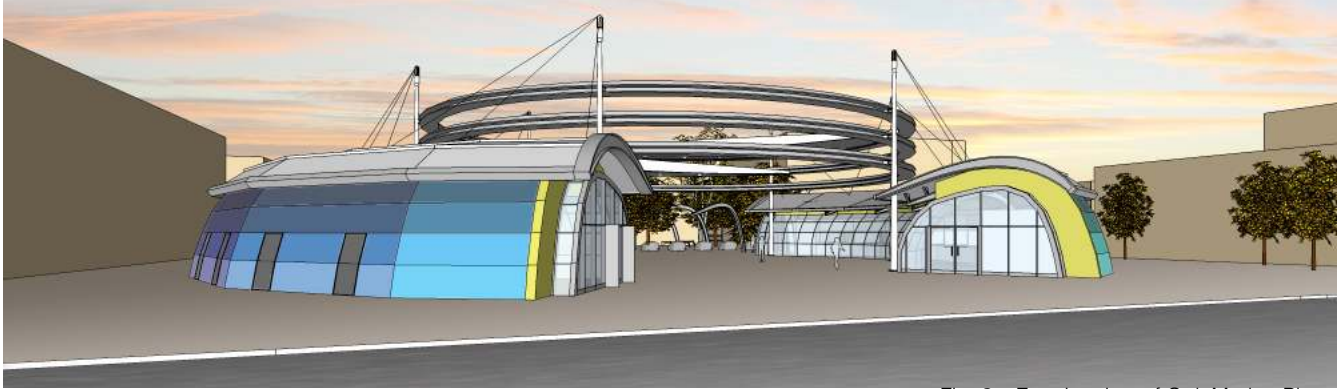


Fig. 3 – Exterior view of Galt Market Place.

This then brings us to the relevance of the site receiving the Galt Market Place. The site is located in the downtown Galt heritage centre, in the city of Cambridge, Ontario, and is operating as a public parking lot adjacent to the Main Street mixed use area with commercial shops at grade and residences above (Fig. 4). This is an ideal location for a new public urban space, given that the city of Cambridge is expanding³, and that current public spaces are limited to vehicular use only. The city of Cambridge needs places accessible and occupiable by pedestrians in order to encourage community engagement, as well as sharing the responsibility for place's prosperity. The archetype of the market place, with its ability to sustain economic and social transactions, presented itself as an ideal addition to the cities gradual improve its economy, which suffered from the collapse of local industries as well as lack of investment in urban developments. The stagnation of urban development has seems to be associated with the most recent significant flooding of the river in 1974. With the city's industry already in decline, the catastrophic damage of the floodwater would have been an immense burden for shop owners in the downtown core of Galt, which even today, contains many vacant storefronts and apartments. It therefore seems most reasonable that new developments in the city encourage economic development of the core. The Galt Market Place accomplishes this in two ways. The first is by encouraging the local participation of food and crafts vendors by designing a self-sustaining building, and by maintaining a low overhead for vendor operation that can be subsidized partially by sponsored use of the performance space. The second way that the Galt Market Place can encourage economic development in the core of Galt, is by replacing the currently stagnant public space of the parking lot, with a pedestrian friendly site plan that connects the various hubs and institutions with a centrally located public event space, permanently anchored by market stalls embodied by the local economy, its cuisine, crafts, and its vendors.



Fig. 4 – View of chosen site for the Galt Market Place, currently a public parking lot across from the Old Galt Post Office.

In order for the Galt Market Place to accomplish its goal of showcasing local art and food at affordable rates, a strategy for structural efficiency and cost effectiveness must be made. For this reason, structural steel was used to meet the design mandates for the program. In particular, architecturally exposed steel was used to create the basic structural parti. The basic design was based on simple form of street food vendor stalls found worldwide. These markets, which often operate throughout the day, provide a space for local foods and crafts to be sold, at relatively low

³ City of Cambridge, *Cambridge Official Plan 2012*, Pg. 1.

prices thanks to the lowered overhead of the shared market accommodations. In the city of Cambridge, many different cultures are represented amongst its citizens⁴, and as the core regions of the city brace for population increases, those cultures will need representation within the city's urban character. In attempting to provide this, the design for the Galt Market Place connects the stalls using a series of bent steel columns, which peer towards the center of the seating area/performance space, supporting the roof structure and cladding above without the need to interior columns. Instead, 6 cylindrical steel poles, 3 per vendor structure, support both the inside of the vendor roof edges, as well as the 3 rotating roof structures above the shared public space. With the two vendor structures being based off of the circular plan of the shared seating/performance area, the structural components can be created as modules, which trace the circumference of the site plan. From the multiplying of the basic module, the design is able to separate the permanent vendor structures from the shared space framed between them, and in doing so, is better prepared to services as a truly public market and place.

FOOD MARKETS

In establishing the form and layout of the market place program, various precedents of street food and craft markets were looked at. With the primary inspiration being markets in which the function of the program was one for stimulating of local working economies, we will explore three different cultural examples. Each market format offers its particular lessons for applying their formula in the chosen site of Cambridge, Ontario. From North American street food vendors, to European pedestrian craft markets, and South-East Asian covered food vendor markets, the typology of the pedestrian based, local community street markets has become important in supporting the working class communities of many cities in the world. By using utilitarian designs implemented with minimal material and construction costs, many of these markets are able to gather local vendors to sell their products to the community (Fig. 5). The result of vendors sharing a space, and in turn, creating a market place, also ensures that local business is kept competitive, but nevertheless, remaining exclusively local.



Fig. 5 - The Stop's Night Market, Toronto, ON, June 2012 (Photo courtesy of BlogTO).

For example, in Singapore, the Hawker Centres (Fig. 6) is a perfect example for a local market place. Originating as through the demand for cheap and convenient meals⁵, the unregulated street hawking emerged as a popular means of life in post-war Singapore. As the city developed into the densely populated global hub that it is today, the government established Hawker Centres as a purpose-built facilities meant to regulate and provide an effective means of control over quality and safety of the prepared food. Today, Singapore's Hawker Centre's represent an important cultural landmark for the city, as they are able to effectively provide affordable meals that vary in their cultural origin as much as the patrons themselves. Observing the variety of local cuisines represented by the multi-cultural immigrant heritages of Singapore provides a great example of successful integration of local street food into a modern and technologically developed city. In any of the cities 107 government operated Hawker Centres⁶, the cuisine options will frequently include Indian, Malaysian, Indonesian, Chinese, Vietnamese, and Thai cuisine, all under one roof. Furthermore, these Hawker Centres are commonly open-air steel structures, which benefits from the tropical climate of the region, and only requires minimal fan ventilation to maintain comfort⁷, helping to keep their relatively low operating costs. Transplanting this model into the Cambridge's humid-continental climate would require a looking into other precedents that deal with the disruption of winter conditions.

⁴ City of Cambridge, *Cambridge Official Plan 2012*, Pg. 6.

⁵ *History of Hawker Centres*, 2009, <http://myhawkers.sg/index.php?m=discover&c=view&id=2>.

⁶ *Hawker Centres in Singapore*, 2009, <http://myhawkers.sg/index.php?m=discover&c=view&id=1>.

⁷ K. R. Rao, J. C. Ho, "Thermal Comfort Studies in Hawker Centres in Singapore", *Building and Environment Volume 13*, (Great Britain: Pergamon Press Ltd., 1978), 161.



Fig. 6 - Maxwell Hawker Centre, Singapore, Singapore (Photo courtesy of YourSingapore).

As a precedent for market places exposed to winter conditions, we can look at food markets in Europe. In particular, the Mercado San Miguel in Madrid (Fig. 7) provides the same elements as the Hawker centres in Singapore, but introduces glass around the perimeter of the structure as a minimal barrier between the interior and exterior environment. One of the last remaining covered markets, the Mercado de San Miguel, built in 1916, was designed for the purpose of improving hygienic control as the city of Madrid experienced population expansion⁸. The iron and glass structure presented itself as a symbol of modern times during its inauguration, as it provided a permanently functioning market place, where local produce and freshly made tapas are still served to this day. The Mercado de San Miguel provides an example of the basic market stalls, enclosed yet remaining ingrained into the local urban armatures surrounding the building. Today it is one of the cities main tourist attractions, and provides an oasis for both visitors and locals alike, to enjoy the best that the Spanish cuisine can offer. The covered markets of Europe therefore provide another insight into designing markets for continental climates, while ensuring quality control and safety.



Fig. 7 - Mercado de San Miguel, Madrid, Spain (Photo courtesy of thosethateat.blogspot.com).

Yet to fully understand how a permanent pedestrian market can be introduced into the local Cambridge culture, we must look at the precedent of North American food markets. In the city of Cambridge, many market types exist, such as the temporary street markets, weekly farmer's markets, permanent franchised supermarkets, and the food courts in the local shopping mall. Of these types,

⁸ Mercado De San Miguel, 2013, <http://www.mercadodesanmiguel.es/el-mercado/>.

the mall presents itself as uniquely contradictory, because it maintains the illusion of a shared public space while it is in fact, a private business entity. This lack of public responsibility is also apparent in the lack of local businesses, which are rarely, if ever, represented. Although this illusion of a shared public space does not allow the place to fully integrated as a permanent and democratic public space in the community, the mall is still a major point of interaction between the city inhabitants. The food court assists this, as it is the largest open area within the mall that is shared exclusively by all of the visitors (Fig. 8). It creates an internalized semi-public square framed by the perimeter vendor stalls, where visitors can congregate and are able to sit down together to enjoy a meal. Taking this format to the project site in the downtown Galt core, we are able to introduce a typology for the permanent market structure resembling the food court, yet it separates from this precedent in its contribution of the open space between the market structures, which even when the markets are closed, can be used by the people of the city, freely and unreservedly, as a truly shared public space.



Fig. 8 – Mall Food Court (Photo courtesy of Jack Hodgson on flickr.com).

LIGHTWEIGHT STEEL STRUCTURES

With the program and plan requirements set, the Galt Market Place required the use of steel systems to create an efficient structure that is both easy to construct and to use. Steel as a building material offers significant advantages in this regard, due to its high material strength in both compression and tension. The introduction of a tensegrity based system, allows the structure to attain force equilibrium using both tension and compression members in unison. Furthermore, the manufacturing process of steel systems combined with the use of repeating members and assemblies, makes a steel system highly compatible with the design mandates of the market. The building needed to ultimately enclose or support the required spaces needed for kitchens, back of house, vendor counters, interior market corridors, outdoor seating area, and outdoor performances or public events. To better understand how this could be accomplished, I researched various precedents for steel and glass structures, tensegrity structures, as well as lightweight steel structures. In these precedents I was looking for a way to design an easily repeatable assembly module, using minimum materials and integrating a 'perfect wall'⁹ system in as much of the enclosed structures as possible.

⁹ John Straube, *High Performance Enclosures* (Somerville, MA: Building Science Press, 2012), Pg. 99.



Fig. 9 – Gateshead Millennium Bridge by Wilkinson Eyre Architects, London, England (Photo courtesy of Wilfred Dechau Photography).

This initially lead to looking at the work vast of Wilkinson Eyre Architects, whose vast portfolio showcases award winning designs that push the common conception of what steel is capable of. Many of their projects, such as the Millennium Bridge in London, England (Fig. 9), which utilized the principle of transformation as the driving force of the design, in the use of massive curved steel member, which was asymmetrically positioned from the outwardly curved pedestrian platform. The asymmetrically aligned suspension of the platform allowed for the structure to accommodate it function as a draw-bridge, and accomplished this through the ingenious distribution of forces along a curved platform, which is mechanically rotated, effortlessly allowing ships to pass underneath it. A more recently constructed project from the firm also presented itself as a great structural steel precedent that uses of an integrated glazing system, separated onto its own layer underneath the steel support beams This can be seen as an overarching theme for the structural design of the Singapore Gardens By The Bay greenhouse and vertical botanical garden (Fig. 10). The two buildings both use large curved steel beams, which arc from their massive foundations below grade across the entire distance covered by the enclosed gardens. The glazing layer is supported underneath the steel beams, allowing for an almost seamless connected field of the glazed units, held in equilibrium using compression along the main steel beams and tension between the glazed units and the beams * * *. The application of a tensegrity system allowed for a relatively lightweight construction for such a large building.



Fig. 10 – Gardens By The Bay by Wilkinson Eyre Architects, Singapore (Photo courtesy of Craig Sheppard Photography).

Another set of precedents for lightweight steel and tensegrity structures also presented itself through the works of Frei Otto. Of particular interest his German Pavilion for the 1965 Montreal World Expo, and his 1972 Munich Olympic Stadium (Fig. 11). These structures have been noted for their beauty and the lightweight construction, and especially the Olympic Stadium, have become recognizable symbols of the city of Munich. In the stadium's use of steel columns, compressive forces are distributed from the cables suspending an expansive tensile mesh below. The use of tensegrity in Frei Otto's design eventually influenced the use of the 6 steel columns used in the court of the Galt Market Place, which similarly support the interior of the of curved columns. The use of steel cables providing tensional support helps to ease the compressive forces on the curved columns, so that equilibrium can be achieved in the overall structural system. The inspiration of Frei Otto's use of tensional support systems for the enclosure of his structures was adapted for the year round needs of the climate in Cambridge, Ontario.



Fig. 11 – Munich Olympic Stadium by Frei Otto, Munich, Germany (Photo courtesy of www.studiomuc.de).

In creating a hybrid of the program requirements, the site, and the influence of the precedent studies, a design was created using a tensegrity structural system and a layered enclosure assembly, allowing for a clear span across the interior length market structures (Fig. 12). With the 6 steel columns in the interior of the court, a transforming element was added in the form of the rotating set of roofs.

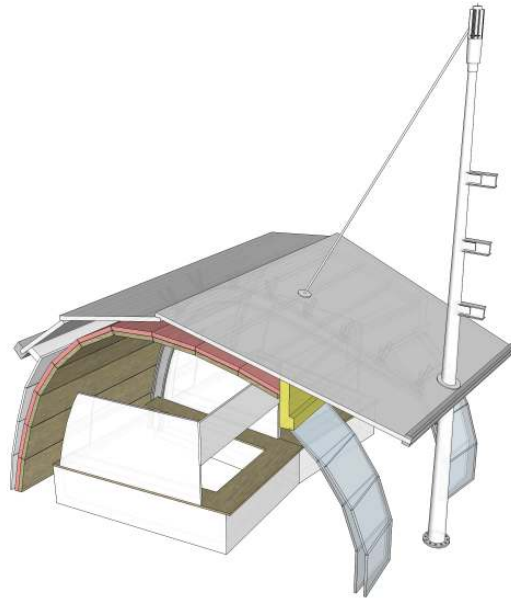


Fig. 12 – Sectional model of the structural part.

HYBRID SYSTEM

The final product in the design of the Galt Market Place was a development involving research into both the social implications of introducing a new marketplace into the city, as well as research into a structural steel designs for enclosure. In gathering the various precedents and along with an understanding of traditional market typologies, applying the hybrid system onto the local environment was the most considerable of the challenges of realizing this project.

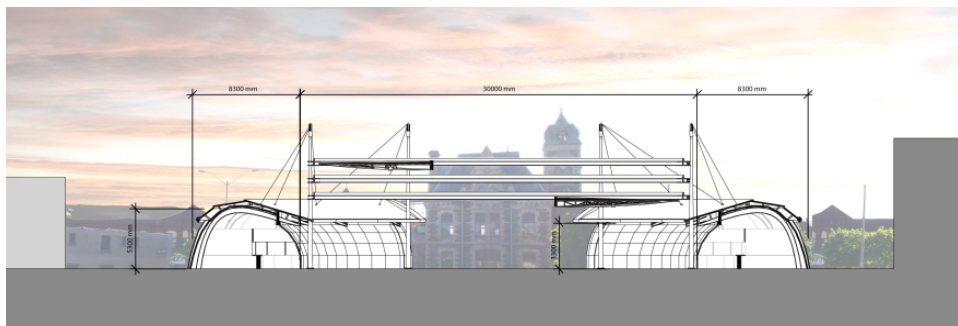


Fig. 13 – Site section showing the relationship of the Galt Market Place to the Old Galt Post Office.

Site development was the first thing to be considered. As the project was located across the Old Galt Post Office built in 1885, it was significant to orient the structures with this building as a focal point in regards to lines of site (Fig. 13). The site plan therefore was oriented to create a direct East/West access line, with the two vendor structures bracing the shared seating/performance and event space in the North and South edges of the site. In addition to the main structures and its covered courtyard, lighting structures were introduced to the site in order to encourage night time occupation. In the East end of the site, a new water pool feature with integrated interactive fountains is introduced. It is connected to the Galt Market Place by the motif of the curved steel column visible inside the vendor structures, which is also carried through the design of the lighting fixtures framing the South East edge of the site. Gradually changes in the dimensions of the light fixtures eventually become seating benches surrounding the new water feature and existing site vegetation.

The motif that extending throughout the site originates from the design of the market structures. Inside the two vendor are 10 vendors each, connected along an almost seamless countertop that is uninterrupted by columns, as the curved column on the exterior circumference of the structure are supported in tension by steel cables suspended from the tips of the steel 3 corresponding steel columns in the interior courtyard. The curved column visible inside the vendor structures is the basis of the site motif, the beautiful curved steel, and is exposed to market visitors from the interior of the building. The assistance from the steel cable and columns on the interior of the courtyard also means that the interior glazing layer can be created also as a seamless façade of glazed curtainwall.

The glazing therefore became a key aspect of the interior experience of the market buildings, but more importantly, it was a critical element to open up and connect the two market buildings together during the favourable weather from the late spring up until the early fall. The overarching design of the Galt Market Place aimed to create a defines exterior edge that is accessible by the public through the East/West openings through the courtyard, and it also aimed to create a reasonably transparent interior edge in the courtyard itself, so that the interiors of the vendor shops are always visible by people inside the new public space. The ability to open the glazed interior of the North and South market buildings increases the functionality of the market place.

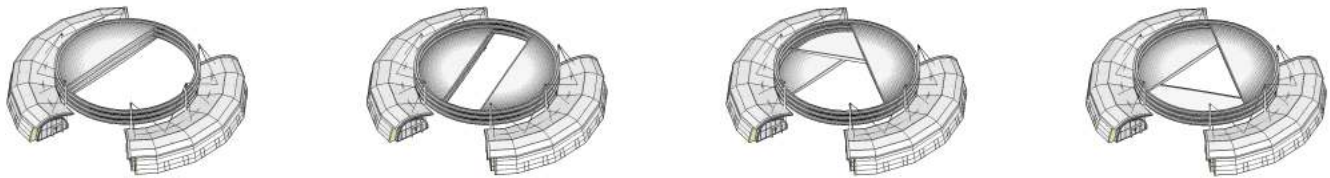


Fig. 14 – Diagram of the various roof configurations.

Given that the central moment of the design is in fact the space between the vendor structures, as it is a new public space, it was therefore important to allow for programmatic flexibility in the courtyard of the Galt Market Place. The central gathering space can be experienced as open, with seating and tables for the market visitors, as a public performance space, and as space for any event that can be considered public. To help facilitate this vague mandate for the courtyard's function, a roof system was devised that used three 1/3 circle shaped roof assemblies. These assemblies were made using conventional deck type steel trusses, with covered corrugated metal sheathing as the primary control layer¹⁰. The assembly includes integrated lighting and also rotates, allowing for a variety of configurations that can suit various performance, events, or gatherings that may occur in the market place (Fig. 14).

Regarding the enclosure of the vendor buildings, an approach similar to Wilkinson Eyre Architect's Gardens By The Bay structures, the curved steel columns hierarchically support the finish control, and support layers of the building (Fig. 15). The typical wall section of the vendor building shows the steel column (support layer) as curving below the control layers of the air/water barrier membrane and insulation, and finally, the flat seam metal panels making the exterior façade of the structures. By keeping these layers above the support members, the steel can remain architecturally exposed, as well as it minimizes the amount of connected protruding through the insulation in order to connect the steel to the tensile cable supporting it on the interior side of the building. This also benefits the glazing on the interior, which only represents approximately 40% of the enclosure surface area. The interior glazing is connected almost seamlessly, and when opened, can take advantage of the natural ventilation during the summer months.

¹⁰ John Straube, *High Performance Enclosures* (Somerville, MA: Building Science Press, 2012), Pg. 6.

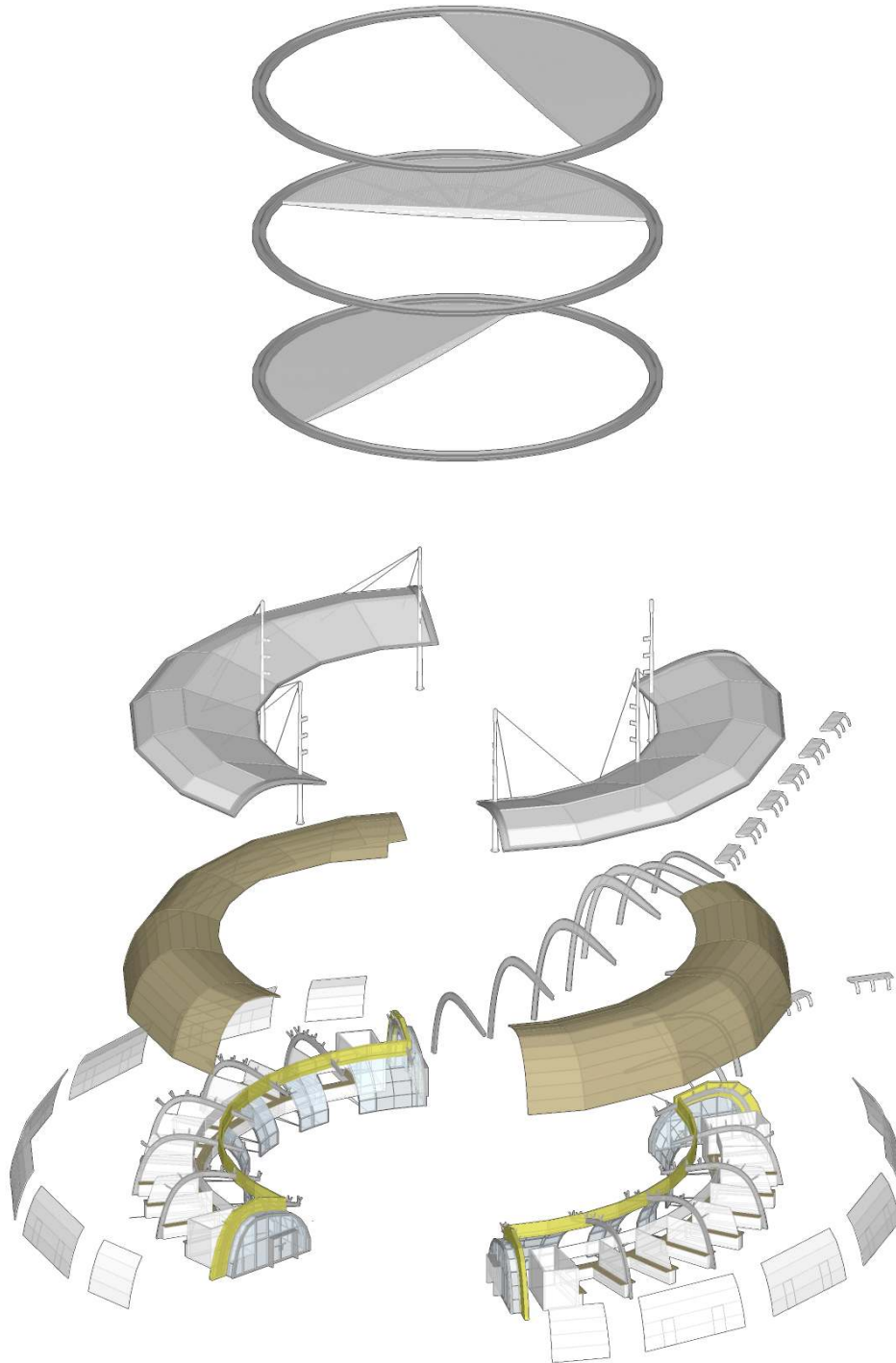


Fig. 15 – Exploded axonometric diagram of the Galt Market Place and its integral structural components.

CONCLUSION

In conclusion, the Galt Market Place was designed as a self-directed project that aimed to introduce a new public space for the city, to explore and enjoy in the exchanges of a new proposed market. The need for local pedestrian integration within the cores of expanding cities is paramount for the economic survival of its historic downtown heritage areas and the businesses that depend on them. By using the steel and its beneficial properties, a tensegrity-based structure was designed to meet the needs and requirements of a local vendor market in Cambridge, Ontario. Precedents in lightweight steel construction furthered the design intervention to eventually present a new public event space supported by two vendor structures selling local food, drinks, and crafts to the culture hungry people of Galt.

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