A Case Study of the Virtual Design Studio in Practice : The Olympic Stadium for Krakow 2006

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Continually being redeveloped since its inception six years ago, Virtual Design Studio (VDS) represents a new method of practicing and teaching design. This paper focuses on a recent project which used VDS in a professional context: a design competition entry for the 2006 Winter Olympic Games. Separated by six time zones, the authors offer distinctive views of VDS, discussing the creative aspects of long-distance design collaboration using both synchronous and asynchronous modes of communication. The authors consider Information Technology (IT) as a facilitator for design collaboration, and examine in this paper the extent to which this new condition expands the possibilities of creative design work.

VDS and Contemporary Design Practice

Parallel to the tremendous growth of the Internet in recent years is the growing acceptance of computerization in architectural practice. The next logical step would thus be the establishment of long-distance design collaboration networks which become inherent in contemporary practice.

This method of architectural design is based upon experimental work which began in the 1990s, primarily in an academic context. It was called the Virtual Design Studio to signify the physical absence of a studio, and the method demonstrated that creative design collaboration was possible over wide area networks. Early projects documented the feasibility of working between diverse geographical locations and time zones, and developed particular methods of working in such a context. Communication between collaborators was both synchronous (through speakerphones, desktop video, and Picturetel as well as asynchronous (through e-mail, web pages, and threaded discussions). The Virtual Design Studio is coined as the new paradigm for Computer-Aided Design, as CAD has been fundamentally refined by VDS from being a purely technical process to being also a social endeavor.

Distance design instruction over the network environment was initially attempted in 1992, when UBC students in Vancouver collaborated with Harvard students in Cambridge to design a tilt-up concrete building. Design ideas were exchanged and developed through the Internet, via FTP (file transfer protocol) and e-mail. Speakerphones

were used for the final jury, and the images were displayed sequentially on a mirrored server. In January 1993, Virtual Village Studio organized a three-week long project between MIT, Hong Kong University (HKU), UBC, and Washington University (WU). Despite the bandwidth limitation, the project was able to connect students to design collaboratively, demonstrating the enormous potential in asynchronous and synchronous internet communication (Figure 1). In 1995, VDS took advantage of and was further enriched by the WWW environment, VRML (Virtual Reality Markup Language), and JAVA scripts. A year later, the University of Oregon and UBC were able to quickly create prototypes using a laser cutter and later, in conjunction with HKU, explored the transitions between real and virtual space. In the fall of 1997, and several design studios later, a collaborative project by Park Xerox and an MIT studio led by Bill Mitchell benefited from almost unlimited bandwidth and videoconferencing in their attempt to integrate information technologies with physical space to produce a new urbanism. Another recent VDS project organized at ETH (the Swiss Federal Institute of Technology) in Zurich and HKU, involved the application of an innovative collaborative software designed to optimize design collaboration between different time zones. As can been seen, the state of Virtual Design Studio is the result of ongoing experimentation, but despite its ever-changing nature it is, as will be discussed in the case study, indispensable in terms of distance collaborative design work in contemporary practice.

Outside of academia, IT is used more and more by designers who engage in long-distance architectural practice. For example, during his 1997 trip to Japan, one of the authors maintained contact with the home studio through e-mail, and thus continued his contribution to the development of the conceptual design project for the Aalto Centenary Competition (see Figure 2). This method of communication is increasingly becoming more commonplace. The Hong Kong office of Foster Associates, a firm renown for high-tech design, realized one of this decade's largest projects—the new Hong Kong Airport (see Figure 3)—which was, predictably, also a product of long-distance collaboration. The design development of the HK Passenger Terminal is done in close collaboration between the branch in Hong Kong and the home branch in England. When the Hong Kong office sleeps, the London office picks up the work, and vice versa. Foster Associates use Bentley MicroStation in this phase of the project, and, due to the regular updates of the project database and the rigorous use of naming conventions, are able to greatly increase their efficiency in design development.

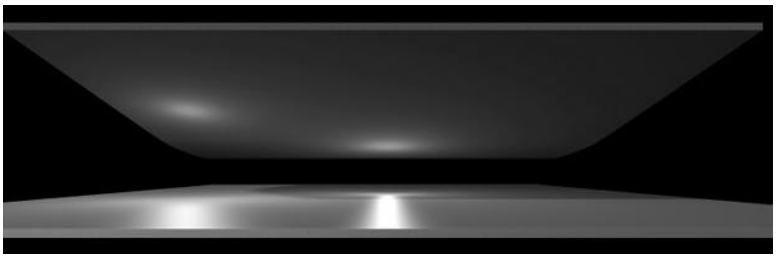

Figure 2: Email attachment from Aalto Centenary Competition, 1977

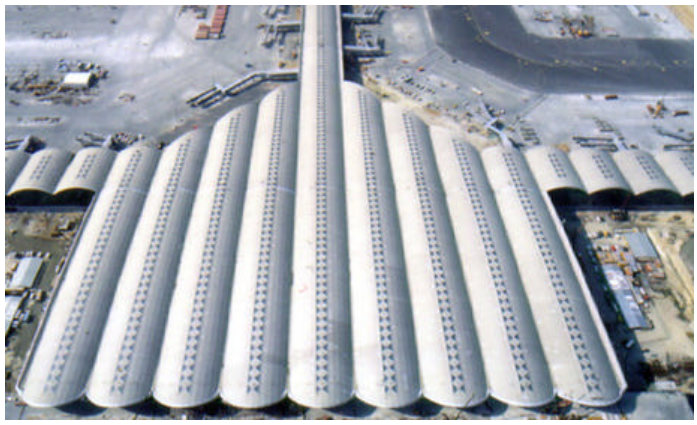

Figure 3: The new Hong Kong Airport, Foster Associates.

Top: Computer-generated image of airport.

Bottom: Arial photograph of Passenger Terminal project to open in 1998.

Case Study

The design entered by the authors for an architectural competition is the most recent implementation of VDS. The competition organizers were SARP (The Polish Architects Association) and the City of Krakow, which, together with the mountain resort city Zakopane, attempted to secure the 2006 Winter Olympic Games for Poland. The design competition was for the Olympic Games facility, to consist of an Olympic Village for 1000 athletes, an Information Centre, an enclosed Hockey Arena for 15 000 spectators, and parking for 3500 vehicles.

The new Olympic facilities would integrate with the existing AWF (Physical Education Academy) campus, which already consisted of numerous athletic and academic facilities, as well as student dormitories. The 35 ha site is mostly flat, except for an east-west embankment. The development of Olympic Hockey Arena, the most important aspect of the projects is use here to illustrate the case of distance design collaboration.

Because the principle members of the competition team, which included the authors, were separated by thousands of kilometers, distance design collaboration was the only way in which work on the project could be possible. The intent was to develop the design under these seemingly adverse conditions and compete as equally as the other teams who did not have to face this challenge. It was seen by the authors as a “test by fire” of the VDS method, as the projects were to be judged on merit alone. Thus, even though the method of design development was not disclosed when the authors’ competition entry was submitted, their entry was among the awarded finalists.

The VDS form of collaboration was implemented from the very beginning. The collaborators in Krakow and Vancouver secured high-speed access to the Internet, enabling efficient communications via e-mail, WWW, FTP, and desktop video-conferencing. Apart from the principal participants, VDS utilized several consultants, particularly Robobat in Krakow, who acted as the structural advisor. As illustrated in Figure 4, more traditional modes of communication (i.e., telephone, fax, face-to-face) were also used in the studios to communicate with others at the local level. The initial phase consisted of e-mail exchanges and attaching scanned material related to the site and to precedent studies. The WWW was used to locate precedent studies such as the Nagano Arena (Figure 5), which in particular could be closely examined as it was published in VRML format. Numerous other web resources were used extensively in later phases of the project.

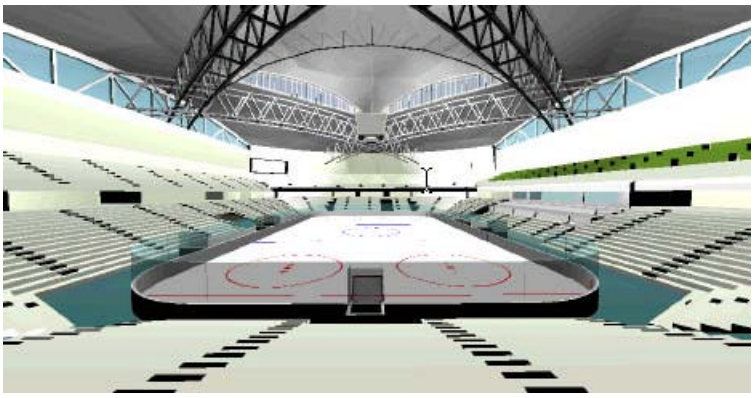

Figure 4: Schematic organization of the studio(s)

Figure 5: Precedent study of Nagano Arena -- as published in VRML format on Olympic web site.

The computational resources used in the project were diverse and no attempt was made to create an environment where the same software and hardware would be used (Figures 6 and 7). There were occasional problems in translating certain data, before the procedures for exchanging data were established, but these problems were considered to be secondary issues of technical efficiency: the focus remained on design resolution. Using IT within the limits of the existing resources enabled designers to continue working in applications they were already familiar with, and concentrate on the content. Furthermore, the IT skills of members were also at different levels. Many had never worked in such a way before, but managed in time to effectively use IT and work with members who, by the time of writing this paper, have only existed for them in the virtual realm.

SOFTWARE	KRAKOW	VANCOUVER
CAD	ARC+	MiniCad, AutoCad
MODELING, RENDERING	ARC+, 3D Studio	FormZ, AutoCad, 3D Studio, Wavfront
TRANSLATION FORMAT	DXF, DWG	DXF, DWG
COMMUNICATION	Netscape v4, Eudora, FTP, CuSeeMe	Netscape v4, Collabria, Pine, FTP, CUSeeMe
IMAGE PROCESSING	PhotoShop, CorelDraw 5	PhotoShop
OPERATING SYSTEM	DOS, win95	Mac OS 8, Win NT, UNIX

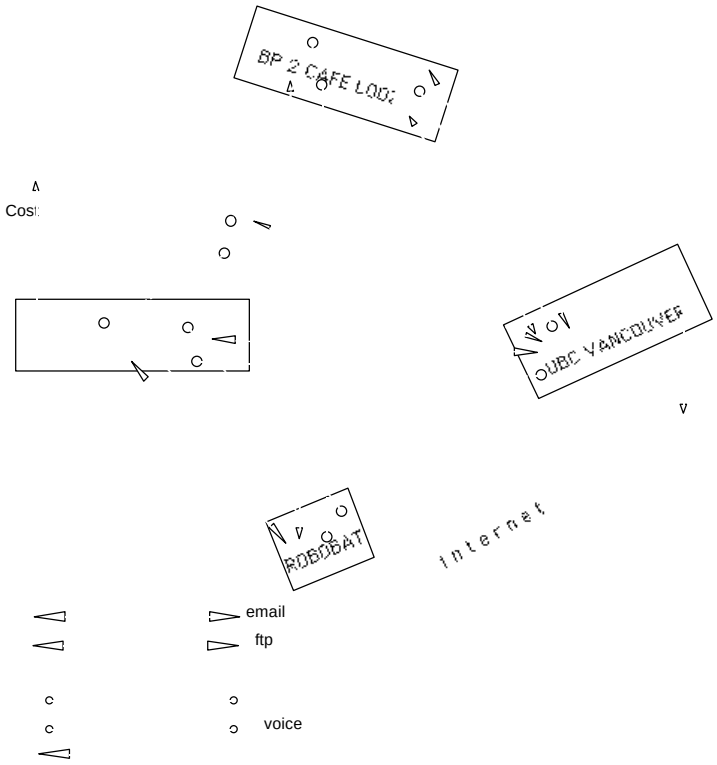

Figure 6: Diverse software used during the competition project

HARDWARE	KRAKOW	VANCOUVER
COMPUTING PLATFORMS	PC Wintel, Multimedia	Power MAC, Win NT, SGI
PRINTERS	Laser, InkJet, Ink Plotter	Ink Jet, Laser
SCANERS	Flatbed	Flatbed
TELEFONES	Digital, Analogue, Mobile	Analogue
MICROPHONES	Misc.	Apple, SGI
CAMERAS	Digital Color	Digital BW

Figure 7: Hardware and equipment varied between sites.

The development of the project had several phases. Initially, the competition program was scanned and distributed via e-mail among team members. This was followed by an animated discussion and the question of whether or not to enter into the competition. After the decision was made to enter, the Krakow team created an account on the Café Internet Looz server to ensure quick access to the internet. The digital site record and photographs were then distributed, and this was followed by a discussion on the conceptual design. This then culminated in the exchange of several possibilities in sketch form and a discussion on the materiality and structural principals, which led to formulating the geometry of enclosure. At this stage, the further examination of precedent projects then led to the confirmation and agreement of the idea. The project concept was sent in VRML format to and from Krakow and Vancouver several times, allowing all members to fine-tune the idea and develop a sense of consensual agreement. This assertive and engaging process of information exchange is illustrated in Figures 8-12.

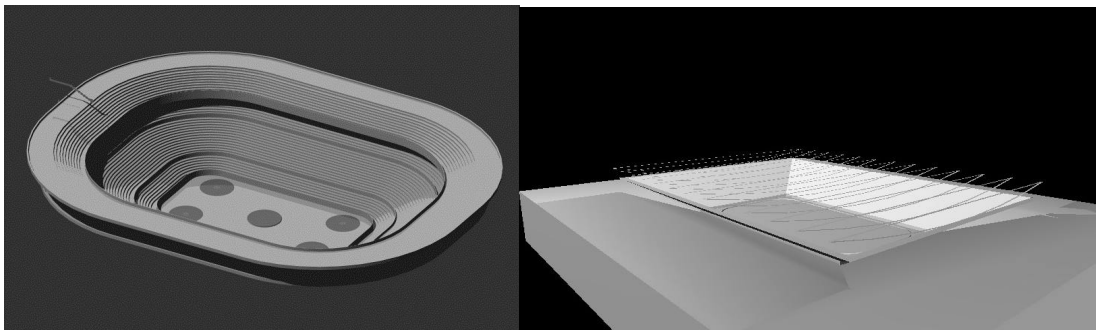

Figure 8. Rejected (right) and accepted (left) siting of the arena.

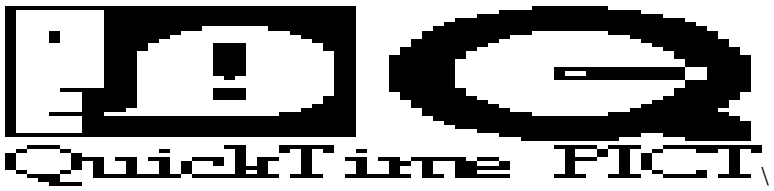

Figure 9a Exchanges of ideas for the area roof. Scanned sketch was seminal in resolving structure later.

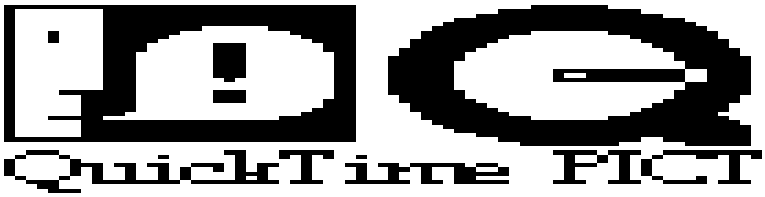

Figure 9b Exchange of ideas for the roof perforation. Only one idea survives. Can you guess which one?

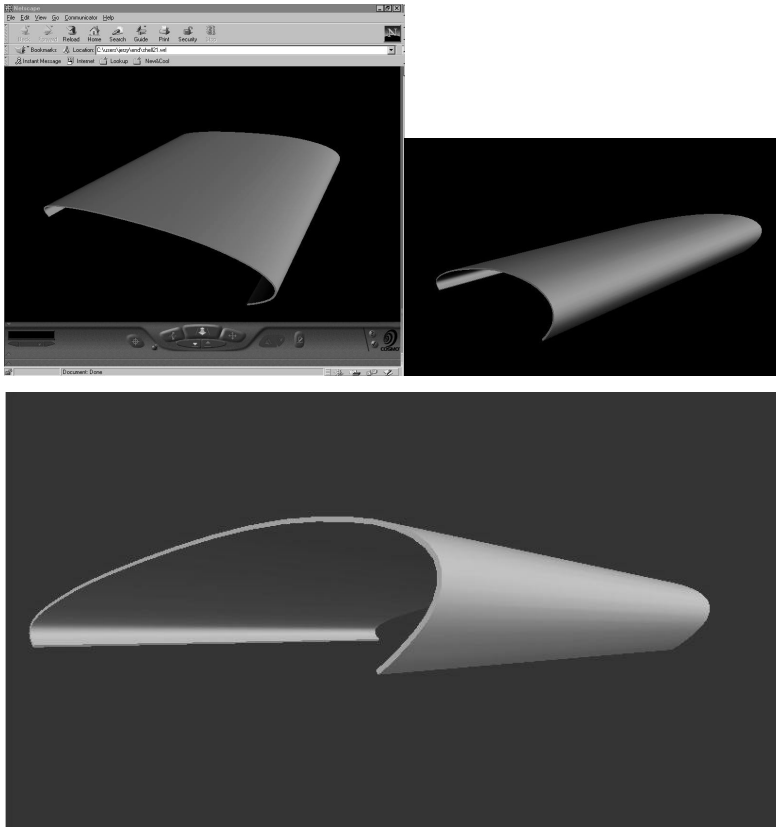

Figure 10 VRML exchanges of the roof surface

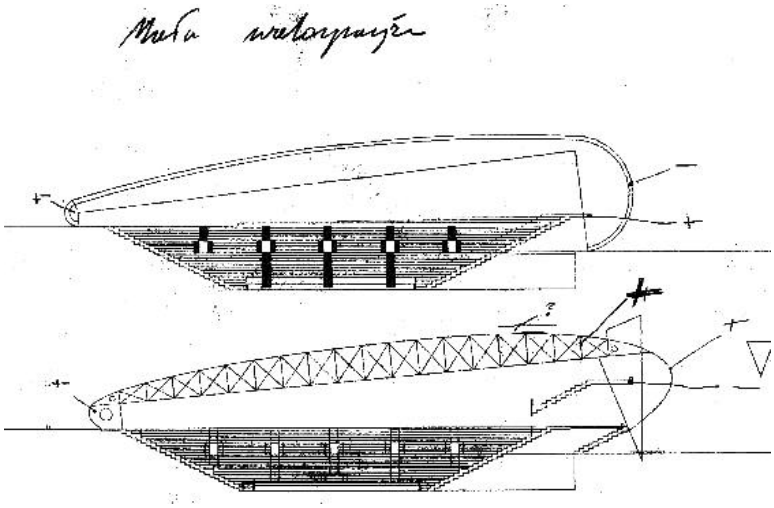

Figure 11a. Errata and comparison of two alternative cross section. Krakow (top) , Vancouver (bottom)

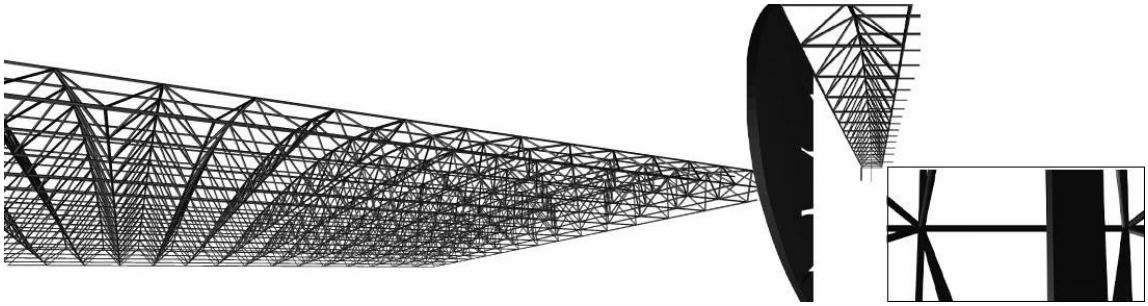

Figure 11b. Exploration of the structural system

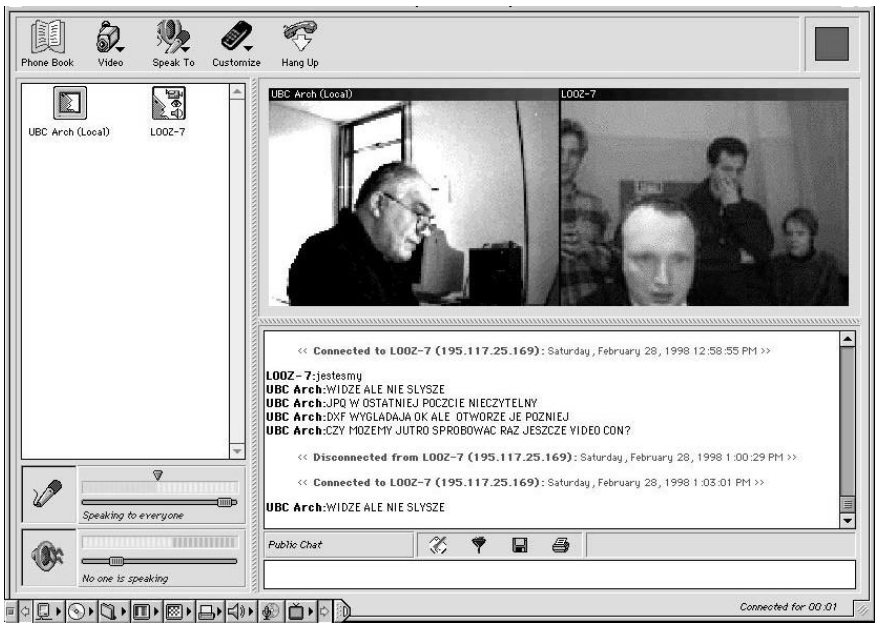

Figure 12. Screen capture during video conference. The text (in Polish) explains the situation: "I can see, but can not hear you. JPG in the last mail is not readable….etc.

Conclusions

It was mostly under asynchronous circumstances that the design concept was formulated for the Krakow Olympic Arena. It was not until the design development stage that, during the real-time video-conferencing sessions, the team was able to solve certain issues and problems with more precision. These session, however, were still limited in facilitating design problem solving, but were beneficial in uniting distant members and developing a sense of togetherness.

The few concluding images from the final, winning submission (Figures 13-15) attest to how the VDS method was implemented with successful results, under the uncompromising conditions of professional competition. The authors see IT as a facilitator for design collaboration. They believe that IT and VDS expand the possibilities of creative design work if computers, in "computer-aided design," are regarded not as tools in the technical sense but as the means to further engage with other designers in the creative aspects of design development.

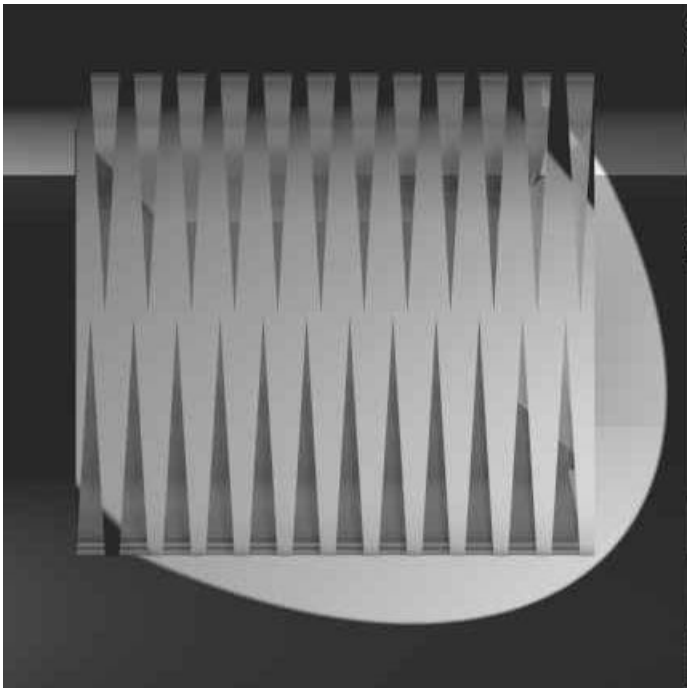

Figure 13 Roof Plan. Olympic Hockey Arena.

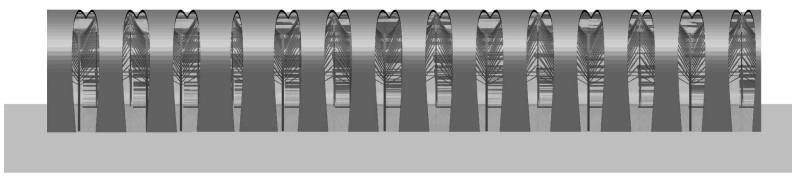

Figure 14 Font Elevation . Olympic Hokey Arena.

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