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THE POST-OLYMPIC DILEMMA: A SYSTEMS APPROACH TO ARCHITECTURE

by

Jorge S. Silva

Bachelor of Technology (Architectural Science), British Columbia Institute of Technology, 2006

A design thesis|project

presented to Ryerson University

in partial fulfillment of the

requirements for the degree of

Master of Architecture

Toronto, Ontario, Canada, 2009

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Author's Declaration

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THE POST OLYMPIC DILEMMA: A SYSTEMS APPROACH TO ARCHITECTURE

Master of Architecture 2009

Jorge Sogalho Silva

Master of Architecture

Ryerson University

Abstract

The practice of Architecture is in need of a new methodology towards Olympic sport infrastructure. The Olympic Games have shown that constructing Olympic buildings with traditional methods is unsustainable. Post-Olympic use is generally unplanned causing financial burdens for those cities maintaining the large buildings. This thesis|project makes reference to work of R. Buckminster Fuller, Cedric Price, and Archigram in developing a systematic approach to Olympic Architecture. The core concepts of systems theory and cybernetics are investigated and a relationship is made with architecture. This culminates in the design of a process that looks to successfully locate an Olympic gymnasium in a Toronto community. It tackles the question of how to build Olympic stadia with lower embodied energy and qualities of stewardship, adaptability, flexibility and modality while maintaining multi-functionality.

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Furthermore, I must express my love, admiration, and respect for my parents Antonio & Maria Manuela Silva, my brother Carlos and two sisters Jeannie and Vanessa who showed much support in every stage of my education. A special thanks to my brother in-law Michael Martins for his help throughout my education and my lifelong friend Sandeep Sangha who always encouraged my abilities within my educational pursuits.

Dedication

This thesis is dedicated to my father Mr. Antonio Tome Costa Silva born on February 29, 1940 in Atouguia da Baleia, Portugal. My Father has been an incredible inspiration and motivation reminding me that everyone has the ability to achieve great things so long as they are prepared to take a chance in their life and are willing to spend the time and effort on them.

Table of Contents

Author's Declaration	iii
Abstract	v
Acknowledgements	vii
Dedication	ix
Table of Contents	xi
List of Tables	xv
List of Figures	xv
List of Appendices	xvii
 1 Introduction	 1
 2 Historical Background	 3
2.1 . Ancient Relevance	3
2.1.1 . Ancient Greece	3
2.1.2 Olympia and Ancient Greek Architecture	3
2.1.3 Olympic Stadia	3
2.1.4 Greek Architecture in Relation to Man	4
2.1.5 Ancient Roman Architecture	4
2.1.6 The Renaissance	6
2.2 Modern Olympic Games	7
2.2.1 Modern Olympics – The Beginnings	7
2.2.2 The Olympic Movement	7
2.2.3 Development of Changing Program	7
2.2.4 Traditional vs. Recent and Future Games	8
2.3 Introduction to Cybernetics	9
2.3.1 Cybernetics and Systems Theory Defined	9
2.3.2 Where Cybernetics Began	10
2.3.3 R. Buckminster Fuller/ Cedric Price/ Archigram	10
2.3.4 Japanese Modular Experience	12
 3 Theoretical Discourse	 15
3.1 A New Methodology Must be Developed for Olympic Architecture	15
3.1.1 Introduction	15
3.1.2 Applying Cybernetics to Architecture	15
3.1.3 Architectural Cybernetic Precedence	19
3.1.3.1 R. Buckminster Fuller	19
3.1.3.2 Cedric Price	23
3.1.3.3 Archigram	28
3.1.3.4 Resulting Cybernetic Concepts	33
3.1.4 The Human Body, Olympic Sports, and Systems in Architecture	34
3.1.5 Integrated Design Process (IDP)	38
3.1.6 Olympic Conditions in Canada	40
3.1.7 Olympic examples of Stewardship	42

4 Research Summaries	43
4.1 Theoretical Hypotheses	43
4.1.1 The Role of Sports Cybernetics	43
4.1.2 An Architectural Systems Approach	45
4.2 Case Studies	47
4.2.1 Vancouver 2010 Olympic Games, Richmond Olympic Oval	47
4.2.2 Toronto Ontario, Rogers Centre (Skydome)	53
5 Design Project	59
5.1 Design Process	59
5.1.1 Principles and Precedence	59
5.1.2 Moving Forward	61
5.1.3 Design Methodology – A Three Level Sports Cybernetics System	62
5.1.3.1 High Order System	62
5.1.3.2 Middle Order System	65
5.1.3.3 Low Order System	69
5.2 Design	75
5.2.1 Design Drawings	75
6 Thesis Project Conclusion	109
Appendices	111
References List	188

List of Figures

Figure 2-1. Leonardo da Vinci's Vitruvian Man redrawn and inscribed in a circle and square considered the fundamental geometric patterns of the cosmic order (skinner, 2006). From Da Vinci, L. (c. 1487). Vitruvian Man. Retrieved March 1, 2009 from edupics.com	5
Figure 2-2. Golden Section Derived from Fibonacci Sequence. From Philosophy and Practice: Sacred Geometry by R. Lawlor, 1982, London: Thames and Hudson.	6
Figure 2-3. Fibonacci Sequence Applied to the Arm. From Philosophy and Practice: Sacred Geometry by R. Lawlor, 1982, London: Thames and Hudson.....	6
Figure 2-4. London 2012 Olympic Stadium. From HOK Sport. Retrieved April 1, 2009 from archifield.net	8
Figure 2-5. Tatami Mats Modular example by Arthur Drexler. From The Architecture of Japan (p. 67), by A. Drexler, 1955, New York: The Museum of Modern Art.	13
Figure 3-1. Dee and Charles Wyly Theatre, USA, 2004. From Office for Metropolitan Architecture. Retrieved April 1, 2009, oma.nl	17
Figure 3-2. Systems Organizational Principles. From Architecture, Engineering and Construction of Built Environment (p. 91) by G.E. Lasker and Y.T. Long, 2005, Canada, International Institute for Advanced Studies in Research and Cybernetics (IIAS).....	18
Figure 3-3. 4D Dymaxion House by Fuller, R. Buckminster. In R. Marks, 1960, The Dymaxion World of Buckminster Fuller . New York: Reinhold Publishing.	19
Figure 3-4. Dymaxion Deployment Unit (DDU). From Bucky Works: Buckminster Fuller's Ideas for Today (p. 36) In J. Baldwin, 1996, Canada: John Wiley & Sons.	22
Figure 3-5. Fun Palace, flexible floor plan. From From agit-prop to free space: The architecture of Cedric Price , by S. Mathews, 2007, London: Black Dog Pub. Ltd.	24
Figure 3-6. Fun palace. From From agit-prop to free space: The architecture of Cedric Price (p. 68), by S. Mathews, 2007, London: Black Dog Pub. Ltd.	25
Figure 3-7. Potteries Thinkbelt, Abandoned Rail Network. From From agit-prop to free space: The architecture of Cedric Price , by S. Mathews, 2007, London: Black Dog Pub. Ltd.....	27
Figure 3-8. Giant overhead crane (example). From From agit-prop to free space: The architecture of Cedric Price , by S. Mathews, 2007, London: Black Dog Pub. Ltd.....	28
Figure 3-9. Centre Pompidou by Richard Rogers and Renzo Piano. From S. Glynn, 2001. Retrieved October 1, 2008, from galinsky.com.....	30
Figure 3-10. Nottingham Shopping Viaduct by Peter Cook. Retrieved December 15, 2008, from fabiofeminofantascience.org.....	30
Figure 3-11. Growth and Change Cycle of Plug-in University Node 1965 by Peter Cook. Note. From Archigram (p. 42 - 43), by P. Cook, Archigram (Group) (Eds.), 1999, New York: Princeton Architectural Press.	31
Figure 3-12. The Capsule, Tower & dwelling. From Archigram (p. 45), by P. Cook, Archigram (Group) (Eds.), 1999, New York: Princeton Architectural Press.	32
Figure 3-13. Gasket Homes. From Archigram (p. 47), by P. Cook, Archigram (Group) (Eds.), 1999, New York: Princeton Architectural Press.	33
Figure 3-14. PERI stairs and grandstands. From Successful construction with PERI: Handbook 2005 Scaffolding (p. 111) by PERI, 2005 [Brochure].	36
Figure 3-15. Auditorium by Santiago Calatrava. From Successful construction with PERI: Handbook 2005 Scaffolding (p. 77) by PERI, 2005 [Brochure].	36

Figure 3-16. Snowboard Ramp. From Successful construction with PERI: Handbook 2005 Scaffolding (p. 77) by PERI, 2005 [Brochure].....	37
Figure 3-17. Church of Notre Dame. From Successful construction with PERI: Handbook 2005 Scaffolding (p. 35) by PERI, 2005 [Brochure].....	37
Figure 3-18. Triad of Limitations. From Design for the real world: Human ecology and social change (Ed. 2) (p. 73) from V. Papenek, 1997, London: Thames and Hudson.....	38
Figure 4-1. The common thread of Sports Cybernetics.....	43
Figure 4-2. This proposed methodology with sports cybernetics outlines the entire system showing need for establishing design requirements and creating a program to then begin the Sports Cybernetics three level system. This culminates in a cyclical system containing a learning feed-back loop.	46
Figure 4-3. Richmond Olympic Oval - December 2008. Photo by author	47
Figure 4-4. Triangular Gluelam at Wall. Photo by author	48
Figure 4-5. Richmond Oval - Gluelam Beam Roof Structure. Photo by author	49
Figure 4-6. Wood-wave panels. Photo by author	49
Figure 4-7. Richmond Olympic Oval, Street Level	50
Figure 4-8. Richmond Olympic Oval, Activity Level.....	51
Figure 4-9. Richmond Olympic Oval, Mezzanine Level.....	51
Figure 4-10 Flexible Bleacher System. Photo by author	52
Figure 4-11 Collapsible Basketball Hoops. Photo by author	52
Figure 4-12: Rogers Centre South Waterfront. From flickr.com	53
Figure 4-13: Rogers Centre, Toronto ON. Canada. Base image from Google Earth	54
Figure 4-14 - Rogers Centre seating configurations for multiple events throughout the year. From Rogers Centre, 2008. Retrieved November 13, 2008, from rogerscentre.com	56
Figure 4-15 - Rogers Centre seating configurations for multiple events throughout the year. From Rogers Centre, 2008. Retrieved November 13, 2008, from rogerscentre.com	57
Figure 5-1. Telstra stadium in 2000, Austrailia. Retrieved June 16, 2009, from gamesbids.com	59
Figure 5-2. Telstra stadium in 2004, Austrailia. Retrieved June 16, 2009, from gamesbids.com	59
Figure 5-3. London 2012 Olympic Stadium, England. From HOK Sport. Retrieved April 1, 2009, from archifield.net.....	60
Figure 5-4. Vancouver 2010 Olympic Oval. Photo by author	60
Figure 5-5. Three level Sports Cybernetics system	62
Figure 5-6. Relationship between the Lower Don Lands and adjacent sports venue, Toronto 2007 aerial photo. From author. Base image retrieved June, 15, 2009, from google earth.	63
Figure 5-7. MVVA Lower Donlands proposal, Toronto 2007. From MVVA. Retrieved Aug, 20, 2009, from bricoleurbanism.org.....	64
Figure 5-8. MVVA Lower Donlands proposal, Toronto 2007. From MVVA. Reproduced by author.	65
Figure 5-9. High level Olympic systems approach.	66
Figure 5-10. Site boundaries, access roads, and predetermined parcels of land	67
Figure 5-11. Permanent legacy infrastructure located on recreational site	67
Figure 5-12. Temporary program located closes roadway	67
Figure 5-13. Organization of programmatic requirements, spatial relationships	68
Figure 5-14. Re-establishment of the roadway and community infrastructure	68
Figure 5-15. Four classifications in an Olympic/post-Olympic systems approach includes Removal of temporary elements necessary during the Games (ex. structure, seating, broadcast media booths, and concession stands). Conversion pertains to elements designed for	

future alteration. Addition concerns any added elements to the post-Olympic building. Left As Is are the elements retained as unchanged legacy items (ex. mechanical/electrical systems, administration offices among other program).....	69
Figure 5-16. Systems approach to architectural components, permits the use of temporary elements to enable reacquiring of floor space after the Olympics.....	70
Figure 5-17. Section of retractable seating modules, these may be removed to require floorspace, and either retained or moved off site	71
Figure 5-18. Concession module section, facing side swings inward to allow for business. Wheels swivel for easy maneuvering.	72
Figure 5-19. Concession module plan, designed based on a half of a shipping container	72
Figure 5-20. Broadcast Booth module section, the rear pulls out to create a pathway around the perimeter.....	73
Figure 5-21. Broadcast Booth module plan, front swings open permitting the broadcasters viewing area. Design is based on a 20 foot long shipping container.	73
Figure 5-22. The Don Lands Olympic Gymnasium in context with the proposed MVVA future Lower Don Lands proposal.	77
Figure 5-23. The blue tone represents the areas dedicated to players and officials throughout the 6 floor levels during the Olympic Games.....	78
Figure 5-24. The green tone represents the areas dedicated to Media Personnel throughout the 6 floor levels during the Olympic Games.....	79
Figure 5-25. The purple tone represents the areas dedicated to Federation Officials throughout the 6 floor levels during the Olympic Games.....	80
Figure 5-26. The beige tone represents the areas dedicated to Spectators throughout the 6 floor levels during the Olympic Games.....	81
Figure 5-27. The light green tone represents the areas dedicated to administration, although the administration will have access to the entire building throughout the 6 floor levels during the Olympic Games.	82
Figure 5-28. Ground Floor Olympic Option	84
Figure 5-29. 2nd Floor Olympic Option	85
Figure 5-30. 3rd Floor Olympic Option	86
Figure 5-31. 4th Floor Olympic Option	87
Figure 5-32. 5th Floor Olympic Option	88
Figure 5-33. 6th Floor Olympic Option	89
Figure 5-34. North-South Section Olympic Option	90
Figure 5-35. West-East Section Olympic Option	91
Figure 5-36. West-East Section Legacy Option	92
Figure 5-37. Site Plan - Legacy Option 1 - Re-naturalizing and re-establishing dividing road with connection from building to water retention ponds and water's edge.	93
Figure 5-38. Site Plan - Legacy Option 2 - The community school insertion and new connection to open-air covered gymnasium	94
Figure 5-39. Ground Floor Legacy Option.....	95
Figure 5-40. 2nd Floor Legacy Option.....	96
Figure 5-41. 3rd Floor Legacy Option.....	97
Figure 5-42. 4th Floor Legacy Option.....	98

Figure 5-43. 5th Floor Legacy Option..... 99

Figure 5-44. 6th Floor Legacy Option..... 100

Figure 5-45. Commissioner St. Olympic Option 102

Figure 5-46. Commissioner St. Legacy Option..... 103

Figure 5-47. Interior Olympic Event View 104

Figure 5-48. Interior Community Legacy View 105

Figure 5-49. South West Olympic View 106

Figure 5-50. South West Legacy View 107

Figure 5-51. Northeast Canoe View Olympic & Legacy Option..... 108

List of Appendices

Appendix A: Diagram - Olympic Sports Categories	111
Appendix B: Matrix - 2008 Beijing Summer Olympics	113
Appendix C: Program Analysis- High Order System	115
Appendix D: Diagram - Olympic Sports Surfaces Analysis	183
Appendix E: Table - Olympic Scheduling Analysis	185
Appendix F: Table - Future Lower Don Lands Demographic Needs	187

1 Introduction

World attention is drawn to one major city every four years to celebrate the Summer Olympic Games. The Olympics are the largest, and most celebrated multi-sporting event in the world. In the past three decades, the cities hosting the event have been confronted with controversy surrounding the Olympics' infrastructure. Host cities have traditionally erected new or completely rebuilt sports venues to satisfy the two week event, which are seldom used to their full potential following the Olympics. This controversy leads to the question of how to build Olympic stadia with lowered embodied energy and qualities of stewardship, adaptability, flexibility, and modality in addition to multi-functionality in architecture. This question is best addressed in the drawings of Archigram and the design of such projects as the Plug in City and Blow Out Village (Archigram, 1999). These drawings showed systems that exhibit most of the above mentioned qualities. In reference to Archigram's method of design, Arata Isozaki states "the work done has been totally divorced from the patterned logic architecture has created within itself. (Archigram, 1999, p.11)". This form of design takes a systematic logic and promotes the need to shift away from the 'patterned logic' of conventional architecture. A systematic logic is one that breaks down a thought process into a flexible system able to transform with every new problem encountered.

In the desire to create efficient and sustainable architecture, an avenue least explored is systems theory, it studies the natural aspects of complex systems first discovered in biology (Van Gigh, 1974). Another type of study that comes from systems theory is that of cybernetics. Cybernetics is the study of feedback, communication and control systems in living organisms and mechanical-electrical systems. Cybernetics studies how these systems process and react to new information (Ashby, 1963). The studies of both systems theory and cybernetics have the potential to be developed into systems by architects to increase efficiency in design and construction. Describing such systems for architecture would involve a logic containing natural qualities able to deal with an array of issues pertaining to a complete architectural process.

The basis of systems theory and cybernetics parallel the rationale of the development of the Olympics as well as architecture. The similarity that exists is that of testing limitations. Both systems theory and cybernetics studied the human body for further understanding of its limits, where the Olympics provide the stage to push the boundaries of the body. Architecture, in turn

uses the knowledge acquired to test the limitations of design. The Olympics, invented in Ancient Greece, resulted in the development of structures as the amphitheatre and Roman Coliseum. The architecture developed for these games formulated the rules and guidelines for the building and construction of the required venues. It is recognized that these ancient structures were influenced by the human body and developed on human limitations and proportions. As a result of using the human body's natural limitations (i.e. arm span, lifting capability) and its proportions, no dramatic transformations in stadia designs have been shown in history as the human body has not changed dramatically over time.

In an effort devoted to the cause of sustainability, the International Olympic Committee (IOC) recently put forth an edict to make the Olympics sustainable. However, the resulting changes have been superficial. The development of a system of construction that allows for the flexibility of stadia may be considered to meet this cause. Such a system should allow the building of new Olympic venues or reuse and adaptation of old facilities. In addition, an understanding of the community and its specifics should be considered where a holistic approach is absorbed into a construction that also achieves environmental responsibility.

This thesis|project seeks to develop a systematic design process for the production of efficient, adaptable, flexible, and sustainable sports buildings for the future. It shall be one that incorporates the necessary Olympic sports regulations and data to guide design of sports buildings within any community in the world. The creation of such a system for Olympic sports will then enable ultimate design flexibility while ensuring a longer lifespan for stadia and community buildings. The human biological system serves as the best example of a system that acts in an efficient and functional manner. It works in a closed feedback mode with limitations as well as flexibility and modality, in a way that allows for natural development and adaptability. With that, there is great potential to further architectural sustainability by utilizing the knowledge gained from studies into the limitations and systematic processes. Systems theory and cybernetics will be the guiding force for this thesis|project which aims at developing a systems approach to architecture.

2 Historical Background

2.1 . Ancient Relevance

2.1.1 . Ancient Greece

Ancient Greece was monumental. Their civilization helped create the foundations for future western civilizations to develop democracy governance, and philosophy. The Greek culture's influence was so powerful that it predisposed one of the greatest Empires, that of the Romans, to conquer and infuse much of Greek culture throughout Europe. It was highly influential in language, politics, educational systems, philosophy, science, and the arts. The Greeks also innovated much of western sports and architecture (Trustees of the British Museum, n.d.).

2.1.2 Olympia and Ancient Greek Architecture

As the originators of the Olympic Games in 776 B.C., the Greeks made it clear that sport was an integral part of their life (Wallechinsky, 2000). Olympia was the site of the ancient Games where the infrastructure necessary to host it was developed. The architectural needs as well as the sports that were played were much different during those times. Sports were held outdoors in an amphitheatre style stadium therefore not protected from natural elements unlike most modern sports. Additionally, there were sporting events that incorporated horses and chariots which were excluded overtime. Of the sports played in these Games, track and field events were the most closely related to our modern version. Therefore the architecture of our current stadia and training gymnasiums find their precedents in those games. The stadium at Olympia was part of a larger Olympic complex including gymnasia and structures for training and development of athletes and the Greek culture. These building's goal were the development of man.

2.1.3 Olympic Stadia

The stadium in Olympia was an open air rectangular track with artificial embankments for spectators. As stadia design progressed many new ones started incorporating convex long sides and vaulted entrances that directed access to the stadium floor (Romano, 1993). Ruins of Hellenistic and Roman stadia included theatres that allowed for increased spectatorship and showed facilities that served multi-purposes. Examples exist in Sardis, Pergamon, Rhodes, and Athens (Romano, 1993). A relationship between sports/ event viewing and architecture is also found with the development of collective places, and although sport was fundamental to Greek culture, the design of stadia for sport was not. More focus was made towards theatricality much

like the Roman Empire where stadia and amphitheatres were designed for spectacles (Tzonis, 2004). This included buildings that had radial aligned columns built for unobstructed view, of spectacles. These designs evolved to U-shaped designs of column-free space for theatres seating up to 1,200 patrons.

2.1.4 Greek Architecture in Relation to Man

“Man is the measure of all things, of the existence of things that are and the nonexistence of things that are not.” Protagoras, Quoted in Plato Theaetetus 152A

In Architectural Space in Ancient Greece, Dixiadis stated that “the Greeks used a uniform system in the disposition of buildings in space that was based on principles of human cognition” (Doxiadis, 1972, p.3). Recognizing that they developed their system of measurement and city planning (on site) in an existing landscape rather than on the drawing board it is clear that building was relative to man (the architect). In studies of Ancient Greek architecture there was a strong link between the visual perception of the architect and the space planning of the site. For example Acropolis III was planned with rules based on a Ten Part system designed from visual angles of 30, 60, 90, 120, 150 degrees in addition to continued sightlines and composition of the architecture and nature (Doxiadis, 1972). Ancient Greece was also the site of the first multifunctional spaces in the form of stoa which were used to define outside spaces surrounding sanctuaries or markets, to create areas of conglomeration (Tzonis, 2004). These aspects of the Greek architecture provided the basis for later refinement and improvement by the Romans.

2.1.5 Ancient Roman Architecture

It is believed that the Romans looked to Ancient Greece for architectural examples as many societies of the same era must have done. Most notable was the Roman Colosseum which evolved from the amphitheatre designs. Its facade incorporated the architectural orders of Doric, Ionic, and Corinthian in addition to their own Tuscan orders (Welch, 2007). The Ten Books on Architecture by Marcus Vitruvius asserted that structure must exhibit three qualities. They were firmitas, utilitas, venustas meaning strong or firm, useful, and beautiful (Vitruvius, 1960). In Vitruvius' writings we can see these ideas were influential in the Colosseum's design which exhibited those qualities. Moreover, the writings created rules that were very influential to the construction that took place during that time. As a result, with knowledge of proportions in addition to Emperors pushing the limits of the engineers, engineers were able to recognize the

physical limitations of the workers and therefore develop the necessary tools to construct the Colosseum based on human limits.

Vitruvius emphasized a human element to architecture which culminated in an understanding of the human body's proportions (see Figure 2-1). He stated that architecture is an imitation of nature (Vitruvius, 1960). Roman architecture was based on three principles supported by Vitruvius and incorporated human elements which provided proportion to their architecture. By understanding these rules Romans, and many future architects would find a rationale for their designs.

Figure 2-1. Leonardo da Vinci's Vitruvian Man redrawn and inscribed in a circle and square considered the fundamental geometric patterns of the cosmic order (skinner, 2006). From Da Vinci, L. (c. 1487). Vitruvian Man. Retrieved March 1, 2009 from edupics.com

2.1.6 The Renaissance

It was during the Renaissance that the introduction to sacred geometry occurred, this worked as a metaphor for universal order emphasizing the relationship of geometry to nature. It also defined its association to the human body by using the Vitruvian Man as the ideal average human body representation and superimposing it with the Golden Section (see Figure 2-2) (Skinner, 2006). It was further rationalized by the Fibonacci sequence (see Figure 2-3) which is shown to occur in all natural things in some form (2006). It was eventually proven through mathematics and geometry that man is part of nature and therefore a part of the universal order. This reaffirmed the idea of Man being the ultimate source of value in architecture and the initial work done by Vitruvius about 1,500 years earlier (2006).

Figure 2-2. Golden Section Derived from Fibonacci Sequence. From Philosophy and Practice: Sacred Geometry by R. Lawlor, 1982, London: Thames and Hudson.

Figure 2-3. Fibonacci Sequence Applied to the Arm. From Philosophy and Practice: Sacred Geometry by R. Lawlor, 1982, London: Thames and Hudson.

2.2 Modern Olympic Games

2.2.1 Modern Olympics – The Beginnings

In 1894, France's Pierre de Coubertin promoted the revival of the ancient Olympic Games which were then awarded to Athens, Greece for the start of the modern Olympic Games in 1896. Coubertin wanted to inspire French youth and present them with a sense of purpose while improving the performance of his nation on and off the sports field (Theodoraki, 2007). The intent was to use the Olympic Games to promote the overall development of mankind as was done in Olympia during the ancient games. The Olympic Games gained a positive worldwide reputation and grew so much that a Winter Olympic event was established in 1924. Coubertin established the International Olympic Committee (IOC) prior to the 1896 Games to manage the planning of the events.

2.2.2 The Olympic Movement

The IOC created the mechanism for all of its partners to work together to maintain the Olympic Movement. This includes: Organising Committees of the Olympic Games (OCOGs), National Olympic Committees (NOCs), and International Federations (IFs), national associations, clubs and athletes (International Olympic Committee, 2008). Along with the Olympic Charter there are a number of other documents that are distributed within the organizing groups dealing with several issues relating to the fundamental ideas of the Olympic Charter. Recently there have been increased discussion of sport and the environment and the issue of sustainability. These documents emphasize the roles of the organizations for the goals of sustainability and how each group can work within their communities to achieve global sustainability. These documents outline the roles and uses of Olympic buildings during and after the Games (IOC, 2008).

2.2.3 Development of Changing Program

Only 15 of the 38 sporting events in the Beijing Games existed as sports in the Games of 1896. These changes contribute to a dynamic environment every four years. The inclusion or exclusion of specific sporting events is based on world wide support and interest (Wallechinsky, 2000). This has lead to very site and time specific design requirements for each host city every four years. But this often results in budget overruns and financial debt to the host city and country along with a legacy of grandiose and partially usable buildings following the event. One of the best examples of this is Montreal's 'Big O' stadium. As a result of these past failures the

IOC is promoting stewardship and sustainability for future Games. The drive to minimize energy consumption and reducing the carbon footprint is now an important initiative.

2.2.4 Traditional vs. Recent and Future Games

The Olympic Stadium in Montreal is a prime example of a controversial Olympic venue. Neither the Province of Quebec nor the City of Montreal wishes to take ownership of the building. The \$1.5 billion building constructed for the 1976 Summer Games in Montreal, has only recently been paid off. The costs of construction and ongoing repairs to the stadium roof are seen as the main cause for this three decade long debt. The building does not have a bright future owing to the costs, maintenance and issues of ownership. It is not unlike several other Olympic cities

Figure 2-4. London 2012 Olympic Stadium. From HOK Sport. Retrieved April 1, 2009 from archifield.net

where many legacy buildings are never used to their full potential as they were during their one-time Olympic event. More recently, with pressure from the sustainability advocacy groups, the IOC has made this a key issue for its building program. In Sydney, Australia there was a push to have their stadium and other sports venues designed to promote the post Olympic use. Their main stadium had its seating reduced and now has continued to be used effectively. The success of Sydney was primarily due to the incorporation of several initiatives in and around the Olympic site (IOC, 2008). The National Stadium (Birds Nest)

at the Beijing Games of 2008 was seen as a sustainable building. The building is set to have the number of seats reduced following their Olympic event from 91,000 to 80,000 (2008). Is the reduction of seats enough to help global stewardship?

The Vancouver 2010 Winter Olympics, as well as the London 2012 Summer Olympics, have both embraced the concept of stewardship by looking for innovative ways of designing for their events. Vancouver will use their BC Place Stadium for the opening and closing ceremonies. The focus for new design is on the holistic or systems approach to the design of their new Olympic Oval in Richmond. London on the other hand has focused their efforts in revitalizing a derelict area of London. It is building a stadium that will dramatically reduce its seating

following the Games from 80,000 to 25,000 seats (see Figure 2-4). It will have a flexible frame wrapped in a mural painted for the Games. They have separated many of the regular stadium functions from the structure of the stadium such as food kiosks and souvenir shops contained within more permanent modern stadia. This will allow them to achieve the dramatic reduction of seats. The regular functions would remain on site but separate from the main building much like the Germans did for the World Cup in 2006 (The official site of the London 2012 Olympic and Paralympic Games, 2008). The future Olympics are beginning to become more environmentally responsible with Vancouver and London, but they still have to deal with many of the same issues of construction: speed, safety, efficiency and budget as in all prior Games. Passed Olympic Games and specifically the Beijing Olympics raised questions of injuries and deaths during their construction process. This raises the subject of human factors in design and construction. The issues merit further investigation. The complex needs of the Olympic Games and its architecture would benefit from a systematic planning process involving Cybernetics.

2.3 Introduction to Cybernetics

2.3.1 Cybernetics and Systems Theory Defined

The term cybernetics is explained by its founder Norbert Wiener as the science of control and communication in mechanisms, organisms and society (Wiener, 1961). The cybernetic theory of control can be applied to any system; meaning any set of elements creating an interconnected whole. It is also considered the study of feedback, the manner in which things process and react to new information. This field of study has extensive applications besides just in architecture. The common link throughout this papers' research shows the primary goal of cybernetics being an understanding and definition of the functions and the way systems work. Essentially cybernetics can be described as a completely autonomous system; any kind of system that has the ability to define itself.

Closely linked to cybernetics is systems theory. This is the bridging element in cybernetics that allows an autonomous system to exist. The definition of a system given by John P. Van Gigch's Applied General Systems Theory is, "an assembly or set of related elements" (Van Gigch, 1974, p.2). He explains that elements can represent concepts, objects, or subjects within a system. A system can contain one, two or all three types. Systems approach, derived from systems theory is one of the main aspects in cybernetics which this thesis seeks to develop. An aim of systems

theory is an interdisciplinary investigation of the commonalities of systems including its structure and properties. By doing so we gain the ability to generalize various systems' organization and how they function. This is an understanding of how systems receive, store, process, and recall information and how they behave, respond, and adapt to varying outside inputs or environments. (1974).

2.3.2 Where Cybernetics Began

Norbert Wiener applied the Greek word *kybernetes* meaning "steersman" and in Latin "governor" to coin the term Cybernetics to define this unique field of study. Cybernetics became the name for the, "...field of control and communication theory, whether in the machine or in the animal" (Wiener, 1961, p.11). It drew knowledge from the study of biology, neurophysiology, anthropology, psychology, mathematics and electrical engineering, all of which showed a systems basis. But in addition to systems it was the manner of how they existed, how they interacted with each other and fed off one another (feedback) and their response to newly attained information (Wiener, 1961). These concepts of controlled systems were clearly displayed through physical systems such as aiming artillery, electrical circuits, and simple robot movements that solidified Cybernetics' role in engineering. These ideas proved of significance to social systems. Therefore the fields of psychology and anthropology became involved in cybernetic theory. The combination of both engineering and social systems made visible a connection with architecture. From the 1940's many researchers such as R. Buckminster Fuller, the Archigram group and initially, Cedric Price, used the basic concepts of cybernetics without actually using the term.

2.3.3 R. Buckminster Fuller/ Cedric Price/ Archigram

R. Buckminster Fuller was a leader and innovator in the movement towards global thinking. Sir Norman Foster stated:

Bucky was fond of quoting Theodore Larson: "It is not to devise a better society so as to arrive at a finer architecture; it is to provide a better architecture in order to arrive at a more desirable society" (Zung, 2002, p.3).

Fuller was probably one of the most gifted cybernetic thinkers of our time, owing to his diverse background and interests. He questioned conventional education, what people accepted as

truth in school. His lack of interest in conventional learning resulted in him twice being dismissed from Harvard. However, he gained valuable experience in machinery and engineering while he apprenticed as a machinist in a cotton mill. As a naval officer during the First World War he was given the opportunity to use and develop his acquired mechanical skills (Baldwin, 1996). Though the term cybernetics did not exist, Fuller was ahead of his time in developing systems of thought that would take a holistic design approach now at the forefront of architectural practice. This approach saw many original designs focused around sustainability and the concept of 'ephemeralization' or doing more with less that dealt with global issues.

In 1960-65 architect Cedric Price and Joan Littlewood a theatre producer, with the help of Gordon Pask, was the first to directly apply cybernetics to architecture. The proposal of the Fun Palace was the start of an architectural career for Price that embodied cybernetic principles. He continued to apply qualities of the Fun Palace into other projects but none would become as theoretically sound as the Fun Palace itself. The Fun Palace presented the opportunity for Gordon Pask's affiliation with architecture. Pask created the Cybernetics committee for the Fun Palace that was composed of professionals of various disciplines. The architecture designed by Cedric Price with the help of Gordon Pask sparked an exciting new experimental and leading edge architecture ranging from Archigram, Sir Norman Foster, Richard Rogers, and Renzo Piano, to the projects of Diller + Scofidio.

In the early 1960's around the same time as Price's Fun Palace, there were the famous avant-garde drawings of Archigram. The group created a magazine of compelling architectural designs that ranged from futuristic mobile cities and buildings to inflatable environments for one person. The Archigram group's success resulted from presenting hypothetical physical environments that were never dreamt before. At the time, with the discussion focused around Cedric Price's Fun Palace, the concept of adaptation of buildings conforming to the needs of users was presented. The group found a way to, "inject flexibility with amphetamines and envisaged adaptation on a daily, if not hourly, basis" as Mike Webb stated (Archigram, 1999, p.2). Over the years the Archigram design studies proved to be a critical architectural study that investigated the extreme possibilities of architecture. Several influential architects of our time, some of which are mentioned above, have been known to credit Archigram with influencing their design process. The processes engrained into Archigram's designs created systems that were evident to architects and so they were able to be extracted and adapted to various projects ever since.

2.3.4 Japanese Modular Experience

Looking towards the Japanese way of life and the development of their society we can definitely learn some things from them in terms of a systems language. The Japanese traditionally built their society based on a modular construction system of measurement called the Shakkan-ho which also doubles as a spiritual philosophy (Leong, 2005). This common language used for centuries is still around in today's Japanese industries. Becoming efficient was imperative for the Japanese during the time after WWII. A high level of quality control was a way of succeeding through the difficult times. Based on quality control and a Kanban system which allows companies to respond to demand in a quicker manner with little risk of overstocking a system, the Lean Production Model was developed (Sasaki, 1984). This quality process is based on the premise that allows for the adjustment of a system until it reaches the desired quality output. At the Toyota Motor Company where the Lean Production method was developed the idea of mass production was deemed inappropriate and so it was conceived that an emphasis would be put on a more integrated approach. This approach focused on "continuous improvement" and "respect for people" (Lesniewski, Krygiel, & Berkebile, 2006). The combination of Lean Production and the Kanban system minimizes the inefficiencies during the process and increases productivity unlike the backward thinking of many Architectural firms today which allow for the errors to pass through and be part of the process. By putting stress on the quality of output there is an increase in the level of quality at the end of the process and so the number of adjustments required is therefore reduced. This is achieved through a high level of integration between the multiple tiers of management involved (Sasaki, 1984). As Lesniewski states the key principle for the Toyota production system is to eliminate waste, and those involved in the design and construction of our built environment have much to learn from this methodology (Lesniewski, Krygiel, & Berkebile, 2006). Therefore the AEC industry can take these principles of systems to derive quality management and a focus on minimization of wastage of materials and time.

The Japanese society's long history of using a modular systems approach to architecture has proved successful for them. The Shakkan-ho system of measurement used in modular construction is closely related to Shaku, which are still used in the manufacturing of construction materials in Japan. It is the equivalent of a sheet of plywood but measures 3 x 6 shaku, one sheet is the size of one tatami mat. The tatami mat is the module that has defined Japanese

homes since the Medieval Period (see Figure 2-5). The method of construction is determined by the number of tatami mats used which further decides the column spacing for a structure. A standardization of such fixtures as sliding doors and paper screens are then enabled by the standard units of measurement (Kansai International Public Relations Promotion Office, 1997). The Japanese were able to understand these systems on a cybernetic level; allowing for a complete understanding of how the elements react with one another and create a system that feeds off each element within it.

Figure 2-5. Tatami Mats Modular example by Arthur Drexler. From *The Architecture of Japan* (p. 67), by A. Drexler, 1955, New York: The Museum of Modern Art.

3 Theoretical Discourse

3.1 A New Methodology Must be Developed for Olympic Architecture

3.1.1 Introduction

Architecture is increasingly being criticized for its lack of stewardship of the environment and use of global resources. Many architects have tried to respond to issues of stewardship but these attempts have been somewhat superficial. Future building typologies are becoming increasingly dependent on flexibility, mobility, and functionality. Therefore that trend will demand more multi-use buildings which will render single-use buildings obsolete. The Archigram group was famous for ideas of dynamicity, flexibility, and mobility. Peter Cook believed civilization was developing into a high consumer society. But he described this as being a healthy and positive development of human culture. His rationale for this belief was based on consumer choice and the expendability of products which was understandable during the 1960s (Archigram, 1999). Today, we can parallel our thinking with his view by replacing the words expendability with stewardship and consumer choice with ultimate flexibility. The similarity between the work of Archigram and this thesis is the systems approach that was taken and evident in their projects. These include Plug in City, Instant City and Blow-out Village where flexibility was a major theme. Conservation and minimizing embodied energy has become an imperative for large structures being built for the Olympic Games. A look back to our most radical thinkers in architecture and cybernetics could give us the direction and knowledge necessary to move forward in developing a new methodology for Olympic Architecture.

3.1.2 Applying Cybernetics to Architecture

There have been several investigations into the application of cybernetics to architecture since the work of Cedric Price with Gordon Pask in the 1960's. The recent exploration of these applications has experienced a recurring struggle. Issues with the communication and information feedback loops, within these systems have hindered development into mechanically autonomous buildings. Significant strides have been made but we still remain far from developing completely self-governing buildings. A primary problem has been full reliance on software programs. The expectations for them to work as the sophisticated cybernetic system directing design of a building, attempting to make it self-governing have proved unrealistic. The software is designed like a biological system designed to adapt and learn based on inputs from

the environment. However the system runs into problems when the architecture is actually built because the systems feedback information loops are subsequently broken. This is a result of the constructed building and its built components having different qualities from those displayed in a computer model of the building. However, strides are being made in the development of such buildings; but are these developments really what is needed in our immediate future? The answer is a definite no.

Making buildings mechanically autonomous is not crucial when compared with more pressing global issues. There has been a lack of concerted interdisciplinary work to address issues of pollution and energy and resource waste. Architects must act quickly to co-ordinate these efforts or lose their place as the master facilitators of the design/construction process.

No one has fully investigated the connection of cybernetics and systems approach to the construction processes of the built form. This results in a disconnection from physical architecture and the information used to design it. *Re-fabricating Architecture* (Kieran & Timberlake, 2004) begins to extract the cybernetic qualities in the processes of mass customization. They have focused on constructing architecture by producing blocks or modules similar to the building methods used by aircraft, car, and shipbuilding industries. But this still presents problems for architects:

One lesson that engineers understand and teach, but architects neglect, is that process sets the stage for outcome. Without a broadly based process that penetrates deeply into the very heart of how things are made, any success will be fleeting and unsustainable. (Kieran & Timberlake, 2004, pp.107)

The need to understand the cybernetic qualities of these systems is crucial to mastering a systems approach to architecture. It remains a hole in the body of architectural research today. Ross Ashby, an instrumental cyberneticist stated:

Many a book has borne the title "Theory of Machines", but it usually contains information about mechanical things, about levers and cogs. Cybernetics, too, is a "theory of machines", but it treats, not things but ways of behaving. It does not ask "what is this thing?" but "what does it do?" (Ashby, 1963, p. 1)

Analysing architecture based on behaviours and developing behavioural systems that helps architecture to become more efficient and sustainable is a research worth investigating.

Well known architects of the past tried to overhaul the methods and thought processes used during their time. Although we can now look back and criticize them for the architecture that was developed in their attempts at new methodologies, we recognize that they had the right idea in terms of systems theory. The systems used were not taking into consideration newly developed technologies or being thought of in terms of stewardship of resources. This was why new views of architecture were needed. Incremental improvements would not succeed for a system unless it is based on a flexible methodology. This relates to systems approach and the issue of Incrementalism versus Innovation as discussed by John P. Van Gigch:

...we are incapable of departing drastically from established solution patterns, we seek solutions near those presently accepted (Incrementalism) and profess to improve the existing systems by analysing the operation of component subsystems (Systems Improvement). These approaches never succeed in solving the entire problem, which requires the adoption of novel designs at the level of the Whole System. (Van Gigch, 1974, p.34)

In developing new methodologies some architects have been successful in creating systems that work with new technological advancements and become responsive to their environment

Figure 3-1. Dee and Charles Wyly Theatre, USA, 2004. From Office for Metropolitan Architecture. Retrieved April 1, 2009, oma.nl

such as Rem Koolhaas and his Dee & Charles Wyly Theatre (see Figure 3-1). By designing the ability for the theatre to raise and lower its walls it allowed for a unique experience of the spaces and permitted changes of configuration for the theatre based on the performance requirements. A key factor for success was the understanding of the systems that were necessary within a theatre in order to ensure the best possible user experience. By consideration of the systems involved in any one situation, an importance must be given to the ability to break down a system to its components. "One of the problems in dealing

with systems stems from our inability to know how far to break down or "decompose" a system into component systems, or how far to "compose" or "organize" a system into larger systems" (Van Gigch, 1974, p.2).

Ross Ashby's (1957) downward causation principle, (as cited in Y.T Leong & George E Lasker, 2005) states: "that each law specifies a particular type of organization at its level, which downwardly determines the arrangement of the subsystems or components at the level below"

A relationship is apparent in Architecture, Engineering, and Construction (AEC) where architecture is one discipline within an industry of several, which are all guided by the same values. These values are (stewardship of resources, user safety and user fit) and should determine the subsystems that are in place to produce the work necessary. The issue is the level of adherence by the various disciplines working together to produce one outcome, a building. The current system is not efficient in the exchange of necessary information between the disciplines and therefore, as mentioned by Leong, a common systems language is imperative to our industry (2005). Figure 3-2 shows the AEC guiding principles and the higher order system that it falls under. It will be important to develop a system that encompasses the AEC industry's guiding values.

Figure 3-2. Systems Organizational Principles. From Architecture, Engineering and Construction of Built Environment (p. 91) by G.E. Lasker and Y.T. Long, 2005, Canada, International Institute for Advanced Studies in Research and Cybernetics (IIAS).

3.1.3 Architectural Cybernetic Precedence

3.1.3.1 R. Buckminster Fuller

R. Buckminster Fuller was an inventor, mathematician, geometer, cartographer, ecologist, manufacturer, industrial designer, moralist, epistemologist and world systems thinker. He used this multitude of skills in creating architecture. He questioned the processes that were being used by architects of his time. Although not an architect at the time of most of his realizations

or designs; his outside the box thinking allowed him to gain popularity through his progressive designs and his ability to challenge established norms in architecture. He was given an honorary degree at the age of 70. He was one of the first to conceive of the planet as a closed ecosystem which he dubbed as "Spaceship Earth". His designs questioned many of our processes and gave alternatives that were in line with today's examples of stewardship of resources. Learning how to forecast efficiently and knowledgeably allowed him to design things that were much ahead of his time. As a result we can make connections between Fullers' ability to forecast and the study of Cybernetics. This will be discussed later in this section under Cedric Price and the idea's committee for the Fun Palace. Fuller looked at everything in the world as a piece of the Universal puzzle where everything has its place (Marks, 1960). Nature has a way of being efficient in its use of structure, as well as its inherent processes.

Figure 3-3. 4D Dymaxion House by Fuller, R. Buckminster. In R. Marks, 1960, *The Dymaxion World of Buckminster Fuller*. New York: Reinhold Publishing.

Most remember R. Buckminster Fuller for his development of the Geodesic Dome but there were

several other key projects that preceded it, of equal or greater importance. 4D Dymaxion House was developed from the 4D Tower, which came before it. This was an apartment with dedicated functions on each floor and an electricity-generating wind turbine on its roof. The Tower would be light enough that it could be air delivered replacing the typical house with one that would take one day rather than six months to erect (see Figure 3-3).

The 4D Dymaxion House was designed in the hope of mass production. Fuller claimed that it made no sense to hand-build houses which didn't benefit from the hands on approach. Mass production would create quality control. One of his arguments was that no person would choose to have their car hand built because it would simply take longer and be more costly (Baldwin, 1996). The design of the Dymaxion House was meant to be built of durable materials making it an efficient and lightweight home. But it was planned to be built primarily of aluminum which was hard to obtain and expensive at that time. The House was designed to function with innovative technology and some of which still doesn't quite exist. The ideas inherent in the plans of the 4D Tower and 4D Dymaxion House encompassed the concept of Autonomy. Fuller was likely the first to conceive of the idea of an autonomous house.

Allowing a house to function on its own with the minimal intervention of complex networks was Fullers' vision for the 4D Dymaxion House. We are still dependant on sewers, electrical wires, plumbing, and our road networks for garbage pickup. This dependence on the complex system made a house expensive but with the 4D Dymaxion House there would be instant savings on construction costs. Fuller claimed the existing house building method was susceptible to "low bid quality, obsolescence, labour unrest, vandals, deferred maintenance, terrorists, and disaster" (Baldwin, 1996, p.28). With the autonomous house the maintenance was the owners' responsibility, but the reliability of the system would be better than the complex city system, if high quality equipment was used. Baldwin states that Fuller believed that:

A house gains considerable advantage from being 'autonomous' that is, from standing alone, with no need for connection to a municipal system of pipes and wires. Undeveloped land is cheaper. Utility bills are lower...With no large-scale hardware and no transmission losses, overall efficiency goes up and environmental problems go down (Baldwin, 1996, p.28)

The Dymaxion House went into production shortly after the Second World War but the enterprise failed owing to management problems.

An important Fuller idea was for the need to evaluate any human venture in terms of imports and exports. Currently our houses are energy importers (gas, electricity, solar), information (newspaper, internet, cable, radio), food, water, and air; making it in Baldwin's words a net consumer. Fuller claimed that with the developments in passive solar design and insulation made heating and air conditioning unnecessary, other than in harsh climates. Additionally

people could save money with the integration of these system types. The goal was to have the home completely off the electrical grid by integrating all the necessary technologies to make it a highly efficient building. This, combined with minimizing household waste by careful shopping to reduce purchasing packaging, and growing one's own food makes for a much more sustainable lifestyle (Baldwin, 1996). Unfortunately people then did not approve of these advanced ideas as food and energy were cheap and in boundless supply.

Exports consisted of heated air, grey water, black water, and garbage. The Autonomous House was claimed to minimize heat loss and air pollution which would minimize the heat island effect and subsequently global warming. Fuller used a Dymaxion waterless toilet design that would package excrement into plastic bags for a scheduled service pickup to be later used as compost and other uses. Further reduction of water use would be made available through his design of the Fog Gun, which used compressed air mixed with atomized water to clean household objects and people with less water (Baldwin, 1996).

Because R. Buckminster Fuller had developed such a holistic system he was able to see the potential in easily incorporating them in various situations. The system allowed him to have the ability to forecast everything that would occur with slight changes to the system. Additionally, it gave him the opportunity to incorporate the system into other modes of architecture. Corrugated cottages for the military became the application for the unaccepted Dymaxion House. Using galvanized steel bins typically used for vermin and weather proof grain storage could be the next emergency housing unit. As a result of having resolved the autonomous system for the Dymaxion House enabled the easy application into the readily available steel bins. The bins were sturdy, simple, watertight, and fireproof and were designed for quick and straightforward assembly ideal for emergencies.

The Dymaxion Deployment Units (DDUs) were delivered as packaged units that could be easily built from top down by utilizing metal masts with a winch apparatus (see Figure 3-4). It allowed the builder to remain safe on ground, and speeded up the process. Through knowledge of geometry, material adjustments were made to the roof, making its compound curved panels to be able to withstand hoisting, wind, and blast concussion. Besides these concerns Fuller gave consideration to the person putting the units together. Many of the workers assembling them were illiterate. A simple process was necessary for them to understand how to build it.

Figure 3-4. Dymaxion Deployment Unit (DDU). From *Bucky Works: Buckminster Fuller's Ideas for Today* (p. 36) In J. Baldwin, 1996, Canada: John Wiley & Sons.

Architects were not happy with the idea of mass production and likely felt their livelihoods were threatened as a result of many of Fuller's holistic mass produced ideas. It was in 1928 that the:

American Institute of Architects (AIA) passed a resolution: "Be it resolved that the American Institute of Architects establish itself on record as inherently opposed to any peas-in-a-pod-like reproducible designs." Bucky retorted that nature commonly makes use of repetition in cells, crystal, and eggs. Evolution tends to standardize design—you don't see animal noses in the middle of their backs. Noses are logically placed by their function (Baldwin, 1996, p.21).

To Fuller and to most of us today it makes sense that we have to accept change in our processes of architecture. Although it makes complete and utter sense that people should accept standardized designs for housing as they already do for everything from cars, furniture, shoes, and books; there is that tendency for people to want something completely unique. The task of attempting to change attitudes is a very difficult and tedious one. Is the Buckminster Fuller mode of thinking the only way to have a sustainable home? People have not traditionally embraced such radical change and so a more gradual introduction of concepts to society must be made. It may just be that Buckminster Fuller inadvertently gradually introduced these concepts to our generation. If we can now develop the systems necessary to allow for gradual change to occur within our current society we will create a platform for success that allows us to control the speed of this change, introducing it at an acceptable pace. The Buckminster

Fuller design was not the only way to design sustainably but his way of thinking was one that encompassed all the right principles for environmental stewardship. His holistic approach was one that worked but was too radical for his time. His system of approach could be broken down to a few simple processes:

1. Selecting a societal or global issue
2. Approaching the problem holistically (universe inwards)
3. Developing the necessary solutions to deal with the problem
4. Analyzing the solutions' details to minimize overall effects and create flexibility.

Having a system of approach to a design methodology that encompasses these principles can help anyone to develop a sensitive manner for dealing with the real issues of any problem. This is particularly true in architecture and pertains to any building size. As seen in Buckminster Fuller's approach, the system that he used about eighty years ago can still be applied today. Once a system is in place it sets the guidelines which you can then build upon, as he did with his Dymaxion House and DDU's. Building from the Universe inwards as Fuller did, gives the opportunity to deal with the main problems first. It then leads to the intricate details that will allow the systems to remain functioning and flexible.

3.1.3.2 *Cedric Price*

In the early 1960's Cedric Price's Fun Palace was the first project to use Cybernetics to help achieve a desired architecture. Although the project was never realized for political reasons it came very close to being built. Projections after World War II indicated a trend to shorter working days resulting from automation in workplaces. This would pave the path for a leisure based economy. The Fun Palace was intended to be an outlet for creativity and education during leisure time. The proposal stated:

that every town should have a space at its disposal where the latest discoveries of engineering and science can provide an environment for pleasure and discovery, a place to look at the stars, to eat, stroll, meet and play (Mathews, 2007, p.78).

Leisure buildings of that time included: adult education schools, movie theatres, and sport facilities like bowling and racetracks. Realistically the problem the Fun Palace encountered was of funding its new architecture typology. (Mathews, 2007)

Cybernetics was introduced into the design of the Fun Palace as the design did not need

a specific form or fixed floor plan. Cedric Price approached the design by first developing a skeletal framework to contain the activities that were free to develop and grow according to demand (Mathews, 2007).

The premise of the Fun Palace was to have a constantly changing program which deemed the uses for the building unpredictable. The spaces were designed to be changeable dependant on the needs of the users which allowed much of the architecture to remain indeterminate. The Fun Palace had to somehow regulate its configurations within the fixed framework. By using the field of Cybernetics, in addition to Game theory and computer technology, it was possible to analyze usage patterns. They were used to predict and react to further future trends. This allowed for a system to be established based on cybernetic principles and game theory strategies that could learn the usage patterns and adapt accordingly for future activities. (Mathews, 2007)

The design of the Fun Palace had a permanent framework that limited its expansion, however everything within the structure confines were seen to be very flexible (see Figure 3-5). The system incorporated modular elements of aluminum and inflatable plastic to allow for easy repositioning. As expected the need for parking and mechanical systems and service areas would be located on the basement and first floor requiring the levels to be fixed along with the

Figure 3-5. Fun Palace, flexible floor plan. From *From agit-prop to free space: The architecture of Cedric Price*, by S. Mathews, 2007, London: Black Dog Pub. Ltd.

structure (see Figure 3-6) (Mathews, 2007).

Mathews stated: "Cybernetics allowed dynamic systems to self regulate and self correct without an end state or definite telos. The performative objectives of cybernetics are in reality fluid criteria and are as subject to modification as is the systems itself" (2007, p.73).

It is important to note that both Ross Ashby and Norbert Wiener both acknowledge the aspect of cybernetics being a science that deals with biological processes that allow living things to manage environmental changes (Ashby, 1963; Wiener, 1961). So the use of cybernetics allowed for the Fun Palace to adapt to the environment of the space and regulate the necessary changes to the program. Games Theory principles were used as the system that created responses and corrections to changing and developing program both in the present and for the future (Mathews, 2007).

What we can learn from the Fun Palace project is that it begins to put together two systems of thought: Cybernetics and Games Theory. Collectively they evolved into one system. This was the ability to deal with daily and long term adjustments to the programmatic issues of the

Figure 3-6. Fun palace. From *From agit-prop to free space: The architecture of Cedric Price* (p. 68), by S. Mathews, 2007, London: Black Dog Pub. Ltd.

building. By using design in a manner for maximizing flexibility and functionality, it was believed that Price was able to derive the ideal system in order to achieve a successful Fun Palace, had it ever been built. In *From Agit-Prop to Free Space: The Architecture of Cedric Price Mathews* mentions that the Fun Palace had established an ideas committee to brainstorm scenarios for what a space would potentially be used for. In addition, other committees dedicated to structure, programming, sociology as well as a Cybernetics sub-committee, led by Gordon Pask, founder of Cybernetics and Systems Research Ltd, were established to work with the Fun Palace Ideas committee (Mathews, 2007). The committee's that were formed were of great importance to the progression of the project. They were much like today's collaboration efforts with consultant groups to obtain the required expertise for a given project. The difference is that these groups were formed early in the process and were composed not only of those forming the AEC disciplines but rather those dealing with social aspects. The groups had people from the fields of psychology, sociology, an editor of *New Scientist* magazine, as well as a theatre professor.

The success of the Fun Palace possibly the most successful theoretical project ever planned can be attributed to five key factors:

1. An idea (Fun Palace) responding to a social issue
2. A well rounded collaborative team implemented early in the process
3. A combination of systems: Cybernetics and Games Theory dealing with present & future
4. A framework to work within
5. A modular system of components aluminum modular elements and inflatable plastics.

Essentially this collaborative project was initiated by the architect Cedric Price who assumed the role of coordinator which is the method practiced today, as it serves as the ideal way to create large infrastructure. Collaboration also proving to develop architecture that is better informed and in tune with its surroundings whether it be natural, social or cultural.

The Potteries Thinkbelt was another example of a project that was designed as a practical proposal but did not materialize. The Thinkbelt included several objectives of Price's, Fun Palace. It focused the project by controlling physical interactions and specific social exchanges through the use of cybernetics. Aside from its two major similarities it contained one important difference: mobility. Price aimed at dealing with educational issues and providing people with the practical knowledge he believed necessary for England's progress in the postwar era (Mathews,

Figure 3-7. Potteries Thinkbelt, Abandoned Rail Network. From *From agit-prop to free space: The architecture of Cedric Price*, by S. Mathews, 2007, London: Black Dog Pub. Ltd.

2007). Mathews stated: "Both the Fun Palace and Potteries Thinkbelt exhibit Price's approach of a responsive, anticipatory architecture, adaptable to the varying needs and desires of the individual and of society" (Mathews, 2007, p.195). And like the Fun Palace, the plan had the ability to change form, based on the information gathered by the computer technology derived

from the cybernetic principles of Norbert Wiener and John von Neumann.

Mobility played the biggest role in the Thinkbelt project. It gave the opportunity for Price to explore never-ending possibilities with the physical rearrangement of the new technical school program continuing on with the concept of future adaptability. This was ultimately made possible by having access to an old vacant railway network (see Figure 3-7). The network was the vital system of mobility needed to create utmost flexibility. "Mobile classroom, laboratory, and residential modules would be placed on the revived railway lines and shunted around the region, to be grouped and assembled as required by current needs, and then moved and regrouped as those needs changed" (Mathews, 2007, p.209). Within the entire project there were three Transfer Areas which were the only permanent parts of the system. The Transfer Areas were utilized to move housing and teaching units using giant overhead cranes (see Figure 3-8). The utilization of mobile and modular units resulted in flexibility of location within the Potteries district. The Transfer Areas served also as connection to national transport networks which presented yet another system of mobility (Mathews, 2007). But was mobility really a necessity in the overall scheme of things?

In *From Agit-Prop to Free Space: The Architecture of Cedric Price*, the author also shares the opinion that the mobility factor was not needed, or the way of the future. The reality of the Internet in today's society renders physical mobility of buildings practically useless. Today,

Figure 3-8. Giant overhead crane (example). From From agit-prop to free space: The architecture of Cedric Price , by S. Mathews, 2007, London: Black Dog Pub. Ltd.

we are capable of taking courses online in our homes, and ordering goods or services over the Internet. We have become virtually mobile which would present a problem for the Thinkbelt project today as there would be no need to expend energy in hauling buildings around from place to place.

However the thinking that was involved for the transportation system presents the idea of mobile units, which if thought of in a less

extreme way begins to work quite well. This was definitely a beginning to the reusing and recycling of architecture elements rather than production and fabrication of new material. The Potteries Thinkbelt did portray a valuable system which could be interpreted as comprising of the following four key components:

1. Social Change - A plan for societal change or a new view of education
2. Network - Thinkbelt transportation network, for mobility of the system
3. Minimized permanent infrastructure maintaining maximum flexibility – Transfer Areas; and
4. Modular unit - teaching units and housing units.

These four components of the system are in hierarchal order similar to the list discussed in the work of R. Buckminster Fuller. This maintains the idea that the analysis of greater issues enables an understanding of how to solve the smaller problems in a way that allows tackling of larger concerns simultaneously. Like Buckminster Fuller's view, we have to look inwards from the Universe.

3.1.3.3 Archigram

During the 1960's, although Cedric Price's Fun Palace was a major topic of discussion, the Archigram Magazine's nine issues between 1961 and 1974 had also become very popular. The architectural group of Archigram consisted of Peter Cook, Warren Chalk, Ron Herron, Dennis Crompton, Michael Webb and David Greene. They were based at the Architectural Association in London where they had all studied (Archigram, 1999). The Archigram Magazine issues contained very avant-garde projects that tested conventional thinking in much the same

manner of Cedric Price and R. Buckminster Fuller. The projects displayed were futuristic, using very advanced technology for their time, and expressed in a seductive manner through their intriguing pop art architecture. The group was heavily motivated to test their current conditions in London, which they described as boring architecture, with new and innovative visionary ideas. In doing so they produced drawings for such influential projects as Plug in City, Living City, Walking City and Blow up Village.

Existing in many large cities are forms of the Plug in City; from the transportation networks and underground passages for movement of pedestrians or various forms of mechanical systems to the very condos that we inhabit. We essentially live in a Plug in City. Massive condos spring up everywhere and are tied into a network that sees ever increasing turnover of the units themselves. People have more choice, they know what they want and they are able to access it most of the time. This relates to the word "expendability" that Peter Cook emphasized in the Archigram compilation meaning the ability to afford change within a consumer based society (1999). The condo unit of today is not a plug in unit that can literally be taken out or unplugged from the building as Archigram displayed. However, it does have similarities to one by how it is created with products that can change or be modified according to the users' needs or wants. Although Plug-In City was never built it has certainly influenced design. Change was gradual but pushed into a direction, one which displayed a system of thought.

Our society, which is largely consumer based is now experiencing the effects our lifestyles are having on the environment. As such society is now trying to embrace environmental stewardship by looking critically at large infrastructure projects being built today. Archigram attempted to do this by giving full control to the user of the Plug in City. They also made us recognize the expendability of architectural parts or wholes used in our daily lives. That trend endured and we now must find ways to minimize the harmful effects that this has on the environment.

An early and almost literal example of Archigram's influence in architecture was Richard Rogers and Renzo Piano's 1977 Centre Pompidou in Paris. The massiveness of the structure and its lightweight exoskeleton steel structure embodies the design principles of the Plug in City's 1962 Nottingham Shopping Viaduct (see Figure 3-9 & 3-10). With the Nottingham Shopping Viaduct, Peter Cook of Archigram demonstrated that a mega-structure is structured to accommodate change through its flexibility could work. This design allowed for multiple functions in the same

Figure 3-9. Centre Pompidou by Richard Rogers and Renzo Piano. From S. Glynn, 2001. Retrieved October 1, 2008, from galinsky.com

Figure 3-10. Nottingham Shopping Viaduct by Peter Cook. Retrieved December 15, 2008, from fabiofeminofantascience.org

structure with expendability determining a hierarchy for those spaces. Spaces with a higher rate of expendability or change would be placed higher in the structure while those of lower needs were located at the base. The Centre Pompidou houses four major activities: a museum, a reference library, centre for industrial design and a centre for music and acoustic research. In addition there are book shops, restaurants, cinemas, children's activities, car parking and a transportation network of transparent escalators. The Centre Pompidou can be clearly attributed to the influences of both Archigram and Cedric Price's Fun Palace.

The concepts used in designing the Plug in City and Fun Palace introduced a thought process that enabled societal interaction with the built form. These concepts are in accord with Gordon Pask's cybernetic research on the Fun Palace. Peter Cook of Archigram used (see Figure 3-11) a systems approach to architecture that relied on the thinking of several levels of systems simultaneously. It was developed as a set of hierarchal rules based on expendability which governed the overall system. The intention was holistic. Looking at Figure 3-11 shows the clear and precise way the system will develop socially. It becomes a flexible system that allows the actual idea of the university to develop into something much different. The physical flexibility imparted by the design gives way to social flexibility. The plug-in component modules that are developed allow for the ease of change, however considering the sequencing of the university's growth is itself another system of specified components. These components are required to have the ability to host a series of changing events over time. One component system consists of pylon feeds, silo decks, and lift tubes. The teaching rooms, housing modules, and the

Figure 3-11. Growth and Change Cycle of Plug-in University Node 1965 by Peter Cook. Note. From Archigram (p. 42 - 43), by P. Cook, Archigram (Group) (Eds.), 1999, New York: Princeton Architectural Press.

inflatable assembly become yet another component system. The entire growth and change cycle of Plug-in University Node is a higher order system which has the potential to grow into and combine with other Plug-in systems. All of these systems would therefore establish a network to work together resulting in endless possibilities due to the adaptability and growth aspects that are inherent in the original concept. The key projects that were designed by the group were focused on modularity and the use of components within various other systems. The systems developed by them were very hierarchal and displayed an ease of construction. When looking at them today, in light of this research, we can see certain aspects of projects such as the Plug in City becoming established. Their approach although based on the idea of expendability, which doesn't fit with our view of architecture and the environment, is still a very good example of how there exists layers to an approach. These layers can manifest in different forms and change over time. If a valid and well planned out system is established, whatever the necessary changes are can then occur within the layers of the system but can do so in an efficient and still valid manner. In the following examples the systems that Archigram established with its design methods were composed of characteristics that allowed for inevitable change. The Plug in City mentioned earlier was derived from the concept of the Living City where the premise was to have a city that focused on its total environment. Social aspects, crowds, movement, communication, sense of place, and particular immediate environmental changes were all looked at in depth. That led to the Plug in City which became an architectural solution for the concept.

Figure 3-12. The Capsule, Tower & dwelling. From Archigram (p. 45), by P. Cook, Archigram (Group) (Eds.), 1999, New York: Princeton Architectural Press.

The Capsule was a project that was designed to work on a similar level as the Plug in City (see Figure 3-12). "The statement was a capsule dwelling, with the ergonomics and the sophistication of a space capsule. The parts would be tailored and able to be updated as technology moved forward, and the dweller changed his needs" (Archigram, 1999, p.44). The concept was one that allowed a crane to move the large elements of the tower and small elements could be moved within. The Capsules were clipped into place along the structural core of the tower. This became part of the Plug in City because it was easily integrated as a result of having the same methodology behind it. Similarly the project known as the Gasket homes were yet another version of pods that hooked up to a system with services (see Figure 3-13). Unlike the

Capsule the Gasket homes display even more flexibility through their flexible service core while inside the home it "uses a series of plastic strip profiles of different patterns that can be built up into an almost infinite series of enclosures" (Archigram, 1999, 46). On another level there was the Blow-out Village which was a disaster relief project that was also a good example of flexibility in a self contained system. It would work based on a series of rearrange-able components and hydraulic masts.

Archigram used a design system that expressed adaptability, flexibility, and mobility through their highly developed architectural drawings and were able to do so as a result of establishing an overall hierarchal system with the following principles:

1. A Societal goal (Social and Physical flexibility)
2. Higher order System (system framework) of the Plug-in-City
3. Designed Plug-in components based on expendability

Figure 3-13. Gasket Homes. From Archigram (p. 47); by P. Cook, Archigram (Group) (Eds.), 1999, New York: Princeton Architectural Press.

3.1.3.4 Resulting Cybernetic Concepts

From Fuller to Price to Archigram we can clearly see that there is a special importance in the thought process involved within all of their designs. The methodology used is highlighted by the systematic approach toward each and every design. Resulting from this kind of approach are projects that begin to build upon one another. The Idea of Plug in components is an indicator of a system working together in order to maintain variables that allow for change. It becomes a balance of trying to accurately predict change and having an established system of maximum flexibility makes the process easier. A cybernetic systems approach allows for growth within a system because it references the systems' limits to produce complete flexibility within these limits to provide everlasting adaptability. In *An Introduction To Cybernetics*, Ross Ashby stated: "Cybernetics typically treats any given, particular, machine by asking not "what individual act will it produce here and now?" but "what are all the possible behaviours that it can produce?" (Ashby, 1963, p.3). This speaks to the importance of looking beyond the conventional means and fully investigating all the possible limitations of any system be it architecture, a mechanical object or a human being.

Information linking cybernetics and a systems approach to architecture has more recently revolved around robotic-like processes and its software rather than with the actual construction technique of these flashy robotic architectural forms. As seen in *Architectural Principles in an Age of Cybernetics* (Hight, 2008) history demonstrates that change is expected. Hight describes how Le Corbusier took the principle of the Vitruvian figure to create his Modular Man. He later crossed it with the Golden Section to develop his Modular system of measurement (2008). By

creating a new unit of measurement, Le Corbusier was looking into the cybernetic qualities that were contained within the two systems of proportion. By examining human based systems such as Le Corbusier's, we can analyse their cybernetic qualities that inform various approaches to complex systems that could be applied in architecture.

3.1.4 The Human Body, Olympic Sports, and Systems in Architecture

The human body has played an important role throughout our architectural, scientific, and cultural history. Human based systems and human body factors and limitations are integrated into what we design. This is how architecture has evolved over time. The importance of the human body and its impact on cultural development and architecture was seen in the Ancient Greek's treatment of the human body. The interconnection between the human body and architecture was further seen in the Vitruvian Man, and the discovery during the Renaissance that geometry, man and nature were interconnected.

In 1956, the Human Factors Society was established in the United States. At about the same time the study of Cybernetics was becoming a leading edge science. Human Factors Society, like the study of Cybernetics, was derived from other disciplines both of which included physiology and psychology. Tilley & Dreyfuss in *The Measure of Man and Woman* state:

The term Human Factors ...covers most factors affecting human performance of tasks using tools or in man-made environments...we have broadened the human-factors view to include cognition – the users' thought processes – in the design equation. Products have become operationally more complex, and a product's physical form often envelopes numerous hidden possibilities that await the user's beck and call. As with the microprocessor and the computer, a product's behaviour may vary depending on the user's input and the if-then conditions programmed into the product. Through the application of cognitive ergonomics to design, products can become easier to use (p.9).

We can appreciate the advances that studies into human factors (also known as Human Engineering or ergonomics) have made. Their most visible role in society has been in the industrial design of products and services to make life more comfortable, easier and safer. We see this in the height of door knobs and maximum stair riser heights as well in adjustable chairs and computer screens. In construction we see it in the manageability of a sheet of

drywall, a standardized window size or the weight of a roll of carpet. Similarly, we see it in athletes' equipment that is becoming more advanced to increase their potential to succeed. This equipment ranges from low friction swimwear, to carbon fibre hockey sticks and to training aids. The goal is to become as efficient as possible, an idea which is emphasized in architecture but rarely achieved. An understanding of the body is required for the best design of these tools so that athletes can fully utilize them. Typically, these tools are developed for the average percentile population in order to satisfy the common denominator. However, the most successful products are those that have the inherent flexibility to allow for adjustment to accommodate those outside the average percentile.

Tilley & Dreyfuss explain that man's tools are an extension of his hands. We see this in pre-historic thumb tools developed for scraping animal skins or the later development of the bow and arrow to extend man's limits even farther. The military has traditionally been a driving force for technological advancements and the relation of man and machine. We have developed such Human Engineered devices to become more efficient for the work that must be accomplished (1993). The level of efficiency gained with the development of tools reflects the importance of incorporating humanistic behaviours into aspects of architecture, design and building. The incorporation of humanistic aspects can lead to additional efficiencies in our building processes by applying the "feedback loops" seen in cybernetics further leading to an easier and safer process in both construction and design.

Safety and efficiency are key elements which modern society is constantly striving to achieve. "A biological design approach can provide solutions to problems by translating a natural, organic design or system into a man-made system or object, so that it operates analogous to nature" (Papanek, 1983, p.7). PERI, an international company that provides and manufactures formwork and scaffolding systems, is an example of a company looking at and considering human factors in order to develop their various scaffolding systems. The use of aluminum for its components results in a lightweight and manageable system designed to assemble in an efficient and safe manner. Each system is developed to allow for ease of use and quick installation on the construction site. The systems require only a minimal number of tools, such as a hammer to set anchoring pins and contain a limited number of components. Systematic assembly sequences with component elements that are designed to hook into each other and swivel into place allow for increased flexibility. The ability of a system that works with minimal

tools, components, and assembly sequences have allowed PERI to take over the scaffolding industry and begin to diversify into other areas, such as providing temporary public use systems for grandstands and stairways (see Figure 3-14). Flexibility in architecture is being sought after and this has allowed PERI to capture a large market share in the scaffolding industry.

The PERI formwork, scaffolding, climbing and working platform systems as well as others have been used in several worldwide examples from Santiago Calatrava's Auditorium in Santa Cruz, Tenerife, Spain (see Figure 3-15), and snowboard ramps in Turin, Italy (see Figure 3-16) to

Figure 3-14. PERI stairs and grandstands. From Successful construction with PERI: Handbook 2005 Scaffolding (p. 111) by PERI, 2005 [Brochure].

Figure 3-15. Auditorium by Santiago Calatrava. From Successful construction with PERI: Handbook 2005 Scaffolding (p. 77) by PERI, 2005 [Brochure].

restoration on the Church of Notre Dame du Lac in Le Thor, Vaucluse, France (see Figure 3-17). The versatility of these modular systems of components is evident when applied to the previously mentioned projects. Realizing that these systems are strong, durable and efficient temporary systems makes us question their temporary status asking why they are not used as more permanent flexible systems. Is it scale issues, workable spans, aesthetics, or are they just not able to perform for a buildings lifecycle? Possibly the truth lies in all three as a result of being designed specifically to deal with certain loading and manoeuvrability of units. This being said, it opens up the possibility for interpretation of the system and how the individual components clip in and fasten to each other which is very reminiscent of Archigram's Plug in components. The PERI systems are typically exposed and therefore not used in an architecturally pleasing manner. However if there were an alternate additive system which adds an aesthetic aspect to an already existing PERI system, the future could potentially see the creation of aesthetically acceptable architectural solutions.

Papanek in Design For The Real World: Human Ecology And Social Change states that people respond to nature as a result of our fascination with pattern and that we constantly try to understand it by seeking order within it. Unconsciously

or subconsciously we react positively to underlying biological systems because we find simplicity and elegance in nature (Papanek, 1997). The beauty found in these natural occurrences, described further in section 1.06 of this paper, can be explained by the Fibonacci sequence which was developed during the Renaissance when an emphasis on exploration of the relationship of man and nature took place. Papanek states that, human beings have basic needs: food, shelter, clothing, clean air and pure water. He says that over the years we have poisoned our air and polluted our water; for complex reasons. He blames this on the design industry (of which he is part) for not focusing on what is important but rather to create aesthetics. Allowing aesthetics to be derived by the nature of the function of the object in question should determine its design and be what is practised (Papanek, 1997). He preaches design simplification to create what is actually required to survive as we designers share the responsibility for stewardship of the environment. It is assumed that most architects and designers share Papanek's view. The task will not be easily accomplished.

The Triad of Limitations (see Figure 3-18) is explained by Papanek to be the limitations that man must conquer in order to realize his full potentiality. He states that man has traditionally been able to conquer two of the sides of the Triad but has never conquered his limitations of mortality, but even that seems to be coming our way with the investigations into cloning and the human genome. These small victories become progress to each individual group and the Triad of Limitations can become a filter establishing a design's social value. Papanek cites U.S. car manufacturers lying to Congress about their failure to achieve basic safety laws within reasonable costs. Instead

Figure 3-16. Snowboard Ramp. From Successful construction with PERI: Handbook 2005 Scaffolding (p. 77) by PERI, 2005 [Brochure].

Figure 3-17. Church of Notre Dame. From Successful construction with PERI: Handbook 2005 Scaffolding (p. 35) by PERI, 2005 [Brochure].

Figure 3-18. Triad of Limitations. From *Design for the real world: Human ecology and social change* (Ed. 2) (p. 73) from V. Papanek, 1997, London: Thames and Hudson.

they hire lobbyists to fight their company's cause. But, Europeans and the Japanese invest in research to develop safe and efficient cars (Papanek, 1997). The Japanese principles in car manufacturing are to eliminate the root of the problem so more effort (i.e. time and money) is spent up front to design systems which will eliminate recurring issues (including safety issues). The outcome of this is an overall acceptance by society for their products and increased profits through increased sales and lower costs (efficiency). The approach is more holistic, which is what the architecture industry is now searching for. Our industry has complicated all our processes to maximize profit, without realizing the unintended consequences. We are no longer master builders but rather co-ordinators of architecture but do not co-ordinate ourselves to truly maximize efficiency. Early co-ordination and collaboration, as mentioned previously with the Fun Palace is proving to be the best way to successfully complete a building. With the increasing need to take social responsibility for stewardship we have no choice but to embrace this piece of the architectural puzzle.

3.1.5 Integrated Design Process (IDP)

It is seen through Cedric Price's Fun Palace and can be seen with the Richmond Olympic Oval case study in section 4.2 that it takes a collaborative effort to capitalize on the expertise necessary to accomplish these complex architectural projects. Integrated Design Process (IDP) is seen to be an effective strategy for the design of large intensive building projects by keeping overall costs down, by creating successful and more efficient projects (Reed & Gordon, 2000). As communication and coordination become increasingly more important along with the implementation of a more Integrated Design Process (IDP), the traditional firm will not survive without making changes. Unsteadiness in the environment creates the need to be flexible to

cope with constantly changing conditions which is crucial for a successful business. The IDP process looks at establishing a systematic complete method by using most of the existing elements of our current design and construction practice. The process calls for a more active role taken by the client while the architect becomes more of a coordinator and team leader and the electrical, mechanical and structural engineers are brought in during early design (Larsson, 2004). The change toward the idea of stewardship of resources is critical practice for architecture in order for it to embrace changes exerted by today's society.

With increasing pressure placed on environmental issues such as increasing greenhouse emissions, climate change, and depleted resources, pressure is being put on government to respond to these changes. Government is beginning to realize the architects' importance and the role one plays in anticipating change over time primarily with how cities grow and develop. This has resulted in a shift in the way we think of the role of the architect. The broad knowledge and awareness that an architect brings to a project is one that allows them to create a system in which a project can develop in a holistic and sustainable manner. It gives the opportunity to create not only a building system but a management system put into place early in the process in order to proceed collaboratively and successfully (Reed & Gordon, 2000).

The use of an integrated design process will add to the efficiency of buildings in addition to adding to the current knowledge base which will result in providing viable matrices for future constructors, architects, owners, and developers (Reed & Gordon, 2000). With the addition of certain Building Information Modeling (BIM) software the industry today is beginning to shift into a more collaborative environment. This will help foster an IDP guided building industry allowing for a better informed team of professionals with the overall same goal of User Fit, User Safety and Stewardship of Resources. With the globalization of businesses the future will call for collaboration between firms in order to cultivate successful business ventures. The technology inherent in Building Information Modeling (BIM) will begin to play a very large role in allowing for this to develop. BIM technology allows us to create a three dimensional building model in a virtual environment the way it would be built in reality. It works on the basis of a set of rules and dependencies that allow an individual 3D model to adjust according to relationships established between certain objects. This begins to read as a very intelligent model that has the ability to be used as a communication tool as well as one that generates many of the tedious office tasks such as window and door schedules on its own. Using BIM technology also means constant

interaction with other team members while working with the same model which translates into a high level of collaboration and more importantly quality output. Many more of the advantages of BIM are listed below (Lesniewski, Krygiel, & Berkebile, 2006):

- higher productivity
- reduction of conflicts between disciplines
- reduction of schedule time for construction
- reduction of costs associated with complexity
- reduction of information/ intent lost in translation
- reduction of material waste
- reduction of errors and omissions
- increase of precision
- increase of communication and integration

By using a technology like BIM that encompasses a common system language and promotes such things as communication between AEC firms; it will allow a company to more readily share information in real-time with clients and consultants. This will be imperative in establishing an IDP process, and for a company looking towards becoming completely sustainable in its practice, highly efficient and ahead of the curve within new emerging economies. We can begin to see that the IDP process fosters the improvement of environmental performance in addition to other facets of the AEC industry. In The Integrated Design Approach, Larson states that “Experience shows that the open inter-disciplinary discussion and synergistic approach will often lead to improvements in the functional program, in the selection of structural systems and in architectural expression.” (p.2, 2004).

The IDP process is systematic; it has been founded on dealing with issues and changes at the beginning of any design process. To confirm the established observation that IDP works is the complex and troublesome nature of the current process for dealing with issues of a project as they later unfold. The reality of a defined plan for the entire design process gives credibility and form to the process, and allows for easier implementation (Larsson, 2004). It has never made more sense than in today's times of sensitive environmental need.

3.1.6 Olympic Conditions in Canada

Canada makes the Olympic Games a priority like most other countries do every two years. The only issue is that it is not a priority anytime between. The lack of sports funding in Canada has been an issue for many years. Canada is well known for its minimal athletics funding (Odland, 2008). Lack of funding for sports and athletes is an issue at several levels. It exists not only at

the Olympic level but at the grassroots level as well and creates significant problems. Calgary and Vancouver, will now, have a legacy of training facilities for Canadian athletes; that have resulted from hosting the Games. Approximately 40 percent of Canada's population resides in the province of Ontario which lacks Olympic training facilities. Canada's slow start in the medal count for the 2008 Olympics raised questions about the Canadian system. This was associated with the lack of accessible facilities for Olympic athletes and the fact that many had to work full time to support themselves and had little time for training.

The majority of athletes begin training with Olympic hopes at a very young age; which means, without facilities relatively accessible it is less likely that an athlete will excel in his or her sport. We are potentially losing several gold medalists every year. Recently the "Own the Podium" program was initiated; it is a five year plan that will distribute \$130 million to athletic funding at the level of the sports Federations. This gives Canada hope, but does not guarantee funding for provinces to build sports infrastructure. Therefore the need exists to create Olympic capable facilities for minimal costs. In *Developing Sports Convention and Performing Arts Centers* (Peterson, 2001) states that the public sector has taken more responsibility for ownership and development of large sports facilities which were traditionally privately owned. With public ownership there has been an increase in multifunctional stadia/arenas. Cities need to create revenue. Multi-functional buildings create more opportunities for both revenue generation and overall use therefore making them a more viable investment.

Sports buildings are related to culture. "Culture is a large economic, social and political force nationally and internationally;" this statement was presented from a study created by Michael Bloom from the Conference Board of Canada. Bloom adds "Countries around the world, as well as many cities and regions, recognize that a dynamic cultural sector plays a key role as a magnet for talent, enhances economic output, and acts as a catalyst for prosperity," (Babiak, 2008). It was recognized in Ancient Greece that sport was a key part of their culture and even part of their religion. Sports are a part of our culture and contribute to our prosperity through health and well being which has numerous positive effects.

With careful planning Olympic facilities could be built for a multitude of sports training purposes. This raises the question of how to build facilities that are multi-functional and cheaper to build than conventional sports infrastructure. The answer is partially in the cybernetics and systems

design approach of the Fun Palace. This thesis seeks to find more answers. There are multi-functional buildings that include some of these necessary qualities. The use of cybernetics and systems theory will help in designing multi-functional buildings with greater flexibility, longer useful live spans and lower construction costs. Such a concept makes sense as Canada strives toward excelling on the world's Olympic stage. Such a system would require very careful planning to incorporate the strategies discussed to achieve flexibility, adaptability, functionality, and modality.

3.1.7 Olympic examples of Stewardship

As previously discussed there have been several attempts by cities to achieve a level of stewardship in the Olympics. But the degree of success has varied. Cities truly committed to a level of stewardship have been blinded by the marketing of the word sustainability. Though they have incorporated many of the LEED requirements for sustainability they have failed to deal with the major issue of legacy. Canon Design and the City of Richmond took a different approach from previous attempts. They looked beyond the Olympic Games and approached the project in a holistic way considering various program variables and planning with legacy in mind (see Case Study 4.2.1). The host stadium for London 2012 has an innovative design with a two stage construction process. Firstly, it is designed for Post Olympic use like the Richmond Oval and secondly for the Summer Games event. Although, London has experienced some problems in acquiring future ownership for the stadium, but have a system in place to drastically minimize costs. The building makes for an allowance to reduce the seating from 80,000 to 25, 000.

Kieran and Timberlake believe that society has developed to a point that we now have the tools to be efficient in every aspect of architecture. However an issue not fully resolved is the process that creates Olympic buildings that become inactive for long periods of time. By synthesizing the systems design information that has been gathered by some of the most revered architects of the 20th century we can now create future guidelines. There is a real need for these systems to be developed. Peterson explains in his *Developing Sports Convention and Performing Arts Centers*, how the public sector has taken greater responsibility for ownership and development of large sports facilities which were traditionally privately owned. With public ownership there has been an increase in multifunctional stadia/arenas (2001). There currently are multi-functional buildings but cybernetics will help to design the ultimate multi-functional building with the greatest flexibility and longest lifespan to justify their high construction cost.

4 Research Summaries

4.1 Theoretical Hypotheses

4.1.1 The Role of Sports Cybernetics

This thesis has shown the previous connections made between cybernetics and architecture in addition to presenting information about the Olympics and its origins. Together they form a common thread for which this writer coined the term Sports Cybernetics. That is, the common human factors found in cybernetics, architecture and the Olympic Games. The term is made apparent when analyzing the relationship between cybernetics and systems theory with architecture and Olympic sport. Cybernetics and systems theory are both based on human biology; cybernetics further studies the feedback, communication and control systems in living organisms. They both share a human element with Architecture which has its origins in the proportions and direct interaction of the human body. Also, the thread is apparent in Olympic sport ever since Ancient Greece began its quest to improve humanity by testing its limitations. Human desire to examine its limits and seek efficiency is displayed most successfully through sport. Similarly, cybernetics also uses systems theory to seek optimal efficiency using minimal resources to create maximum effect. These qualities are increasingly desired in architecture to develop stewardship towards the environment.

Figure 4-1. The common thread of Sports Cybernetics

The majority of the cybernetics information considered for this thesis dates from 1940's to the 1970's. As a relatively new field, cybernetics made its way to the forefront of advanced technology in a short time. Applications of it vary from biology to psychology, anthropology, physiology, mathematics, computer systems, business management, architecture and others. Architecture found its relation to cybernetics and systems theory fairly early and peaked as a study in the 1960's and 1970's with Cedric Price and Gordon Pask. During that time, the

Archigram magazine was able to prolong the visions of a systematic architecture of flexibility and adaptability by tantalizing architects with images of unlimited technological possibilities. As architectural cybernetics progressed over the last fifty years, studies have become quite varied and are more associated to computer applications of architecture. Considering information from the beginning of cybernetic application to architecture has enabled a fresh look at the raw aspects of the study and, more importantly, its effects on the AEC industry.

Contemporary architects like Richard Rogers and Renzo Piano were able to push the limits of a building with the Centre Pompidou by introducing flexible systems and technological advances. Similarly, Moshe Safdie's Habitat 67's, reinforced concrete building modules while Kieran and Timberlake's manufacturing methodologies begin to encompass ideas of modularity and mass production (Kieran, 2004). The influential projects of the past attempted to overhaul the methods and attitudes of architecture during that time. Although initially criticized for their attempts of drastically changing architecture, it is recognized and supported through systems theory that the change was pivotal. Today we are able to see that these critical thinkers were correct in their suggestions and many of our environmental problems could have been avoided if these ideas were adopted many years ago. Today we find crucial need to implement many of them.

The Olympics are one of the world's largest recurring events; the popularity of the Games shows the need for it to continue as a world cultural event. The infrastructure built for the Games has traditionally been specific for the one time use. A legacy of under-used massive infrastructure and resources that may have been better served elsewhere is then left for the host city to manage. Only recently has there been a move by the IOC towards environmental stewardship. As a result we have seen several attempts in the past 12 years by cities to host a sustainable Olympics. Only now are we beginning to see more sustainable thinking by the designers associated with the 2010 Winter Olympics in Vancouver, Canada, and the 2012 Summer Olympics in London, England. The methodology used for the design of the main stadia for both these Games enables better future use of these facilities. By analyzing successful examples in addition to other methods such as the Japanese modular systems or PERI scaffolding systems we are able to develop deeper understanding towards architecture. This knowledge adds to the idea of stewardship, adaptability, flexibility, modality in addition to multifunctionality.

Inherent in architecture are aspects of the human body, moreover, sports are known to test and extend the limitations of the human body. Systems theory studies the natural aspects of complex systems discovered in biology and is synonymous with cybernetics. Cybernetics on its own has been a test of the biological nature of the human body which investigates man's natural systems and their limitations. Systems theory and cybernetics allows us to create the necessary bridge connecting the natural human systems intrinsic in both architecture and sports, to help create the concept of Sports Cybernetics (see Figure 4-1).

4.1.2 An Architectural Systems Approach

The importance of a systematic approach to architecture must be made. This approach should involve a system that is inspected in detail upon the analysis of all the facets of the particular system. As stated earlier in section 3.02 of this research, it is difficult to understand the extent to which we have to break down a system into component sub-systems. Furthermore, to what extent we organize the higher order systems in which they are contained. A need to have different orders of systems is crucial in the comprehension of Sports Cybernetics. R. Buckminster Fuller emphasized the importance of starting the analysis at the highest level possible and developing a system in a hierarchal manner. As Fuller explained, it is necessary to start at the universe and work inward (Marks, 1960). Moreover, systems theory indicates that each level of a hierarchal system cannot be governed by the rules of the level below it. It is supported with the downward causation principle, stated in section 3.02, which indicates that the system level above dictates the rules for the level below.

Sports Cybernetics will be a system within a higher order universal system (see Figure 4-2) that contains a three-level system of its own. Sports Cybernetics is divided into the following three Levels:

1. Overall organisation of the major systems (ex. site, access, program organization) –based on design requirements for specific events.
2. A Building system – determined by program - flexible specific needs (ex. floor, roof, and wall systems that are able to be adjusted)
3. A Building components system, where the previous building systems of level 2 are broken down further to encompass human factors (components are able to be manually manipulated)

Figure 4-2. This proposed methodology with sports cybernetics outlines the entire system showing need for establishing design requirements and creating a program to then begin the Sports Cybernetics three level system. This culminates in a cyclical system containing a learning feed-back loop.

By creating a three-level system that gets broken down to a system of components we may consider the factors involved within the higher order systems while remaining flexible.

For this systems approach in architecture to take place it will require the need for further research and the attainment of the necessary design requirements. The information shall contain all necessary characteristics for each of the spaces indicated by the governing institution establishing these outlines. This information shall be the body of knowledge used to inform the following levels of the system above. Additionally, this knowledge base creates the opportunity to synthesize characteristics of different spaces allowing for architectural decisions based on the evidence gathered. This allows us to work through level one and two. It also informs level three, but inherent in this level is the human factor. By incorporating human factors we begin to look at ideas of modularity and the ability to manually manipulate architectural systems that are in place. We can then achieve flexibility through level three resulting from developing it based on human factors and limits. This sets the stage for a construction that speeds up the building process, enhances safety, and decreases cost; while being very flexible in constructing, renovating or dismantling and reusing elsewhere. A structure built using this system should become flexible, adaptable and have low embodied energy as a result. In addition, any necessary future changes that may take place will be able to work through a feed-back loop. This creates the ability to direct changes back through either level 1, 2, or 3 of Sports Cybernetics, creating a learning platform for the AEC industry based on stewardship of resources, user safety, and user fit.

4.2 Case Studies

4.2.1 Vancouver 2010 Olympic Games, Richmond Olympic Oval

Historically, Olympic host cities face problems in that legacy buildings remain seldom used and never regain their full potential after the event for which they were designed. The Richmond Olympic Oval demonstrates a responsible approach to the sensitive issue of designing Olympic Legacy buildings. Located along the Fraser River, the \$178-million building will act as a multi-purpose facility that integrates sports, recreation, culture, and business year around. It is intended to become the heart of a mixed-use neighbourhood.

The 33,700 square-foot, Olympic Oval opened in December of 2008. During a lecture by Greg Scott, the Oval's facilities manager, he spoke about the key issues dealt with during the planning

Figure 4-3. Richmond Olympic Oval - December 2008. Photo by author

and construction of the Oval and those receiving special focus. A mutual understanding, business terms of agreement, culture, programs, challenges and opportunities were the issues spoken about. Most importantly, the plan for post-Olympic use was made clear throughout the presentation. Post-Olympic use of the Oval was made a priority from the start of the project. Typically, most Olympic stadia have focused primarily on the two week long event, and then found it difficult to incorporate program to pay for the operation and maintenance of the stadia. By using an Integrated Design Process (IDP) to deal with these key issues initially guaranteed the Oval a successful future. Canon Design Inc worked with the local community groups and organizations to ensure that the building would cater to everyone's needs. A three tier business plan was used where the three stages were Pre-Olympics, Olympics and Post-Olympics. The Authorities involved were: the parties paying for the building, the IOC, and the City of Richmond who is the heir to the building. This Olympic Oval is meant to be an iconic building where

sustainability and wellness were major aspects that the designing group and community wanted to display and then inherit.” Greg Scott.

In his presentation at the IDEX 2008, Greg Scott stated that the success of the oval was primarily attributed to organization. The ability to develop a successful system involved getting a project team together right at the start, essentially beginning with the IDP process. This allowed the professionals to begin discussing and working together earlier. It provided the opportunity for close collaboration in such details as reusing waste heat produced in the ice factory to help heat other spaces and containing the air ducts within the gluelam beams of the structure. It also meant collaborating with the local First Nations groups and integrating local art and culture into the facility. Moreover, Richmond contains the largest Asian population in Greater Vancouver and so the post-Olympic sports incorporated into the facility were catered to the majority.

When visiting the Richmond Oval, site supervisor Greg Kensick described several of the processes and decisions that took place during design and construction of the project. In analysing the methods used for the completion of the project they can be said to have cybernetic or systems approach qualities. The Richmond Olympic Oval was analyzed according to the hypothesis and three level system for Sports Cybernetics established in section 4.1.2. It showed a similar approach as that discussed in the previous section. The system established by the Canon Design designers is broken into a three level system that is described below:

1.They established the building typology based on the Olympic requirements and addressed post Olympic use early in the process. It was also determined by the types of sports and permanent facilities required for Post-Games success. They considered the decisions discussed with the local community. With the information gathered, they set their stewardship goals which became their designing principles. In summary, they determined the building typology and their highest order laws of stewardship. They then considered all issues inherent in the Olympic typology, which set the stage for level 2.

2.Designers determined the playing surfaces that were necessary for the multi-functioning venue. With this information they established the specific building systems necessary to allow

Figure 4-4. Triangular Gluelam at Wall.
Photo by author

for the functioning of the intended sports. The permanent floor system was determined by the speed skating function but remains flexible with the incorporation of a system of valves. These valves allow to control the areas of the slab that are cooled which then allow for dividing the ice surface into two hockey rinks without energy waste. Furthermore, a system of removable seating was used so that the Post-Olympic uses are able to maximize the floor area. The roof system takes advantage of long spans that allow for column free space making for a flexible interior during the building's lifetime.

3. Analyzing the building components system is defined by the systems used for the roof, floor, wall, seating and other miscellaneous items.

Roof – Starting with the main feature of the Oval, the gluelam beams (see Figure 4-4) came from 500 km away in Penticton BC. These were made in 4 sections. The sections of gluelam were designed smaller than necessary in order to ease transportation (on the back of a flat bed transport truck), construction and fit in a steel fabrication shop. Rather than delivering these beams to the site, they were taken to the steel fabrication shop. There they were able to coordinate and apply the triangular duct work placed within the V-shaped Gluelam beams (see Figure 4-4 & 4-5). The resulting four sections were then moved to the site and assembled in place easily during the construction process. The other elements described as the wood-wave panels that span between each beam were also very systematic in design. These were made in three sections and from dimensional lumber of the compromised pine beetle wood from the forests in British Columbia. This allowed for easier integration with the acoustics, sprinkler, and lighting systems that are hidden within the wood-wave panels (see Figure 4-6). The three

Figure 4-5. Richmond Oval - Gluelam Beam Roof Structure.
Photo by author

Figure 4-6. Wood-wave panels. Photo by author

sections of wood-wave panels were then assembled on site on the ground and hoisted into place, spanning each consecutive gluelam beam as they were installed.

Floor – As mentioned earlier, the floor system is determined by the speed skating function but remains flexible by incorporating a system of valves. The floor of the space is finished concrete and is completely flush in order to maintain flexible and able reorganization (see Figure 4-7, 4-8 & 4-9) for division of the floor program. The speed skating oval is placed on the second level as a result of a high water table enabling the organizers to maintain the strict skating surface regulations of the Olympics. In addition, they were able to place controllable valves on the underside of the slab to regulate the cooling of the floor for making ice. The piping was distributed in three different sections of the floor to allow for turning off the main section of the oval and maintaining control of the Olympic hockey rink ice following the Olympics. A thick 40mm nylon rope was used for the inside and outside perimeters of the oval which was then simply sprayed with water in layers allowing for the water to freeze. The centre of the oval is wood gym flooring permitting multi-sport use. For the Olympic ice rinks a board system that is intended to run on a track for easy installation and removal was indicated by the site supervisor although there was no visible evidence of the track system. It is intended for the combination of the two rinks for larger community ice events. The remaining floor functions will be simply applied onto the finished concrete.

Street Level

Figure 4-7. Richmond Olympic Oval, Street Level

Activity Level

Figure 4-8. Richmond Olympic Oval, Activity Level.

Mezzanine Level

Figure 4-9. Richmond Olympic Oval, Mezzanine Level

Wall – The wall system that was utilized for the building, aside from areas of glazing, was a combination of corrugated aluminum panels and poly-carbonate cladding. These were meant for fast and easy installation and they are lighter materials and are less intensive a process to install. The poly-carbonate cladding provides a high insulating value as a result of being a panel of corrugated plastic sandwiching a sealed airspace. Modular, easily handled sizes were used.

Seats – Within the Olympic oval there will be approximately 5000 seats for viewing the event. This is in the form of a collapsible bleacher system (see Figure 4-10). It will allow for the maximum use of the floor area after the Olympic event is over by simply removing

Figure 4-10 Flexible Bleacher System.
Photo by author

these bleachers and reusing them for other community events elsewhere; some maybe retained for use with the ice rinks.

Miscellaneous – The mechanical louvers placed within the gluelam beams regulate the different heating and cooling zones of the open space; they are all controlled automatically. Indoor soccer nets and basketball hoops used are of the collapsible type (see Figure 4-11).

Figure 4-11 Collapsible Basketball
Hoops. Photo by author

With the Olympic Oval's ability to contain a multitude of activities for Post-Olympic use it should become the most successful legacy building built for either the Summer or Winter Olympics. Although many of these spaces are most likely going to remain in place for the life of the building, the potential exists for the space to be transformed back to the original long track speed skating oval. The fact that it encompasses ten different sports in addition to other functions makes it a sustainable building. Within the limits of the highly specified 400m speed skating Oval requirements, the design team was able to make design choices that will guarantee the longevity of this legacy building.

4.2.2 Toronto Ontario, Rogers Centre (Skydome)

Known as the SkyDome until 2005 the Rogers Centre in Toronto Ontario, Canada was built from 1986-1989 (see Figure 4-12). The Stadium is famous worldwide for its fully retractable roof. As a premier stadium it has been home to the Toronto Blue Jays MLB Baseball Club and the Toronto Argonauts CFL Football team. It also accommodated the Toronto Raptors NBA Basketball Team from 1995 – 1999 during the construction of the Air Canada Centre. The versatility of the venue allows for a variety of events suited for arenas, domed stadiums and open-air facilities. Its capacity ranges from 5000 to 60 000 when used for sporting events, concerts, family shows, trade shows, motor sports, conventions, and private events. In addition, the Rogers Centre also

Figure 4-12: Rogers Centre South Waterfront. From flickr.com

holds businesses such as Premier Fitness, the Renaissance Hotel, several restaurants, bars and a Theatre (Rogers Stadium Limited Partnership, 2009).

The architect Roderick Robbie was able to create a stadium with the ability to transform its function to accommodate a variety of uses throughout the year. In 1997 the stadium recorded 302 event days making it one of the most used venues in the world. The design of this stadium was an important investigation into flexibility and adaptability, as it has continuously been successful in adapting to different functions. When analyzing the venue, it can be seen that there are several things occurring within the structure and its components. The following analysis of the systems approach used for the Rogers Centre is broken down only to explain its high level building system and organization:

1. Roof System - The Rogers Centre's retractable roof system allows for an increased attraction for events taking place during good weather months. It allows for the traditional ballpark open-air experience while giving the venue a dynamic presence in Toronto. The roof is comprised of four sections, three of which are moveable (see Figure 4-13). While two sections simply retract back over the stationary northern part, the smaller southern section of the roof uses a track to guide its rotation and tucks underneath the larger northern circular part. The roof covers approximately 8 acres and weighs 11,000 tonnes. By designing the retractable roof system using railway tracks a reliable proven system, the roof has been functioning successfully since its completion. Using this system it minimized the number of movable parts within it, which allows the roof to retract in approximately 20 minutes. This permits the stadium to allow for 91% of the seating area and the whole field to be exposed when in the open position (Munsey & Suppes, 2005). This emphasizes the possibility and importance in developing high technological solutions using low tech but proven systems.

Figure 4-13: Rogers Centre, Toronto ON, Canada. Base image from Google Earth

2. Floor System – A large part of the success of the Rogers Centre is due to the flexibility of its floor system and the speed and efficiency in which it can be reorganized. By having this ability it is able to respond to the several changes that take place, due to the varied events scheduled throughout the year. To accomplish this task, Rogers Centre makes use of a synthetic playing surface for baseball, football, soccer and other sporting events. This synthetic surface is called 'FieldTurf', it is made to look, feel and react just like natural grass (Rogers Stadium Limited Partnership, 2009). It enables the field to be rolled up quickly, which permits the

transformation of the surface from one set of requirements for a particular sport to another set or to a completely different event (Munsey & Suppes, 2005).

3. Seating Bleacher/Grandstand System - Quickness of change over is also made possible by the incorporation of flexible seating; these grandstands are at the lowest levels of the stadium closest to the playing surface. The lower stands are placed on rollers making the system easily manipulated into different configurations for the unique requirements of the different events taking place (Munsey & Suppes, 2005).

The ability that sets the Rogers Centre "Skydome" aside from the majority of other major stadiums around the world is its ability to convert the stadium very quickly between its most extreme uses. The combination of its two major systems, that of the floor and seating/grandstand systems allows this to take place. The conversion from football to baseball takes up to 30 hours. For other events it takes 20 hours to remove the baseball diamond right to the concrete floor. Furthermore it only takes 16 hours to get to the concrete floor when removing the football field (Rogers Stadium Limited Partnership, 2009). Combined with good scheduling it becomes a very efficient system that allows the stadium to maximize its usage. This satisfies the needs of the city of Toronto without having to build alternate sports infrastructure to house the number of events that take place over the course of a year; making it a sustainable building in this sense.

The following figures (4-14 to 4-19) display the various configurations of the Skydome seating, we begin to see with these six examples that they begin to have some similarities. Most musical entertainment will have the same seating arrangement, even for an event such as Disney on Ice also adapts, with slight variation, the same arrangement as concerts. The Football both CFL and NFL as well as any soccer event will have the same seating configuration. The largest and most dissimilar use is Baseball but by having a module that worked for Baseball and allowing for flexibility of the infield space the stadium is able to adapt into many other event spaces.

WBC – World Baseball Championships

Seating arrangement in the infield changes for each sport to be played

NFL Football (BILLS Toronto Series)

Seating arrangement for the CFL and NFL is the same the difference occurs on the field size where the CFL has larger end zones.

Supercross 2009 Configuration

Arrangement is similar to that of the CFL except that there are not any seats at surface level these are all raised.

Figure 4-14 - Rogers Centre seating configurations for multiple events throughout the year. From Rogers Centre, 2008. Retrieved November 13, 2008, from rogerscentre.com

Monster Jam 2009 Configuration

Seating arrangement for the Monster Jam and Supercross remain similar.

AC/DC Concert Configuration

For most concerts the seating configurations should be very similar to this example.

Disney On Ice: A Disneyland adventure

This example shows the seating arrangement similar to the one above.

Figure 4-15 - Rogers Centre seating configurations for multiple events throughout the year. From Rogers Centre, 2008. Retrieved November 13, 2008, from rogerscentre.com

5 Design Project

5.1 Design Process

5.1.1 Principles and Precedence

After an in-depth review of the work of R. Buckminster Fuller, Cedric Price and Archigram, we may consider them systems approach precedence. We may take from Fuller's work the idea of stewardship of resources; learning from his views on the impact of construction, choice of materials and reusing and recycling. This differs from the focus of Price's work which was heavily based on the flexibility of his designs. We must move forward his design methods that respond to social issues, dealing with present and future trends while creating a framework to work within and using systems of modular components to achieve flexibility. Similarly, the work of Archigram was a systematic approach where ideas of physical flexibility and plug-in component modules may be brought forward. In researching current systems of flexibility, PERI Formwork Systems Inc. provides various modular systems that are used worldwide. These systems of formwork allow for complex designs to be achieved safely and accurately. Their success has spilled over into providing temporary public use systems for grandstands, stairways and various temporary structures (see Figure 3-14) that are proven to be quick, sturdy, and able to withstand the stresses of live loads. In summarizing a systematic approach to architecture, we will carry forward 4 principles into the design phase:

1. Consideration of short and long term uses;
2. Planning with future programmatic changes in mind;
3. Identifying and understanding the needs of the particular architecture;
4. And, developing methods that work together to create a successful system.

Figure 5-1. Telstra stadium in 2000, Australia. Retrieved June 16, 2009, from gamesbids.com

Figure 5-2. Telstra stadium in 2004, Australia. Retrieved June 16, 2009, from gamesbids.com

In re-associating with the Olympic Games, precedence studies show an attempt to achieve a sustainable event status. The first effort of sustainability recognized by the IOC was the Sydney, Australia Olympics in 2000. Its major objectives for the Olympics were to remediate an industrial wasteland and create an Olympic park where venues work in partnership to create a successful long term attraction and use of these facilities. With respect to the Telstra Olympic Stadium, the major adjustment that took place was the removal of excess seating following the Games (see Figure's 5-1 & 5-2).

Figure 5-3. London 2012 Olympic Stadium, England. From HOK Sport. Retrieved April 1, 2009, from archifield.net

The London, England Olympics of 2012 is another example of a local organizing committee placing a focus on sustainability. These Games focus on remediating Lee Valley which was another industrial wasteland. The design of the main venue for Athletics will have its seating capacity

reduced by 55,000. This is achievable because of careful planning for flexibility. The designers located food concession pods around the site rather than within the building which automatically relieves the building of much of the utilities necessary for the extra 55,000 spectators during the Olympics (see Figure 5-3). It creates a division between the temporary and permanent elements; this allows it to have a clear post-Olympic reduction plan.

The designers of the Olympic Oval for the 2010 Winter Olympics in Vancouver British Columbia showed sensitivity towards designing Olympic venues in a community setting (see Figure 5-4). An emphasis was placed on locating it within a growing community and truly considering the post-Olympic effect early, by involving the community in the programming process. The Oval, also indicated in case study 3.2.1, was planned to have its main sports surface reprogrammed for the Games and then back to its community configuration following the events. Its architecture

Figure 5-4. Vancouver 2010 Olympic Oval. Photo by author

is also comprised of a set of prefabricated and modular elements such as gluelam arches, wood wave panels, cladding, and the smaller elements of collapsible basketball hoops and temporary seating. This made the construction very systematic, and allowed the project to be completed

ahead of schedule (as per discussions with the site supervisor Greg Kensick on December 15, 2008)

5.1.2 Moving Forward

In linking the research presented earlier to a design project, a focus is placed on creating a system that can deal with the concern surrounding the legacy of Olympic buildings. The issue of stewardship towards resources is a matter that pertains to all communities and cultures. Using a systems approach we can build Olympic venues that reduce embodied energy and increase adaptability and flexibility for post-Olympic community use. In utilizing the examples set forth by R. Buckminster Fuller, Cedric Price, Archigram and others and moving forward, it is crucial to tackle more than simply the issues pertaining to any one particular design. As stated earlier, a great problem encountered is the large infrastructure built but never utilized to its intended capacity following the Olympic event. Consideration should be given to the aspect of creating Olympic structures for the communities that help pay for them. Ideally the desire is to create a design that has the ability to be iconic while respecting the post-Olympic community scale in a sustainable and efficient manner.

The decision to propose a new methodology for the building of Olympic Venues is one that looks at key issues dealt with during the Olympic bid process. This design project builds upon the idea of the City of Toronto, Ontario Canada hosting a Pan American or Summer Olympic Games event. It is developed based on the establishment of a future neighbourhood contained within the winning bid design by Michael Van Valkenburgh Associates, Inc. (MVVA) for the Lower Don Lands hosted by Waterfront Toronto. The MVVA bid is designed on the basis of being flexible & adaptable and remaining sustainable throughout its development. This begins to tie in with the approach that this thesis design project is aiming for.

Recognizing that a community has several needs, the decision to focus on the recreational needs was made as the logical choice given the topic of this research. This design thesis attempts to show how to develop the architecture required for hosting an Olympic event or events while showing sensitivity towards the legacy for a community. This legacy shall recognize the community's needs as well as scale. The design begins to distinguish between a permanent Olympic legacy and a temporary Olympic event. The key terms of assembly, disassembly and reconfiguration become important in the creation of this particular methodology and design.

5.1.3 Design Methodology – A Three Level Sports Cybernetics System

A categorization of Olympic sports shows a division between Water, Gymnasium & large/small courts, and Outdoor sports (see Appendix A). During the Beijing 2008 Olympics, 15 of 37 sports were played within the Gymnasium and large/small court sports category (See Appendix B). It becomes clear that this category is the area in which we may have the greatest influence on stewardship of resources in the Olympics. The decision to focus on a design project was made with this information. The following methodology deals with this category of Olympic Infrastructure.

The methodology used during the design process was based on a systematic approach to the construction of an Olympic venue. This system considers the macroscopic issues involved with locating a venue in a bid city. The same system also requires analysing the microscopic details

Figure 5-5. Three level Sports Cybernetics system

compulsory to the success of the venue itself. Recognizing these facets of the system we may introduce a process that involves a High, Middle and Low order system (see Figure 5-5).

5.1.3.1 High Order System

The High order system is established to define the most efficient building in a specific setting. It is divided into the aspects of Space, Time and Site. Space deals with exploring the microscopic details and technical requirements of an Olympic venue specified by the IOC and its member sports federations. A detailed investigation of these needs was essential to understand the requirements of the eleven sports considered. Each sport was surveyed for its technical and spatial needs. A synthesis of the support space programming was necessary for all sports

Figure 5-6. Relationship between the Lower Don Lands and adjacent sports venue, Toronto 2007 aerial photo. From author. Base image retrieved June, 15, 2009, from google earth.

considered. By using the strictest programming requirements, we are able to develop a template drawing for each space (see Appendix C). In conducting this research it enables logic behind the potential overlapping of sport surfaces (see Appendix D). The decision of the sports that may be played in the venue can remain flexible during this stage of the process. The ability to keep this flexibility results from combining the strictest requirements for the support spaces of all sports considered. The variables of Space become a data set to help predict the sports that shall work together for optimal efficiency for a building when evaluated with Time and Site.

The aspect of Time addresses the information needed to accommodate Olympic sports in the typical two week timeframe in which the Games are generally held. In the table seen in Appendix E, information compiled based on the 2008 Beijing Olympics synthesizes the data collected from the scheduling of the games. The information shows the number of surfaces necessary for any of the eleven sports in consideration. In addition, it indicates the number of events per day per surface that is required and is color coded as preliminary, quarter-final, semi-final or final events. This information gives us the opportunity to determine the sports that may be hosted within the same building with no scheduling overlap.

When considering the aspect of Site, we begin to look at the site, its relationship to the other potential venues and demographic needs (see Figure 5-6). The site chosen for this design

Figure 5-7. MVVA Lower Donlands proposal, Toronto 2007. From MVVA. Retrieved Aug, 20, 2009, from bricoleurbanism.org

project is a future redevelopment of the Lower Don Lands in Toronto, Ontario Canada (See Figure 5-7). It has been indicated that the demographic targeted for the Future Lower Don Lands community will represent a diverse neighbourhood much like the city of Toronto (Waterfront Toronto, 2008). Therefore, the decision was made to base the table seen in Appendix F on the demographic of the district of Toronto and East York. It is found that the most popular sports for the area are badminton, basketball and volleyball. Furthermore, the popular community programs found are yoga, various dance classes, cardio and ball hockey.

After considering the information pertaining to the categories of Space, Time and Site we are able to make an evidence based decision on the ideal and most efficient type of Olympic and post-Olympic venue for this particular site and demographic. The decision was made to create a venue that would have an Olympic use of taekwondo and basketball or volleyball. It is determined that the efficient number of seats is 8000. It should be noted that only the

Figure 5-8. MVVA Lower Donlands proposal, Toronto 2007. From MVVA. Reproduced by author preliminaries of basketball or volleyball would be played in the venue, considering the final games would likely be hosted in the Air Canada Center. The post-Olympic use would be for basketball, volleyball, badminton among other flexible program.

5.1.3.2 Middle Order System

The Middle order system is a consideration of the systematic approach to the site. A typical site analysis is required for this to take place. When looking at the future plan for the Lower Don Lands (see Figure 5-8), the selected site is bounded by Commissioner Street to the north and the MVVA proposed naturalized Don River running along the east and south. It also contains several access roads that have been deemed as the fixed elements for the purpose of this project. There is a visual connection to outdoor recreation fields towards the south and west of the site. General transportation for the area would be in the form of a Light Rapid Transit (LRT) line that will have major stops at the intersections of Cherry and Commissioner Street and at the northeast corner of the site. The Lower Don Lands will maintain a connection to the

Martin Goodman Trail that runs along the Toronto waterfront. This major trail is connected to the recreation site via new park trails that diverge from it, bringing people to and from the site via various paths. The major multi-use trail that runs north-south along the Don River has a connection to the Lower Don Lands via access through the site. Additionally, it connects to the new park trails making its way along the future estuary planned as part of the naturalized Don River and then reconnecting to the existing waterfront path to the west.

Figure 5-9. High level Olympic systems approach.

With the pre-existing conditions for this project established in conjunction with the MVVA proposal we can now look more closely at the approach that can be taken towards the particular site. If we look at any Olympic project there is a clear division between the Olympic and post-Olympic setting. Furthermore, there occurs a very clear separation between the needs during these periods of time. Taking into consideration that this project is being designed within a future community we can approach it by looking at the Olympic need versus the community need (see Figure 5-9). The logic is that the addition of the Olympic need to the community need shall render an Olympic venue. If these needs are situated in a manner that a separation may be made after the event, then, the Olympic infrastructure may be removed from the post-Olympic infrastructure. This would leave us with a community size building as a legacy. When considering the site we must acknowledge the fact that for an Olympic building we necessitate more area than only one of the two parcels of land indicated within the site property line (see Figures 5-10 to 5-14). This is a result of the space required to seat 8000 spectators and provide safe and easy access and exiting for the building. It requires us to look at developing the two parcels that are divided by a road into one larger parcel that can then accommodate the space requirements that were established via the programmatic research in the high order system.

Figure 5-10. Site boundaries, access roads, and predetermined parcels of land

Figure 5-11. Permanent legacy infrastructure located on recreational site

Figure 5-12. Temporary program located closes roadway

Figure 5-13. Organization of programmatic requirements, spatial relationships

Figure 5-14. Re-establishment of the roadway and community infrastructure

The access roads surrounding the two parcels create boundaries that shall be considered as long term infrastructure. The original site deemed for a recreational building will be the location for the permanent legacy program, whereas the temporary Olympic program may be placed adjacent to it. This will temporarily close the access road that divides the two parcels for the period during the Games. This systematic approach allows us to begin organising the entire area in terms of permanent versus temporary infrastructure using the programmatic requirements found in the program analysis (see Appendix C). This information is used to inform space relationships and sequence of events among other considerations established in the high order system. Creating a system that has this clear division permits us to re-establish the dividing road and provide area for the future school, which is slated for the adjacent site, after the Olympic event.

Figure 5-15. Four classifications in an Olympic/post-Olympic systems approach includes Removal of temporary elements necessary during the Games (ex. structure, seating, broadcast media booths, and concession stands). Conversion pertains to elements designed for future alteration. Addition concerns any added elements to the post-Olympic building. Left As Is are the elements retained as unchanged legacy items (ex. mechanical/electrical systems, administration offices among other program).

5.1.3.3 Low Order System

The Low order system shall be defined as the architectural approach to the building components. First, we will clarify four classifications in an Olympic and post-Olympic approach, please refer to explanation found in figure 5-15. By establishing the Removal, Conversion, Addition, and Left As Is classifications of components to the system, it is easier to visualize the separation between Olympic and post-Olympic infrastructure. These categories become important throughout the consideration of the Low order system and design process. Furthermore, this enables us to keep comprehensive hold on the elements that are found throughout the two stages of design.

This approach to the architectural components of the system begins with knowledge of the site boundary and the need to create a division within it. It enables the allotment of a permanent versus temporary site (see Figure 5-16). A permanent infrastructure can then be considered first and the needs of the community moved forward with the legacy building design. This simplification initiates thoughts of using Conversion, Addition or Left As Is elements within the

Figure 5-16. Systems approach to architectural components, permits the use of temporary elements to enable reacquiring of floor space after the Olympics

legacy building and its considered program. Once set, we may consider the addition of infrastructure needed for the Olympics. This Olympic infrastructure required becomes the designated Removal items of the four classifications in an Olympic and post-Olympic approach.

The temporary portion of the Olympic venue, indicated as the Removal items, shall be designed as a system that enables for dismantling of everything from flooring and finishes to structure and roof. The use of materials such as steel and aluminum for structural and cladding purposes and glass where necessary will permit for the reuse or recycling of these components elsewhere after the events. If we use the same methodology as proven in the PERI examples discussed in Chapter 3 it will allow for a design of a structure able to withstand the live loads of a venue. The logic behind this is direct. We will create an exoskeleton using steel to span the larger distances and carry the major loads. The rest of the system resembles a post and beam style construction where the exoskeleton of steel combines with the lightweight PERI aluminum supporting elements creating the interior supports. These interior supports become the second level support for the flooring modules that will get laid as per the PERI system. This is an overview of how this temporary portion of the design may be realized. To get into extreme

detail would involve defining the entire construction of the system and a comprehensive account of the components that would be needed. As for this thesis|project we will continue to focus on the overall methodology towards the design.

With the additional Olympic infrastructure defined as a set of removal elements we can now look at the Low Order set of modular elements. The use of temporary removal items for seating, concessions, and broadcast booths are used for the purposes of space planning (see Figure 5-16). This permits designing spaces that typically require large areas for the Olympics but are unnecessary in community buildings; spaces may then be reacquired for community use in the legacy building.

When planning out the seating modules we must acknowledge sightlines for spectators. This concern is addressed by a balance between sightlines and floor to floor heights in order to stay within acceptable sightline standards (John, 2007). Using established retractable seating will allow the legacy building to retain seating without having to dedicate a large gross floor area (see Figure 5-17). This also enables flexibility for the future community to hold large events when desired. Any remaining seating may then be relocated to public schools or other community buildings that may require it.

Figure 5-17. Section of retractable seating modules, these may be removed to reacquire floorspace, and either retained or moved off site

Figure 5-18. Concession module section, facing side swings inward to allow for business. Wheels swivel for easy maneuvering.

Food and snacks are an important part of the experience spectators have at every venue. Concession stands become a necessary part of the Low order system but one that is completely unnecessary for a community recreational building. Portable concession stands already exist but there has not been any example of modular concessions designed to accommodate the needs of indoor stadia. According to stadia guidelines the standard concession stand measures 2600mm x 2600mm (John, 2007). This happens to be a size that can be accommodated on a typical flatbed transport truck. The hope is to have a series of modular concessions built from typical shipping container units and outfitted with the necessary fittings to allow the plugging into an already planned location within a venue. These modular concessions would be transported to the site and hoisted to the floor level required and be guided into place easily via pre-assembled wheels (see Figure 5-18 & 5-19). It would then plug into the predetermined power outlets enabling it to function as a regular concession stand.

Figure 5-19. Concession module plan, designed based on a half of a shipping container

Media is very crucial to the delivery of an Olympic event to offsite spectators. Broadcast booths therefore

Figure 5-20. Broadcast Booth module section, the rear pulls out to create a pathway around the perimeter.

become a key part of a successful venue and the last of the Low Order set of modular elements. Building upon the idea of the use to shipping containers and modularity it was found that it would be extremely beneficial to modify these into broadcast booths (see Figure 5-20 & 5-21). With a few modifications, these containers could be pre-packaged with the necessary equipment, transported to the site, hoisted and slid into place, and plugged into the existing infrastructure. Using the same plug-in method we could also retain several additional container units. These would serve for placement of the dismantled removal items following the Games; they could then be shipped away directly from the site.

Figure 5-21. Broadcast Booth module plan, front swings open permitting the broadcasters viewing area. Design is based on a 20 foot long shipping container.

By considering the seating, concession, and broadcast booth modules as removal items it enables us to toggle back and forth between the Olympic and post-Olympic design options more easily. Having the foresight of temporary versus permanent with assembly, disassembly, and reconfiguration creates ultimate flexibility of the spaces on each level. More importantly, it facilitates the design process to remain more flexible when laying out spaces within the building for the legacy option.

After applying the three level Sports Cybernetics system to the chosen Gymnasium & large/small courts category we were able to create a balance between the Olympic and post-Olympic situations. It became increasingly apparent the importance of approaching this system from both the macroscopic as well as the microscopic levels. By establishing a systematic approach to the project it enabled a more comprehensive and ordered method to follow. The High, Middle, and Low Order system provides a method that takes into account the regulations and guidelines of the governing body while creating the ability for design choice. In addition, it allows us to respect the scale of the post-Olympic community with a scaled down legacy building.

5.2 Design

5.2.1 Design Drawings

The Don Lands Olympic Gymnasium design took into consideration the Olympic needs and those of the future Lower Don Lands community. It began with a detailed understanding of the Olympic requirements which allowed for the development of a successful Olympic building design. In doing this, we greatly exceeded the needs of the community legacy building. For that reason it was desired to physically reduce the size of the building for the legacy option. Reduction in the building size was achieved with the use of the three level sports cybernetics system discussed earlier. We attained the knowledge of the individual user groups within this system. An important aspect of this design was the sequencing of the user groups during the Olympics. The users are divided into five groups:

1. Players and Officials;
2. Media Personnel;
3. Federation Officials;
4. Spectators;
5. Administration.

In order to create a cohesive approach to the design, the criteria of the five groups were combined with the concept of separation between the temporary and permanent infrastructure. To accommodate proper security measures for the five groups, an understanding of the technical and spatial criteria is needed but more importantly the knowledge of the arrival times of each group. This pertains to secure building access for user groups into private areas in addition to shared areas that occur between players and media personnel and their arrival sequence.

The players and officials share the same access point to the building. Players may arrive by team bus or shuttle service and have direct access into the building and towards the change room and player areas, whereas the officials arrive by car and require secure parking spaces. They access the building as the players do and are directed to the referee change rooms. Media personnel similarly require a secure parking area for media trucks, as well as secure building access. Upon entry, they are directed towards an accreditation center in order to gain access to the broadcast booths on the sixth level among other media areas within the building. Players and officials along with media personnel arrive much before the federation officials and

spectators and have separate controlled access into the building.

Federation officials typically arrive from one to one and a half hours before the event and are ushered into the building by the administration staff and accredited volunteers. Generally, they are brought to the designated Very Important Person (VIP) hospitality areas, VIP seats or VIP suites and those officials who require offices within the building are given passes to access the secure offices on the fifth level. When approaching the building as a spectator one would be encouraged to arrive by the LRT line, shuttle bus or by foot along Commissioner Street or nature paths. The spectator is then able to access, upon presentation of an event ticket, the major access stairs at the four corners of the building. They may then make their way up to the second, third or fourth levels in order to reach their seats.

The Don Lands Olympic Gymnasium has double height entrances on the north and south side. The north lobby entrance is connected on the ground floor to the south main entrance and lobby creating a funnelling effect towards this south entrance and reception area. This lobby looks out to the future Don Lands estuary. The intention is to encourage people to be part of the revitalization of this area and become sensitive to the environment. It attempts to reconnect the users to the environment and provide a direct path out into nature.

The gymnasium located on the second floor has allowed for the design and placement of the supporting infrastructure on the ground floor beneath it. This allowed for maximum flexibility of the floors above, especially important for a building with a legacy option involving different program. The Olympic building undergoes a removal of the west portion in preparation for the legacy mode. This allows for the re- establishment of the planned roadway and pathways immediately adjacent to the building. An initial intention of removing the warm-up gymnasium was reconsidered. It is expected that this gymnasium may be stripped of its flooring and surrounding walls and retained as an outdoor covered space for a multitude of summer and winter recreational programs. Throughout the planning of the legacy there was conversion of spaces as well as the addition of a 200 meter indoor running track that bridges the fifth level north to south side along the west side of the building.

The following is a compilation of the design plans sections and renderings.

Figure 5-22. The Don Lands Olympic Gymnasium in context with the proposed MVVA future Lower Don Lands proposal.

Level 1

Level 2

Level 3

Level 4

Level 5

Level 6

Figure 5-23. The blue tone represents the areas dedicated to players and officials throughout the 6 floor levels during the Olympic Games.

Figure 5-24. The green tone represents the areas dedicated to Media Personnel throughout the 6 floor levels during the Olympic Games.

Level 1

Level 2

Level 3

Level 4

Level 5

Level 6

Figure 5-25. The purple tone represents the areas dedicated to Federation Officials throughout the 6 floor levels during the Olympic Games.

Level 1

Level 2

Level 3

Level 4

Level 5

Level 6

Figure 5-26. The beige tone represents the areas dedicated to Spectators throughout the 6 floor levels during the Olympic Games.

Level 1

Level 2

Level 3

Level 4

Level 5

Level 6

Figure 5-27. The light green tone represents the areas dedicated to administration, although the administration will have access to the entire building throughout the 6 floor levels during the Olympic Games.

Figure 5-28. Ground Floor Olympic Option

Media 1. Accred. Centre 2. Mixed Zone Media 3. Media Work 4. Press Conf. 5. Comm. Centre 6. Private Entrance **Players & Officials** 7. Private Entrance 8. Warm-Up Gym 9. Players Lounge 10. Team Change 11. Indiv. Change 12. Doping Control 13. Ref Change 14. Players First Aid 15. Team Storage 16. w/c 17. Cafe/Restaurant 18. Concession Zone 19. Fan Zone **Admin. & Others** 20. South Lobby 21. Reception 22. Offices 23. Olym. Gift Shop & Fan Zone 24. Commercial Partner Storage 25. Shipping & Receiving 26. Sign Storage 27. Elec. 28. Water Entry 29. Mech. 30. Volun. Centre 31. Gen. First Aid 32. Security 33. North Entrance

Figure 5-29. 2nd Floor Olympic Option

Legend: 1. Lower Tier Seating Access 2. Media Seating 3. Court Access 4. VIP Hospitality Rm. 5. VIP Seating 6. Equipment Rm.

Figure 5-30. 3rd Floor Olympic Option

Spectators 1. Lower Tier Seating Access 2. w/c Federation Officials 3. V-VIP Hospitality Rm 4. VIP Suites Admin. & Others 5. Concessions

Figure 5-31. 4th Floor Olympic Option

Speakers 1. Upper Tier Seating Access 2. w/c Federation Officials 3. V-VIP Hospitality Rm. **Admin&Others** 4. Concessions

Figure 5-32. 5th Floor Olympic Option

Federation Officials 1. VIP Office 2. Meeting Rm. 3. General Offices 4. Commissioners Office 5. Services Office Admin. & Others 6. General Meeting Rm.

Figure 5-33. 6th Floor Olympic Option

Media 1. Broadcast Booths 2. Interview & Media Amenities

Figure 5-34. North-South Section Olympic Option

Media 1. Broadcast Booths 2. Mixed Zone Media Players & Officials 3. Corridor 4. Referee Change Room 5. Players First Aid 6. Olympic Team Storage Administration 7. North Lobby
8. Olympic Gift & Souvenir Shop 9. South Lobby Spectators 10. Second Tier Seating Access Federation 11. VIP Suites Other 12. Gymnasium 13. Equipment Rm 14. Roadway

Figure 5-35. West-East Section Olympic Option

Media 1. Broadcast Booths **Players & Officials** 2. Warm-Up Gymnasium 3. Players Lounge 4. Team Change Rooms 5. Shower Area 6. Corridor 7. Olympic Storage **Administration** 8. Volunteer-Centre 9. General Corridor 10. Commercial Partner Storage 11. Shipping / Receiving **Spectators** 12. Concessions **Federation** 13. VIP Hospitality Room 14. VIP Suites **Other** 15. Roadway

Figure 5-36. West-East Section Legacy Option

Community Users 1. Covered Open Air Court 2. Team Change Rooms 3. Shower Area 4. Corridor 5. Arts & Crafts Studio 6. N - S Corridor 7. Class / Conference Rm.
 8. Boxing Zone 9. 200 m Running Track Administration 10. Community Storage 11. Shipping / Receiving Other 12. Roadway 13. Re - Established Roadway

Figure 5-37. Site Plan - Legacy Option 1 - Re-naturalizing and re-establishing dividing road with connection from building to water retention ponds and water's edge.

Figure 5-38. Site Plan - Legacy Option 2 - The community school insertion and new connection to open-air covered gymnasium

Figure 5-39. Ground Floor Legacy Option

Ground Floor

Conversion 1. Bicycle Fitness 2. Plate's/Dance/Table Tennis 3. Juice Bar/Cafe 4. Covered Open Air Court 5. Music Rm. 6. Art-Crafts 7. Community Storage 8. Building Storage **Left As Is** 9. Indiv. Change Rm 10. Team Change 11. Referee Change 12. Security Rm 13. Gen. First Aid 14. South Lobby 15. Reception 16. Admin. Offices 17. Shipping & Receiving 18. Elec. 19. Water Entry 20. Mech. 21. w/c 22. North Entrance **Addition** 23. Exit Stair

Figure 5-40. 2nd Floor Legacy Option

Conversion 1. Weight Rm Area 2. Cardio Zone 3. Main Gymnasium Left As Is 4. Equipment Room Addition 5. Exit Stair

Figure 5-41. 3rd Floor Legacy Option

Conversion 1. Flex. Activity - Spin /Aerobics 2. Female Fitness Only 3. Aerobic 4. Meeting Rm 5. Class-Conference 6. Storage 7. Daycare 8. Physio-Massage Therapy Clinic Left As Is 9. w/c Addition 10. Exit Stair

Figure 5-42. 4th Floor Legacy Option

Conversion 1. Dance Studio 2. Ballet Studio 3. Flexible Space 4. Locker Area 5. Boxing Zone 6. Martial Arts Zone Left As Is 7. w/c Addition 8. Exit Stair

Figure 5-43. 5th Floor Legacy Option

Conversion 1. (3/4) Running Track 2. Cardio & Stretching Area Addition 3. Bridge (1/4) Running Track

Figure 5-44. 6th Floor Legacy Option

Conversion 1. Clear Storey Glazing Left As Is 2. Outdoor Space Addition 3. Channeled Glass Wall

Figure 5-45. Commissioner St. Olympic Option

Figure 5-46. Commissioner St. Legacy Option

Figure 5-47. Interior Olympic Event View

Figure 5-48. Interior Community Legacy View

Figure 5-49. South West Olympic View

Figure 5-50. South West Legacy View

Figure 5-51. Northeast Canoe View Olympic & Legacy Option

6 Thesis|Project Conclusion

This research inquires into the application of concepts used by systems theory and cybernetics to the process of architectural design. It presents evidence that supports the argument that by using a systems approach we can build Olympic venues that reduce embodied energy and increase adaptability and flexibility for post-Olympic community use. Evidence is presented in support of systematic processes and examples are shown from practice and theory that exhibit the potential of systems approach in architectural design. It is revealed that there have been architects in the profession that have made strides towards achieving qualities of stewardship, adaptability, flexibility and modality in architecture by using a systematic approach. Current studies into the application of systems theory and cybernetics in architecture have been much removed from their root studies. This thesis shows that a renewed interest is needed into the origins of these studies in order to have a positive effect on the environment.

The research supports the claim and hypothesis that it is the origins of systems theory and cybernetics that architects need to utilize in the search for stewardship of resources, flexibility, and adaptability within design. A model system for enabling a systems approach to architecture in conjunction with a systems attitude towards design thinking strategies are the needs this thesis addresses most explicitly. The focus of the thesis is the development of a generic system for architecture and to show how this system may be used within a project example. The creation of, what this author has named the Sports Cybernetics system, is a system that can be adapted to encompass all architectural typologies. It is the goal of this thesis to have it tested through the intensive regulations of Olympic sports architecture in order to allow for the adaptation into other less regulated typologies.

The exploration into applying the system to a site in Toronto, Canada initiates an intensive front loaded process that requires research for knowledge of the technical and spatial needs of the eleven sports considered for the project. With this particular information we have the ability to work with any city in the world, on the development of the most efficient and adaptable Olympic gymnasias for each city. There is only minor research needed to tailor this system to any site context. The required research would involve investigating the community aspects of the Three Level Sports Cybernetics System, shown in section 5.1.3 of this thesis, in order to tailor the particular design to its physical setting. The inherent quality of adaptability and flexibility in this

system is passed onto the design project and is shown in the degree of flexibility of the Olympic gymnasium design and its legacy option. The ability to synthesize the micro and macroscopic information pertaining to those Olympic sports into a set of requirements that satisfy all the sports considered was essential to achieving a high degree of adaptability. It should be stressed that without the investigation into the microscopic detail of the program spaces it is impossible to understand the macroscopic details of the entire project. Therefore, a great deal relies on a full understanding of each space in terms of what is required, the reason for use, who is the user, how it will be utilized and its relation to its adjacent spaces. With the explored information, an architect may then make his design choices based on rationale and evidence.

It is the hope that this research has begun to create a focus on the value of developing a systems approach and systems thinking towards design in contribution to furthering the sustainability movement. The design process of an architect is something that is unique to each individual. Therefore, it is important to establish systems that allow for flexibility within the built structure and most importantly flexibility within the design process itself. People are visual beings and the need to have variety is essential to creating environments that generate interest in our lives. By ensuring flexibility, we ensure adaptability and create environments that are more susceptible to change.

Appendix A: Diagram - Olympic Sports Categories

The above diagram accounts for the sports surfaces involved in the Summer Olympic Games. The measurements shown are for the playing surface boundaries. Note (1): this information was extracted from the IOC, and individual sports federation websites. A link to each federation is supplied from within the IOC website at (www.olympic.org). Note (2): The information supplied by the gymnastics sports federation is incomplete, and further discussions with the federation have yet to yield new information.

Appendix B: Matrix - 2008 Beijing Summer Olympics

Back of page: Matrix based on the 2008 Beijing Summer Olympics. This matrix provides analytical information that rationalizes the focus behind minimization of stadia infrastructure that is built for each of the Olympic Games. The key information has been highlighted or noted at the bottom to the matrix

Generic Building Type Largest to Smallest	Building Type & Name		Existing Perm. bldg	New Perm. Bldgs	Temp. Venue	Track	Field
	Stadium						
		Capacity					
1	Birds Nest	91,000		x		Athletics	
2	Olympic Sports Centre	36,228	x				Football, Modn-Pen (X-Country & Show Jump)
3	Workers Stadium	70,161	x				Football
4	Shanghai Stadium	80,000	x				
5	Fengtai Softball Field	10,000	x				Softball
6	Wukesong Baseball Field	15,000			x		Baseball
7	Olympic Green Convention Centre	5,695			x		
8	Shenyang Olympic Stadium	60,000	x				Football
9	Tianjin Olympic Center Stadium	54,696	x				Football
10	Qinhuangdao Olympic Sports Centre Stadium	31,085	x				Football
11	Olympic Green Hockey Stadium	17,002			x		Field Hockey
	Arena						
12	National Aquatics Centre	17,000		x			
13	Beijing National Indoor Stadium	20,000		x			
14	Beijing Wukesong Indoor Stadium	18,000		x			
15	Laoshan Velodrome	6,000		x		Cycling Track	
16	Beijing Olympic Green Tennis Court	17,400		x			
17	Workers' Indoor Arena	13,000	x				
18	Capital Indoor Stadium	17,345	x				
19	Chaoyang Park Beach Volleyball Ground	12,200			x		
20	Ying Tung Natatorium	4,852	x				
21	Olympic Green Archery Field	5,000			x		Archery
	Gymnasia						
22	China Agriculture University Gymnasium	8,200		x			
23	Peking University Gymnasium	8,000		x			
24	Beijing Science & Technology University Gymnasium	8,024		x			
25	Beijing University of Technology Gymnasium	7,500		x			
26	Olympic Sports Center Gymnasium	7,000	x				
27	Beijing Institute of Technology Gymnasium	5,000					
28	Beihang University Gymnasium	5,400	x				
	Hall						
29	Beijing Shooting Range Hall, (8,600 Capacity)	8,600		x			
	Nature						
30	Shunyi University Rowing-Canoeing Park	1,200 Perm, 25,800 Temp.		x			
31	Laoshan Mountain Bike Course (with fixed building)	2,000 Temp	x				
32	Beijing Shooting Range Clay Target Field	5,000	x				
33	Laoshan Bicycle Moto Cross (BMX) Venue	4,000			x		
34	Triathlon Venue	10,000			x		
35	Urban Cycling Road Course	0			x		
36	Qingdao International Sailing Centre		x				
37	Hong Kong Sports Institute	18,000	x				

Findings:

**26 of the 37 venues contain only one event.

**5 Separate venues are used for Football

**Volleyball is able to be held in both a Gymnasia or Stadia

**Handball is able to be held in both Gymnasia or Stadia

**12 of 37 venues are New and 6 of which house only 1 sport

**16 of 37 were existing permanent bldgs and 13 of which house only 1 sport

The Orange highlighted finding indicates a very important factor. The fact that 15 of the 37 sports played in the Summer Olympics are actually housed within a Gymnasium, Large Court and Small Court. This indicates that If the largest grouping of sports are those played on the smaller

Generic Playing Surface (Large to Small)				
Pool	Gymnasium	Court (Large)	Court (Small)	Nature
	Fencing, Modn-Pen. (Fencing & Shooting)			
Swimming, Synchronized Swimming, Diving, Water Polo				
	Gymnastics Artistic, Trampoline, Handball			
	Basketball			
		Tennis		
	Volleyball		Boxing	
				Beach Volleyball
Water Polo, Modn-Pen				
			Wrestling	
			Table Tennis	
			Judo, Taekwondo	
	Gymnastics Rhythmic, Badminton			
		Handball		
	Volleyball			
			Weightlifting	
	Shooting			
				Rowing, Canoe, Kayak
				Cycling Mountain Bike
				Shooting (skeet & trap)
				Cycling BMX
				Triathlon
				Cycling Road
				Sailing
				Equestrian

** 15 of 37 sports were housed in Either a Gymnasium, Large court, or Small court

** 9 of 37 sports are outdoor nature sports

** 4 sports are pool sports

**9 sports are held in either on a Track or Field

Appendix C: Program Analysis- High Order System

Note:

The following pages are a detailed synthesis of the programmatic requirements that are strictly regulated by the International Olympic Committee (IOC) and its member sports federations. It is part of the High order system defined within the Design|Project Chapter. It combines the strictest regulations of the eleven gymnasium sports considered in this thesis. It is developed as guidelines that facilitate a faster design process by presenting the pertinent design information first. It is developed once, as done here, and will only involve further updating as sports change and adapt according to the IOC and its member sports federations.

Analysis of physical facility requirements

Project:	<u>Olympic Gymnasium 2009</u>	Department	<u>Playing Surfaces</u>
Name of Space:	<u>Badminton Floor</u>	Net Assignable Sq. m	

Space Description

Purpose: To provide a gymnasium floor area for Olympic Badminton as per the requirements of the Olympic Games. To serve as a spectator viewed space and a space where media may set up for broadcasting live events.

Space Relationships:

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located to allow for multiple access points by spectators.

Close to warm-up area, equipment storage areas, loading, change rooms, referees rooms, first aid.

b. Specific - Is this space part of a suite? Yes ☐ No ☒

Activity Description:

Playing Olympic, national, provincial and community level badminton games

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☒
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☒	8. Other Specify:	☐

Users: (insert number in appropriate boxes)

Federation/Staff		Competitors	12
		Floor personnel ex:Ref,Doctor,Scorer's	6
		Average hours per week usage	80

Space Components:

[illegible]

Seating Requirments	No. of Seats	Position	Comments
Total spectators	5- 8000	X	
Reserved Seats			
Presidential stand			
Stand A a)Federation members	25	Inclined	Level head of state
b) Federation guests, sponsors, VIP	100		
c) Organizers' guests, local spons. gov. officials	100		
Stand B Press - Journalists & photographers	Varies		tables & chairs
Stand C Team members, players, tech's, other officials	Varies		
Stand D Internat'l referees, & nat'l tech. officials			determined by # matches played

[illegible]

Communications:

(place X in box if required)

Telephone ☐

P.A System ☒

Cable TV ☐

Wireless Internet ☐

Satellite Communication ☐

Other Specify: ☐

Audio Visual

The following audio visual aids will be used:

Scoreboards	☐
Television	☐
Projector	☐
Sound Reinforcement	☐
Other Specify: Announcer mic plugged in to PA	

Furnishings: (place x in box if required)	
Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☒	
Movable: (List items and quantity) Tables, Chairs	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements		Yes	No	Noise: Any special requirements	
If any state clear height		x		Is activity noisy	
min-9m-14m				Does activity require quiet	
				Yes	No
Heating & Air Conditioning:				Lighting: Any special requirements	
Standard for building is all that is required.			x	Is natural daylight needed	
Space must be air-conditioned		x		Above average Intensity	
				Ultra Violet required	
				Dimmer Control	
				x	
Flooring:					
Accurate Temp. Control required				What type of flooring will be required:	
If so, give range from to				Gymnasium sprung	
				Tile	
				concrete	
				non-slip	
				Other (Specify under comments)	
				x	

Services: (place x in box if required)	
Water:	Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐
Electrical Power:	Local Emergency Power Required ☒

Additional Requirements or Comments:

Playing floor must be Sprung wooden floor at a length of 42,000mm and a minimum width of 25,000mm
Synthetic flooring may be used to comply with the regulation of: Only Badminton court lines shall be used on courts for an Olympic event

The Referee chair shall be those specifically built for the height at which the net is placed

Direct Natural light shall be eliminated from the gymnasium

All lighting shall be placed in order NOT to interfere with the view of the shuttlecock in play

Drop down lighting may be used with low brightness.

Control over **main lighting** for dimming of the space or switching off completely so light may be focused properly

Badminton
42 x 25m

Furnishings: (place x in box if required)								
Fixed blackboard	☐	Tackboard	☐	Shelving	☐			
Advertising Boards	☐							
Movable: (List items and quantity)	Tables	3	Chairs	13	Benches	2	Ball trolley	1

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements	Yes	No	Noise: Any special requirements	Yes	No
If any state clear height min - 7m	x		Is activity noisy		x
			Does activity require quiet		
Heating & Air Conditioning:			Lighting: Any special requirements		
Standard for building is all that is required.		x	Is natural daylight needed		x
Space must be air-conditioned	x		Above average intensity		x
	x		Ultra Violet required		x
			Dimmer Control	x	
			Black out	x	
			Other (Specify under comments)	x	
Flooring:			Flooring:		
Accurate Temp. Control required			What type of flooring will be required:		
If so, give range from to			Gymnasium sprung	x	
			Tile		x
			concrete	x	
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)							
Water:	Hot	☐	Cold	☐	Deionized	☐	
	Distilled	☐	Drainage:	Floor	☐	Trough	☐
Electrical Power:	Local Emergency Power Required				☒		

Additional Requirements or Comments:

Playing floor must be Sprung wooden or synthetic flooring but may be permanent or mobile and a minimum length of 32,000mm and a minimum width of 19,000mm

Lighting - Each set located min. 5,000mm from the boundary line and at a recommended ht. 15,000mm. It must be uniformly lit with no less than 1800 lux in the vertical plane measured 1.5 m above the playing court, and spread evenly on the basketball court floor area without any shadows or patches. The rest of the Venue should have sufficient illumination approximately 1000 lux

Seating - All spectators must be seated at a distance of at least 5,000mm from the outside edges of the boundary lines of the playing court

Warm-Up Court - One court is required in the same venue

Basketball
38 x 25m

120

Department Playing Surfaces
Net Assignable Sq. m

Purpose: To provide an area for Olympic Boxing to take place as per the requirements of the Olympic Games. To serve as a spectator viewed space and a space where media may set up for broadcasting live events.

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Close to warm-up area, equipment storage areas, loading, change rooms, referees rooms, first aid

b. Specific - Is this space part of a suite? Yes ☐ No ☒

If yes, then describe its relationships to other spaces in the suite

Competing in Olympic, national, provincial and recreational level boxing matches

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☒
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☒	8. Other Specify:	☐

Staff		Competitors	4
		Floor personnel ex:Ref,Doctor,Scorer's	19
		Average hours per week usage	80

[illegible]

Seating Requirements	No. of Seats	Position	Comments
Total spectators	5- 8000	x	
Reserved Seats			
Presidential stand			
Stand A a) Federation members	25	inclined	Level
b) Federation guests, sponsors, ViP	100		
c) Organizers' guests, local spons. gov. officials	100		
Stand B Press - Journalists & photographers	Varies		
Stand C Team members, players, tech's, other officials	Varies		
Stand D Internat'l referees, & nat'l tech. officials			

[illegible]

Telephone ☐

P.A System ☒

Cable TV ☐

Wireless Internet ☐

Satellite Communication ☐

Other Specify: ☐

Scoreboards	☐
Television	☐
Projector	☐
Sound Reinforcement	☐
Other Specify: Announcer mic plugged in to PA	

Furnishings: (place x in box if required)	
Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☒	
Movable: (List items and quantity) Tables, Chairs	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements If any state clear height	Yes	No	Noise: Any special requirements Is activity noisy Does activity require quiet	Yes	No
	x				
Heating & Air Conditioning:			Lighting: Any special requirements		
Standard for building is all that is required.			Is natural daylight needed		
Space must be air-conditioned			Above average intensity		
			Ultra Violet required		
			Dimmer Control		
Accurate Temp. Control required			Flooring:		
If so, give range from to			What type of flooring will be required:		
			Gymnasium sprung		
			Tile		
			concrete		
			non-slip		
			Other (Specify under comments)		

Services: (place x in box if required)					
Water:	Hot ☐	Cold ☐	Deionized ☐	Distilled ☐	Drainage: Floor ☐ Trough ☐
Electrical Power:	Local Emergency Power Required				☒

Additional Requirements or Comments:

Surface of the Ring Floor shall be covered with felt, rubber or other suitable approved material over which a canvas shall be stretched and secured in place.

Canvas shall cover the entire platform and be of non-slippery material.

Competition floor surface must be of elastic tatami surface

Direct Natural light shall be eliminated from the gymnasium

All lighting shall be placed in order NOT to interfere with the view of the shuttlecock in play

Control over **main lighting** for dimming of the space or switching off completely so light may be focused properly

Individual Ring
19.8 x 19.8m

Boxing
37.9 x 19.8m

Analysis of physical facility requirements

Project:	<u>Olympic Gymnasium 2009</u>	Department	<u>Playing Surfaces</u>
Name of Space:	<u>Fencing Floor</u>	Net Assignable Sq. m	

Space Description

Purpose: To provide a floor area for Olympic Fencing as per the requirements of the Olympic Games. To serve as a spectator viewed space and a space where media may set up for broadcasting live events.

Space Relationships:

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located to allow for multiple access points by spectators

Close to warm-up area, equipment storage areas, loading, change rooms, referees rooms, first aid.

b. Specific - Is this space part of a suite? Yes ☐ No ☒

If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Competing in Olympic, national, provincial and recreational level Fencing

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☒
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☒	8. Other Specify:	☐

Users: (insert number in appropriate boxes)

Staff		Competitors	#
		Floor personelle	ex:Ref,Doctor,Scorer's
		Average hours per week usage	80

Space Components:

[illegible]

Seating Requirments	No. of Seats	Position	Comments
Total spectators	5- 8000	x	
Reserved Seats			
Presidential stand			
Stand A a) Federation members	n/a	inclined	Level
b) Federation guests, sponsors, VIP	n/a		head of state
c) Organizers' guests, local spons. gov. officials	n/a		varies
Stand B Press - Journalists & photographers	n/a		varies
Stand C Team members, players, tech's, other officials	n/a		varies
Stand D Internat'l referees, & nat'l tech. officials			determined by #
			matches played

[illegible]

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone	☐	Scoreboards	☒
P.A System	☒	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☐	Sound Reinforcement	☐
Satellite Communication	☐	Other	Specify: <u>Announcer mic plugged in to PA</u>
Other	Specify: _____		

Furnishings: (place x in box if required)

Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☒

Movable: (List items and quantity) Tables, Chairs

Environmental Characteristics (place x in appropriate column)

	Yes	No		Yes	No
Ceiling Heights: Any special requirements If any state clear height		☒	Noise: Any special requirements Is activity noisy Does activity require quiet		☒
Heating & Air Conditioning:			Lighting: Any special requirements	☒	
Standard for building is all that is required.		☒	Is natural daylight needed		☒
Space must be air-conditioned	☒		Above average intensity		☒
			Ultra Violet required		☒
			Dimmer Control	☒	
			Flooring:		
Accurate Temp. Control required			What type of flooring will be required:		
If so, give range from to			Gymnasium sprung	☒	☒
			Tile		
			concrete	☒	
			non-slip	☒	
			Other (Specify under comments)	☒	

Services: (place x in box if required)

Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐

Electrical Power: Local Emergency Power Required ☒

Additional Requirements or Comments:

Playing floor must be Sprung wooden floor at a length of 40,000mm and a minimum width of 50,000mm
Direct Natural light shall be eliminated from the gymnasium
All lighting shall be placed in order NOT to interfere with the view of the shuttlecock in play
 Control over *main lighting* for dimming of the space or switching off completely so light may be focused properly

Analysis of physical facility requirements

Project:	Olympic Gymnasium 2009	Department	Playing Surfaces
Name of Space:	Handball Floor	Net Assignable Sq. m	

Space Description

Purpose: To provide a gymnasium floor area for Olympic Handball as per the requirements of the Olympic Games. To serve as a spectator viewed space and a space where media may set up for broadcasting live events.

Space Relationships:

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located to allow for multiple access points by spectators

Close to warm-up area, equipment storage areas, loading, change rooms, referees rooms, first aid.

b. Specific - Is this space part of a suite? Yes ☐ No ☒

Activity Description:

Playing Olympic, national, provincial level Handball

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☒
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☒	8. Other Specify:	☐

Users: (insert number in appropriate boxes)

Federation/Staff		Competitors	28
		Floor personnel ex:Ref,Doctor,Scorer's	14
		Average hours per week usage	80

Space Components:

[illegible]

Seating Requirements	No. of Seats	Position	Comments
Total spectators	8 - 20,000	x	
Reserved Seats			
Presidential stand			
Stand A a) Federation members	25	inclined	head of state
b) Federation guests, sponsors, ViP	100		
c) Organizers' guests, local spons. gov. officials	100		
Stand B Press - Journalists & photographers			tables & chairs
Stand C Team members, players, tech's, other officials			
Stand D Internat'l referees, & nat'l tech. officials			determined by # matches played

[illegible]

Communications: (place X in box if required)		Audio Visual The following audio visual aids will be used:	
Telephone	☐	Scoreboard(s)	☒
P.A. System	☒	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☒	Sound Reinforcement	☒
Satellite Communication	☐	Other: Specify _____	
Other: Specify _____			

Furnishings: (place x in box if required)

Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☒

Movable: (List items and quantity) Tables ☒ Chairs ☒ Benches ☒ Ball trolley ☒

Environmental Characteristics (place x in appropriate column)

	Yes	No		Yes	No
Ceiling Heights: Any special requirements	x		Noise: Any special requirements		x
If any state clear height			Is activity noisy		
			Does activity require quiet		
Heating & Air Conditioning:			Lighting: Any special requirements	x	
Standard for building is all that is required.		x	Is natural daylight needed		x
Space must be air-conditioned	x		Above average intensity	x	
			Ultra Violet required		x
			Dimmer Control	x	
			Black out	x	
			Flooring:		
Accurate Temp. Control required			What type of flooring will be required:		
If so, give range from to			Gymnasium sprung	x	
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)		

Services: (place x in box if required)

Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐

Electrical Power: Local Emergency Power Required ☒

Additional Requirements or Comments:

Handball
48 x 26m

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department: Playing Surfaces
 Name of Space: Judo Mat Net Assignable Sq. m:

Space Description

Purpose: To provide a competition area for Olympic Judo as per the requirements of the Olympic Games. To serve as a spectator viewed space and a space where media may set up for broadcasting live events.

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located to allow for multiple access points by spectators.

Close to warm-up area, equipment storage areas, loading, change rooms, referees rooms, first aid.

- b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Competing & practicing Olympic, national, provincial and community level Judo

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☒
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☒	8. Other Specify: <u> </u>	

Users: (insert number in appropriate boxes)

Federation/Staff	☐	Competitors	☐
Floor personnel: ex: Ref, Doctor, Score's	☐		☐
Average hours per week usage	☐		☐

Space Components:

Cabinet Components		Dimensions		Storage		Utilities								Finishes		Misc									
Working Surfaces		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Fume Hood	Fume Cabinet
Types																									

Seating Requirements			No. of Seats	Position	Comments
Total spectators			8 - 10,000	☒	
Reserved Seats					
Presidential stand					head of state
Stand A a) Federation members			25	inclined	tables & chairs
b) Federation guests, sponsors, VIP			100		
c) Organizers' guests, local spons. gov. officials			100		
Stand B Press - Journalists & photographers					determined by # matches played
Stand C Team members, players, tech's, other officials					
Stand D Internat'l referees, & nat'l tech. officials					

Equipment		Quantity	Length mm	Width mm	Height mm	Weight Est'd (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
Scoreboards - each end, & if applicable 1 cube type center court		2				80	☒				☒	☒
Playing floor		1	37 m	18 m			☒	☒				
Adequate lighting											☒	

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone	☐	Scoreboards	☒
P.A. System	☒	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☐	Sound Reinforcement	☐
Satellite Communication	☐	Other Specify: <u> </u>	
Other Specify: <u> </u>			

Furnishings: (place x in box if required)

Fixed blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☒

Movable: (List items and quantity) Tables ☒ 11 Chair ☒ 45

Environmental Characteristics (place x in appropriate column)

	Yes	No		Yes	No
Ceiling Heights: Any special requirements	☒	☐	Noise: Any special requirements	☐	☒
If any state clear height min - 7m			Is activity noisy		
			Does activity require quiet		
Heating & Air Conditioning:			Lighting: Any special requirements	☒	☐
Standard for building is all that is required.	☒	☐	Is natural daylight needed		☒
Space must be air-conditioned	☒	☐	Above average intensity	☒	☐
			Ultra Violet required		☒
			Dimmer Control	☒	☐
			Black out	☒	☐
			Flooring:		
Accurate Temp. Control required			What type of flooring will be required:		
If so, give range from n/a to 18 dgr's			Gymnasium sprung		☒
			Tile		☒
			concrete		☒
			non-slip		☒
			Other (Specify under comments)	☒	☐

Services: (place x in box if required)

Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐

Electrical Power: Local Emergency Power Required ☒

Additional Requirements or Comments:

Tatamis Flooring - must be made of 1m x2m pressed straw or pressed foam. Must be on a Resilient floor or Platform built up to ensure a solid base for tatamis & may be mobile

Lighting - Lighting on the playing area should range from 1500 - 1800 lux at 1m above the surface

Spare Equipment - Changing Booth for any competitor needing to change during competition

Warm-Up Room - 400/600 m² tatami surface

Judo
43 x 24m

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department: Playing Surfaces
 Name of Space: Table Tennis Net Assignable Sq. m: _____

Space Description

Purpose: To provide a floor area for Olympic Table Tennis as per the requirements of the Olympic Games. To serve as a spectator viewed space and a space where media may set up for broadcasting live events.

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located to allow for multiple access points by spectators.

Close to warm-up area, equipment storage areas, loading, change rooms, referees rooms, first aid.

- b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Playing Olympic, national, provincial and community level Table Tennis games

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☒
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☒	8. Other Specify: ☐	

Users: (insert number in appropriate boxes)

Federation/Staff	☐	Competitors	☐
Floor personnel: ex: Ref, Doctor, Scorer's	☐		☐
Average hours per week usage	☐		☐

Space Components:

Space Components																									
Working Surfaces		Dimensions			Storage			Utilities										Finishes		Misc					
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Fume Hood	Fume Cabinet
Types																									

Seating Requirements		No. of Seats	Position	Comments
Total spectators		5-8000	☒	
Reserved Seats				
Presidential stand				head of state
Stand A: a) Federation members		25	Inclined	
b) Federation guests, sponsors, VIP		100	Level	
c) Organizers' guests, local spons. gov. officials		100		tables & chairs
Stand B: Press - Journalists & photographers		Varies		
Stand C: Team members, players, tech's, other officials		Varies		determined by # matches played
Stand D: Internat'l referees, & nat'l tech. officials				

Equipment	Quantity	Length mm	Width mm	Height mm	Weight Earled (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
Table-Tennis Table	8	2740	1525	760		x	x	x			
Net	8					x	x	x			
Umpire Chair	8					x					
Assistant Umpire Chair	8					x					
Tape (for Taping ends of synthetic floor to permanent floor)	n/a										
Playing floor (Synthetic rolled floor)	8	14m	7m			x					
Adequate lighting	n/a			5 m							x

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone	☐	Scoreboards	☐
P.A System	☒	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☐	Sound Reinforcement	☐
Satellite Communication	☐	Other Specify: <u>Announcer mic plugged in to PA</u>	
Other Specify: _____			

Furnishings: (place x in box if required)	
Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☒	
Movable: (List items and quantity) Tables, Chairs	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements If any state clear height min-5m	Yes x	No	Noise: Any special requirements Is activity noisy Does activity require quiet	Yes x	No x
Heating & Air Conditioning:			Lighting: Any special requirements	x	
Standard for building is all that is required.		x	Is natural daylight needed		x
Space must be air-conditioned	x		Above average intensity		x
			Ultra Violet required		x
			Dimmer Control	x	
			Flooring:		
Accurate Temp. Control required			What type of flooring will be required:		
If so, give range from to			Gymnasium sprung	x	
			Tile		x
			concrete		x
			non-slip	x	
			Other (Specify under comments)	x	

Services: (place x in box if required)	
Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐	
Electrical Power:	Local Emergency Power Required ☒

Additional Requirements or Comments:

The Light source shall not be less than 5m above the floor.
Table Tennis Table must be 760 mm high and a perfectly level playing surface.
Playing floor must be Sprung wooden floor at a length of 48,000mm and a minimum width of 25,000mm.
Synthetic flooring may be used to cover the sprung wood floor to ensure a non-slip surface.
Direct Natural light shall be eliminated from the gymnasium.
Light intensity at the height of the table shall be 1000 lux and at least 500 lux elsewhere.
Level of lighting in the background shall not be greater than the lowest level in the playing area.
Control over main lighting for dimming of the space or switching off completely is needed.
Changing rooms with individual lockers for players shall be provided.

Table Tennis
48 x 25m

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009
 Name of Space: TaeKwonDo Floor

Department: Playing Surfaces
 Net Assignable Sq. m: _____

Space Description

Purpose: To provide a gymnasium floor area for Olympic TaeKwonDo as per the requirements of the Olympic Games. To serve as a spectator viewed space and a space where media may set up for broadcasting live events.

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located to allow for multiple access points by spectators.

Close to warm-up area, equipment storage areas, loading, change rooms, referees rooms, first aid.

- b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Partake in Olympic, national, provincial and community level TaeKwonDo matches

Activity type: (insert x in applicable box)

1. Private Office ☐	6. Fitness ☐
2. Admin Office ☐	5. Spectator Seating ☒
3. Classroom ☐	6. Concourse ☐
4. Staff Room ☐	7. Medical Clinic ☐
5. Sports Surface ☒	8. Other Specify: ☐

Users: (insert number in appropriate boxes)

Staff ☐	Competitors ☐
Floor personnel ex: Ref, Doctor, Scorer's ☐	☐
Average hours per week usage ☐	☐

Space Components:

Space Components																									
Working Surfaces		Dimensions			Storage		Utilities										Finishes			Misc.					
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Fume Hood	Fume Cabinet
Types																									

Seating Requirements		No. of Seats	Position	Comments
Total spectators		5-8000	x	
Reserved Seats				
Presidential stand				head of state
Stand A a) Federation members		25	inclined	tables & chairs
b) Federation guests, sponsors, VIP		100		
c) Organizers' guests, local spons. gov. officials		100		
Stand B Press - Journalists & photographers		Varies		
Stand C Team members, players, tech's, other officials		Varies		
Stand D Internat'l referees, & nat'l tech. officials				determined by # matches played

Equipment	Quantity	Length mm		Width mm		Height mm		Weight Est'd (kg)		Movable				
		Length mm	Width mm	Height mm	Weight Est'd (kg)	Fixed	Floor	Bench	Wall	Ceiling				
Scorer's Table	2					x								
Doctor and Recorder's Chairs	4					x								
Judge's Chair	8					x								
Coaches Chair	2					x								
Court Announcers Table & Platform	2	1525	750	750		x								
Playing floor must be covered in Elastic tatami mats (1x2m)	1	2200	3200	500										
Built-up Platform 1m high from the base floor	2	14m	14m			x								
Stair up to platform	1	38m	18m	0.5m-1m							x			
	3													

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone	☐	Scoreboards	☐
P.A System	☒	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☐	Sound Reinforcement	☐
Satellite Communication	☐	Other Specify: <u>Announcer mic plugged in to PA</u>	
Other Specify: _____			

Furnishings: (place x in box if required)	
Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☒	
Movable: (List items)	Tables, Chairs, small court announcer platform

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements If any state clear height	Yes	No	Noise: Any special requirements Is activity noisy Does activity require quiet	Yes	No
		x			x
Heating & Air Conditioning:			Lighting: Any special requirements	x	
Standard for building is all that is required.		x	Is natural daylight needed		x
Space must be air-conditioned	x		Above average intensity		x
			Dimmer Control	x	
			Flooring:		
			What type of flooring will be required:		
Accurate Temp. Control required		x	Gymnasium sprung		x
If so, give range from to and limits +/- %RH			Tile		x
Intake air must be dust free			concrete		x
Other - (specify under comments)			non-slip	x	
			Other (Specify under comments)	x	

Services: (place x in box if required)	
Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐	
Electrical Power:	Local Emergency Power Required ☒

Additional Requirements or Comments:

Competition floor must be a raised platform of Sprung wooden floor at a length of 43,000mm and a minimum width of 18,000mm and height from the base floor of 500mm -1000mm
Competition floor surface must be of elastic tatami surface
Direct Natural light shall be eliminated from the gymnasium
All lighting shall be placed in order NOT to interfere with competing athletes or referees/judges

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department: Playing Surfaces
 Name of Space: Volleyball Floor Net Assignable Sq. m: _____

Space Description

Purpose: To provide a gymnasium floor area for Olympic Volleyball as per the requirements of the Olympic Games. To serve as a spectator viewed space and a space where media may set up for broadcasting live events.

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located to allow for multiple access points by spectators.

Close to warm-up area, equipment storage areas, loading, change rooms, referees rooms, first aid.

- b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Playing Olympic, national, provincial and community level basketball games

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☒
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☒	8. Other Specify: ☐	

Users: (insert number in appropriate boxes)

Federation/Staff	☐	Competitors	☐ 24
Floor personnel ex: Ref, Doctor, Scorer's	☐		☐ 8
Average hours per week usage	☐		☐ 80

Space Components:

		Dimensions				Storage		Utilities								Finishes		Misc.							
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Fume Hood	Fume Cabinet
Working Surfaces	Types																								

Seating Requirements		No. of Seats	Position	Comments
Total spectators		5 - 15,000	☒	
Reserved Seats			☒	
Presidential stand			☒	head of state
Stand A a) FIVB members		25	☒	
b) FIVB guests, sponsors, VIP		100	☒	
c) Organizers' guests, local spons. gov. officials		100	☒	
Stand B Press - Journalists & photographers			☒	tables & chairs
Stand C Team members, players, tech's, other officials			☒	
Stand D International referees, & nat'l tech. officials			☒	determined by # matches played

Equipment	Quantity	Length mm	Width mm	Height mm	Weight (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
Item											
Nets and Posts						☒	☒	☒			
Net	2			2430		☒	☒				
Antennae	2	1800				☒					
Posts (posts are placed at 1m outside sidelines)	2			2550							
Volleyballs	29										
Scoreboard - each end, & if applicable 1 cube type center court	2			80		☒				☒	☒
Playing floor	1	32 m	19 m			☒	☒				
Adequate lighting	1			15 m							☒
spectator seating						☒	☒				

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone	☐	Scoreboards	☒
P.A System	☒	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☐	Sound Reinforcement	☐
Satellite Communication	☐	Other Specify: _____	
Other Specify: _____			

Furnishings: (place x in box if required)					
Fixed blackboard	☐	Tackboard	☐	Shelving	☐
Advertising Boards	☐				
Movable: (List items and quantity)	Tables	4	Chair	8	Benches
				2	Ball trolley
				2	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements	Yes	No	Noise: Any special requirements	Yes	No
If any state clear height min - 7m	x		Is activity noisy		x
			Does activity require quiet		
Heating & Air Conditioning:			Lighting: Any special requirements	x	
Standard for building is all that is required.		x	Is natural daylight needed		x
Space must be air-conditioned	x		Above average intensity		x
			Ultra Violet required		x
			Dimmer Control	x	
			Black out	x	
			Flooring:		
Accurate Temp. Control required			What type of flooring will be required:		
If so, give range from 16 to 25 dgr's			Gymnasium sprung	x	
			Tile		x
			concrete	x	
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)					
Water:	Hot	☐	Cold	☐	Deionized
				☐	Distilled
				☐	Drainage:
				☐	Floor
				☐	Trough
Electrical Power:					Local Emergency Power Required
					☒

Additional Requirements or Comments:

Playing floor - must be Sprung wooden or synthetic flooring but may be permanent or mobile and a minimum minimum length of 32,000mm and a minimum width of 19,000mm

Lighting - Lighting on the playing area should range from 1000 - 1500 lux at 1m above the surface

Spare Equipment - 2 official nets with antennae, a pair of posts and a measuring rod

Two ball measuring devices, pressure gauges, two mops, 30 towels for moppers, extra balls, 4 red or yellow flags for the line judges

Warm-Up Hall - is required close to the Main Hall. No less than 7m in ht. and 32,000 x 19,000 mm

Volleyball Court
38 x 25.5m

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department: Playing Surfaces
 Name of Space: Weightlifting Area Net Assignable Sq. m: _____

Space Description

Purpose: To provide a floor area for Olympic Weightlifting as per the requirements of the Olympic Games. To serve as a spectator viewed space and a space where media may set up for broadcasting live events.

Space Relationships:

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located to allow for multiple access points by spectators.

Close to warm-up area, equipment storage areas, loading, change rooms, referees rooms, first aid.

b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

For display of Olympic, national, provincial Weightlifting competitions

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☒
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☒	8. Other Specify: _____	

Users: (insert number in appropriate boxes)

Staff	☐	Competitors	☐
		Floor personnel: ex:Ref, Doctor, Scorer's	☐
		Average hours per week usage	☐

Space Components:

Space Components																									
Working Surfaces		Dimensions			Storage			Utilities										Finishes		Misc.					
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Fume Hood	Fume Cabinet
Types																									

Seating Requirements		No. of Seats	Position	Comments
Total spectators		5-8000	x	
Reserved Seats				
Presidential stand				head of state
Stand A a) Federation members		25	inclined	
b) Federation guests, sponsors, VIP		100		
c) Organizers' guests, local spons. gov. officials		100		
Stand B Press - Journalists & photographers		Varies		tables & chairs
Stand C Team members, players, tech's, other officials		Varies		determined by #
Stand D Internat'l referees, & nat'l tech. officials				matches played

Equipment	Quantity	Dimensions				Weight (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
		Length mm	Width mm	Height mm	Weight (kg)							
Referees/ Jury Table	16	1525	750	750		x						
Referees / Jury Chair	16					x						
Medical Staff Chairs	4					x						
Built-up Platform 1m high from the base floor	1	10m	10m	0.5m-1m		x						
Stair up to platform	2						x					

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone	☐	Scoreboards	☒
P.A. System	☒	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☐	Sound Reinforcement	☐
Satellite Communication	☐	Other Specify: <u>Announcer mic plugged in to PA</u>	
Other Specify: _____			

Furnishings: (place x in box if required)	
Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☒	
Movable: (List items) Tables, Chairs	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements If any state clear height min-13m	Yes x	No	Noise: Any special requirements Is activity noisy Does activity require quiet	Yes x	No
Heating & Air Conditioning:			Lighting: Any special requirements	x	
Standard for building is all that is required.		x	Is natural daylight needed		x
Space must be air-conditioned	x		Above average intensity		x
			Ultra Violet required		x
			Dimmer Control	x	
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)	
Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐	
Electrical Power:	Local Emergency Power Required ☒

Additional Requirements or Comments:

Competition floor must be a raised platform made of wood, plastic or any solid material at a length of 10,000mm and a minimum width of 10,000mm and height from the base floor of 1000mm

Competition floor surface measuring 4m x 4m must be covered with a non slippery material

Direct Natural light shall be eliminated from the gymnasium

All lighting shall be placed in order NOT to interfere with competing athletes or referees/judges

Trolley Stretcher must be supplied for medical staff at hand

Weightlifting
28 x 19 m

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009
 Name of Space: Wrestling Floor

Department: Playing Surfaces
 Net Assignable Sq. m: _____

Space Description

Purpose: To provide a gymnasium floor area for Olympic Wrestling as per the requirements of the Olympic Games. To serve as a spectator viewed space and a space where media may set up for broadcasting live events.

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located to allow for multiple access points by spectators:

Close to warm-up area, equipment storage areas, loading, change rooms, referees rooms, first aid.

- b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Partake in Olympic, national, provincial and community level Wrestling matches

Activity type: (insert x in applicable box)

1. Private Office ☐	6. Fitness ☐
2. Admin Office ☐	5. Spectator Seating ☒
3. Classroom ☐	6. Concourse ☐
4. Staff Room ☐	7. Medical Clinic ☐
5. Sports Surface ☒	8. Other Specify: ☐

Users: (insert number in appropriate boxes)

Staff ☐	Competitors ☐
Floor personnel: ex: Ref, Doctor, Score's ☐	Average hours per week usage ☐

Space Components:

Cupboard Components		Dimensions				Storage		Utilities										Finishes		Misc.					
Working Surfaces		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Fume Hood	Fume Cabinet
Types																									

Seating Requirements		No. of Seats	Position	Comments
Total spectators		5-8000	x	
Reserved Seats				
Presidential stand				head of state
Stand A a) Federation members		25	inclined	tables & chairs
b) Federation guests, sponsors, VIP		100		
c) Organizers' guests, local spons. gov. officials		100		
Stand B Press - Journalists & photographers		Varies		determined by # matches played
Stand C Team members, players, tech's, other officials		Varies		
Stand D Internat'l referees, & nat'l tech. officials				

Equipment	Item	Quantity	Length mm	Width mm	Height mm	Weight Est'd (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
	Score's / Judges' Table	15	1525	750	750		x					
	Score's / Judges' platform	3	5500	2000	250		x					
	Score's / Judge's Chair	18					x					
	Court Announcers' / Control Committee / Delegates Tables	20	1525	750	750		x					
	Chairs	40					x					
	Playing floor must be covered in Elastic tatami mats (1x2m)		n/a	n/a			x					
	Built-up Platform 1m high from the base floor	1	16m	16m	0.5m-1m		x					
	Stair up to platform	6										

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone	☐	Scoreboards	☐
P.A System	☒	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☐	Sound Reinforcement	☐
Satellite Communication	☐	Other Specify: <u>Announcer mic plugged in to PA</u>	
Other Specify: _____			

Furnishings: (place x in box if required)

Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☒

Movable: (List items) Tables, Chairs, Built-up platform, 1 Lot drawing notice board, one Gong or Siren with different sounds for each mat.

Environmental Characteristics (place x in appropriate column)

	Yes	No		Yes	No
Ceiling Heights: Any special requirements If any state clear height		☒	Noise: Any special requirements Is activity noisy Does activity require quiet		☒
Heating & Air Conditioning:			Lighting: Any special requirements	☒	
Standard for building is all that is required.		☒	Is natural daylight needed		☒
Space must be air-conditioned	☒		Above average Intensity		☒
			Dimmer Control	☒	
			Flooring:		
Accurate Temp. Control required			What type of flooring will be required:		
If so, give range: 18° to 25°			Gymnasium sprung		☒
			Tile		☒
			concrete		☒
Other - (specify under comments)			non-slip	☒	
			Other (Specify under comments)	☒	

Services: (place x in box if required)

Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐

Electrical Power: Local Emergency Power Required ☒

Additional Requirements or Comments:

Competition floor must be a raised Sprung wooden floor platform at a length of 43,000mm and a minimum width of 18,000mm and height from the base floor of 500mm -1000mm

Competition floor surface must be of elastic tatami surface

Direct Natural light shall be eliminated from the gymnasium

All lighting shall be placed in order NOT to interfere with competing athletes or referees/judges

One information board, on view to everyone from all angles, giving information of the bout

One pairing and results board for each category, available to the competitors and officials placed in a position accessible to everyone

Option 1 - Octagon

Individual Floor
16 x 18m

Wrestling
48 x 18m

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department: Changing Rooms
 Name of Space: Team Change Rooms Net Assignable Sq. m: _____

Space Description

Purpose: To provide a changing and showering area for team sports of 20 or less players

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located to allow for close and easy access to the playing surface
Close to warm-up area, easy access to first aid room

- b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Changing into and out of equipment and uniforms used for play as well as showering after games.

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☐	8. Other Specify: ☒	

preparation for sport

Users: (insert number in appropriate boxes)

Staff	☐	Competitors	☐
Floor personnel: ex: Ref, Doctor, Scorer's	☐		☐
Average hours per week usage	☐		☐

Space Components:

Space Components																									
Required Surfaces		Dimensions				Storage				Utilities								Finishes		Misc.					
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Fume Hood	Fume Cabinet
Types																									
Countertop									x	x	x														

Seating Requirments	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand			
Stand A: a) Federation members			
b) Federation guests, sponsors, VIP			
c) Organizers' guests, local spons. gov. officials			
Stand B: Press - Journalists & photographers			
Stand C: Team members, players, tech's, other officials			
Stand D: Internat'l referees, & nat'l tech. officials			

Equipment	Quantity	Length mm	Width mm	Height mm	Weight Est'd (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
Benches or Chairs for players	20					x				x	
Massage Table	1					x					
Fridge	1					x					
Ice box	1					x					
Showers	6						x				
Toilets	2						x	x			
Urinals	2						x				
Sinks	2						x				
Garbage Bins	2					x					
Individual lockers/stalls	14						x			x	

Communications:	Audio Visual
(place X in box if required)	The following audio visual aids will be used:
Telephone	Scoreboards
P.A. System	Television
Cable TV	Projector
Wireless Internet	Sound Reinforcement
Satellite Communication	Other Specify: _____
Other Specify: _____	

Furnishings: (place x in box if required)

Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐

Movable: (List items) Movable blackboard

Environmental Characteristics (place x in appropriate column)

	Yes	No		Yes	No
Ceiling Heights: Any special requirements	x		Noise: Any special requirements		x
If any state clear height min- 2.7 m			Is activity noisy		
			Does activity require quiet		
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average intensity		x
			Dimmer Control		x
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)

Water: Hot ☒ Cold ☒ Deionized ☐ Distilled ☐ Drainage: Floor ☒ Trough ☐

Electrical Power: Local Emergency Power Required ☒

Additional Requirements or Comments:

Resilient Flooring - flooring shall be of easily cleaned material (ex. Linoleum, tile)

Ceiling and Door height shall be a minimum height of 2.7 m as per Olympic Basketball requirements

Hangers or Lockers for at minimum 14 competitors

Shower heads must be at a minimum height of 2.5m

Note: When designed with shared shower facilities 4 dressing rooms are required so two teams competing against one another do not shower together.

If basketball and/or volleyball is to be played

- Ceiling heights and door heights shall be 2.70m
- Shower heads shall be placed at a 2.5m height

Team Change Room
Change Rooms min 50 m²

Scale 1:100

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department: Changing Rooms
 Name of Space: Referee Change Rooms Net Assignable Sq. m: _____

Space Description

Purpose: To provide a changing and showering area for Officials of any particular game

Space Relationships:

a. General - How should this space relate to general areas in the building? eg. offices, teaching areas, loading dock, storage areas.

Located to allow for close and easy access to the playing surface

b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Changing into and out of official uniforms used for Officiating play in addition to showering after games.

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☐	8. Other Specify: ☒	

preparation for sport

Users: (insert number in appropriate boxes)

Staff	☐	Competitors	☐
		Floor personnel: ex: Ref, Doctor, Scorer's	☐
		Average hours per week usage	☐

Space Components:

Space Components																									
Required Surfaces		Dimensions				Storage				Utilities								Finishes				Mac			
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Fume Hood	Fume Cabinet
Types																									
Countertop										x	x	x													

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand			
Stand A: a) Federation members b) Federation guests, sponsors, VIP c) Organizers' guests, local spons. gov. officials		Inclined	
Stand B: Press - Journalists & photographers		Level	
Stand C: Team members, players, tech's, other officials			
Stand D: Internat'l referees, & nat'l tech. officials			

Equipment	Quantity	Length mm	Width mm	Height mm	Weight Est'd (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
Benches or Chairs for players	5					x				x	
Fridge	1					x					
Table	1					x					
Showers	2						x				
Toilets	1						x	x			
Urinals	1						x				
Sinks	1						x				
Garbage Bins	1					x					
Individual lockers/stalls	5						x		x		

Communications:	Audio Visual
(place X in box if required)	The following audio visual aids will be used:
Telephone	Scoreboards
P.A. System	Television
Cable TV	Projector
Wireless Internet	Sound Reinforcement
Satellite Communication	Other Specify: _____
Other Specify: _____	

Furnishings: (place x in box if required)			
Fixed: blackboard	☐	Tackboard	☐
Shelving	☐	Advertising Boards	☐
Movable: (List items)			

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements	Yes	No	Noise: Any special requirements	Yes	No
If any state clear height	x		Is activity noisy		x
min - 2.7 m			Does activity require quiet		
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average intensity		x
			Dimmer Control		x
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)					
Water:	Hot	☒	Cold	☒	Deionized
				☐	Distilled
				☐	Drainage: Floor
				☒	Trough
Electrical Power:					Local Emergency Power Required
					☒

Additional Requirements or Comments:

Resilient Flooring - flooring shall be of easily cleaned material (ex. Linoleum, tile)

Hangers or Lockers for at minimum 5 Officials

Note:

- * There shall be quick and short access to playing floor from change rooms.

Referee Change Room
20 m²

Scale 1:100

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009

Department: Changing Rooms

Name of Space: Entertainment, Indiv. Sport, General Change Room

Net Assignable Sq. m:

Space Description

Purpose: To provide a changing and showering area for competitors in individual competitions in addition to individuals or entertainment squads.

Space Relationships:

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located to allow for close and easy access to the playing surface

Close to warm-up area, easy access to first aid room

b. Specific - Is this space part of a suite? Yes ☐ No ☒

If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Changing into and out of equipment and uniforms used for play or entertainment in addition to showering after games.

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☒
2. Admin Office	☐	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☐	8. Other Specify: ☒	

preparation for sport or entertainment

Users: (insert number in appropriate boxes)

Staff	<input type="text"/>	Competitors	<input type="text" value="1-42"/>
Floor personnel	ex: Ref, Doctor, Scorer's		<input type="text" value="n/a"/>
Average hours per week usage			<input type="text" value="80"/>

Space Components:

Cupboard Components		Dimensions		Storage		Utilities										Finishes		Misc.							
Required Surfaces		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Fume Hood	Fume Cabinet
Types																									
Countertop										x	x	x													

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand			
Stand A a) Federation members			
b) Federation guests, sponsors, VIP			
c) Organizers' guests, local spons. gov. officials			
Stand B Press - Journalists & photographers			
Stand C Team members, players, tech's, other officials			
Stand D International referees, & nat'l tech. officials			

Equipment	Quantity	Length mm	Width mm	Height mm	Weight Est'd (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
Benches or Chairs for players	20					x	x				
Table	1					x					
Showers	8					x					
Toilets	2					x	x				
Urinals	2					x					
Sinks	3					x					
Garbage Bins	2					x					
Individual lockers/stalls	42					x				x	

Communications:	Audio Visual
(place X in box if required)	The following audio visual aids will be used:
Telephone	☐
P.A. System	☐
Cable TV	☐
Wireless Internet	☐
Satellite Communication	☐
Other Specify: _____	

Furnishings: (place x in box if required)			
Fixed: blackboard	☐	Tackboard	☐
Shelving	☐	Advertising Boards	☐
Movable: (List items)			

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements If any state clear height	Yes	No	Noise: Any special requirements Is activity noisy Does activity require quiet	Yes	No
		x			x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average Intensity		x
			Dimmer Control		x
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)													
Water:	Hot	☒	Cold	☒	Deionized	☐	Distilled	☐	Drainage:	Floor	☒	Trough	☐
Electrical Power:	Local Emergency Power Required										☒		

Additional Requirements or Comments:

Resilient Flooring - flooring shall be of easily cleaned material (ex. Linoleum, tile)

Lockers shall be standard size lockers

Note:

- Changing Room shown will be designated for one sex
- Olympic use shall include Entertainment changing and sports consisting of individual competition.
- Post Olympic Use may be as General Changing Rooms

Entertainment & General #1
Change Rooms 75 m²

Scale 1:100

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department Medical
 Name of Space: Players First Aid Room Net Assignable Sq. m

Space Description

Purpose: To provide emergency First Aid medical consultation to the Olympic competitors

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg. offices, teaching areas, loading dock, storage areas.

Located to allow for close and easy access from changing rooms
Should be easily accessed from the floor surface as well

- b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Provide emergency First Aid and normal preventative medical consultation.

Activity type: (insert x in applicable box)

1. Private Office ☐	6. Fitness ☐
2. Admin Office ☐	5. Spectator Seating ☐
3. Classroom ☐	6. Concourse ☐
4. Staff Room ☐	7. Medical Clinic ☒
5. Sports Surface ☐	8. Other Specify: ☒ <u>Emergency First Aid</u>

Users: (insert number in appropriate boxes)

Staff ☐ <u>1</u>	Competitors ☐ <u>1</u>
Floor personnel: ex: Ref, Doctor, Scorer's ☐ <u>2</u>	
Average hours per week usage ☐ <u>80</u>	

Space Components:

Equipment Components																								
Required Surfaces		Dimensions			Storage		Utilities										Finishes			Misc.				
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Refrigerator
Types																								
Wall Bench									x	x	x													2

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand			
Stand A: a) Federation members b) Federation guests, sponsors, VIP c) Organizers' guests, local spons. gov. officials		Inclined	
Stand B: Press - Journalists & photographers		Level	
Stand C: Team members, players, tech's, other officials			
Stand D: Internat'l referees, & nat'l tech. officials			

Equipment	Quantity	Length mm	Width mm	Height mm	Weight Est'd (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
Chairs	1					x					
Bed	1	2400	900			x					
Fridge	2					x					
Wardrobe	1					x					
Coat Rack	1					x					
Privacy Screen	1					x					
Trolley Stretcher	1					x					
Desk	1					x					
Oxygen cylinder & Defibrillator	1					x					
Couches	2					x					

Communications:	Audio Visual
(place X in box if required)	The following audio visual aids will be used:
Telephone ☒	Scoreboards ☐
P.A. System ☐	Television ☐
Cable TV ☐	Projector ☐
Wireless Internet ☒	Sound Reinforcement ☐
Satellite Communication ☐	Other Specify: _____
Other Specify: _____	

Furnishings: (place x in box if required)	
Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐	
Movable: (List items) Wardrobe, Privacy Screen, 2 comfortable chairs, coat rack	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements If any state clear height	Yes	No	Noise: Any special requirements Is activity noisy Does activity require quiet	Yes	No
		x			x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average Intensity		x
			Dimmer Control		x
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)	
Water: Hot ☒ Cold ☒ Deionized ☐ Distilled ☐ Drainage: Floor ☒ Trough ☐	
Electrical Power:	Local Emergency Power Required ☐

Additional Requirements or Comments:

Resilient Flooring - flooring shall be of easily cleaned material (ex. Linoleum, tile)

Privacy Screen shall divide the entire space from the waiting area

Should have access to **Natural light**

Note: Easily accessed by emergency services outside the hall as well as the playing court. Injured player to be taken there quickly.

Player First Aid Room
30 m²

Scale 1:50

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009

Department Medical

Name of Space: General First Aid Room

Net Assignable Sq. m

Space Description

Purpose: To provide emergency First Aid medical consultation for all areas of the building

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located to allow for close and easy access from spectator seating

Should be easily accessed from other facility areas in the building.

b. Specific - Is this space part of a suite? Yes ☐ No ☒

If yes, then describe its relationships to other spaces in the suite

Activity Description:

Provide First Aid and normal preventative medical consultation

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☒
5. Sports Surface	☐	8. Other Specify: ☒	

General emergency First Aid

Users: (insert number in appropriate boxes)

Staff Competitors Floor personnel ex: Ref. Doctor, Scorer's ☐

Average hours per week usage 80

Space Components:

[illegible]

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand			
Stand A: a) Federation members b) Federation guests, sponsors, VIP c) Organizers' guests, local spons. gov. officials		Inclined	Level
Stand B: Press - Journalists & photographers			
Stand C: Team members, players, tech's, other officials			
Stand D: Internat'l referees, & nat'l tech. officials			

[illegible]

Communications:

(place X in box if required)

Telephone x

P.A. System

Cable TV ☐

Wireless Internet	x
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Satellite Communication

Other Specify: _____

Audio Visual

The following audio visual aids will be used:

Scoreboards

Television

Projector ☐

Sound Reinforcement ☐

Other Specify: _____

Furnishings: (place x in box if required)

Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐

Movable: (List items) Wardrobe, Privacy Screen, 2 comfortable chairs, coat rack

Environmental Characteristics (place x in appropriate column)

	Yes	No		Yes	No
Ceiling Heights: Any special requirements		x	Noise: Any special requirements		x
If any state clear height			Is activity noisy		
			Does activity require quiet		
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average Intensity		x
			Dimmer Control		x
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)

Water: Hot ☒ Cold ☒ Deionized ☐ Distilled ☐ Drainage: Floor ☒ Trough ☐

Electrical Power: Local Emergency Power Required ☐

Additional Requirements or Comments:

Resilient Flooring - flooring shall be of easily cleaned material (ex. Linoleum, tile)
Should have access to **Natural light (a window)**

Note: For First Aid and normal preventative medical consultation.
Should be easily accessed from other facility areas in venue.

General First Aid Room Small
10.5 m²

Scale 1:50

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department: Medical
 Name of Space: Doping Control Station Net Assignable Sq. m: _____

Space Description

Purpose: For the controlled testing of athletes for use of performance enhancing drugs

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Located as close to the competition area as possible. There should not be visibility of competitors being escorted to the station and should not have to walk across the competition venue in front of spectators.

- b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

To take both urine and blood samples from competitors to send off to a lab for testing.

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☒
5. Sports Surface	☐	8. Other Specify: <u>x</u>	

Sample taking

Users: (insert number in appropriate boxes)

Staff	<input type="text"/>	Competitors	<input type="text"/>
Floor personnel ex: Ref, Doctor, Scorer's	<input type="text"/>		<input type="text"/>
Average hours per week usage	<input type="text"/>		<input type="text"/>

Space Components:

Space Components																								
Required Surfaces		Dimensions			Storage		Utilities										Finishes		Misc					
		Linear (m)	Width mm	Standing Ht.	Standing Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Refrigerator
Types																								
Wall Bench									x	x	x													2

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand			
Stand A: a) Federation members b) Federation guests, sponsors, VIP c) Organizers' guests, local spons. gov. officials		Inclined	Level
Stand B: Press - Journalists & photographers			
Stand C: Team members, players, tech's, other officials			
Stand D: Internal referees, & nat'l tech. officials			

Equipment		And Furniture		Quantity	Length mm	Width mm	Height mm	Weight Est'd (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
Item														
Chairs	7								x					
Bed	1	2400	900						x					
Fridge	2								x					
Garbage Bin	3								x					
Couches	5								x					
Side tables	2								x					
Desk	2								x					
Adjustable Medical chairs	3								x					

Communications:	Audio Visual
(place X in box if required)	The following audio visual aids will be used:
Telephone	Scoreboards
P.A. System	Television
Cable TV	Projector
Wireless Internet	Sound Reinforcement
Satellite Communication	Other Specify: _____
Other Specify: _____	

Furnishings: (place x in box if required)	
Fixed: blackboard ☐	Tackboard ☐ Shelving ☐ Advertising Boards ☐
Movable: (List items)	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements If any state clear height	Yes	No	Noise: Any special requirements Is activity noisy Does activity require quiet	Yes	No
		x			x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average intensity		x
			Dimmer Control		x
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)	
Water: Hot ☒ Cold ☒ Deionized ☐ Distilled ☐	Drainage: Floor ☒ Trough ☐
Electrical Power:	Local Emergency Power Required ☐

Additional Requirements or Comments:

Resilient Flooring - flooring shall be of easily cleaned material (ex. Linoleum, tile)

Must be a controlled setting

Athletes may not have the opportunity to switch samples or anything of the sort

Doping Control Station
66 m²

Scale 1:100

Furnishings: (place x in box if required)	
Fixed: blackboard ☐	Tackboard ☐ Shelving ☐ Advertising Boards ☐
Movable: (List items)	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements If any state clear height	Yes	No	Noise: Any special requirements Is activity noisy Does activity require quiet	Yes	No
		x			x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average intensity		x
			Dimmer Control	x	
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)		

Services: (place x in box if required)	
Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐	Drainage: Floor ☐ Trough ☐
Electrical Power:	Local Emergency Power Required ☐

Additional Requirements or Comments:

May be placed high up in the gymnasium so as to also have a view of the game if needed
Natural Light would be preferred

Note: Adjacent to a Meeting Room suitable for 10 persons
 Furniture must be of better quality

Sports Federation VIP Office
 22 m²

Scale 1:50

152

Department	Offices
Net Assignable Sq. m	

Purpose: *To hold meetings within the particular Federation*

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

b. Specific - Is this space part of a suite? Yes ☐ No ☒
If yes, then describe its relationships to other spaces in the suite.

Meeting and conducting the duties pertaining to the Federation and its involvement with the Olympic Games

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☒	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☐	8. Other Specify: ☐	

Federation/Staff	10	Competitors	
Floor personnel	ex: Ref, Doctor, Scorer's		
Average hours per week usage			80

[illegible]

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand		Inclined	Level
Stand A a) Federation members			
b) Federation guests, sponsors, VIP			
c) Organizers' guests, local spons. gov. officials			
Stand B Press - Journalists & photographers			
Stand C Team members, players, tech's, other officials			
Stand D Internat'l referees, & nat'l tech. officials			

[illegible]

Telephone	X
P A System	
Cable TV	X
Wireless internet	X
Satellite Communication	X
Other Specify:	

Scoreboards	☐
Television	☒
Projector	☒
Sound Reinforcement	☐
Other Specify:	

Furnishings: (place x in box if required)	
Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐	
Movable: (List items)	

Environmental Characteristics (place x in appropriate column)					
	Yes	No		Yes	No
Ceiling Heights: Any special requirements If any state clear height		x	Noise: Any special requirements Is activity noisy Does activity require quiet		x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average intensity		x
			Dimmer Control	x	
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)		

Services: (place x in box if required)	
Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐	
Electrical Power:	Local Emergency Power Required ☐

Additional Requirements or Comments:

May be placed high up in the gymnasium so as to also have a view of the game if needed
Natural Light would be preferred

Note: Adjacent to Federation VIP Office

10 Person Meeting Room
 41 m²

Scale 1:50

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department: Offices
 Name of Space: Federation Offices Net Assignable Sq. m: _____

Space Description

Purpose: To provide office space for the Sports Federations using the building

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg. offices, teaching areas, loading dock, storage areas.

Shall be located in close relationship to the other federation offices within the building

- b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Meeting and conducting the duties pertaining to the Federation and its involvement with the Olympic Games

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☒	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☐	8. Other Specify: ☐	_____

Users: (insert number in appropriate boxes)

Federation/Staff	☒	Competitors	☐
Floor personnel	ex: Ref, Doctor, Scorer's		☐
Average hours per week usage	☒		

Space Components:

Space Components.																								
Required Surfaces		Dimensions				Storage				Utilities								Finishes		Misc.				
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Refrigerator
Types																								

Seating Requirements										No. of Seats	Position	Comments
Total spectators												
Reserved Seats												
Presidential stand												
Stand A a) Federation members												
b) Federation guests, sponsors, VIP												
c) Organizers' guests, local spons. gov. officials												
Stand B Press - Journalists & photographers												
Stand C Team members, players, tech's, other officials												
Stand D Internat'l referees, & nat'l tech. officials												

Equipment											
And Furniture											
Item	Quantity	Length mm	Width mm	Height mm	Weight Estimated (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
Desk chair	6					x					
Meeting Chairs	9					x					
Fridge	1					x					
Storage Cabinets	1					x					
Wall Mounted TV's	1						x				
Photocopier	1					x					

Communications:

(place X in box if required)

Telephone	☒
P.A System	☐
Cable TV	☒
Wireless Internet	☒
Satellite Communication	☐
Other Specify: _____	

Audio Visual

The following audio visual aids will be used:

Scoreboards	☐
Television	☒
Projector	☐
Sound Reinforcement	☐
Other Specify: _____	

Furnishings: (place x in box if required)

Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐

Movable: (List items)

Environmental Characteristics (place x in appropriate column)

	Yes	No		Yes	No
Ceiling Heights: Any special requirements If any state clear height		x	Noise: Any special requirements Is activity noisy Does activity require quiet		x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average Intensity		x
			Dimmer Control	x	
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)		

Services: (place x in box if required)

Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐

Electrical Power: Local Emergency Power Required ☐

Additional Requirements or Comments:

Flooring may be specified as of a resilient type
Natural Light would be preferred

Note: Must accommodate 6 people and have a meeting area with ability to watch live and review events on TV.

Federation offices
47 m²

Scale 1:50

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009
Name of Space: Federation Commissioners Office

Department Offices
Net Assignable Sq. m. _____

Space Description

Purpose: *To provide a private office space for the Federation commissioner*

Space Relationships:

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas

Shall be located in close relationship to the other federation offices within the building

b. Specific - Is this space part of a suite? Yes ☐ No ☒
If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Meeting and conducting the duties pertaining to the Federation and its involvement with the Olympic Games

Activity type: (insert x in applicable box)

1. Private Office	☒	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☐	8. Other Specify: ☐	

Users: (insert number in appropriate boxes)

Federation/Staff 1 Competitors

Floor personelle ex:Ref,Doctor,Scorer's

Average hours per week usage 80

Space Components:

[illegible]

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand		Inclined	Level
Stand A a) Federation members b) Federation guests, sponsors, VIP c) Organizers' guests, local spons. gov. officials			
Stand B Press - Journalists & photographers			
Stand C Team members, players, tech's, other officials			
Stand D Internat'l referees, & nat'l tech. officials			

[illegible]

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone	☐	Scoreboards	☐
P.A System	☐	Television	☒
Cable TV	☒	Projector	☐
Wireless Internet	☒	Sound Reinforcement	☐
Satellite Communication	☐	Other Specify: _____	
Other Specify: _____			

Furnishings: (place x in box if required)

Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐

Movable: (List items)

Environmental Characteristics (place x in appropriate column)

	Yes	No		Yes	No
Ceiling Heights: Any special requirements		x	Noise: Any special requirements		x
If any state clear height			Is activity noisy		
			Does activity require quiet		
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average intensity		x
			Dimmer Control	x	
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)		

Services: (place x in box if required)

Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐

Electrical Power: Local Emergency Power Required ☐

Additional Requirements or Comments:

Flooring may be specified as of a resilient type
Natural Light would be preferred

Note: Must accommodate 6 people and have a meeting area with ability to watch live and review events on TV.

Federation Commissioners Office

12 m²

Scale 1:50

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009
Name of Space: Federation Services Office

Department	Offices
Net Assignable Sq. m	

Space Description

Purpose: To provide a private office space staff assisting the sports federations involved

Space Relationships:

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Shall be located in close relationship to the other federation offices within the building

b. Specific - Is this space part of a suite? Yes ☐ No ☒
If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Meeting and conducting the duties pertaining to the the installation and servicing of the various advertising signage and courtside signage in and around the building

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☒	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☐	8. Other Specify:	☐

Users: (insert number in appropriate boxes)

Federation/Staff	5
------------------	---

Competitors	
Floor personnel ex: Ref, Doctor, Scorer's	

Average hours per week usage 80

Space Components:

[illegible]

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand			
Stand A a) Federation members b) Federation guests, sponsors, VIP c) Organizers' guests, local spons. gov. officials		Inclined	Level
Stand B Press - Journalists & photographers			
Stand C Team members, players, tech's, other officials			
Stand D Internat'l referees, & nat'l tech. officials			

[illegible]

Communications: (place X in box if required)		Audio Visual The following audio visual aids will be used.	
Telephone	☒	Scoreboards	☐
P.A. System	☐	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☒	Sound Reinforcement	☐
Satellite Communication	☐	Other Specify: _____	
Other Specify: _____			

Furnishings: (place x in box if required)	
Fixed: blackboard ☐	Tackboard ☐ Shelving ☐ Advertising Boards ☐
Movable: (List items)	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements If any state clear height	Yes	No	Noise: Any special requirements Is activity noisy Does activity require quiet	Yes	No
		x			x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average Intensity		x
			Dimmer Control	x	
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)		

Services: (place x in box if required)	
Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐	
Electrical Power:	Local Emergency Power Required ☐

Additional Requirements or Comments:

Flooring may be specified as of a resilient type
Natural Light would be preferred

Note: For staff that assist the individual sports federation in the installation and servicing of the various advertising signage and courtside signage

Federation Services Office
 23 m²

Scale 1:50

Furnishings: (place x in box if required)	
Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐	
Movable: (List items)	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements	Yes	No	Noise: Any special requirements	Yes	No
If any state clear height		x	Is activity noisy		x
			Does activity require quiet		
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average intensity		x
			Dimmer Control	x	
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)		

Services: (place x in box if required)	
Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐	
Electrical Power:	Local Emergency Power Required ☐

Additional Requirements or Comments:

Flooring may be specified as a resilient type
Natural Light would be preferred

Note: An office from which it coordinates all of the venues various operations during the Olympics

LOC (Local Organising Committee)
 Control Office
 187 m²

Scale 1:100

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department Media
 Name of Space: Mixed Zone Area Sq. m 80

Space Description

Purpose: For players and coaches to meet Media after the event

Space Relationships:

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Shall be between areas where players leave the court to the changing rooms

b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

For TV, Radio and Print Media to interview the athlete and coaches informally after the event during the Olympic Games

Activity type: (insert x in applicable box)

1. Private Office ☐	6. Fitness ☐
2. Admin Office ☐	5. Spectator Seating ☐
3. Classroom ☐	6. Concourse ☐
4. Staff Room ☐	7. Medical Clinic ☐
5. Sports Surface ☐	8. Other Specify: ☒ Media Facilities

Users: (insert number in appropriate boxes)

Federation/Staff <input type="text"/>	Competitors <input type="text"/>
Media <input type="text"/>	Floor personnel ex: Ref, Doctor, Scorer's <input type="text"/>
	Average hours per week usage <input type="text"/>

Space Components:

Space Components																								
Required Surfaces		Dimensions			Storage		Utilities										Finishes		Misc					
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Air	Vacuum	Steam	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Refrigerator
Types																								

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand			
Stand A a) Federation members			
b) Federation guests, sponsors, VIP			
c) Organizers' guests, local spons. gov. officials			
Stand B Press - Journalists & photographers			
Stand C Team members, players, tech's, other officials			
Stand D Internat'l referees, & nat'l tech. officials			

Equipment	Quantity	Length mm	Width mm	Height mm	Weight Est'd (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
And Furniture											
Item											
Movable Barriers sufficient so journalists have 80m ²						x	x				
Olympic Backdrop	1					x			x		

Communications:	Audio Visual
(place X in box if required)	The following audio visual aids will be used:
Telephone ☐	Scoreboards ☐
P.A. System ☐	Television ☐
Cable TV ☐	Projector ☐
Wireless Internet ☐	Sound Reinforcement ☒
Satellite Communication ☐	Other Specify: _____
Other Specify: _____	

Furnishings: (place x in box if required)

Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐

Movable: (List items)

Environmental Characteristics (place x in appropriate column)

	Yes	No		Yes	No
Ceiling Heights: Any special requirements		x	Noise: Any special requirements		x
If any state clear height			Is activity noisy	x	
			Does activity require quiet		
Heating & Air Conditioning:			Lighting: Any special requirements	x	
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned	x		Above average Intensity	x	
			Dimmer Control		x
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)

Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐

Electrical Power: Local Emergency Power Required ☐

Additional Requirements or Comments:

Important for teams to follow this pathway after games and training sessions at the venue

Flooring may be specified as a resilient type

Walls should be made with with sound control in mind

Walls should contain the Olympic backdrop

Lighting should be sufficient and use spotlights for television broadcasting

Media Area shall be large enough to accommodate 200 journalists

Mixed Zone Room
200 journalists - 80m²
Area = 200m²

Scale 1:100

Analysis of physical facility requirements

Project:	<u>Olympic Gymnasium 2009</u>	Department:	<u>Media</u>
Name of Space:	<u>Communication Centre</u>	Area Sq. m	<u>50</u>

Space Description

Purpose: For telephone and electronic transmission for media and their home base

Space Relationships:

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Shall be located close to all other Media areas, easily accessed from Press Conference room and Media workroom

b. Specific - Is this space part of a suite? Yes ☐ No ☒
If yes, then describe its relationships to other spaces in the suite.

Activity Description:

For media to access and use for business purposes. To transmit information via telephone, fax and internet

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☐	8. Other Specify: ☒ Media Facilities	

Users: (insert number in appropriate boxes)

Federation/Staff		Competitors	
Media	10	Floor personnel: ex:Ref,Doctor,Scorer's	
		Average hours per week usage	80

Space Components:

[illegible]

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand		Inclined	Level
Stand A a) Federation members			
b) Federation guests, sponsors, VIP			
c) Organizers' guests, local spons. gov. officials			
Stand B Press - Journalists & photographers			
Stand C Team members, players, tech's, other officials			
Stand D Internat'l referees, & nat'l tech. officials			

[illegible]

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone	☒	Scoreboards	☐
P.A. System	☐	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☒	Sound Reinforcement	☐
Satellite Communication	☐	Other: Specify: _____	
Other: Specify: _____			

Environmental Characteristics (place x in appropriate column)		Yes	No	Environmental Characteristics (place x in appropriate column)		Yes	No
Ceiling Heights: Any special requirements				Noise: Any special requirements			
If any state clear height				Is activity noisy			
				Does activity require quiet			
Heating & Air Conditioning:				Lighting: Any special requirements			
Standard for building is all that is required.				Is natural daylight needed			
Space must be air-conditioned				Above average Intensity			
				Dimmer Control			
				Flooring:			
Accurate Temp. Control required				What type of flooring will be required:			
If so, give range from to				Gymnasium sprung			
				Tile			
				concrete			
				non-slip			
				Other (Specify under comments)			

Services: (place x in box if required)

Water:	Hot	☐	Cold	☐	Deionized	☐	Ostiled	☐	Drainage:	Floor	☐	Trough	☐
Electrical Power:	Local Emergency Power Required										☐		

Additional Requirements or Comments:

Flooring may be specified as a resilient type

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009

Department Media

Name of Space: Press Conference Room

Area Sq. m	155
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Space Description

Purpose: To provide an area for press conferences for the Preliminaries of Olympic Events

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

It should be separated from the Media Workroom and other areas creating disturbing noises

- b. Specific - Is this space part of a suite?

Yes ☐ No ☒

If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Conducting press conferences after events in a controlled setting during the Olympic Games

Activity type: (insert x in applicable box)

1. Private Office
2. Admin Office
3. Classroom
4. Staff Room
5. Sports Surface

5555

- 6. Fitness
- 5. Spectator Seating
- 6. Concourse
- 7. Medical Clinic

4444

8. Other Specify: ☒ Media Facilities

Users: (insert number in appropriate boxes)

Federation/Staff

14

Compellers

Media

106

Floor personnel ex:Ref,Doctor,Scorer's

Average hours per week usage

80

Space Components:

[illegible]

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand		Inclined	Level
Stand A a) Federation members b) Federation guests, sponsors, VIP c) Organizers' guests, local spons. gov. officials			
Stand B Press - Journalists & photographers			
Stand C Team members, players, tech's, other officials			
Stand D Internat'l referees, & nat'l tech. officials			

[illegible]

Communications: (place X in box if required)		Audio Visual The following audio visual aids will be used:	
Telephone	☐	Scoreboards	☐
P.A. System	☐	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☒	Sound Reinforcement	☒
Satellite Communication	☐	Other Specify: _____	
Other Specify: _____			

Furnishings: (place x in box if required)	
Fixed: blackboard ☐	Tackboard ☐ Shelving ☐ Advertising Boards ☐
Movable: (List items)	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements	Yes	No	Noise: Any special requirements	Yes	No
If any state clear height		x	Is activity noisy		x
			Does activity require quiet	x	
Heating & Air Conditioning:			Lighting: Any special requirements	x	
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned	x		Above average Intensity	x	
			Dimmer Control	x	
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)	
Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐	
Electrical Power: Local Emergency Power Required ☐	

Additional Requirements or Comments:

Podium should be lit with minimum 1200 lux by using additional spotlights

Flooring may be specified as a resilient type

Walls should be made with with sound control in mind

Space is required to have stationary TV Cameras set up to record the press conference

Room should be soundproof

Sound System should be professional and consist of several loud speakers and 4-6 mic's

Press Conference Room
Preliminary rounds
100 person capacity 155 m²

Scale 1:100

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department Support
 Name of Space: Security Centre Area Sq. m 19

Space Description

Purpose: To provide a room with all necessary security technology and monitoring equipment

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Shall be located near the main control point of the building

- b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

To maintain a level of security over the entire venue space and enable quick assistance when needed

Activity type: (insert x in applicable box)

1. Private Office ☐	6. Fitness ☐
2. Admin Office ☐	5. Spectator Seating ☐
3. Classroom ☐	6. Concourse ☐
4. Staff Room ☐	7. Medical Clinic ☐
5. Sports Surface ☐	8. Other Specify: ☒ Support Services

Users: (insert number in appropriate boxes)

Federation/Staff ☐	Competitors ☐
Media ☐	Floor personnel ex: Ref, Doctor, Scorer's ☐
Average hours per week usage ☐ 80	

Space Components:

Space Components																								
Required Surfaces		Dimensions			Storage		Utilities						Finishes		Misc.									
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Dishwasher	Stovetop	Special (other)	Refrigerator
Types																								

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand			
Stand A a) Federation members			
b) Federation guests, sponsors, VIP			
c) Organizers' guests, local spons. gov. officials			
Stand B Press - Journalists & photographers			
Stand C Team members, players, tech's, other officials			
Stand D Internat'l referees, & nat'l tech. officials			

Equipment	Quantity	Length mm	Width mm	Height mm	Weight Est'd (kg)	Movable	Fixed	Floor	Bench	Wall	Coiling
And Furniture											
Table	7	1525	750	750		x	x				
Chair	2					x	x				
Wall mounted tv monitors (as many as needed)								x		x	
Computers	2					x					

Communications:	Audio Visual
(place X in box if required)	The following audio visual aids will be used:
Telephone ☒	Scoreboards ☐
P.A System ☐	Television ☐
Cable TV ☐	Projector ☐
Wireless Internet ☒	Sound Reinforcement ☐
Satellite Communication ☐	Other Specify: _____
Other Specify: _____	

Furnishings: (place x in box if required)	
Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐	
Movable: (List items)	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements If any state clear height	Yes	No	Noise: Any special requirements Is activity noisy Does activity require quiet	Yes	No
		x			x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.		x	Is natural daylight needed		x
Space must be air-conditioned	x		Above average Intensity		x
			Dimmer Control		x
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete	x	x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)	
Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐	
Electrical Power:	Local Emergency Power Required ☒

Additional Requirements or Comments:

Flooring may be of any resilient material

The Security Centre shall be a secure and lockable room for the security manager

Note: Contains all appropriate technical equipment for the security manager

- Internet connection
- Connected to all security camera feeds on site

Security Centre
19 m²

Scale 1:50

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009

Department Support

Name of Space: Hospitality Area

Area Sq. m	650
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Space Description

Purpose: For VIP accomodation 1 hour before, during, and 1 hour after the event

Space Relationships:

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Shall be located close to the VIP seats, and Catering room

b. Specific - Is this space part of a suite? Yes ☐ No ☒

If yes, then describe its relationships to other spaces in the suite.

Activity Description:

To accommodate catering for 300 guests during Preliminaries and 500 during Final rounds

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☐	8. Other Specify: ☐ Support Services	

Users: (insert number in appropriate boxes)

Federation/Staff 3-500

Media ☐Competitors ☐Floor personnel: ex:Ref,Doctor,Scorer's ☐

Average hours per week usage 80

Space Components:

[illegible]

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand			
Stand A a) Federation members b) Federation guests, sponsors, VIP c) Organizers' guests, local spons. gov. officials		inclined	Level
Stand B Press - Journalists & photographers			
Stand C Team members, players, tech's, other officials			
Stand D Internat'l referees, & nat'l tech. officials			

[illegible]

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone	☐	Scoreboards	☐
P.A System	☒	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☐	Sound Reinforcement	☐
Satellite Communication	☐	Other Specify: _____	
Other Specify: _____			

Furnishings: (place x in box if required)

Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐

Movable: (List items)

Environmental Characteristics (place x in appropriate column)

	Yes	No		Yes	No
Ceiling Heights: Any special requirements	x		Noise: Any special requirements	x	
If any state clear height			Is activity noisy		
*review additional comments at bottom	x		Does activity require quiet	x	
Heating & Air Conditioning:			Lighting: Any special requirements	x	
Standard for building is all that is required.	x		Is natural daylight needed	x	
Space must be air-conditioned			Above average Intensity		x
			Dimmer Control		x
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)

Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐

Electrical Power: Local Emergency Power Required ☐

Additional Requirements or Comments:

*Ceiling Ht. may be that of a Basketball court for ease in converting to a sports hall for Post Olympic use

Flooring may be specified as a resilient type

Natural Daylight and views are desirable but not required

Note: Not necessarily needed to be one large open area

Note: VIP Hospitality Area, suitable for Federation and Local Organising Committee VIP guests

- big enough to accommodate 300 people
- to provide catering
- electric supply 220V

Hospitality Area

300 Guests Pre-lims
500 Guests Final Rounds
48 x 18m

Scale: 1:350

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009

Department Support

Name of Space: Catering Room

Area Sq. m	36
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Space Description

Purpose: For preparation of food to be served in the Hospitality area

Space Relationships:

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas

Shall be located close to the Hospitality Areas

b. Specific - Is this space part of a suite? Yes ☐ No ☒

If yes, then describe its relationships to other spaces in the suite.

Activity Description:

To accommodate the preparation of food, catering from 300 to 500 guests during

Activity type: (insert x in applicable box)

1. Private Office ☐ 6. Fitness ☐

2. Admin Office ☐ 5. Spectator Seating ☐3. Classroom ☐ 6. Concourse ☐4. Staff Room ☐ 7. Medical Clinic ☐

5. Sports Surface ☐ 8. Other Specify: ☒ Support Service

Users: (insert number in appropriate boxes)

Federation/Staff	4 to 6	Competitors	
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Media ☐ Floor personnel ex: Raf, Doctor, Scorer's ☐

Average hours per week usage 80

Space Components:

Required Surfaces		Dimensions		Storage		Utilities						Finishes		Misc.										
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Dishwasher	Stove/Top	Special (other)	Refrigerator
Types																								
Preparation Island	2.4	1250																						
Counter						x	x	x																
Counter						x				x	x	x									x			

Seating Requirements	No of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand			
Stand A a) Federation members			
b) Federation guests, sponsors, VIP			
c) Organizers' guests, local spons. gov. officials			
Stand B Press - Journalists & photographers			
Stand C Team members, players, tech's, other officials			
Stand D Internat'l referees, & nat'l tech. officials			

[illegible]

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone	☒	Scoreboards	☐
P.A System	☒	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☐	Sound Reinforcement	☐
Satellite Communication	☐	Other Specify: _____	
Other Specify: _____			

Furnishings: (place x in box if required)

Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐

Movable: (List items)

Environmental Characteristics (place x in appropriate column)

	Yes	No		Yes	No
Ceiling Heights: Any special requirements		x	Noise: Any special requirements		x
If any state clear height			Is activity noisy		x
			Does activity require quiet		x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average Intensity		x
			Dimmer Control		x
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)

Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐

Electrical Power: Local Emergency Power Required ☐

Additional Requirements or Comments:

Flooring may be specified as a resilient type easily cleaned material

Note: As close as possible to Hospitality areas where the catering can be prepared and then served in the Hospitality areas

Catering Room
36 m²

Scale 1:50

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department Support
 Name of Space: Accreditation Centre Area Sq. m 94

Space Description

Purpose: To provide a secure space to accredit Olympic family members and workers

Space Relationships:

a. General - How should this space relate to general areas in the building? eg. offices, teaching areas, loading dock, storage areas.

Shall be close to the entry of the building for accreditation prior to full access to the building and event space

b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite:

Activity Description:

To validate the Olympic family members and workers and provide them with valid passes for access to the venue

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☐	8. Other Specify: ☒ Support Services	

Users: (insert number in appropriate boxes)

Federation/Staff	<u>6</u>	Competitors	☐
Media	☐	Floor personnel ex: Ref, Doctor, Scorer's	☐
		Average hours per week usage	<u>80</u>

Space Components:

Space Components																								
Required Surfaces		Dimensions			Storage		Utilities						Finishes			Misc								
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Dishwasher	Stove/Top	Special (other)	Refrigerator
Types :																								

Seating Requirements		No. of Seats	Position	Comments
Total spectators				
Reserved Seats			Inclined	Level
Presidential stand				
Stand A a) Federation members				
b) Federation guests, sponsors, VIP				
c) Organizers' guests, local spons. gov. officials				
Stand B Press - Journalists & photographers				
Stand C Team members, players, tech's, other officials				
Stand D Internat'l referees, & nat'l tech. officials				

Equipment And Furniture	Quantity	Length mm	Width mm	Height mm	Weight Est'd (kg)	Movable	Fixed	Floor	Bench	Wall	Ceiling
Desk	7	1525	750	750		x	x				
Chairs	6					x	x				
Comfortable arm-chairs	11					x	x				
Photo Copier	1					x	x				
File cabinet	6					x	x				
Storage cabinet	3					x	x				
table	1					x	x				
coffee table	2					x	x				

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone	☒	Scoreboards	☐
P.A. System	☐	Television	☐
Cable TV	☐	Projector	☐
Wireless Internet	☒	Sound Reinforcement	☐
Satellite Communication	☐	Other Specify: _____	
Other Specify: _____			

Furnishings: (place x in box if required)	
Fixed: blackboard ☐	Tackboard ☐ Shelving ☐ Advertising Boards ☐
Movable: (List items)	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements	Yes	No	Noise: Any special requirements	Yes	No
If any state clear height		x	Is activity noisy		x
			Does activity require quiet		x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average intensity		x
			Dimmer Control		x
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)	
Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐	
Electrical Power:	Local Emergency Power Required ☐

Additional Requirements or Comments:

Flooring may be specified as a resilient type easily cleaned material

Note: The venue accreditation office mainly deals with the validation and day pass issues for both the Olympic family members and workers.

Accreditation Centre
94 m²

Scale 1:100

Furnishings: (place x in box if required)	
Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐	
Movable: (List items)	

Environmental Characteristics (place x in appropriate column)					
Ceiling Heights: Any special requirements If any state clear height	Yes	No	Noise: Any special requirements Is activity noisy Does activity require quiet	Yes	No
		x			x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.	x		Is natural daylight needed		x
Space must be air-conditioned			Above average Intensity		x
			Dimmer Control	x	
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)	x	

Services: (place x in box if required)	
Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐	Drainage: Floor ☐ Trough ☐
Electrical Power:	Local Emergency Power Required ☐

Additional Requirements or Comments:

Flooring may be specified as a resilient type easily cleaned material

Note: A room where volunteers can register each day and get tasks. It shall have tables and seats and refreshments

Volunteer Centre
47 m²

Scale 1:50

Project: Olympic Gymnasium 2009
Name of Space: Commercial Partner Storage

Department	Support
Area Sq. m	100

Purpose: To provide space for storage for the commercial partners who supply products for the event and have display stands in the venues

a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Shall be located in the storage areas of the building with secured access

b. Specific - Is this space part of a suite? Yes ☐ No ☒
If yes, then describe its relationships to other spaces in the suite.

The room is reserved for the federation apparel supplier and is also used for the distribution of the volunteer equipment. Additional secured storage for remaining Commercial Partners shall also be a minimum of 100m²

1. Private Office ☐

2. Admin Office ☐

3. Classroom ☐

4. Staff Room ☐

5. Sports Surface ☐

6. Fitness ☐

5. Spectator Seating ☐

6. Concourse ☐

7. Medical Clinic ☐

8. Other Specify: ☒ Support Services

Federation/Staff	1
Media	

Competitors	
Floor personnel ex:Ref,Doctor,Scorer's	18
Average hours per week usage	80

[illegible]

Seating Requirements	No. of Seats	Position	Comments
Total spectators			
Reserved Seats			
Presidential stand			
Stand A a) Federation members			
b) Federation guests, sponsors, VIP			
c) Organizers' guests, local spons. gov. officials			
Stand B Press - Journalists & photographers			
Stand C Team members, players, tech's, other officials			
Stand D Internat'l referees, & nat'l tech. officials			

[illegible]

(place X in box if required)

Telephone ☐

P.A. System ☐

Cable TV ☐

Wireless Internet ☐

Satellite Communication ☐

Other Specify: _____

The following audio visual aids will be used.

Scoreboards ☐

Television ☐

Projector ☐

Sound Reinforcement ☐

Other Specify _____

Furnishings: (place x in box if required)	
Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐	
Movable: (List items)	

Environmental Characteristics (place x in appropriate column)					
	Yes	No		Yes	No
Ceiling Heights: Any special requirements If any state clear height		x	Noise: Any special requirements Is activity noisy Does activity require quiet		x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required	x		Is natural daylight needed		x
Space must be air-conditioned			Above average Intensity		x
			Dimmer Control	x	
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete	x	
			non-slip		x
			Other (Specify under comments)		

Services: (place x in box if required)	
Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐	
Electrical Power:	Local Emergency Power Required ☐

Additional Requirements or Comments:

Note: The Commercial Partners who supply products for the event and have display stands in the Venues will require storage facilities:

- The room is reserved for the Federation apparel supplier and is also used for distribution of the volunteer equipment.
- Each Federation will require a minimum of 100m²
- Additional secured storage (locked) minimum of 100m² for other remaining Commercial Partners.

Commercial Partner Storage
100 m²

Scale 1:100

Analysis of physical facility requirements

Project: Olympic Gymnasium 2009 Department Support
 Name of Space: Signage Storage Room Area Sq. m 100

Space Description

Purpose: To provide space for sign storage for the event court-side signage and other advertising material

Space Relationships:

- a. General - How should this space relate to general areas in the building? eg: offices, teaching areas, loading dock, storage areas.

Shall be located close to other storage areas, loading and unloading and have direct access to the main event gymnasium space

- b. Specific - Is this space part of a suite? Yes ☐ No ☒
 If yes, then describe its relationships to other spaces in the suite.

Activity Description:

Loading and unloading and storage of rotating court-side signage

Activity type: (insert x in applicable box)

1. Private Office	☐	6. Fitness	☐
2. Admin Office	☐	5. Spectator Seating	☐
3. Classroom	☐	6. Concourse	☐
4. Staff Room	☐	7. Medical Clinic	☐
5. Sports Surface	☐	8. Other Specify: ☒ Support Services	

Users: (insert number in appropriate boxes)

Federation/Staff	☐	Competitors	☐
Media	☐	Floor personnel: ex:Ref, Doctor, Scorer's	☐
		Average hours per week usage	☐

Space Components:

Space Components																								
Required Surfaces		Dimensions		Storage		Utilities						Finishes		Misc										
		Linear (m)	Width mm	Standing Ht.	Sitting Ht.	Cupboards Above	Cupboards Below	Drawers	Shelving	Sinks	Hot Water	Cold Water	Deionized Water	Distilled Water	Gas	Electrical 110 V	Electrical 220 V	Acid Resistant	Non Permeable	Special (other)	Dishwasher	Stovetop	Special (other)	Refrigerator
Types																								

Seating Requirements		No. of Seats		Position		Comments	
Total spectators							
Reserved Seats							
Presidential stand							
Stand A: a) Federation members							
b) Federation guests, sponsors, VIP							
c) Organizers' guests, local spons. gov. officials							
Stand B: Press - Journalists & photographers							
Stand C: Team members, players, tech's, other officials							
Stand D: Internat'l referees, & nat'l tech. officials							

Equipment		And Furniture		Quantity		Length mm		Width mm		Height mm		Weight Est'd (kg)		Movable		Fixed		Floor		Bench		Wall		Ceiling	
Wide pull-up Doors		For forklift access		2		3500																			

Communications:		Audio Visual	
(place X in box if required)		The following audio visual aids will be used:	
Telephone		Scoreboards	
P.A. System		Television	
Cable TV		Projector	
Wireless Internet		Sound Reinforcement	
Satellite Communication		Other Specify:	
Other Specify:			

Furnishings: (place x in box if required)

Fixed: blackboard ☐ Tackboard ☐ Shelving ☐ Advertising Boards ☐

Movable: (List items)

Environmental Characteristics (place x in appropriate column)

	Yes	No		Yes	No
Ceiling Heights: Any special requirements		x	Noise: Any special requirements		x
If any state clear height			Is activity noisy		x
			Does activity require quiet		x
Heating & Air Conditioning:			Lighting: Any special requirements		x
Standard for building is all that is required.		x	Is natural daylight needed		x
Space must be air-conditioned		x	Above average Intensity		x
			Dimmer Control		x
			Flooring:		
Accurate Temp. Control required		x	What type of flooring will be required:		
If so, give range from to			Gymnasium sprung		x
			Tile		x
			concrete		x
			non-slip		x
			Other (Specify under comments)		

Services: (place x in box if required)

Water: Hot ☐ Cold ☐ Deionized ☐ Distilled ☐ Drainage: Floor ☐ Trough ☐

Electrical Power: Local Emergency Power Required ☐

Additional Requirements or Comments:

Note: Large room required for the storage of the courtside signage (rotating signage) and other advertising materials.

- Locate close to loading/unloading area for trucks
- Wide doors for forklifts to enter with easy access between storage and court

Signage Storage Room
100 m²

Scale 1:100

Appendix D: Diagram - Olympic Sports Surfaces Analysis

Sports Surfaces Analysis. This diagram is an account of the full sports floor space for the eleven sports considered throughout this thesis. With this diagram we begin to see the potential overlap that may be permitted to occur successfully within the same sports surface area within a gymnasium.

Appendix E: Table - Olympic Scheduling Analysis

Sport	Total # of Surfaces Req. for	Surfaces	Total # of Events per Day per Surface during Olympic Time Frame																Notes & Legends
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Badminton	3	A	12	10	10	10	10	8	8	7	3								> Preliminaries
		B	5	8	9	4												> Preliminaries & Quarter-Finals	
		C	5	7	9	5												> Semi-Finals & Finals	
Basketball	1	A	6	6	6	6	6	6	6	6	6	4	4	2	2	2	2	> Quarter-Finals	
																		> Preliminaries & Quarter-Finals	
																		> Finals Occur on Each day	
Boxing	1	A	24	25	23	22	29	24	24	12	12	8	22	5	8			** 17 Minutes Between Match's	
Handball	1	A	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	** Semi-Finals and Finals Held in Other Bldg	
		B																	
Judo	2	A	41	41	40	43	39	40	41									** 15 Minutes Between Match's	
		B	35	34	34	36	34	34	33										
Tae Kwon Do	1	A	38	38	38	38												** All matches took place in one Gymnasium - the Beijing PKU Gymnasium	
																		** There is one Main table for the finals to take place	
																		** At the busiest day use of tables is every 4.5 hours	
Table Tennis	1	1	24	24	6	4	4	16	49	44	36	3	4					** In Beijing BIT Gymnasium	
																		** In Beijing Capital Gymnasium	
																		** No times overlap therefore can take place in same venue	
Volleyball	2	A	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	** Blank Day represents a "REST DAY"	
		B	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	** Typical duration of a session with 12 lifters is approx. - 2 hours	
																		** Numbers in boxes represent number of lifters	
Weightlifting	1	A	14	29	38	42	38	34	11	18	20	15						** Preliminaries and finals occur on each day but are only held on one Mat	
																		** Match duration is 30 minutes	
Wrestling	3	A	15	15	20	11	11	14	15	20									
		B	20	20	30	18	18	21	23	28									
		C	12	12	20	10	10	11	12	21									
Fencing	5	A	9	9	9	9	10	1	1	1	1								
		B	9	9	9	9	10	4	4	4	4								
		C	9	9	9	9	11	1	1	1	1								
		D	8	10	10	9	12	4	5	4	4								
		E	4	4	4	4	8	2	2	2	2								

Scheduling Matrix. Used to create pairings of Olympic gymnasium sports, able to be played in the two week time frame of the Games. Shows the rationale behind the choice of hosting a Taekwondo and preliminaries of Basketball and Volleyball event, in addition to other combinations. Matrix based on info. from (en.beijing2008.cn) Beijing 2008 Olympics

Appendix F: Table - Future Lower Don Lands Demographic Needs

Toronto & East York District

Community (CC) & Recreation Centre's (RC)	Sports & Recreation Program																			
	Olympic Sports										Community Programs									
	Badminton	Basketball	Boxing	Fencing	Handball	Judo	Table Tennis	TaeKwonDo	Volleyball	Weightlifting	Wrestling	Archery	Ball Hockey	Soccer	Indoor Soccer	Karate	Dance (various)	Yoga	Ballet	Music
1 . Adam Beck CC		1											1	1		1	1			
2 . Balmly Beach CC		1											1	1		1	1			
3 . Beaches RC	1	1						1	1			1	1	1	1	1	1	1	1	1
4 . Bob Abate CRC		1					1	1				1	1				1	1	1	1
5 . Brown CC	1																1	1	1	1
6 . Earl Beatty CC													1			1	1	1		1
7 . East York CC																1	1	1	1	1
8 . Fairmount Park CC		1															1	1		1
9 . Frankland CC	1	1							1				1							1
10 . Gordon A. Brown MS		1											1		1					
11 . Hillcrest CC		1															1	1	1	1
12 . Holy Family		1							1				1							
13 . Humewood CS		1																		
14 . Jimmie Simpson RC	1	1													1	1	1	1	1	1
15 . John Innes CRC	1														1		1	1	1	1
*16 . Main Square CRC							1									1	1	1	1	1
17 . Mary McCormick RC																	1	1	1	1
18 . Masaryk - Cowan CRC	1	1							1				1	1	1	1	1	1	1	1
19 . Matty Eckler CRC	1	1					1	1					1	1	1	1	1	1	1	1
20 . Maurice Cody CC	1	1						1	1					1			1	1	1	1
21 . Parkdale CRC	1	1							1				1		1					
22 . Regent Park North RC														1						
23 . Regent Park South CC	1	1							1				1	1			1	1	1	1
*24 . Riverdale Farm																	1			1
25 . S.H. Armstrong CRC		1											1		1	1		1		1
26 . Scadding Court CC																		1		
27 . Secord CC		1											1		1	1			1	
28 . St.Lawrence CRC	1	1							1							1	1	1	1	1
*29 . Stan Wadlow Clubhouse															1		1			
30 . Terry Fox CC													1		1					
31 . Trinity Community RC	1	1					1	1					1	1	1	1	1	1	1	1
32 . Wallace Emerson CC		1														1	1	1	1	1
33 . Wellesley CC	1	1							1				1	1	1		1	1	1	1
*34 . Withrow Clubhouse															1	1				1
Popular Sports Totals	13	22	0	0	0	0	4	1	12	0	0	2	17	10	11	9	19	22	12	8

Note: * Community & Recreation Centres with an (*) denote that they do not contain a gymnasium

- 1st most popular sport/program
- 2nd most popular sport/program
- 3rd most popular sport/program

Information Gathered from Toronto & East York Fun Guide @ www.cityoftoronto

Note: The Demographic that is targeted for the Future Lower Don Lands Community has been set out to represent a diverse neighbourhood much like the city of Toronto. Therefore this table represents the demographic district of Toronto and East York.

Toronto and East York District recreational program matrix, portrayed to show the most popular recreational sports.

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