

SASKATCHEWAN MULTI-USE
SPORTS AND ENTERTAINMENT FACILITY
CONCEPT DESIGN FEASIBILITY STUDY



FEBRUARY 2010

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Sports and Entertainment Facility
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1. FOREWORD

1. FOREWORD

Stadium Consultants International (SCI) were retained by the Crown Investment Corporation (CIC) of Saskatchewan in the fall of 2009 to undertake and lead a six month design exercise, in order to help determine the feasibility of an ‘All-Weather Multi-use” facility for the Province of Saskatchewan. The project is to be located on a thirty-four acre site in downtown Regina, currently owned and occupied by CP Rail. SCI assembled an experienced team of engineers and supporting consultants, who have extensive experience in the design and development of large spectator multi-use facilities, and many of whom have worked with SCI on several past similar projects. The SCI team, along with CIC, undertook a series of meetings with the City of Regina, Province of Saskatchewan, Roughrider Football Club, local community and business groups as well as other stakeholders in Regina, Saskatoon and the surrounding region. The focus of the meetings was to receive input and direction, in order to establish the most appropriate size and building program that would define the proposed sports & entertainment facility and meet the needs of all of the user groups. SCI, along with their engineering team, developed the following design concept for a 33,000 capacity multi-use spectator facility, which will have the ability to expand to accommodate 45,000 patrons within the proposed building envelope. The scope of the design study also required SCI to look at three scenarios for the roof, a fully retractable option, an option that retracted the roof only over the football field, and a permanently installed roof with no retractability.

In addition to the Design Study by SCI, Crown Investments mobilized PCL, a major contractor, to provide a construction cost analysis for the proposed design, as well as Global Spectrum, a major facility operator, to develop a business pro forma for the facility.

2. DESIGN TEAM PROFILE

Stadium Consultants International, Inc. (SCI) is a multi-disciplinary consulting firm specializing in the financial and physical planning, development, implementation and project management of sports, recreation, leisure and entertainment facilities. SCI, works closely with BBB Architects who are experts in sports facility design.

In the past decade, SCI has been involved in more than 100 sports-related projects internationally and has been responsible for the programming and design of major stadia and arenas in North America, Europe and Asia.

Our clients include NBA, NHL, MLB and European professional soccer franchises, various levels of government, minor league and community sports organizations and private developers.

STADIUM CONSULTANTS INTERNATIONAL

Corporate Profile



Projects completed or underway include Windsor's Family Credit Union Centre, the new Madison Square Garden, Nassau Coliseum Renovation, General Motors Place in Vancouver (originally for NBA Grizzlies and NHL Canucks), Air Canada Centre in Toronto (NBA Raptors, NHL Maple Leafs), Hartwall Arena in Helsinki, Color Line Arena in Hamburg, Siemens Arena in Lithuania, Riga Arena in Latvia, Kingston K-Rock Centre, Brampton Sports & Entertainment Centre, Barrie Molson Centre (OHL Colts), Hank Aaron Ballpark (Mobile, Alabama – Double A), Germain Arena in Naples, FL., Bridgeport Arena, John Labatt's Centre in London, Renovations to Calgary's Saddledome, and Edmonton's Rexall Place, Ricoh Coliseum, the Kitchener Auditorium Renovation, as well as a variety of other projects involving the retrofitting of facilities to enhance event use and revenue generation.

SCI is, as well, specialized in the development of downtown multi-purpose arenas for medium and large-size cities and in strategic project programming which maximizes the revitalization potential of these projects.

Our revenue enhancement programs involve innovative financing and funding sources, operational efficiencies to reduce annual expenses, operating revenue enhancement programs and concise implementation plans that respond to the requirements of the public and private sectors.



SCI has assembled a team of financial experts, skilled designers, sport facility operators, entertainment event producers, marketing and sports media experts. These experienced professionals have in most cases worked in senior positions within the sports industry and have a direct "client's view" of the business.

SCI's specialized technical expertise in roof design has resulted in technical patents in North America, Europe and Japan for retractable roof technologies.

SCI also acts as a sports facility consultant for government agencies undertaking joint venture or design-build projects. In this coordination role, SCI assists with the programming, concept design, tendering and technical review of the project.

As a result of its long-term involvement with many major sport, entertainment and recreational facilities, SCI has acquired and maintains a comprehensive data base on major North American, European and Asian stadia, arenas and recreation centres.



Included in this information resource are many examples of innovative methods for public and private joint ventures, as well as detailed records of complex financial models and procedures necessary to launch these types of projects. This impressive collection of case material is extensively catalogued in SCI's data library and CAD system.

SCI's mission is to provide its clients (sporting organizations, business enterprises, government agencies, community groups, etc.) with the most up-to-date consulting services in the areas of design, financial feasibility, budgeting, strategic planning, programming, retractable dome technology and project management for all forms and scale of sports, leisure, and entertainment facilities.

Potential Areas of Assistance

Consulting

- Feasibility Studies
- Economic Analysis
- Impact Investigations
- Development Planning
- Event Coordination
- Project Management
- Competition Documents

Design

- Programming Criteria
- Site Evaluation
- Urban Design and Planning
- Facility Design
- Contract Documents
- Contract Administration
- Retractable Roof Technology

Financial

- Financial Engineering
- Project Financing
- Corporate Sponsorship
- Economic Impacts
- Advertising Programs
- Corporate Suite and
- Premium Seating Marketing and Sales

STADIUM CONSULTANTS INTERNATIONAL

Corporate Profile

BBB Team

BBB Architects



The uniqueness of the BBB architectural practice is maintained by its partners who sustain a hands-on role in the design and development of each project. In addition to the Sports and Entertainment work, these projects range from resort and tourist communities to complex urban mixed-use projects combining office, retail, residential and recreational facilities. BBB Architects is fortunate to include as its valued clients, universities, government agencies, prominent financial institutions and major private sector development companies in North America, Europe and Asia.

In order to manage effectively, the many complex projects and assignments involving accurate coordination and demanding technical requirements of diverse specialized consultants, regulatory agencies, political and financial organizations, BBB Architects relies on the able talents, education and experience of its 70-person staff. As a result of our dedication to client service, quality, and design excellence, the firm and its partners have received more than thirty awards for design including two Massey Medals (Canada's premier design award).

To respond to the diversity of projects in which the SCI organization is involved, the following divisions of BBB were created to manage the specialized services required by our clients:

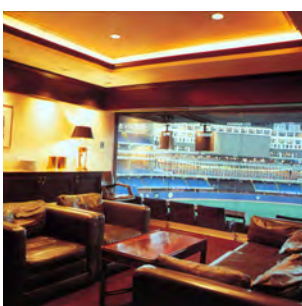
BBB, Urban Design and Planning



BBB Urban Design and Planning manages the masterplanning work of the firm and is involved in the regulatory approvals and planning phases of the firm's architectural projects. An important focus of this department is its experience in downtown revitalization through sports and tourism facilities and the community consultation process as a key ingredient in the planning of large-scale projects. Other areas of specialization include business, institutional and campus masterplanning, recreation and resort planning, and coastal development.

Staffing for this division has brought together a range of experience from both the public and private sector. Professional planning and urban design services include masterplanning, all aspects of approvals and negotiations with municipal authorities, rezoning and official plan amendments, production of design guidelines and reports, programming, site analysis and inventories, and coordination of public consultation and workshops.

BBB, Interiors



This division was established to allow for the dynamic integration of architectural and interior design within one operation. Projects range from complex institutional facilities such as Metro Hall; the headquarters for the Municipality of Metropolitan Toronto to the renovation of sports facilities such as the \$30 million renovation to Calgary's Saddledome. BBB, Interiors was responsible for several areas of Toronto's SkyDome, including design and coordination of the 150 private SkyBoxes and Clubhouses for the Blue Jays, Argonauts and visitor teams, and is currently designing all of the interiors for the new Madison Square Garden project.

CORPORATE PROFILE

The Halcrow Group has established itself globally as one of the premier consulting engineering practices. With 7,000 staff and 80 offices worldwide it provides a full range of engineering services globally.

Halcrow's Property Group, Halcrow Yolles, operates from offices in Toronto, Calgary, New York, Chicago, Las Vegas, London and throughout the UK, the Middle East and the Cayman Islands. Its portfolio includes projects in the Americas, Europe, North Africa, the Middle East and Asia.

Halcrow Yolles has developed a solid reputation in the commercial, hospitality, sports, parking, entertainment, healthcare, residential, transportation and institutional building sectors.

Halcrow Yolles' successful collaborations with architects, developers, government agencies, corporations and contractors are due to its understanding of architectural expression, its cost-effective and functional solutions, as well as its fundamental understanding of, and critical contribution to, the design and construction processes.

The firm provides key support services throughout all phases of the design and construction process, from feasibility studies through to construction review. Halcrow Yolles also provides services throughout the cycle of a building by providing remedial work strategies, restoration programs and condition assessment reports.

PRIMARY SERVICES

STRUCTURAL

- Conceptual Design and Feasibility
- Complete Detailed Design
- Contract Administration
- Investigations
- Performance Specs.
- Evaluation and Upgrading



PHYSICAL CONDITION ASSESSMENT

- Complete Building Assessments
- Capital Expenditure Analysis
- Life Safety Studies
- Building Investigations



FAÇADE CONSULTING

- Building Physics
- Energy Efficient Design
- Roof Consulting
- Cable Structures
- Glass Engineering



STRATEGIC SERVICES

- Value Engineering
- Risk Management
- Peer Review
- Fast Tracking
- Design Build
- Replacement Cost Analysis



SPECIALIZED SERVICES

SUSTAINABLE DESIGN

- LEED Evaluation
- Build Green Assessments
- Building Service Systems
- Embodied Energy Evaluation
- Green Roof Design



BLAST RESISTANT DESIGN

- Threat and Vulnerability Assessment
- Blast Pressure Calculation
- Building/ Façade Response
- Structural Integrity Provisions
- Passive Resistance/ Preventive Measures



RESTORATION SERVICES

- Bridge Restoration
- Building Restoration
- Parking Structures



Our Firm

The Mitchell Partnership Inc. was founded in Toronto (1958) as a mechanical building services consulting engineering practice. Our firm continues to evolve in direct response to our Clients' needs. The Toronto office with approximately 80 technical staff, including 40 professional engineers and designers, are networked with an additional 75 in our associated Boston and Calgary offices. We have established alliances with selected firms' worldwide, facilitating qualified local representation in major centres.

Our design philosophy expands TMP's services beyond traditional boundaries. We have cultivated a sensitivity for client and market priorities in all facets of the building services mechanical engineering field from engineering assessments and studies through typical and specialized design commissions, document production, construction phase inspection, design/build, energy studies, field inspection and supervision, to building systems commissioning and consulting services for building operations. Project types include a broad spectrum of commercial, high rise, institutional, retail and industrial applications of all sizes. The specific expertise gained by recognized champions in each specialty, is shared by means of a purposeful and dedicated inter and intra-office communications system.

Our approach to each project is centred on the assignment of a principal of the firm to full responsibility for the leadership role through all of its phases. This principal manages the assigned TMP team and its continuing client interface from initial concept design through the warranty period, drawing the specific expertise required from our staff group.

The Mitchell Partnership Inc. has gained a unique reputation for the design of energy efficient mechanical systems including original development of central heat pump chillers, hot and cold thermal storage, compartmentalized VAV air conditioning systems and office underfloor air distribution. Many of our techniques have since become industry standards.

Our close association with the construction and building operations components of our industry provides valuable feedback, giving our staff unique insight into the effectiveness of their efforts and allowing them to continuously upgrade their familiarity with, and understanding of, our increasingly complex specialty. As an example of the benefit of this exposure, we develop our own mechanical systems cost estimates for most projects and have worked very successfully with team cost consultants to apply this expertise.

Construction practices, traditionally very parochial, have benefited immensely from the global expansion of markets. We have contributed to this evolution through the transfer of advanced technologies from international projects, to encourage adoption of innovative practices on all our projects. Our 25 years of overseas project participation has developed within us a respect for other social and technical cultures. We research new and proven opportunities, listen to our clients' needs, and investigate local conditions before arriving at recommended design solutions. Ultimate success in operating locally, or overseas, transcends technical competence, to focus upon committed team participation, collectively assuring technical excellence.

The Mitchell Partnership Inc. has prospered as a strong member of a project team. We contribute our full resources to the specifics of our own discipline, while maintaining an overall dedication to the ultimate success of the project and the objectives and requirements of the Client.

Smith + Andersen

Company Profile

Founded in Toronto in 1965, Smith + Andersen first focus was in the field of mechanical building systems. Over time we've assembled a variety of engineering talent to both complement and add to our core strengths. Notable growth occurred in 1976-77 when we opened branch offices in Calgary and Ottawa. In 1997 we created electrical division focus specifically on electrical building services. As well, in 1999 we integrated a well-known, full-service communications consulting and project management division. Further expansion includes the establishment of our Dubai office in 2007, Edmonton and Vancouver offices in 2009.

Since 1965, We have been delivering integrated services and project management for building systems. Backed by a team of engineers & designers responsible for an accomplished portfolio, we take pride in offering clients engineering excellence through creative design, attentive service and a dedication to professionalism at every stage of our involvement. Together we provide broad professional expertise and the strategic know-how to manage the most elaborate projects. **'We Engineer Confidence.'** At Smith + Andersen it's a belief that as much guides us as it does define us, but more than that it is also a promise that we make to our clients.

Sports Facilities pose many interesting design challenges due to the varied functions they can house and the flexibility such varied programming demands. They all have different occupancy levels and require different lighting levels and special power requirements. Our approach to the design involves collaboration with the various stakeholders including maintenance and operation staff, the design team, contractors, the public and user groups. The systems for a sports facility must be designed to allow flexible operation of the complex while maintaining energy efficiency. Equipment and systems must be selected for quality, ease of maintenance and for the lowest life cycle owning and operating costs possible while staying within the budget allocated.

Lana MacInnes, LEED AP has designed and managed over 40 sports and recreational facility projects, more than half of which are stadium and arenas. Some examples of her engineering work include Air Canada Centre (Toronto), BMO Field / National Soccer Stadium (Toronto), General Motors Place (Vancouver), Ali Sami Yen Soccer Stadium (Turkey), Varsity Stadium and Sports Pavilion (University of Toronto, Toronto), Applebee Ball Park (Lexington, Kentucky), Kingston LVEC Arena (Kingston, ON), Ricoh Coliseum (Toronto), Hershey Centre Arena and Soccer Facility (Mississauga) and Rogers Centre (Renovation, Toronto). Lana has also won several lighting design awards and is a member of Illumination Engineering Society of North America Sports and Recreational Lighting Committee.



Global operations

Hatch has more than 9,000 employees in 65 offices around the world. New offices were recently opened to serve regional clients in Kuala Lumpur, Malaysia; Markham and Saskatoon, Canada; and Abu Dhabi, UAE.

Market sectors

Hatch is prominent globally in three market sectors: mining and metals, infrastructure and energy. The world's leading companies in each sector have relied on Hatch for more than 50 years to develop innovative processes and provide EPCM and operational services on every industrial continent.

Core services

Hatch provides consulting, design engineering, technologies, environmental services, operational services and comprehensive project and construction management to the global mining, metallurgical, infrastructure and energy sectors.

Safety, quality & innovation

Hatch has an excellent safety record as evidenced by safety awards in every region of the world. The objective is always zero harm to employees and the contractors we manage. Quality springs from our technical excellence, our experience driven methodologies, our proven iPas project-management system, and our reputation for innovation.

Engineering

Since our founding in 1955, Hatch has earned a reputation for superior project outcomes based on a strong tradition of engineering excellence and innovative design. Our commitment to ongoing recruitment and development of the brightest new graduates around the world ensure that the tradition continues. To serve all client sectors, Hatch's expertise incorporates all major disciplines of engineering including Civil, Structural, Mechanical, Piping, Electrical Instrumentation and Control as well as areas of specialist expertise such as Process Control, Hydrotechnical, Structural Assets and Custom Equipment Design.

Our teams are equipped with the latest tools and technologies including data-centric 3D plant design systems, parametric 3D component design software, finite element analysis, computational fluid dynamics and many types of simulation software. Our teams are also able to access the multi-discipline and multi-industry expertise resident in Hatch through communities of practice, expertise directories and peer networks.

Our teams work closely with clients to incorporate the client's knowledge and requirements are built into the project starting at the earliest projects stages. We "do our homework" and ensure that technical decisions and designs are sound, and where appropriate, include the input and expertise of Hatch specialists from around the world. Finally, our engineering teams deliver their work as an integral part of Hatch's Project LifeCycle Process, working closely with our procurement, construction and commissioning teams to achieve optimal overall project outcomes.

Machine Design

The Machine Design Group specializes in the custom design and build of innovative machines to suit the client's specific requirements. Our main focus is heavy industry applications to support some of our clients and Hatches proprietary technologies. We bring designs from concept, proof of principle to finished working equipment. Including the design, specifications, purchase, bid review, build, shop testing, QA, shipping, installation, site supervision, start up, trouble shooting and maintenance of mechanical equipment. We have a community of related skills available including welding inspection and design, controls and SIL safety equipment reviews.

Retractable Roof Experience

The following is a list of the Machine Design Group's experience with retractable roofs:

ROGERS CENTRE (Toronto Ontario, Canada)

Hatch was retained by the owner to do the peer review of the mechanical design pertaining to the retractable roof system.

CHASE FIELD (Phoenix Arizona, USA)

Hatch was responsible for the detail designed of the mechanical equipment for the retractable roof system and North wall doors. Hatch has been involved in the annual maintenance inspection and repairs for the last eight (8) years.

CONSULTING

Hatch has been retained by various clients to consult on retractable roofs of other stadiums.

PROPOSALS

Hatch has been involved in a number of proposals involving retractable roofs and/or fields for various international stadiums.

RWDI is a unique consulting firm that uses an array of engineering, computer and scientific capabilities to help designers create comfortable environments and high performance buildings and structures for all of the world's climates.

Our experts collaborate effectively with architects, engineers, planners and developers on integrating design issues such as sustainability, wind, sun, snow, sand, ventilation and cooling, air quality, noise, acoustics, vibration, energy, daylighting, renewables, structural dynamics, motion control, and other unique and demanding design issues. Our involvement helps clients save money, save time, reduce risk and achieve designs with higher levels of performance overall.

With substantial resources in seven countries, we are accessible and responsive - using our experience, four wind tunnels, computer clusters and advanced building-science software - to help our clients achieve greater success.

FIELDS OF SPECIALIZATION

Wind Engineering
Wind + Thermal Comfort
Air Quality
Energy

Solar Benefits + Daylighting
Green Buildings
Renewable Energy
Snow Sand Rain

Ventilation
Vibration
Dynamics + Motion
Noise + Acoustics

SASKATCHEWAN MULTI-USE FACILITY

RWDI used our experience as part of the design teams of every retractable roof stadium in North America to provide qualitative analysis for wind and snow loads and highlight examples of both positive and negative design features of the proposed facility. We provided a review of the building geometry in order to reduce the likelihood of large roof snow loads or wind loads with consideration of important structural design combinations and provided input on sliding ice and snow considerations.

RWDI also provided the design team initial wind and snow load estimates for key load cases. Using applicable codes, results from past studies, technical papers, the local wind statistics, the structure's shape, and site exposure key wind and snow loading cases were provided.

3. DESIGN PROCESS

3 (a) SITE

The overall proposed site is approximately thirty-four acres in area, located immediately north of the main rail line which passes through downtown Regina, just north of and parallel to, Saskatchewan Drive. The trapezoid shaped site is bounded by Broad Street to the East, Dewdney Avenue to the North and Albert Street to the West. Its North-South dimension is greatest at the western edge of the site, the width narrowing as you approach the eastern boundary. The site is owned and occupied by CP Rail and is currently employed as a maintenance yard and shipping container storage area. The intent is to remove the many 'spur' rail lines on the site, but leave the two main east-west lines, which are located at the southern border of the site, for continued use. The storage operation for CP would have to be moved elsewhere, away from the downtown core. An important objective of the design study was to determine where on the site the Multi-use Sports & Entertainment Facility would best serve the needs of the people of Regina and the surrounding region. As a sub-set to the main design exercise, since the actual footprint of the facility was anticipated to require only roughly half of the available site, SCI suggested some possible development/uses for areas of the site that were not consumed by the sports & entertainment facility. This adjacent development will complement the uses taking place within the facility as well as enhance the overall development of Regina's downtown, including the Warehouse district. Subsequently, SCI reviewed and coordinated our design suggestions with the Office for Urbanism group, who, for the City of Regina, were developing a parallel analysis of the general Downtown Plan, and how a new Sports & Entertainment Structure might integrate within that master plan vision.

For many decades the CP Site and the main rail line formed an obstacle which prevented the downtown core to the south of Saskatchewan Drive from forming a natural connection with the Warehouse District north of Dewdney Avenue. The North-South street connections at Albert and Broad Streets are considerably far apart, which makes accessing the central part of the Warehouse district from Downtown difficult for pedestrians. It was quite evident that putting a new Sports & Entertainment Facility on this site would also create a unique and timely opportunity to link these two important areas of Regina.

The topography of the site is flat. The long trapezoid shaped footprint is oriented east-west. Our objective was to create direct access to events at the new facility, from the main downtown core, as well as create a strong North-South path to connect the warehouse district to the downtown at anytime, regardless of event schedules.

A recent parking/traffic study, authorized by the City of Regina, indicated that approximately half of the parking spaces required by the new facility were already located in the downtown core, south of Saskatchewan drive. Our experience with these types of facilities has proven, in an urban situation, people park where they work, dine or shop, and walk to an event from there. This reinforced our goal of establishing a strong address for the facility for the

downtown inhabitants that would be moving north over the rail lines to access the building. The other half of the parking inventory would be located on streets to the north of the site, in both directions along the Dewdney Avenue corridor. New parking inventory would also be integrated within the adjacent site development that would be taking place as the downtown area expands. While investigating the best location within the site for the multi-use facility, we were mindful of the need for public space around the building perimeter, to handle large crowds entering or exiting the building. By locating the main structure adjacent to the rail lines, SCI created an opportunity to develop significant outdoor public plaza between the north face of the building and Dewdney Avenue. We also saw the benefit of introducing a Public Square, adjacent to the east side of the building that could host large crowds during pre or post event festivities. The proposed building location allows the development of a strong north-south linkage between the Warehouse district and the Downtown, along the east face of the proposed Sports & Entertainment Centre. We developed an 'Atrium' building at the north east corner of the spectator building, to act as a main entrance and lobby for patrons entering from the Warehouse district. The three storey atrium structure transitions the large scale and proportion of the spectator facility with the surrounding smaller scale of the warehouse buildings. The new Sports & Entertainment complex along with the proposed complementary development to the east could transform the Warehouse area into a vibrant destination entertainment district.



Site Plan – East-West Field

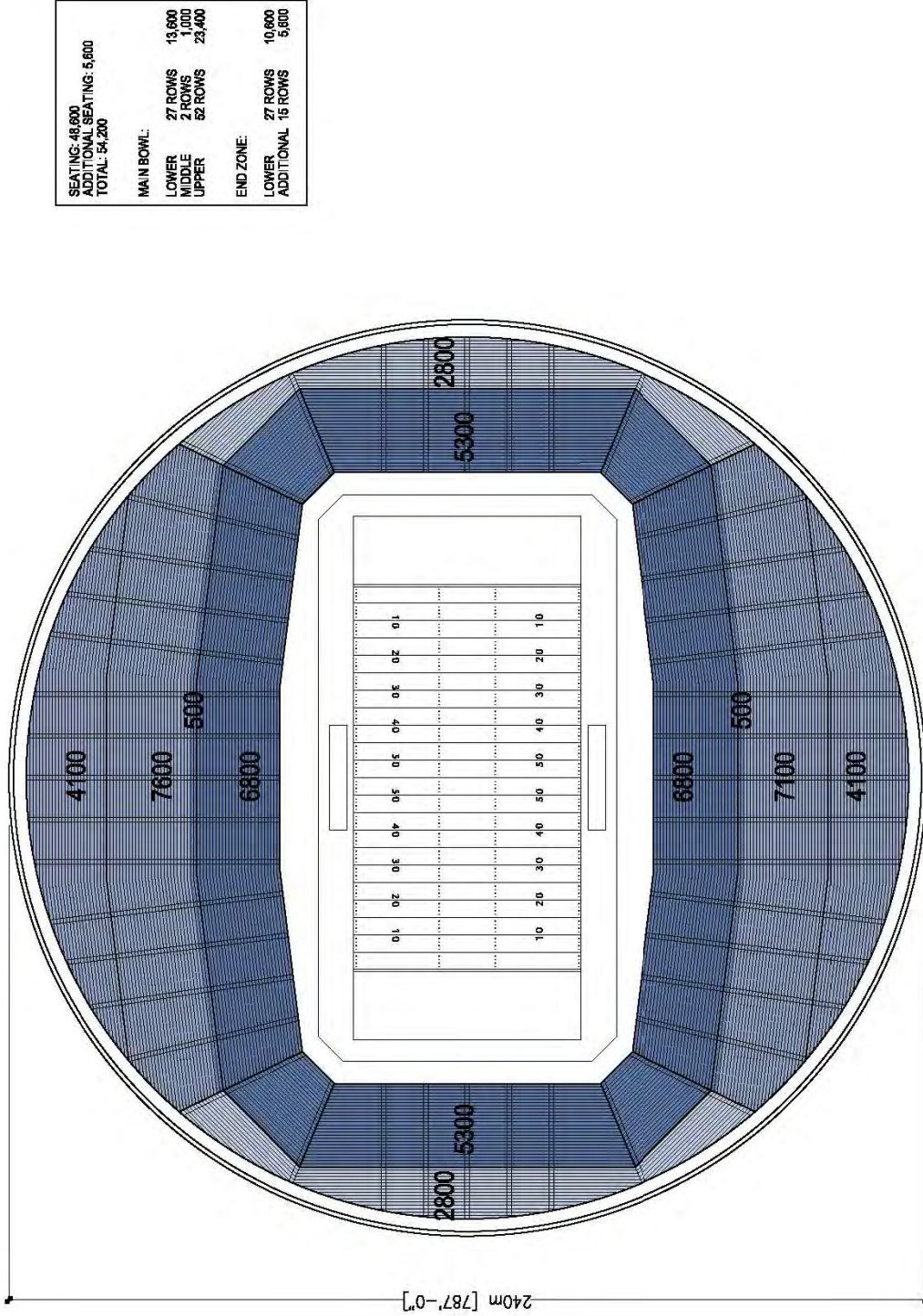
Saskatchewan Multi-Use Facility

3 (b) BUILDING GEOMETRY

In establishing the most appropriate and efficient footprint for the facility, SCI looked at the most dominant sports/events that would take place within the structure. The CFL football field along with the MLS soccer field were the largest sports surfaces that were among the list of intended uses for the new facility. The intent was to organize spectator seating around those sports field footprints such that a majority of the seats would be concentrated in the 'prime' viewing areas along the sidelines between the goal lines, and spread over two main seating tiers. Some seating was located in the end zones in order to establish a continuous seating bowl effect around the playing surface. This arrangement would also provide flexibility for various concert capacities and their respective stage configurations. Once the general seating patterns were established, large public concourse space, with evenly distributed Food & Beverage and washroom amenities, were laid out to support the seating areas properly.

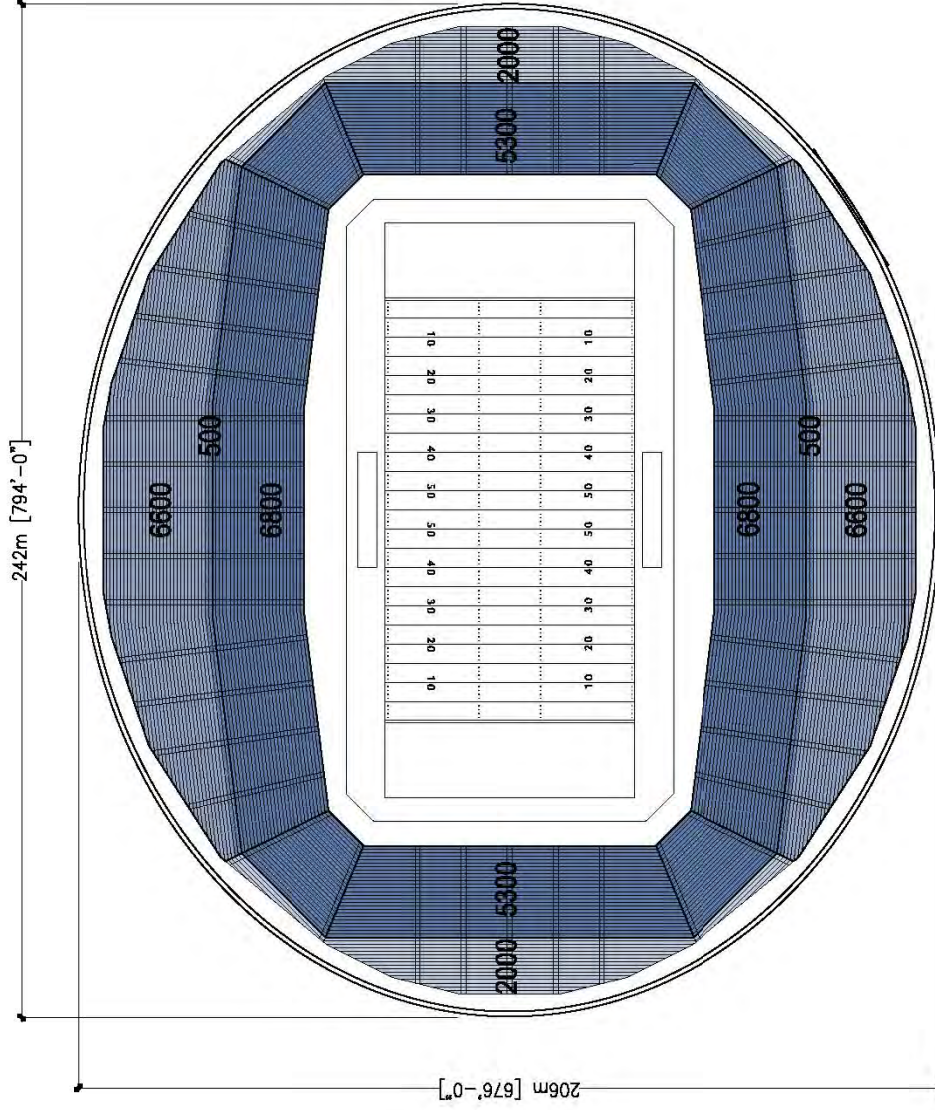
Initially, SCI investigated several geometries for the seating patterns and resultant building envelope. We looked at the impact of a round footprint, an elliptical as well as modified elliptical footprint. Finally we looked at a rectangular arrangement, similar to several recent facilities that were constructed in North America and in Europe.

The result was a generally rectangular shaped footprint for the building, highly efficient, and which typically can be a more cost-effective geometry compared to round or elliptical shape structures.



Seating Bowl – Option 1
Circular

Capacity: 49,000 - 54,000

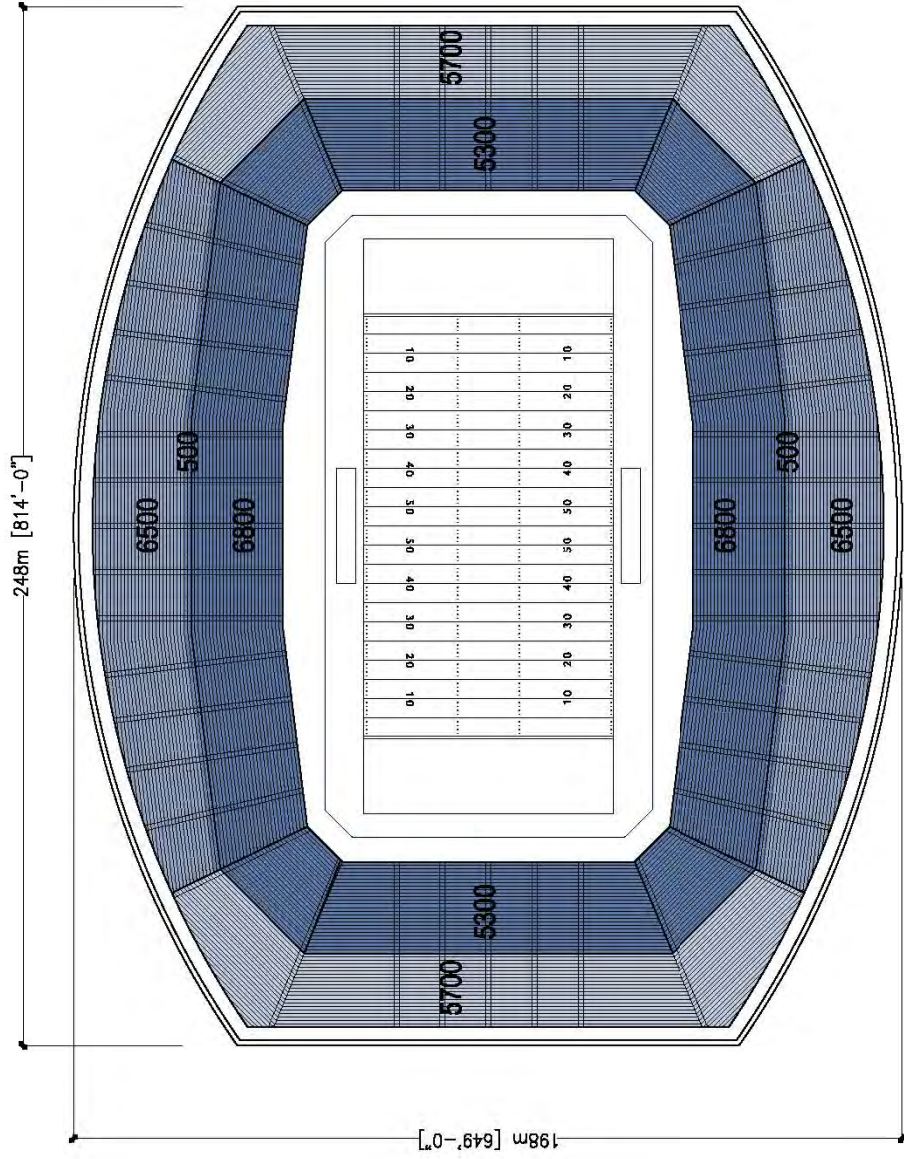


SEATING: 38,400	13,600
ADDITIONAL SEATING: 4,000	1,000
TOTAL: 42,400	13,200
MAIN BOWL:	
LOWER 27 ROWS	13,600
MIDDLE 2 ROWS	1,000
UPPER 31 ROWS	13,200
END ZONE:	
LOWER 27 ROWS	10,600
ADDITIONAL 16 ROWS	4,000

Seating Bowl – Option 2

Elliptical

Capacity: 38,000 - 42,000

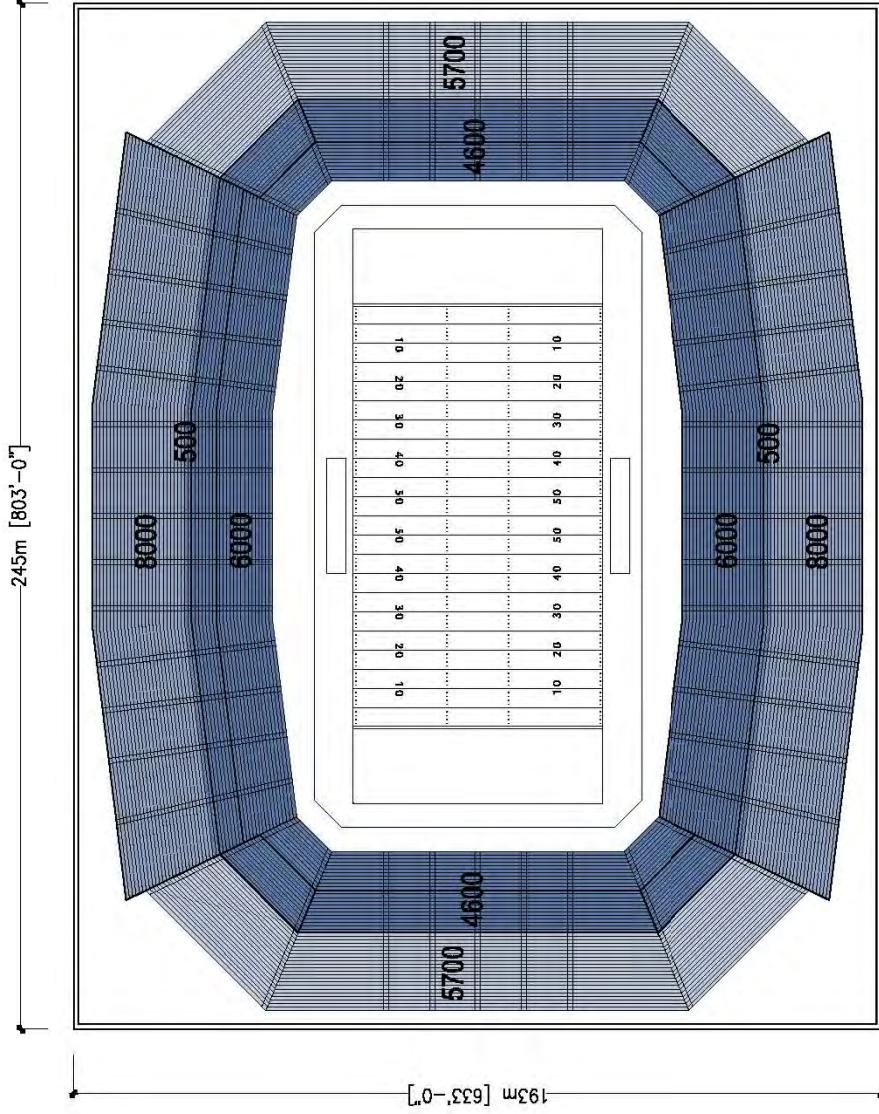


SEATING: 38,200	27 ROWS	13,800
ADDITIONAL SEATING: 12,000	27 ROWS	13,000
TOTAL: 49,900	27 ROWS	13,000
MAIN BOWL:		
LOWER	27 ROWS	13,800
MIDDLE	27 ROWS	13,000
UPPER	27 ROWS	13,000
END ZONE:		
LOWER	27 ROWS	10,800
ADDITIONAL	20 ROWS	11,400

Seating Bowl – Option 3

Elliptical Cut

Capacity: 38,000 - 50,000

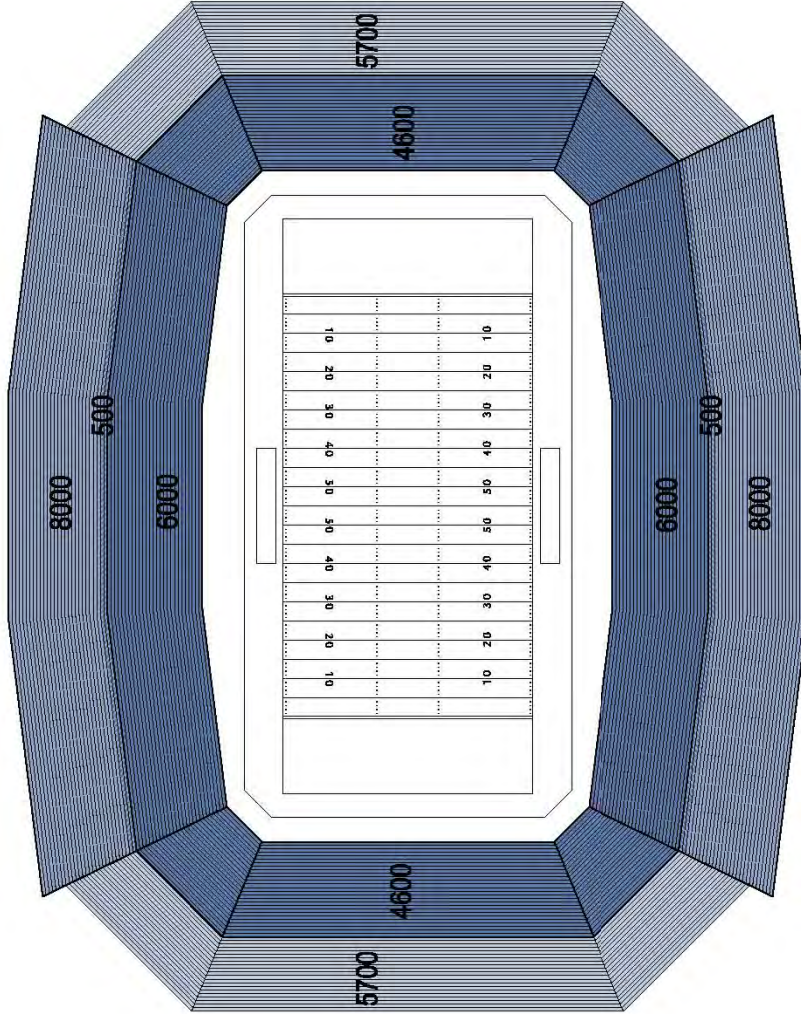


SEATING:	38,200
ADDITIONAL SEATING:	11,400
TOTAL:	49,600
MAIN BOWL:	
LOWER	13,600
MIDDLE	1,000
UPPER	16,600
END ZONE:	
LOWER	10,600
ADDITIONAL	11,400

Seating Bowl – Option 4 Rectangular

Capacity: 38,000 - 50,000

SEATING: 38,200	21,200
ADDITIONAL SEATING: 11,400	1,000
TOTAL: 49,600	18,000
LOWER BOWL	25 ROWS
MIDDLE BOWL	2 ROWS
UPPER BOWL	28 ROWS
ADDITIONAL	22 ROWS
	11,400

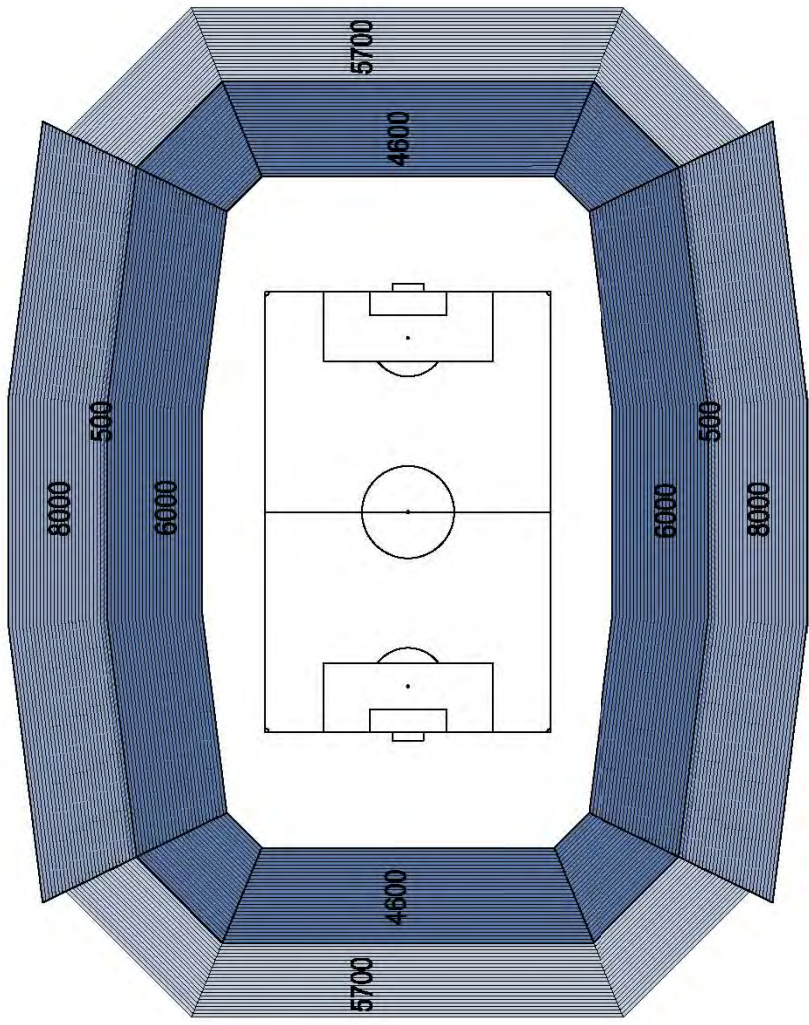


Seating Bowl - Event Options

Football

Capacity: 38,000 - 50,000

SEATING: 38,200	21,200
ADDITIONAL SEATING: 11,400	1,000
TOTAL: 49,600	18,000
LOWER BOWL	25 ROWS
MIDDLE BOWL	2 ROWS
UPPER BOWL	28 ROWS
ADDITIONAL	22 ROWS

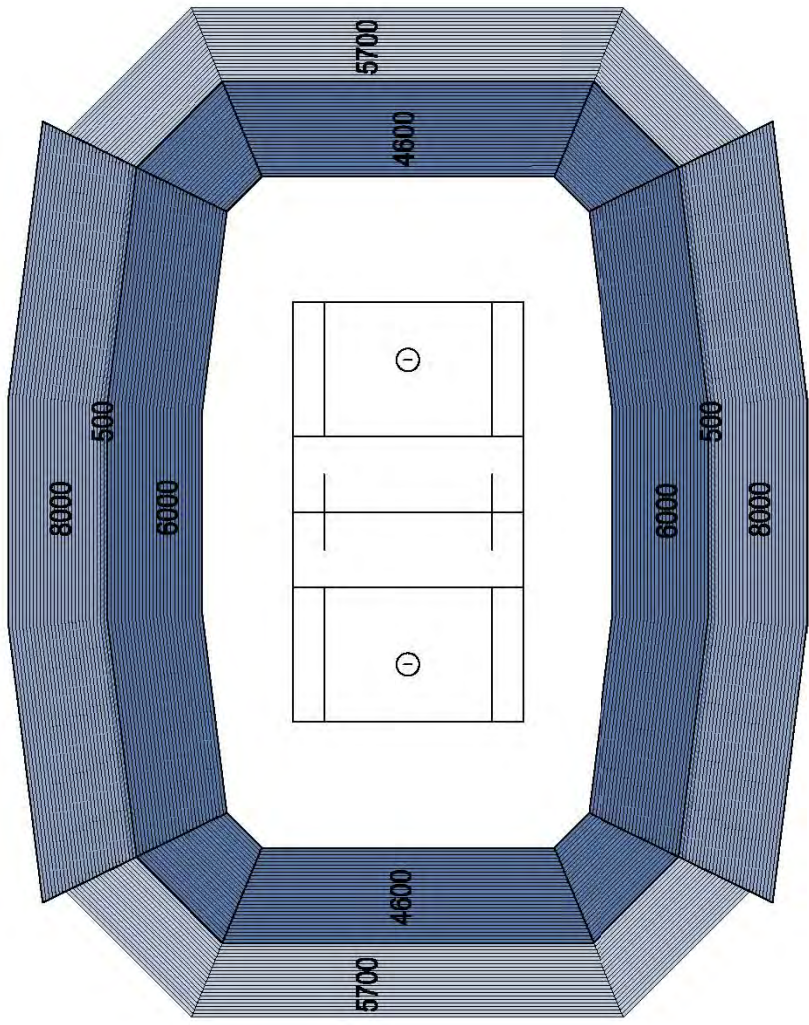


Seating Bowl - Event Options

Soccer

Capacity: 38,000 - 50,000

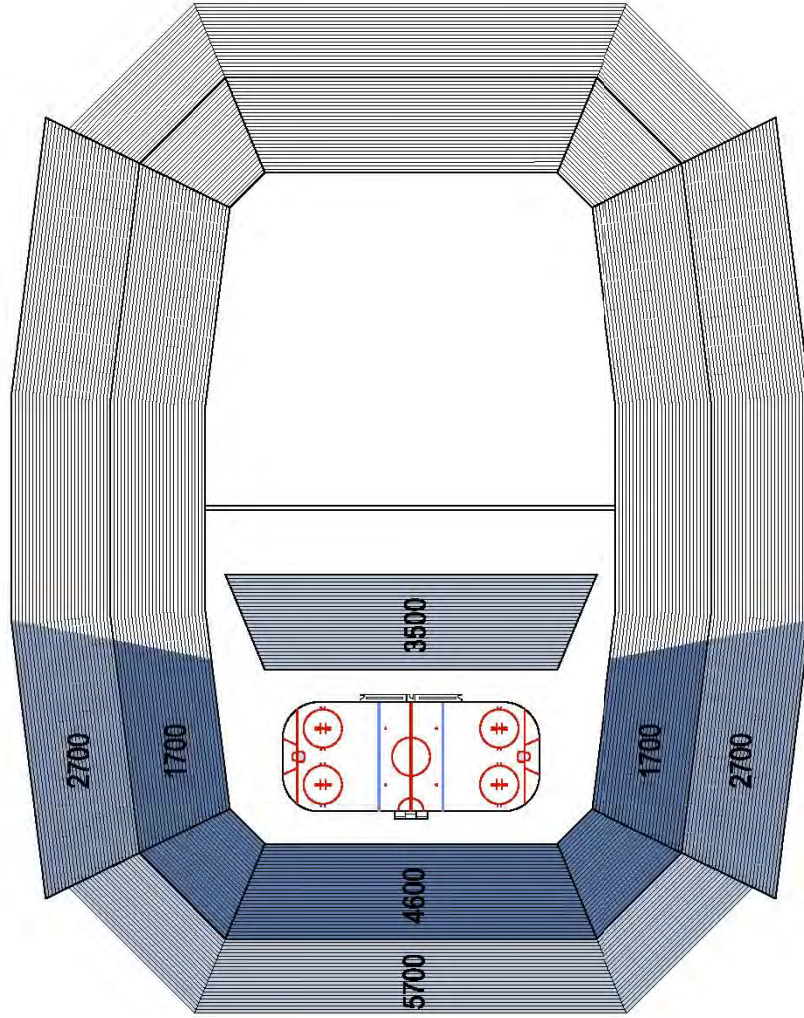
SEATING:	38,200	25 ROWS	21,200
ADDITIONAL SEATING:	11,400	2 ROWS	1,000
TOTAL:	49,600	MIDDLE BOWL	18,000
		UPPER BOWL	11,400
		ADDITIONAL	



Seating Bowl - Event Options
Lacrosse

Capacity: 38,000 - 50,000

SEATING: 18,900	ADDITIONAL SEATING: 5,700	25 ROWS	8,000
TOTAL: 22,600		UPPER BOWL	5,400
		ADDTL UPPER:	5,700
		ADDTL LOWER:	3,600

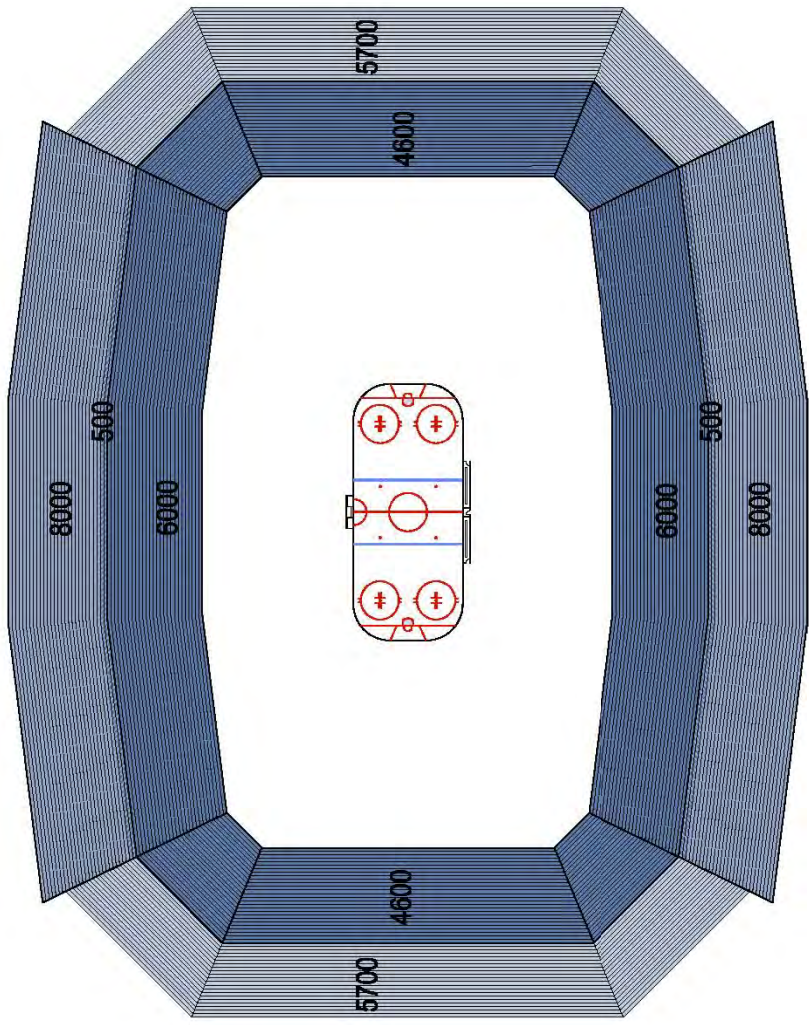


Seating Bowl - Event Options

Hockey/ Family Ice Show

Capacity: 17,000 - 23,000

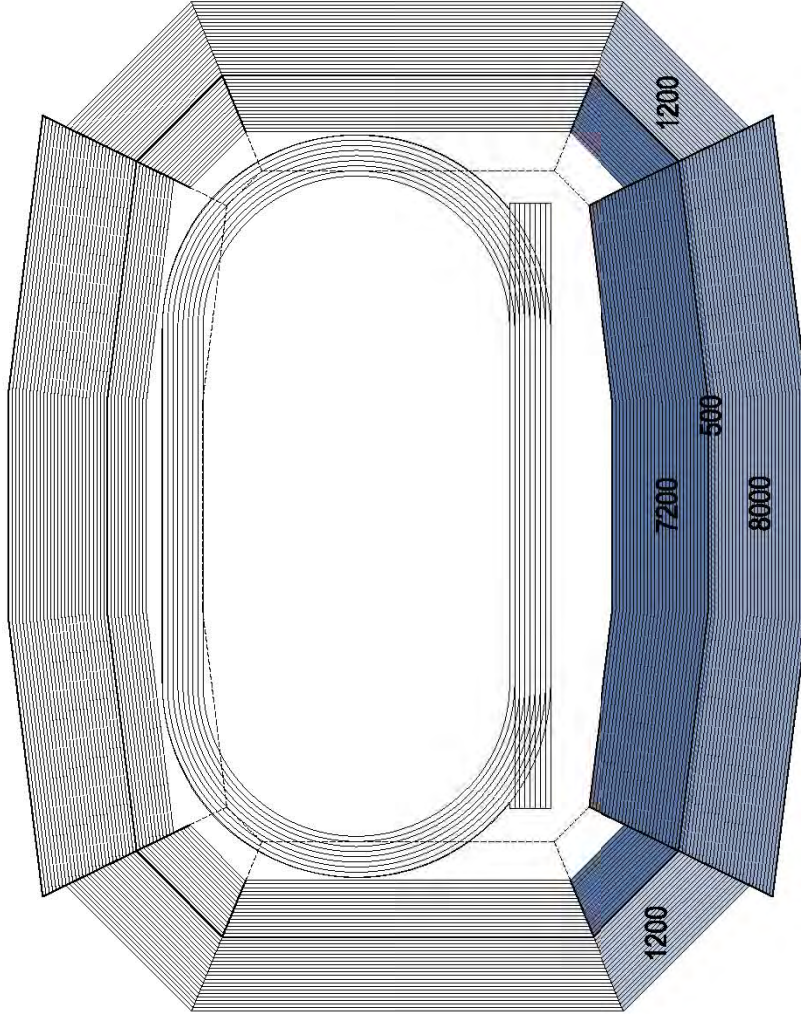
SEATING: 38,200	21,200
ADDITIONAL SEATING: 11,400	1,000
TOTAL: 49,600	18,000
LOWER BOWL	25 ROWS
MIDDLE BOWL	2 ROWS
UPPER BOWL	28 ROWS
ADDITIONAL	22 ROWS
	11,400



Seating Bowl - Event Options
 One-Time Hockey Event

Capacity: 38,000 - 50,000

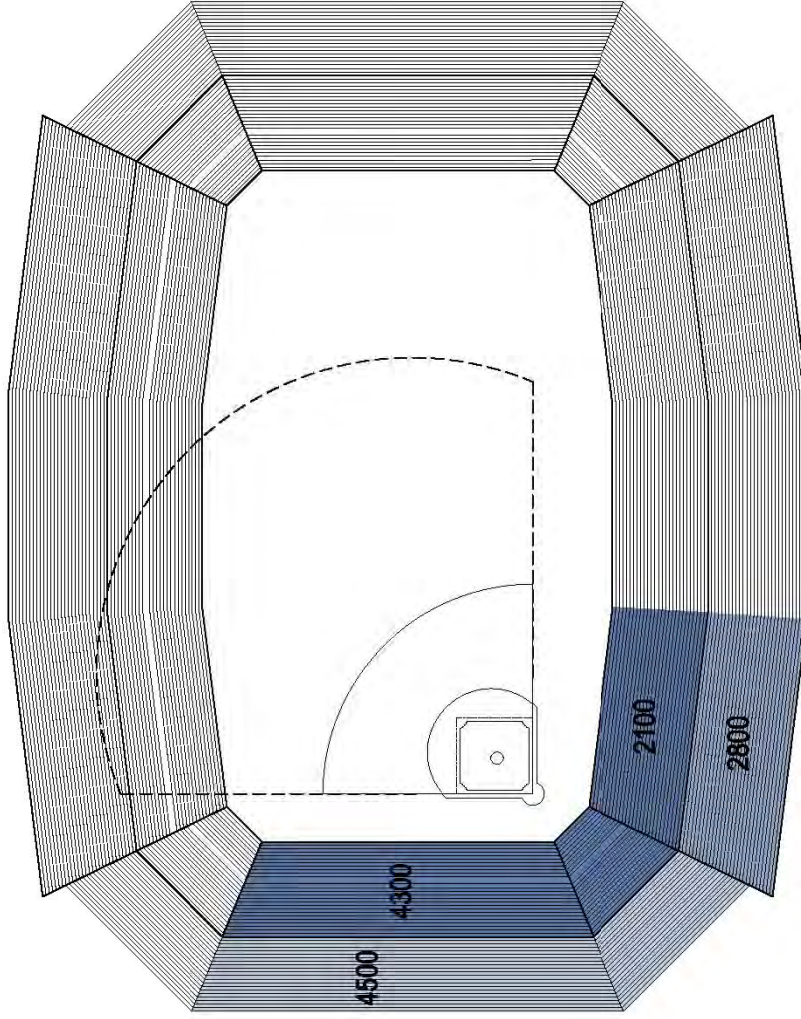
SEATING:	15,700
ADDITIONAL:	2,400
TOTAL:	18,100
LOWER BOWL:	25 ROWS
MIDDLE BOWL:	2 ROWS
UPPER BOWL:	28 ROWS
ADDITIONAL:	22 ROWS
	7,200
	1,000
	8,000
	2,400



Seating Bowl - Event Options
Track – 400m

Capacity: 16,000 - 18,000

SEATING: 9,200	ADDITIONAL SEATING: 4,500	TOTAL: 13,700
LOWER BOWL	25 ROWS	6,400
UPPER BOWL	26 ROWS	2,800
ADDITIONAL	22 ROWS	4,500



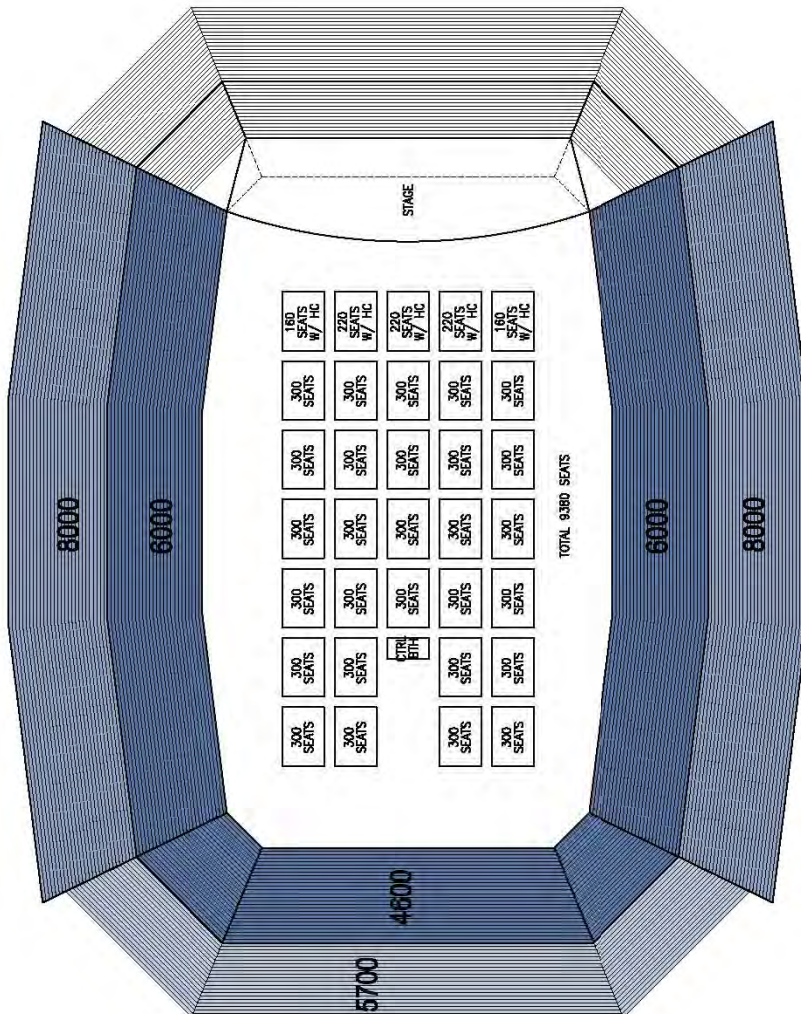
Seating Bowl - Event Options

Little League Baseball (MLB shown dashed)

Capacity: 9,000 - 13,000

SEATING: 41,980 (INCL. 9380 ON FIELD)
 ADDITIONAL SEATING: 5,700
 TOTAL: 47,680

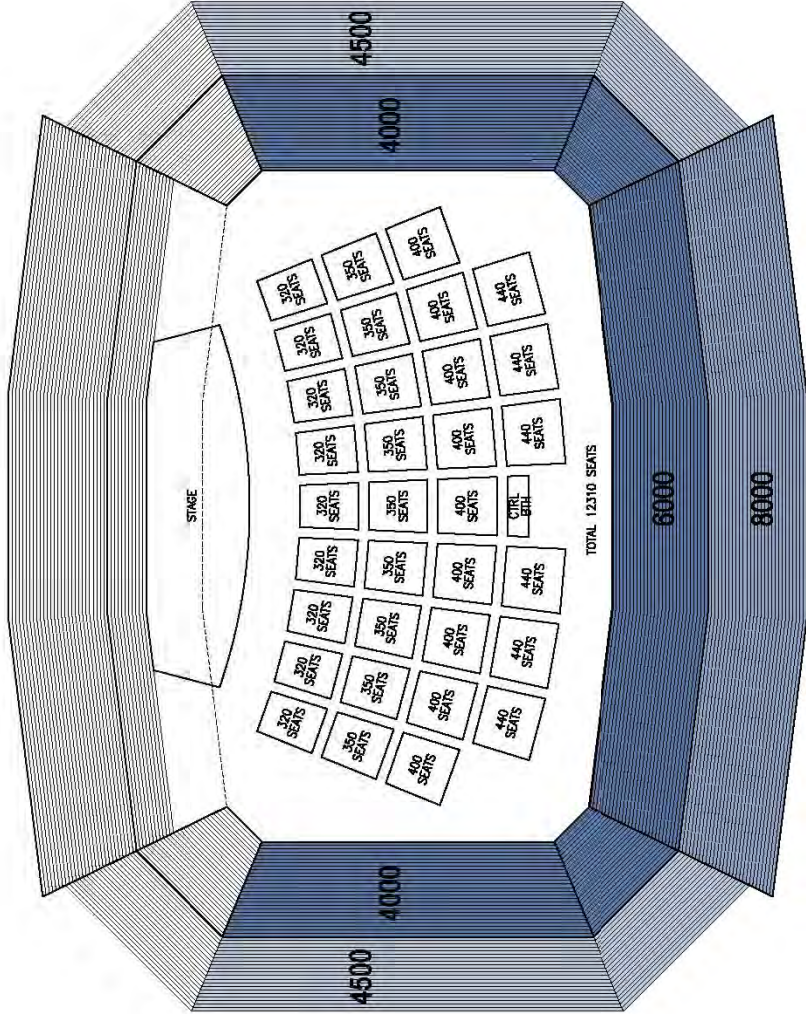
LOWER BOWL 25 ROWS 18,600
 UPPER BOWL 28 ROWS 18,000
 ADDITIONAL 22 ROWS 5,700



Capacity: 42,000 - 48,000

Seating Bowl - Event Options Concert Layout 1

SEATING: 34,310 (INCL. 12,310 ON FIELD)	
ADDITIONAL SEATING: 9,000	
TOTAL: 43,310	
LOWER BOWL	28 ROWS
UPPER BOWL	28 ROWS
ADDITIONAL	22 ROWS
	14,000
	8,000
	9,000



Seating Bowl - Event Options Concert Layout 2

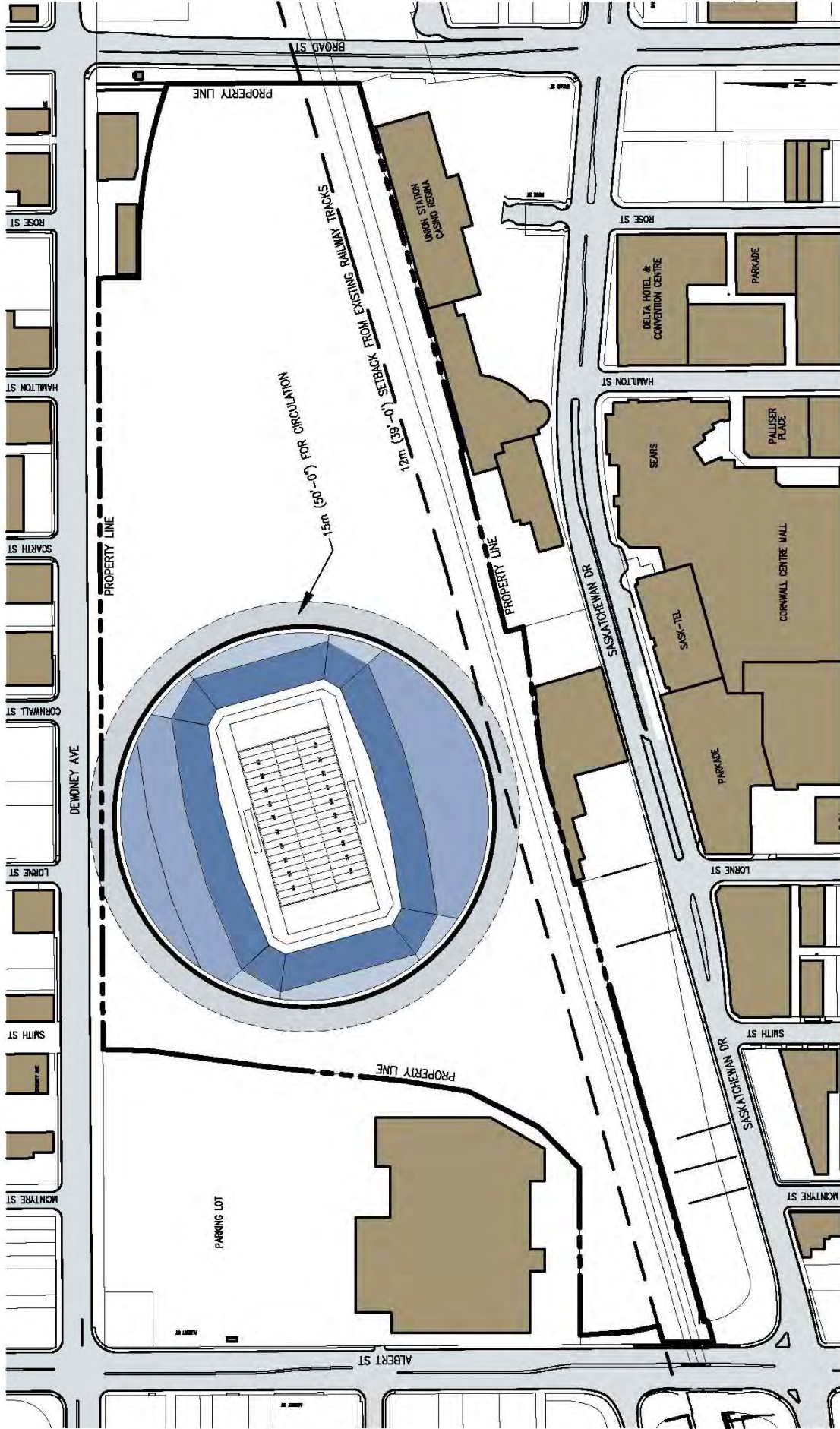
Capacity: 34,000 - 43,000

3 (c) BUILDING ORIENTATION

The East-West orientation of the rectangular building footprint fits well within the site, providing all of the necessary access and egress requirements for the patrons, with ample options for 'public' space that could act as a buffer between the large scale of the sports & entertainment centre and the relatively smaller scale of the warehouse district buildings along Dewdney Ave. Since SCI was looking at the possibility of a fully retractable roof over the facility, thought was also given to the potential shape and technology of a retractable roof, and the impact the size and movement of the roof panels may have on the shape of the building structure supporting it below. Also considered were any potential overhangs of the large roof panels, in both the closed and open position, and the influence they might have on the final positioning of the building footprint in order to have all potential building projections remain within the bounds of the site. SCI initially reviewed the possibility of a north-south building orientation as well as an east-west. North-South orientation would have required the spectator facility to be located further west on the site, where the north-south dimension was at its maximum. If located at the very western edge of the site, the resultant space around the north end of the building would be much more constrained. The building would also be further removed from Hamilton Street, which is seen as an important North-South artery within the downtown area, and from where considerable pedestrian traffic would be approaching the new Sports & Entertainment Facility site.

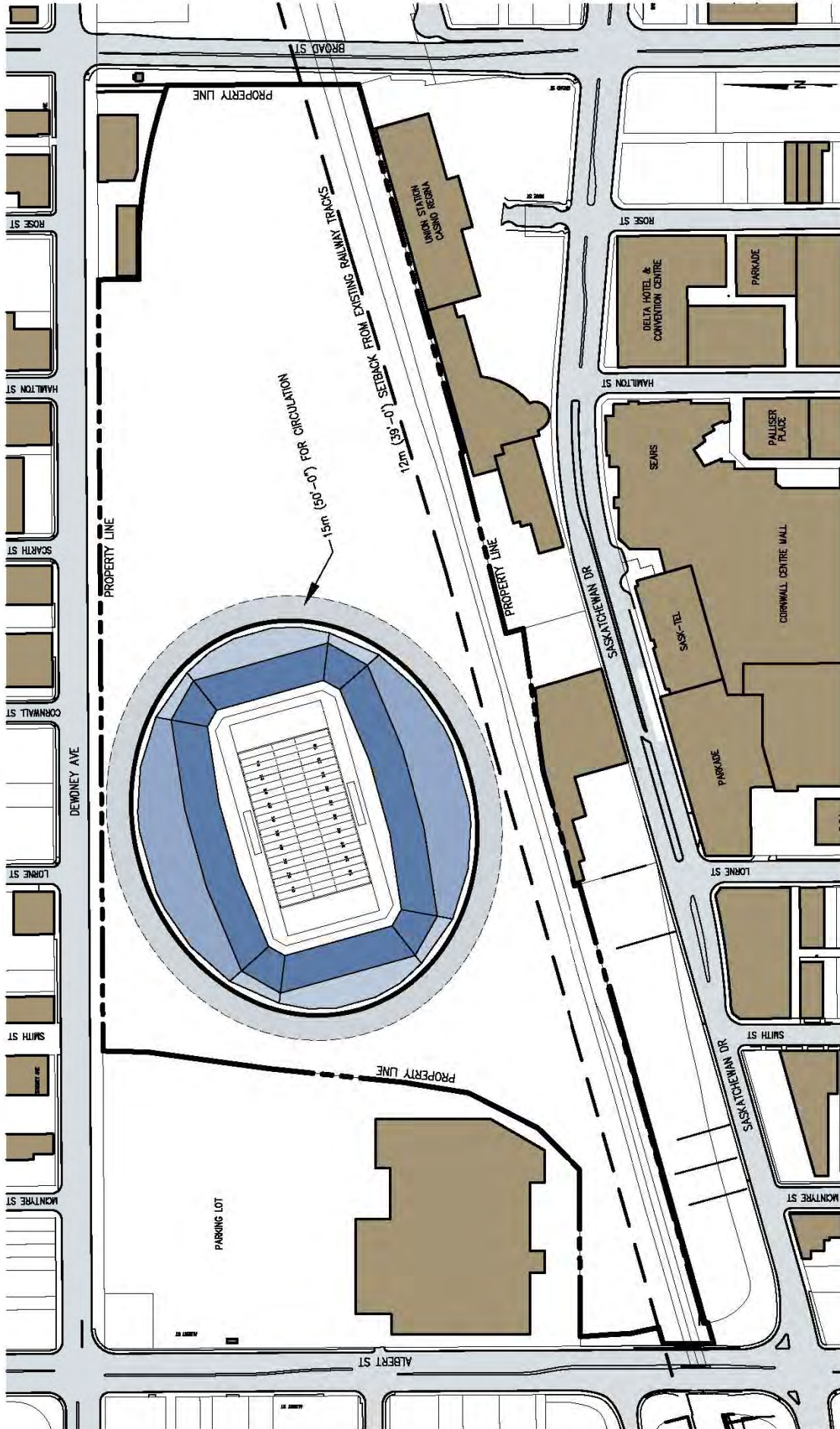
The westernmost location option, we feel, does not provide enough space between the building and Dewdney Avenue, in order to properly service the requirements for large capacities of patrons accessing or egressing the facility. The building in this location would in effect 'bisect' the site.

By locating the large mass of the spectator building more towards the centre of the site and closer to the rail lines, open space and/or lower scale development is able to buffer the height of the spectator facility from adjacent sites with lower scale buildings and pedestrian areas. In the final scenario, the practice football field fits nicely to the west of the facility, out of the main public realm, yet still quite accessible if so desired.



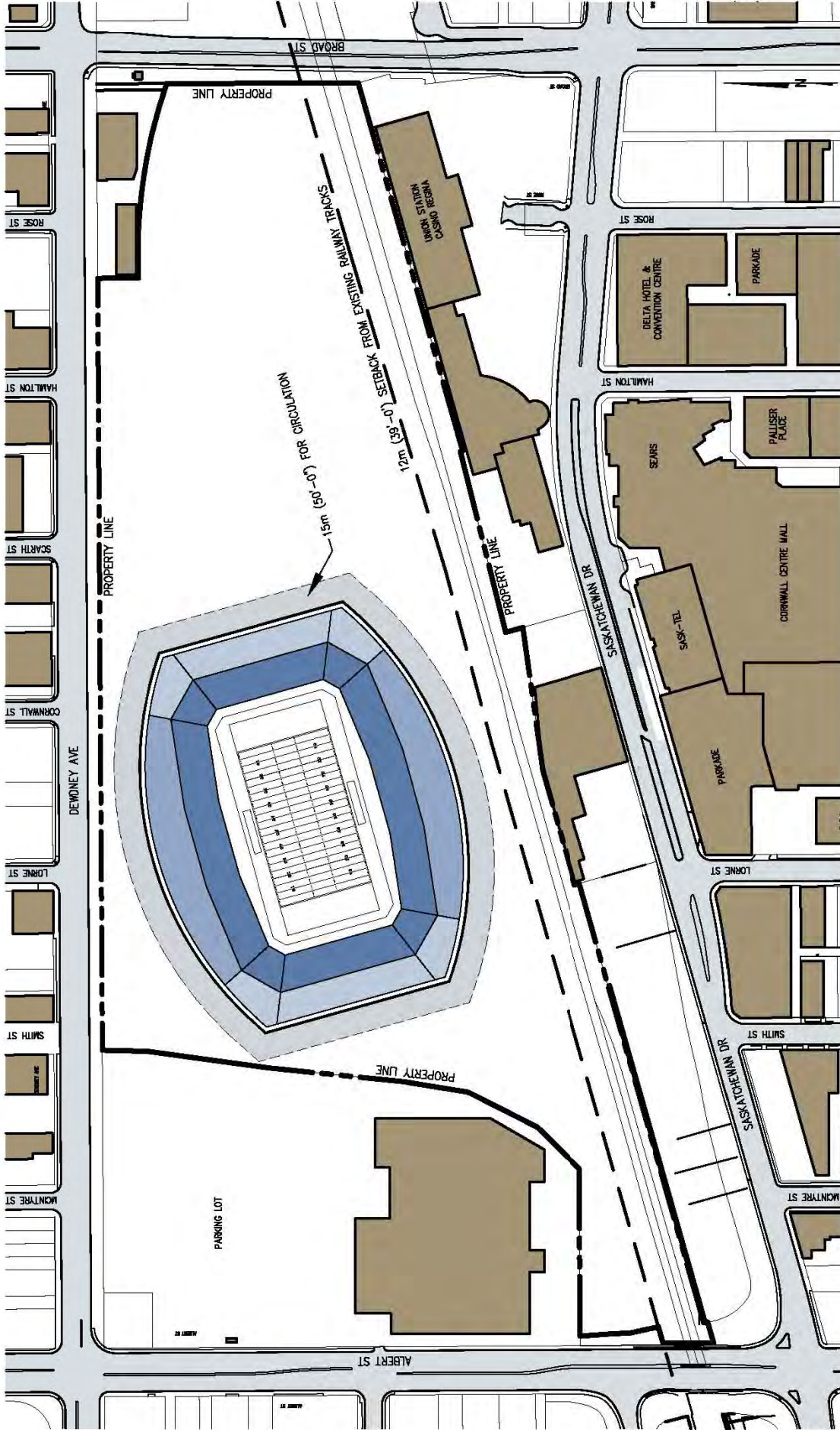
Site Plan – Option 1

Capacity: 49,000 - 54,000



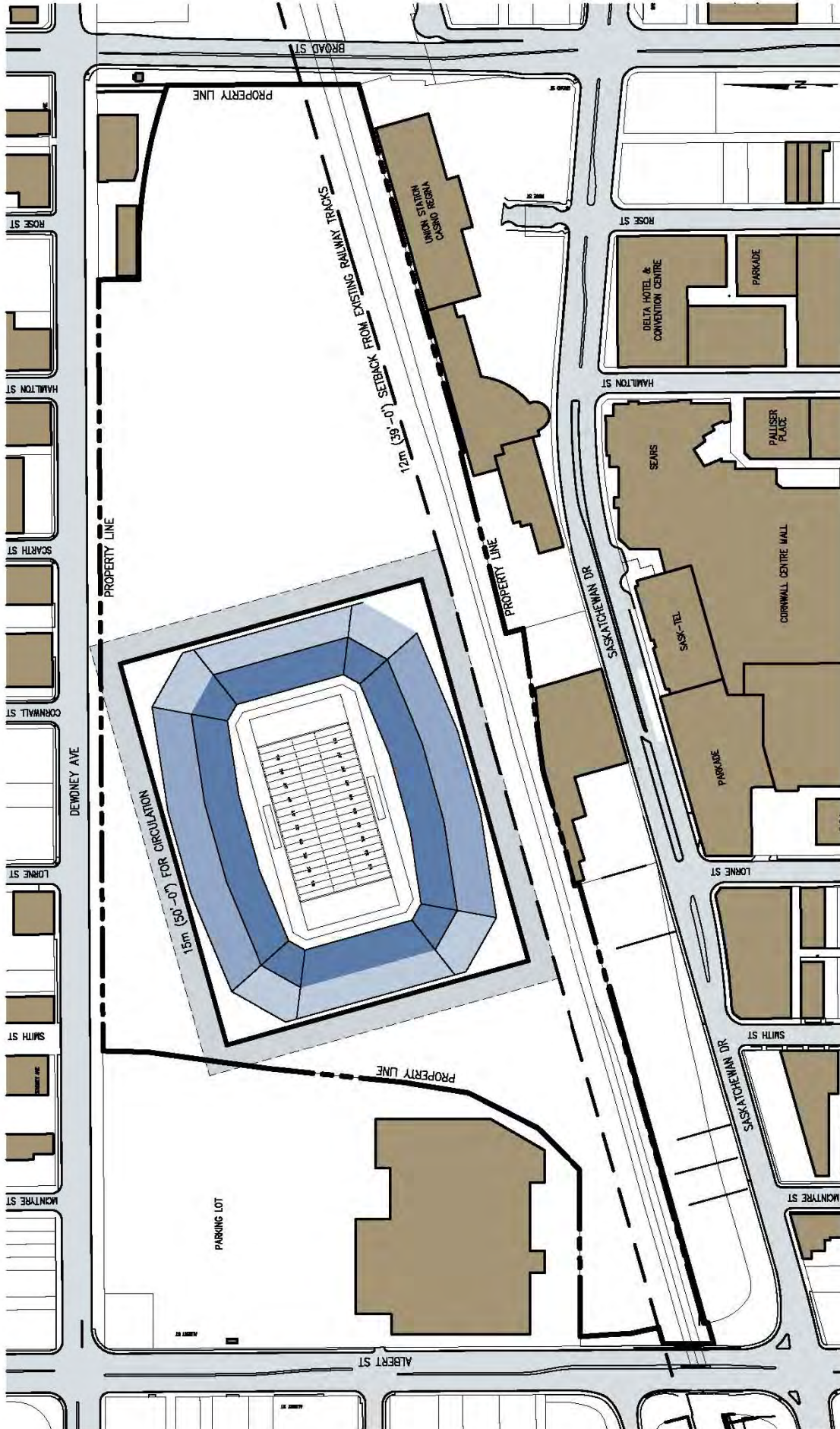
Site Plan – Option 2

Capacity: 42,000 - 49,000



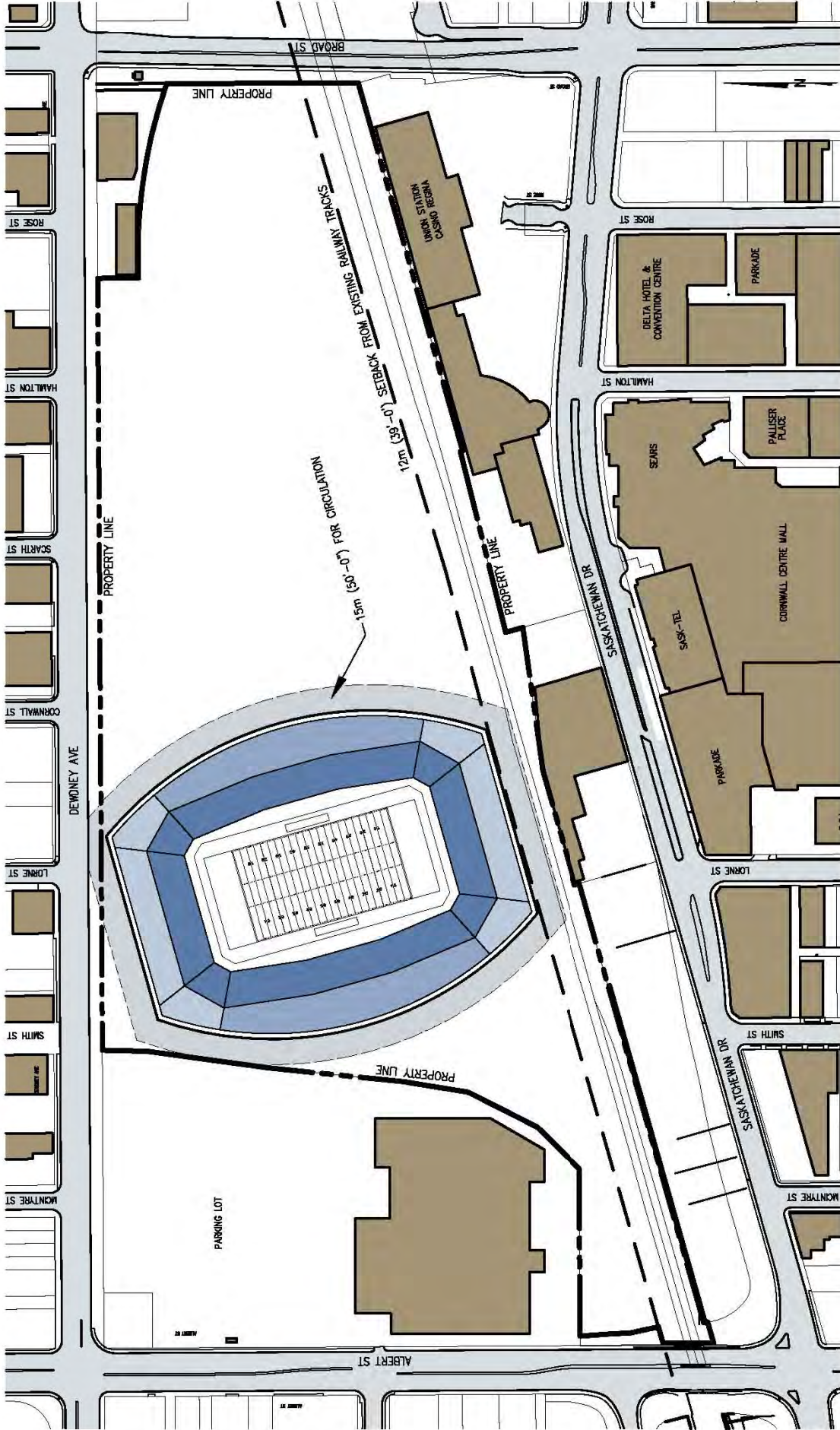
Site Plan – Option 3

Capacity: 39,000 - 51,000



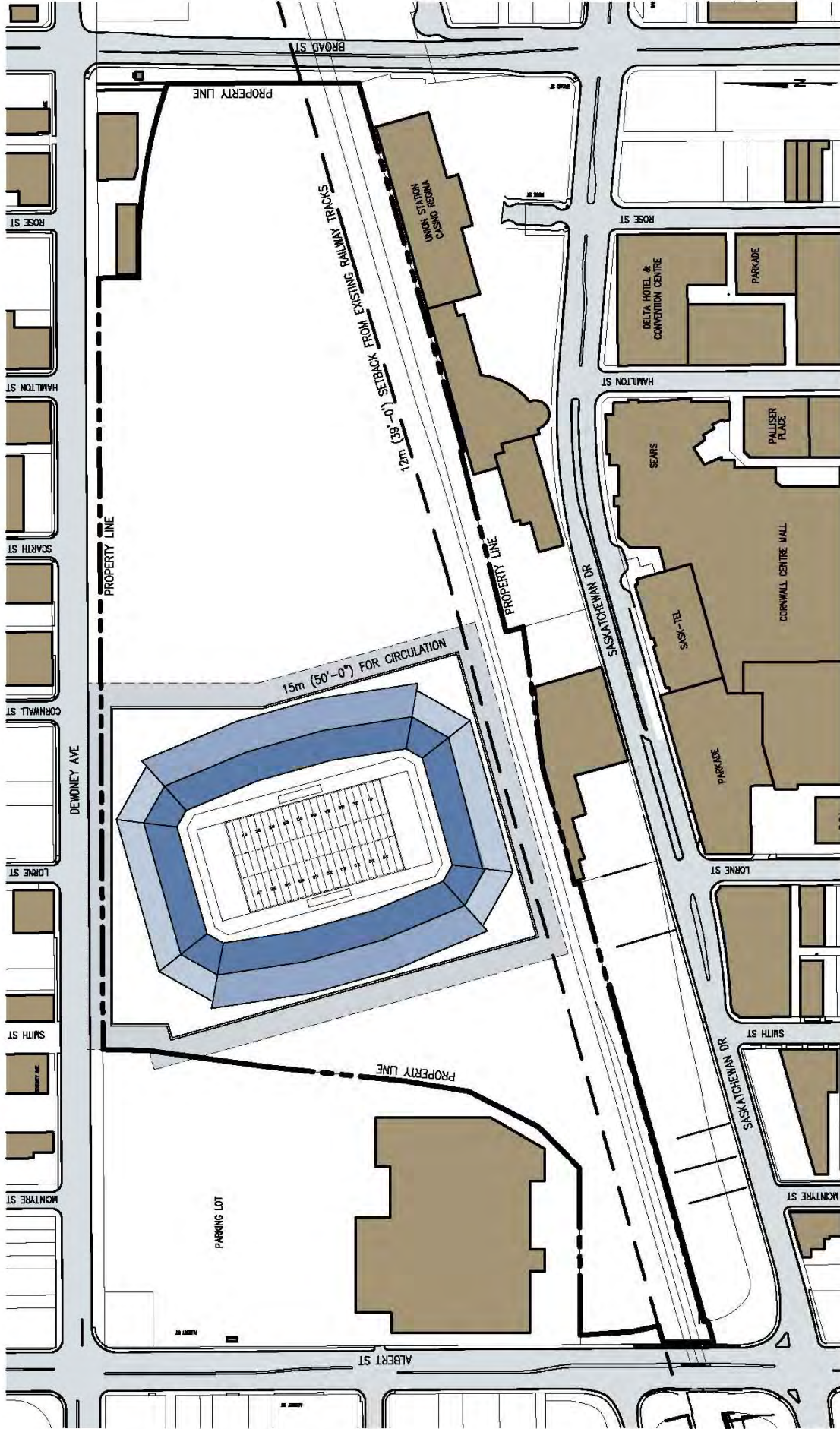
Site Plan – Option 4

Capacity: 41,000 - 55,000



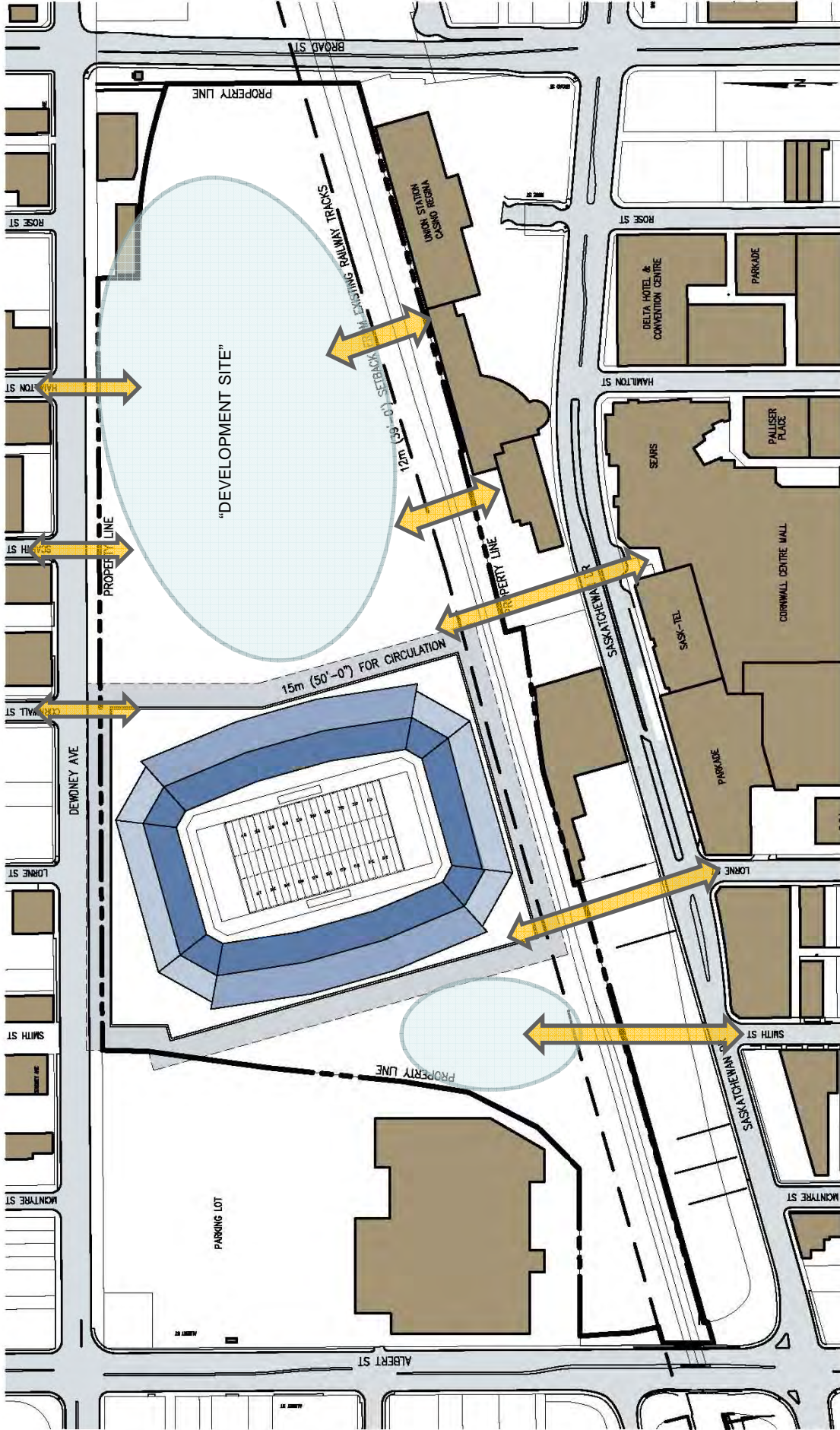
Site Plan – North/ South Orientation

Capacity: 39,000 - 51,000



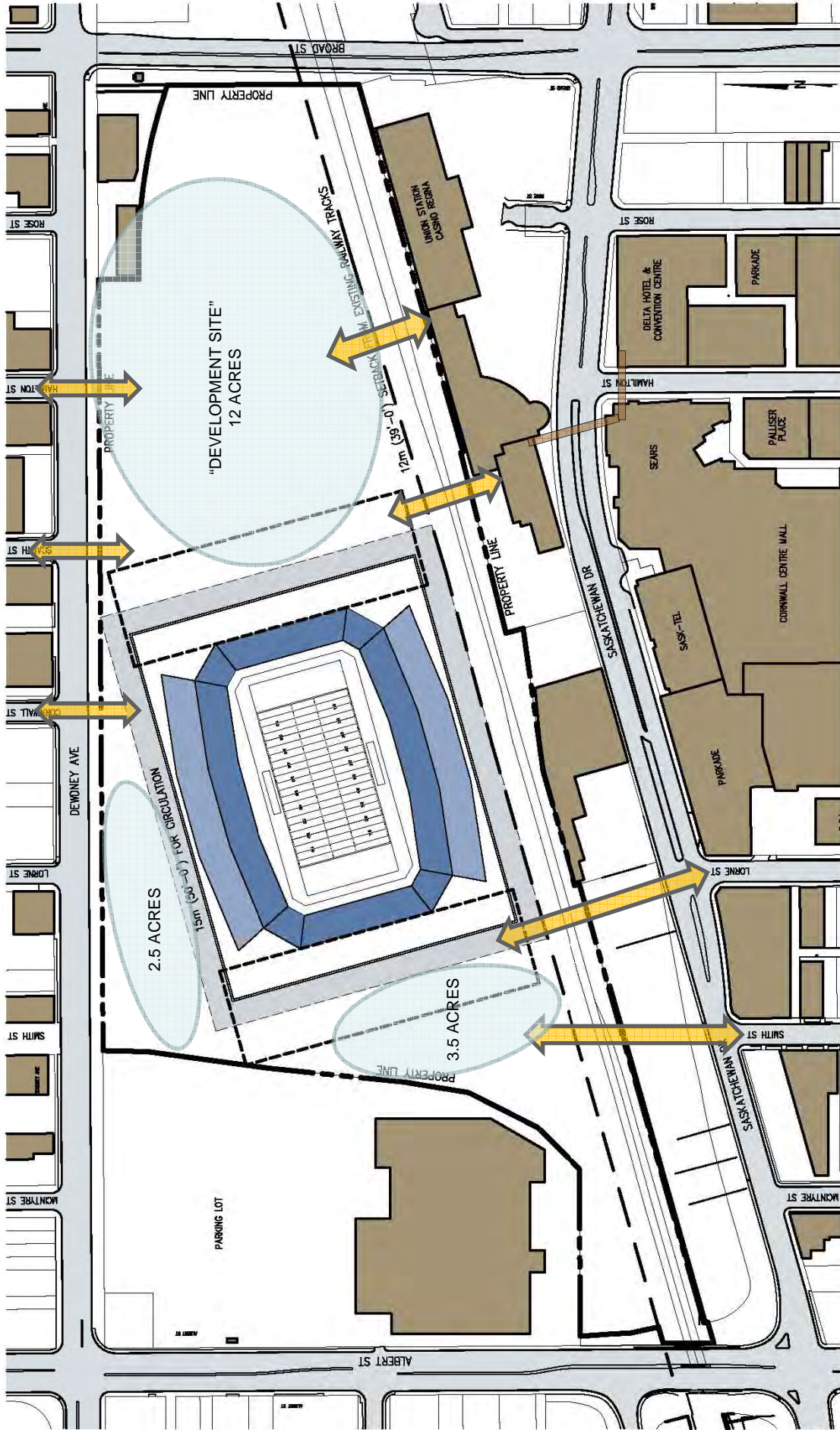
Site Plan – Orientation with Rail Tracks

Capacity: 35,000 - 45,000



Site Plan – Orientation with Rail Tracks

Capacity: 35,000 - 45,000

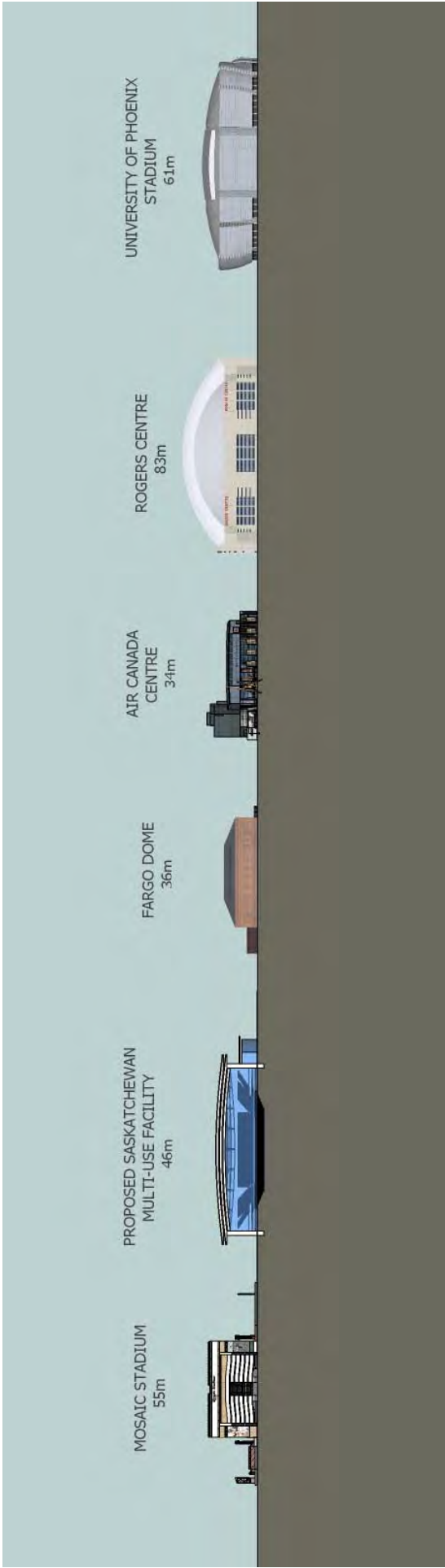


Site Plan – Option 5

Capacity: 35,000 - 45,000

3 (d) ROOF PRECEDENTS

Various spectator facility projects were referenced and shown to the Stakeholder and Client groups in order to demonstrate the options and variations of design for permanently fixed roofs, partially retractable roofs as well as fully retractable roofs. For the retractable roof options, our objective was to pursue a reliable, proven technology that would be simple to operate with relatively low maintenance costs over the life of the building. Given the cold winter climate, with snow, ice and strong winds in Regina, keeping the extent of the connections between roof panels to a minimum and keeping the panel geometry simple was important from both a cost and reliability point of view. SCI found, during the Stakeholder and Client meetings over the course of the study, there was much interest in a retractable roof option that would allow patrons to experience an event in an outdoor atmosphere during seasons of fair weather, but would provide the insurance of a weather tight roof during cold or inclement weather. The following pages demonstrate several different roof precedents from around the world, from the permanently fixed to fully retractable.



Comparison with Existing Stadiums By Height

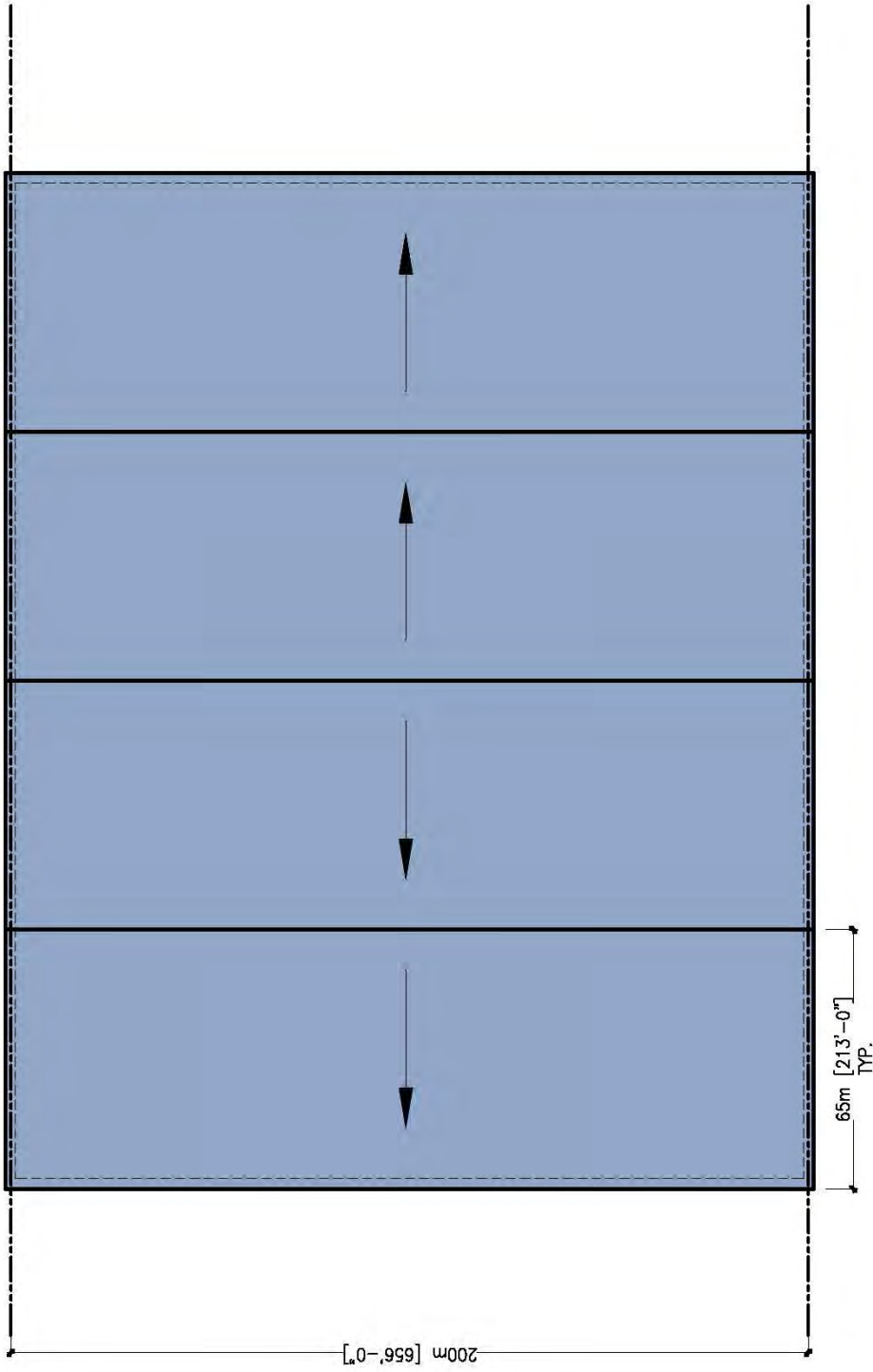
Saskatchewan Multi-Use Facility



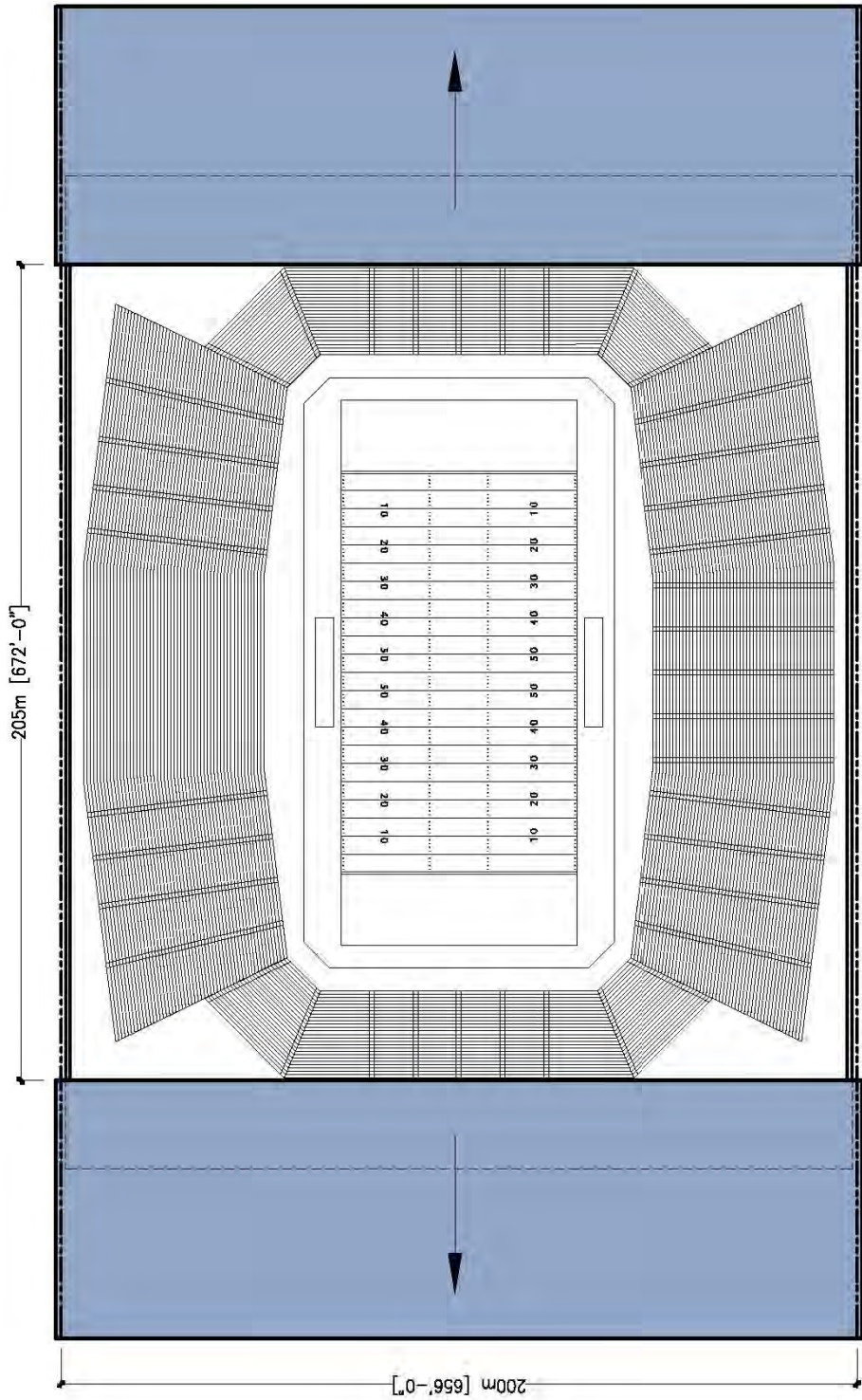
Fully Retractable Roof

This roof option is comprised of six large curved roof panels which cover the entire footprint of the spectator complex. The two outermost panels are fixed in place, while the four central panels can move on tracks located along the north and south edges of the building, at the upper walls.

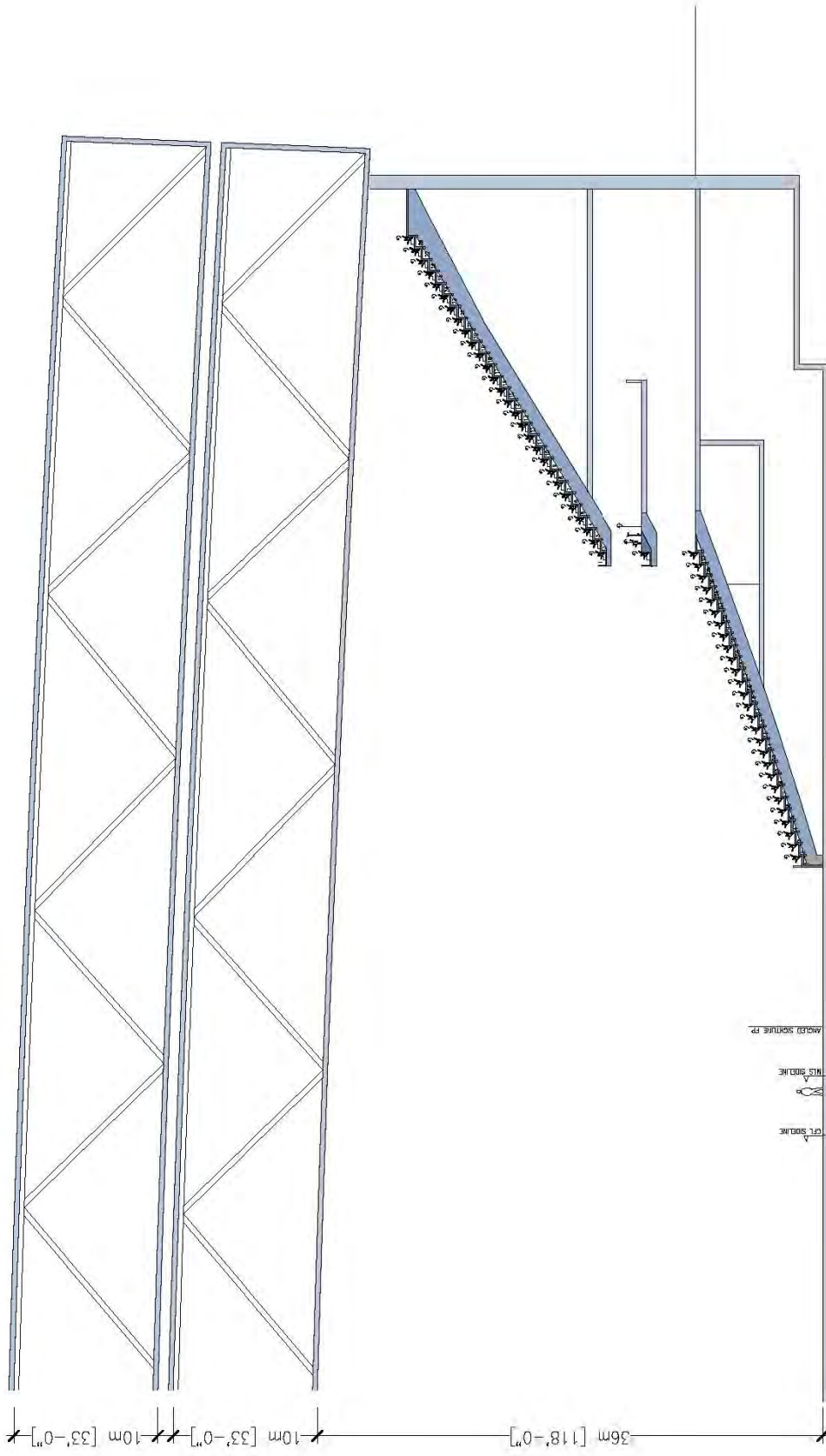
Of the four movable panels, two panels on the west side of centrefield move away from two panels on the east side of centrefield. The movable panels successively stack over the outermost fixed panels such that a great majority of the seating bowl and event surface below are exposed to the natural elements. The mechanism for moving the roof panels is a relatively straightforward motor and cable system, located in the roof area and accessible from the perimeter catwalk system. The roof panels can be in the fully closed position, fully open position, or in many various combinations in between. One half of the roof can be opened and closed independently of the other half if desired. An option was included to have poly-carbonate translucent panels located in the two centre roof panels, in order to provide natural light onto the playing surface below while the roof is in the closed position.



Retractable Roof – Option 2
Full Span Track



Retractable Roof – Option 2 Full Span Track



Schematic Section – Option 2
Full Span Track

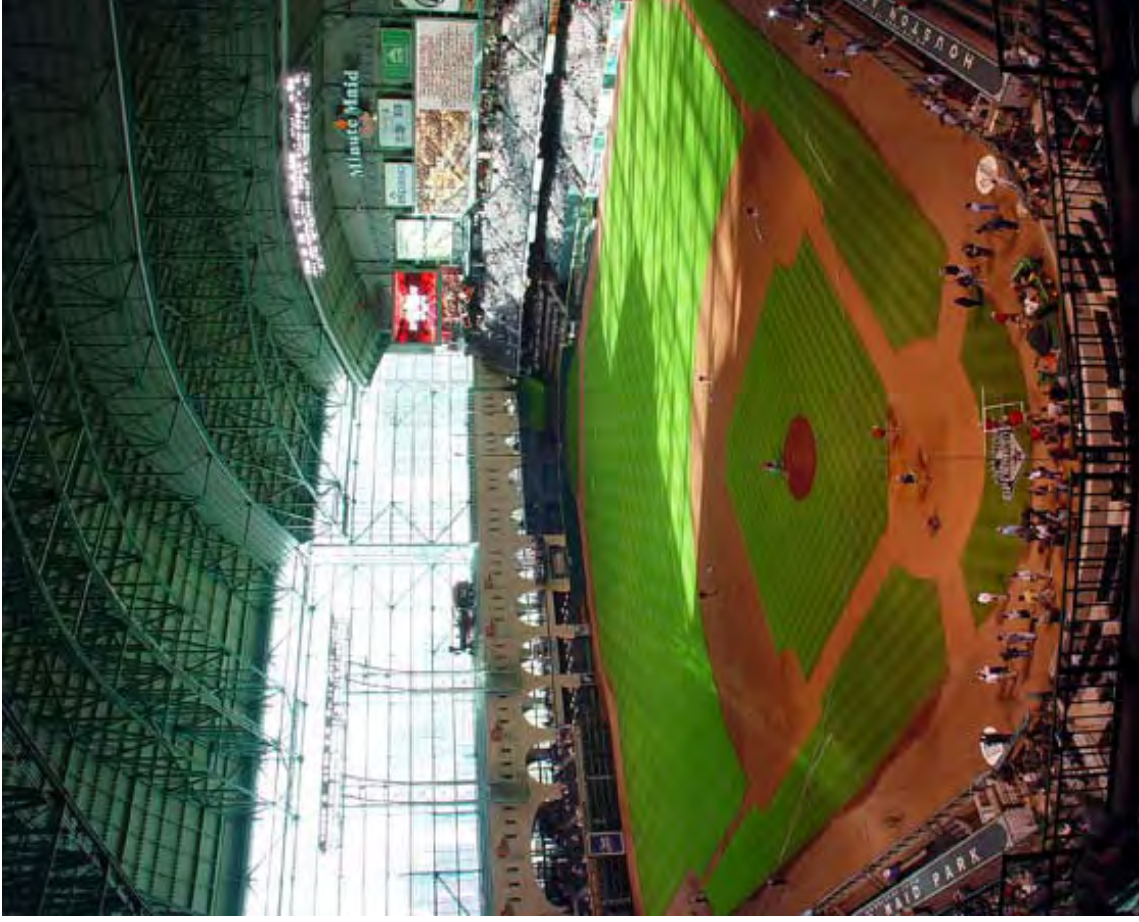


Reliant Stadium
Houston Texans

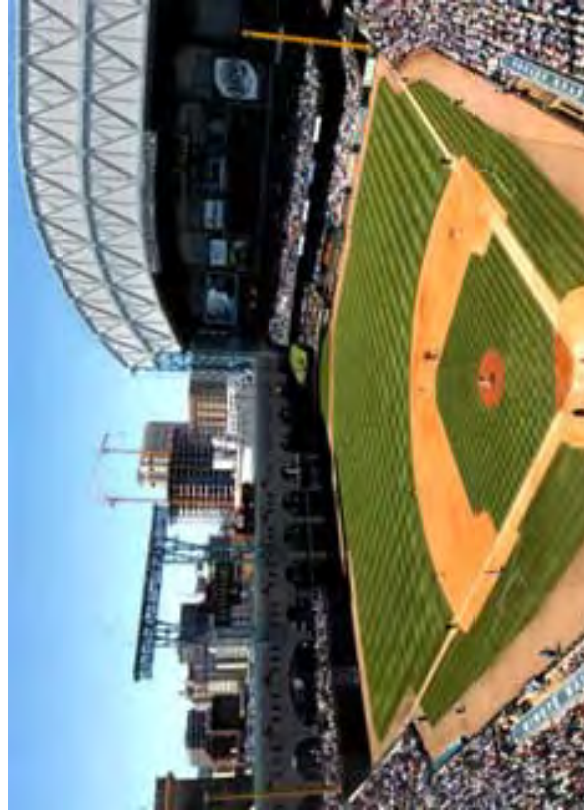
Football (NFL), Livestock & Rodeo, Basketball (NCAA)
Capacity: 71,500



Minute Maid Park
Houston Astros

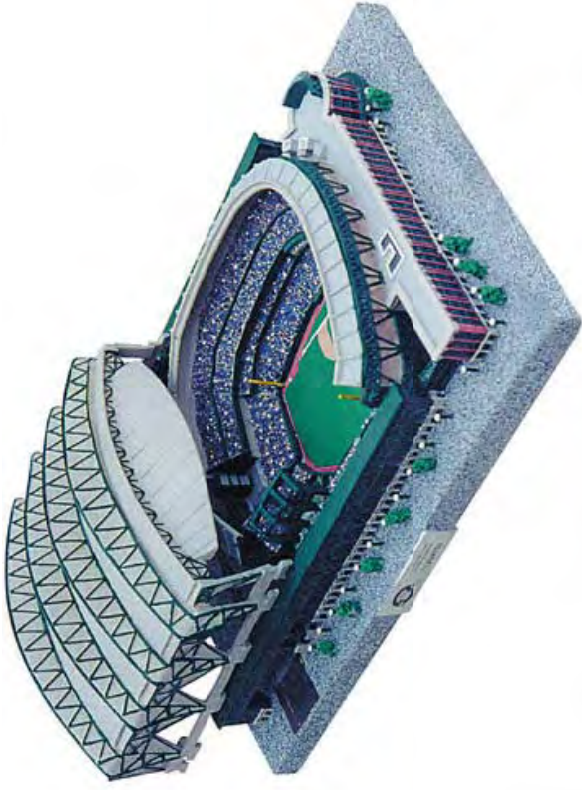


Baseball (MLB)
Capacity: 40,950



Saskatchewan Multi-Use Facility





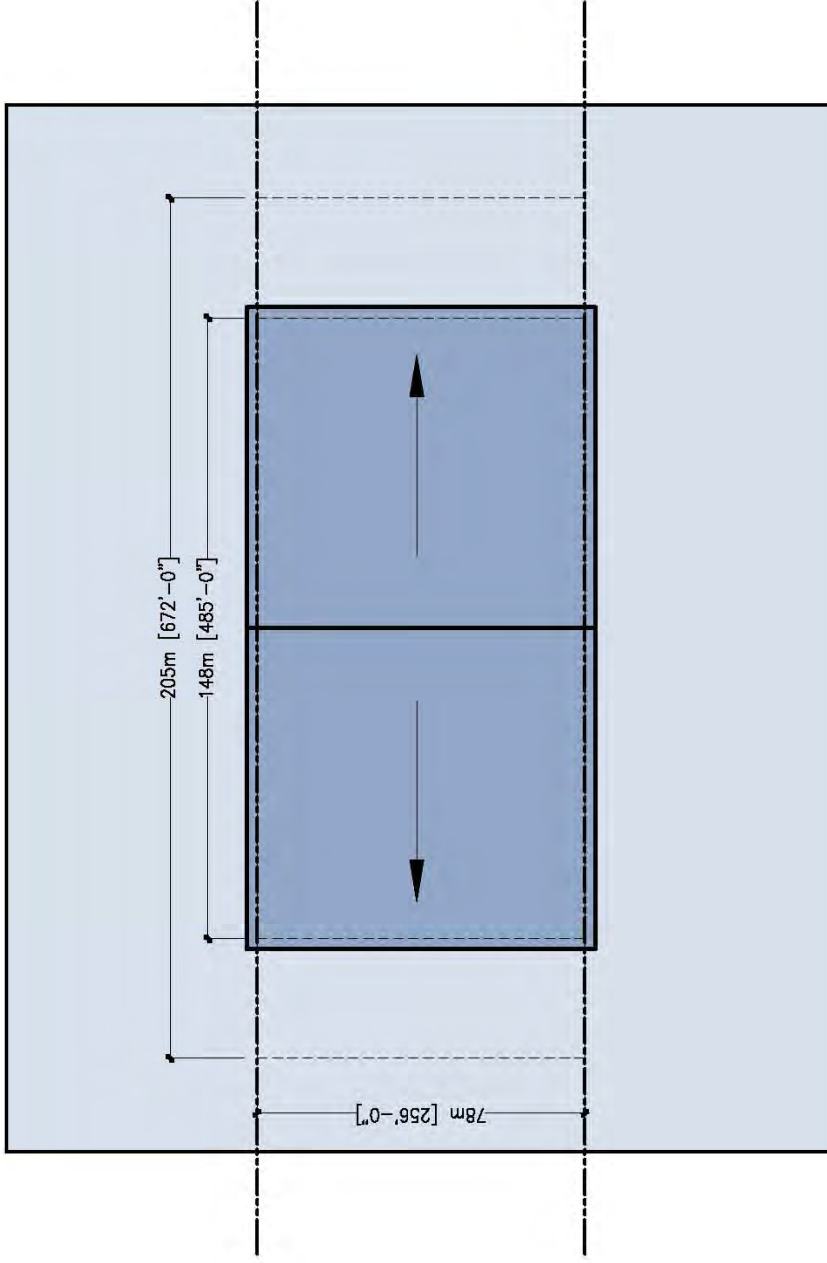
Safeco Field
Seattle Mariners



Baseball (MLB), Football, Wrestling (WWE)
Capacity: 30,144 – 54,097

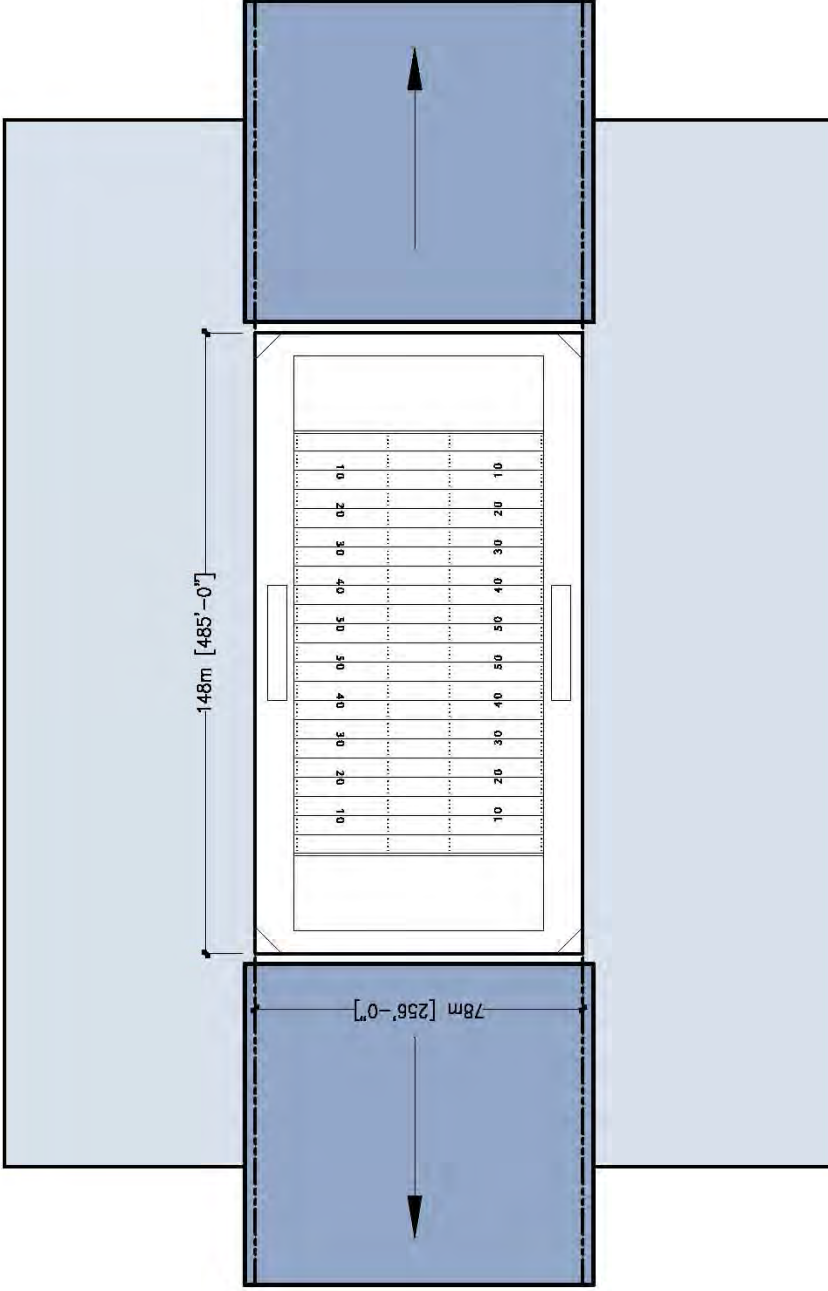
Partially Retractable Roof

The partially retractable roof has movable panels only over the playing field below. The partial retraction option proved to be more expensive than the full retraction due to the requirement for a duplication of structural steel in the roof to support the edges of the movable panels, whereas the fully retractable roof panels were taking advantage of the outer wall structure, which was in place already. The roof movement is similar to the fully retractable, with a similar visual appearance while in the closed position. However, in this scenario, the movable panels are smaller, and when in the open position expose approximately the area of the playing surface below. The upper seating areas and lower seating areas are still under cover of a portion of the fixed roof which surrounds the movable panels. This design also has an option for the movable panels to be clad in poly-carbonate translucent material to provide natural light onto the event surface below when the roof is in the closed position.



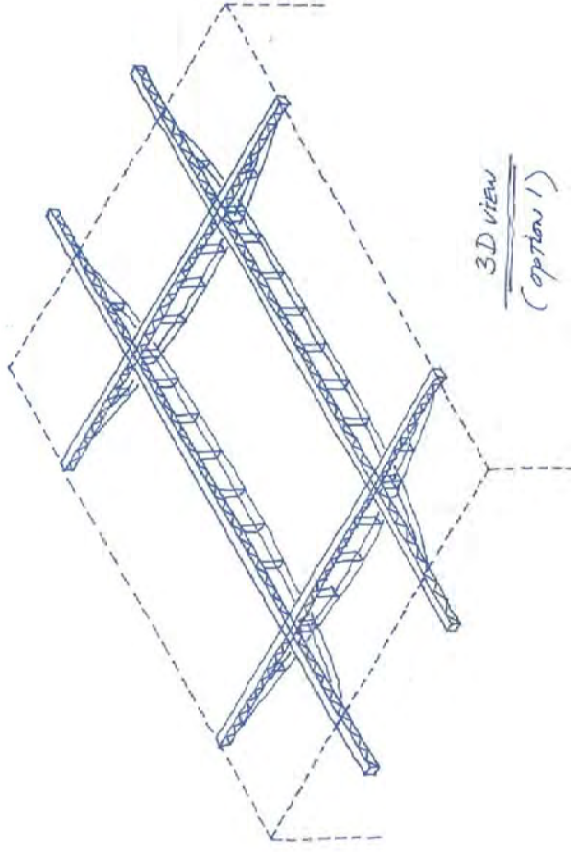
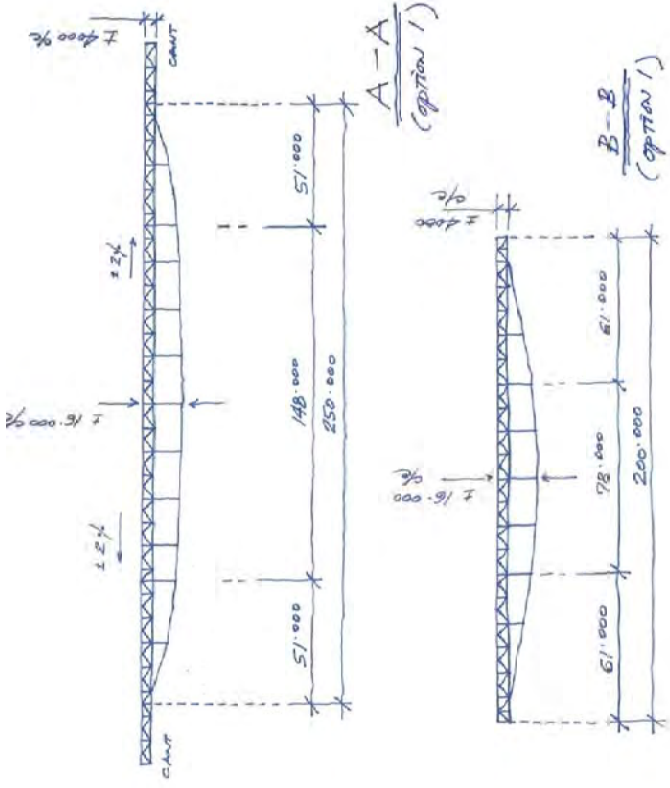
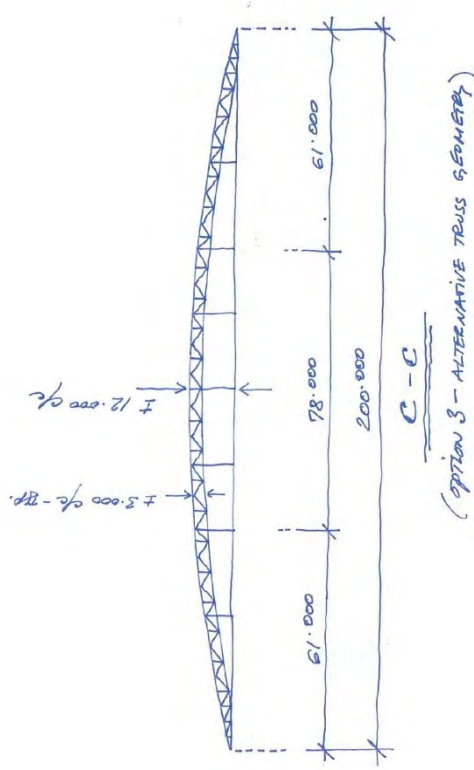
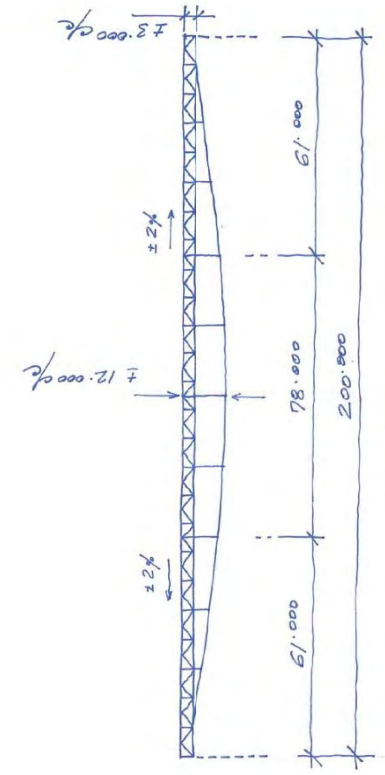
Retractable Roof – Option 1

Long-Span Beam

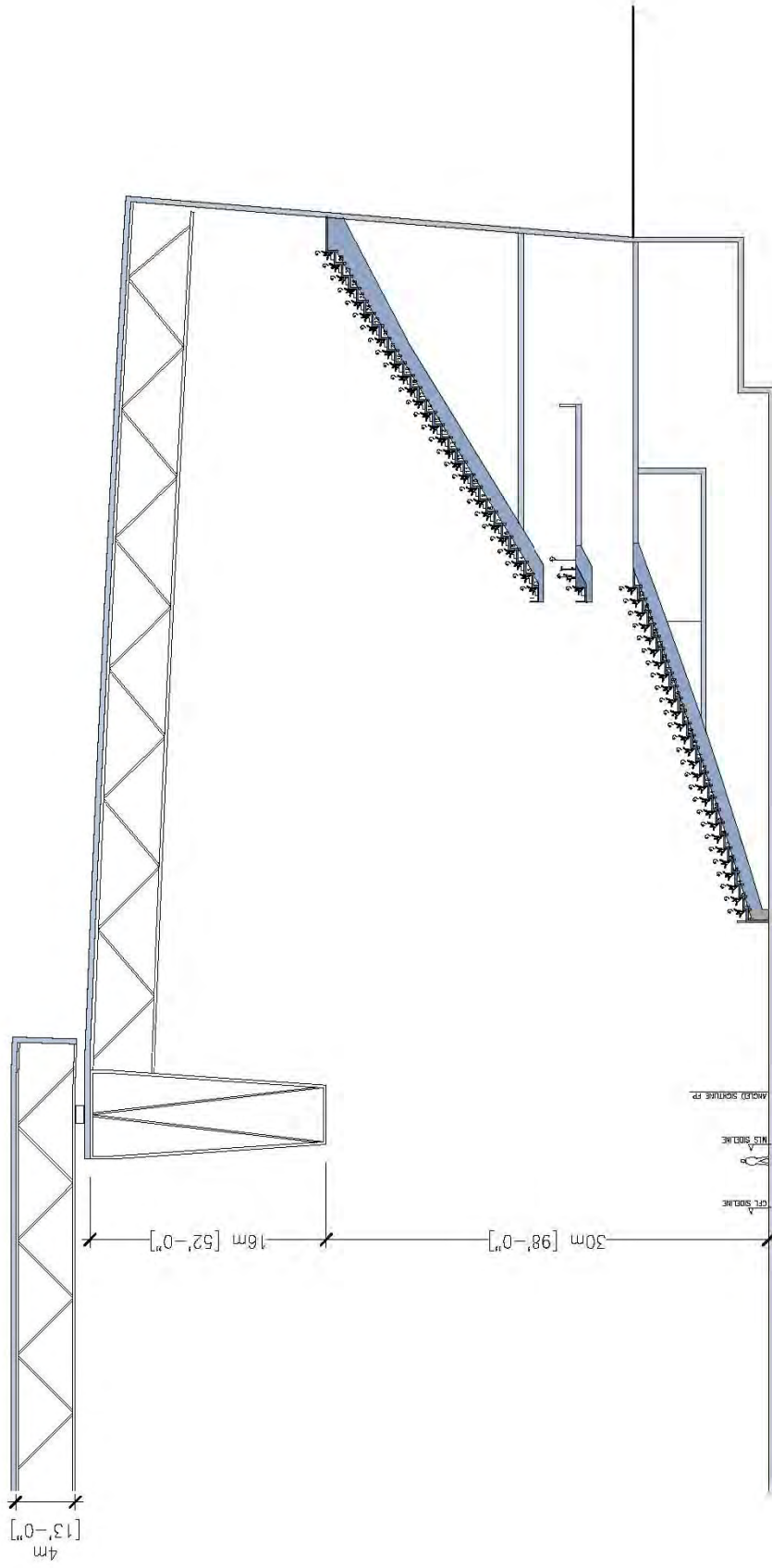


Retractable Roof – Option 1

Long-Span Beam



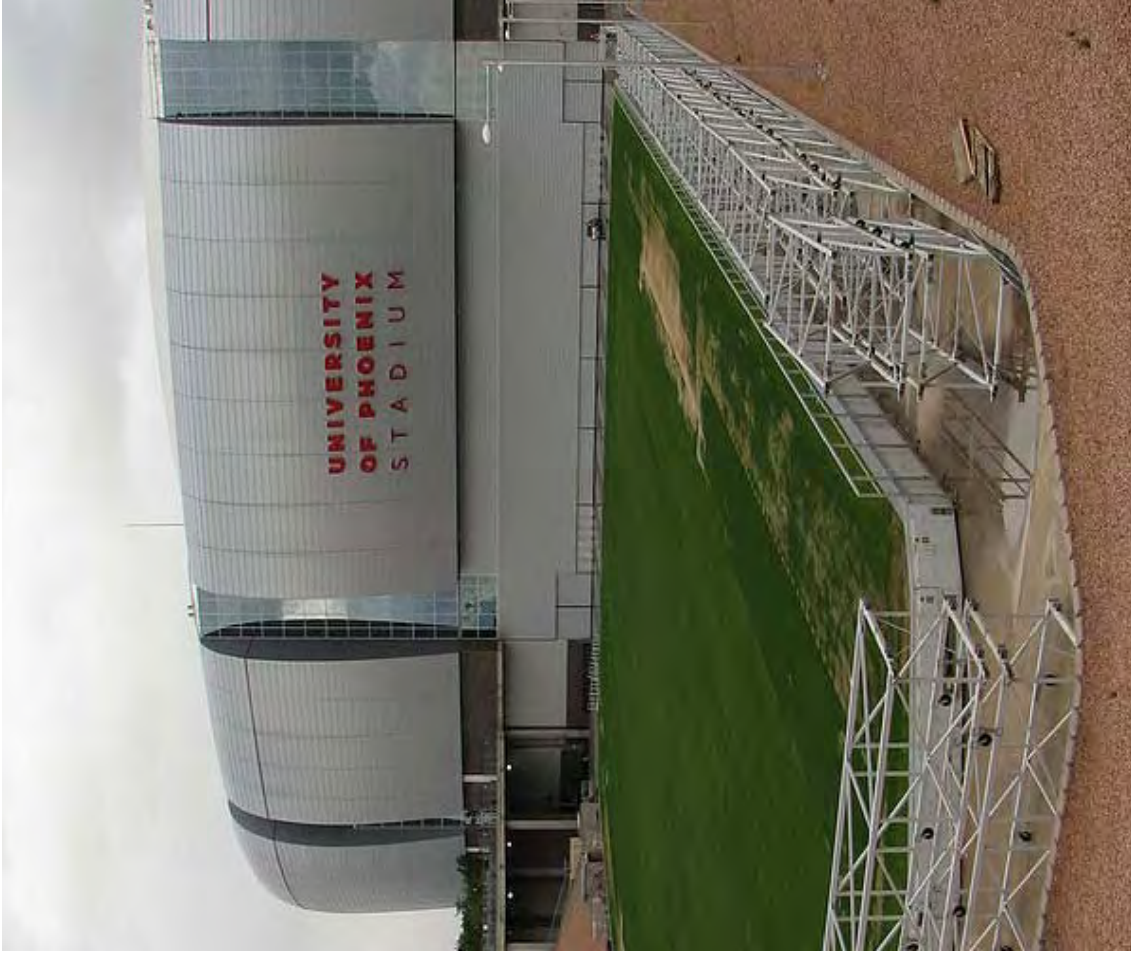
Structure Diagrams – Option 1 Long-Span Beam



Schematic Section – Option 1
 Long-Span Beam



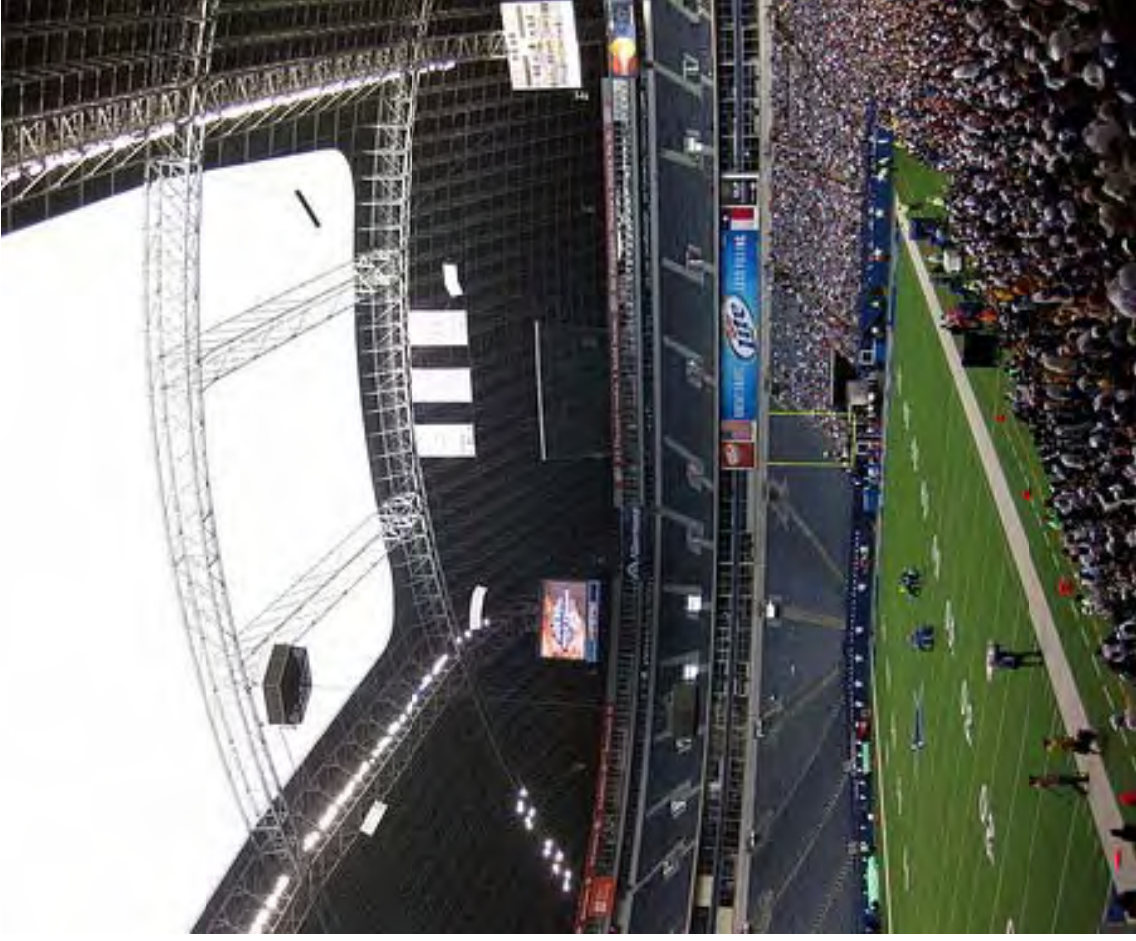
University of Phoenix Stadium
Arizona Cardinals



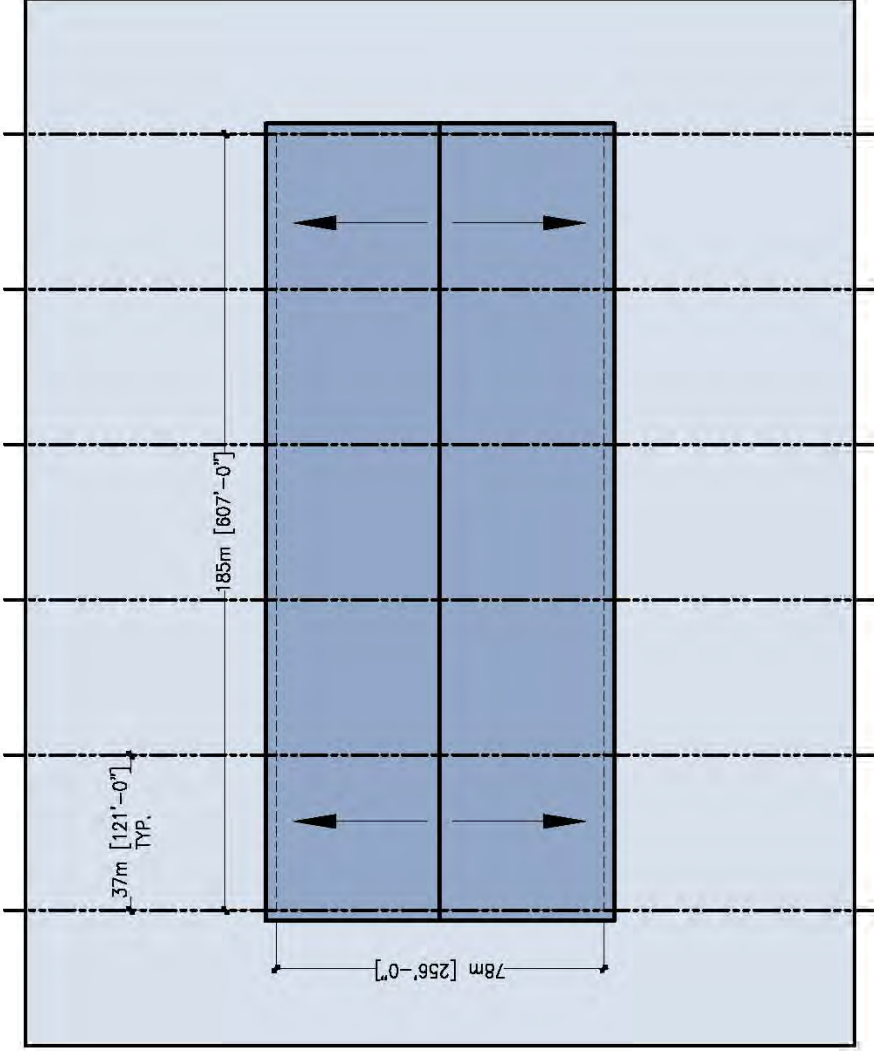
Football (NFL), Basketball (NCAA)
Capacity: 63,400 - 72,200



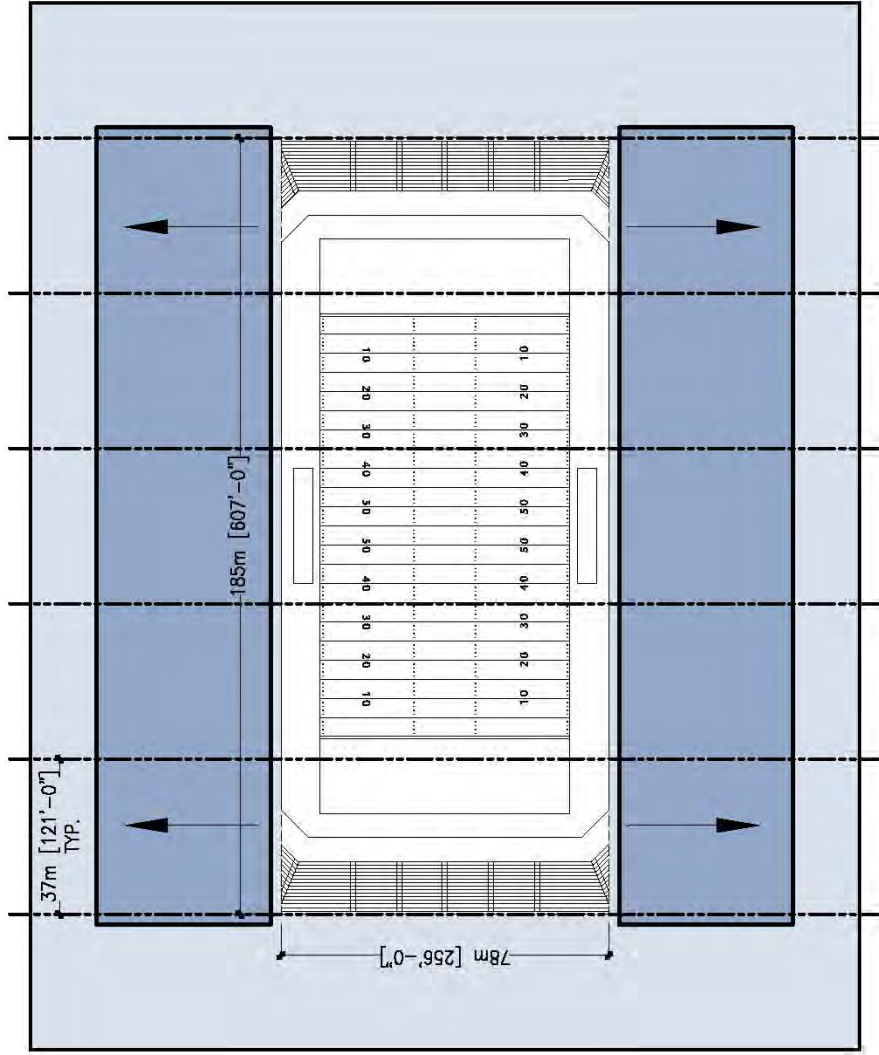
Cowboys Stadium
Dallas Cowboys



Football (NFL), Basketball (NBA, NCAA)
Capacity: 80,000 - 100,000

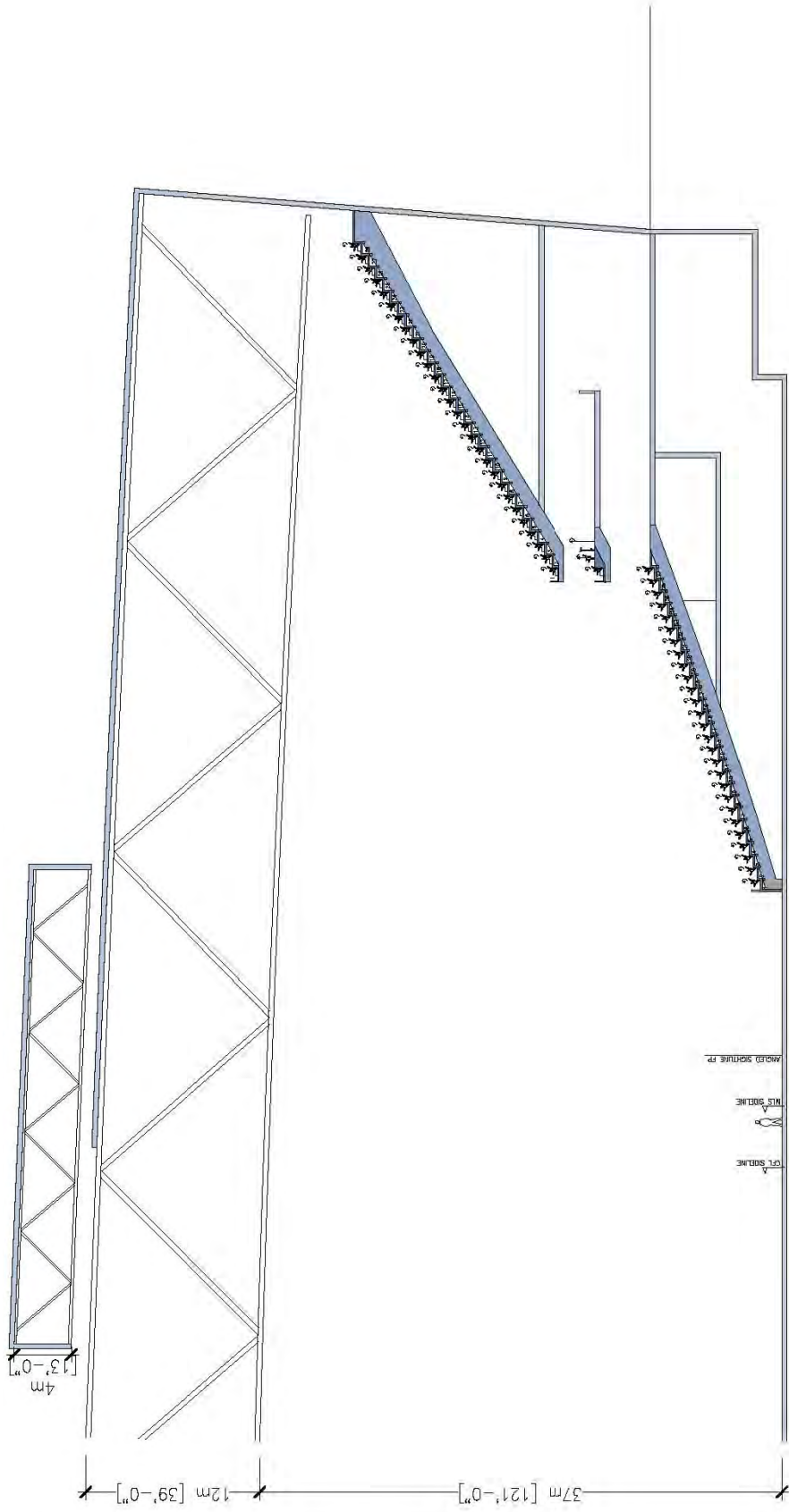


Retractable Roof – Option 3 Visible Spanning Beams



Retractable Roof – Option 3

Visible Spanning Beams

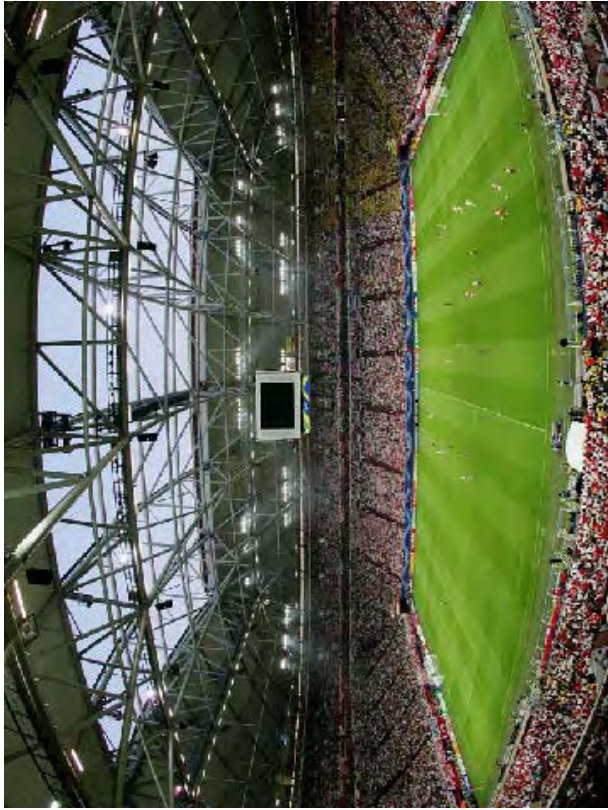


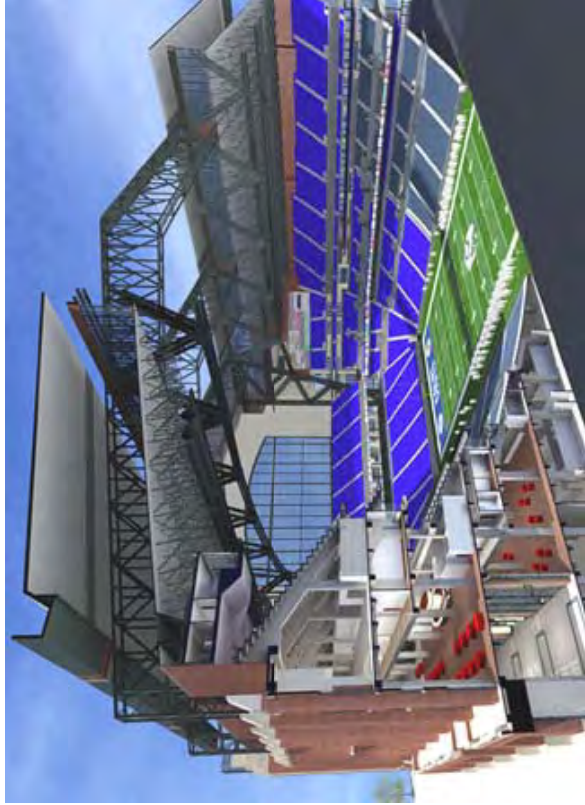
Schematic Section – Option 3
Visible Spanning Beams



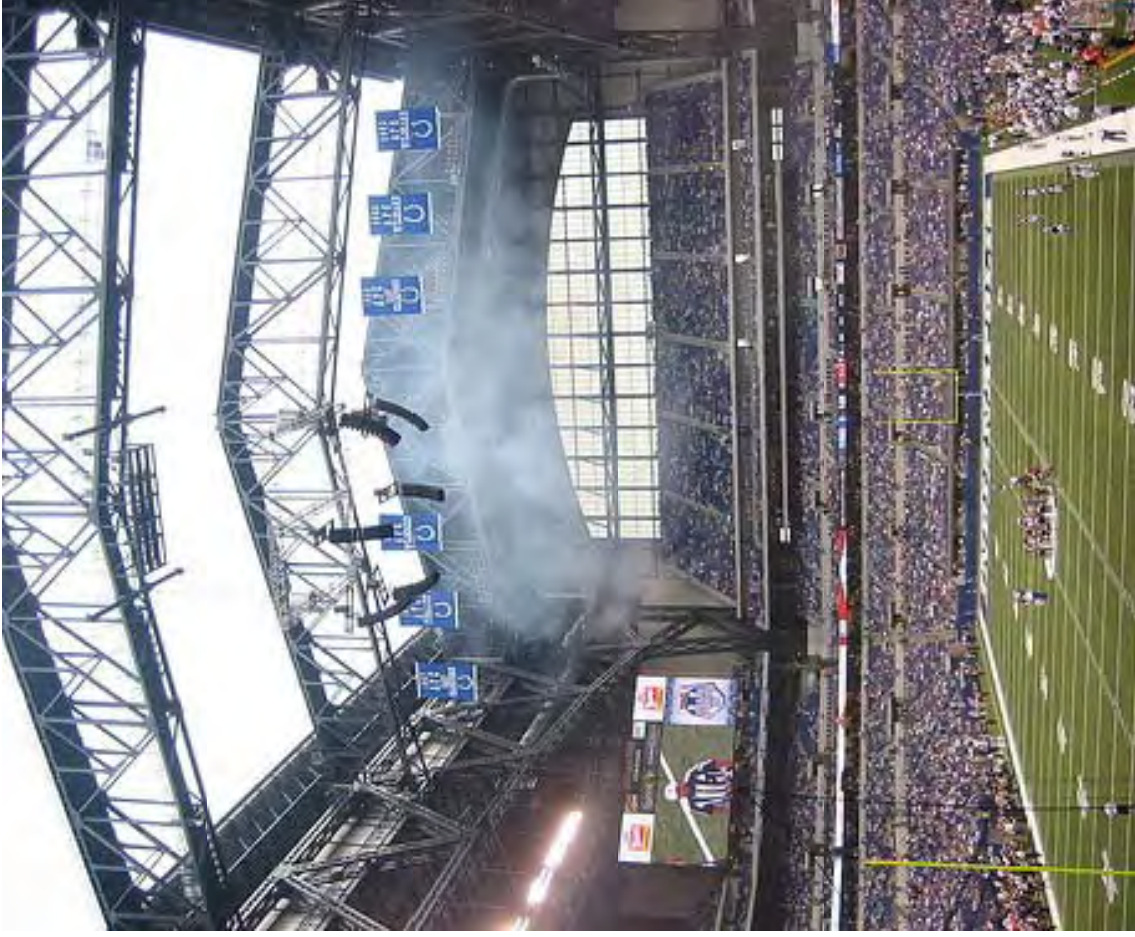
Veltins-Arena
Gelsenkirchen, Germany

Soccer
Capacity: 54,142 - 61,673

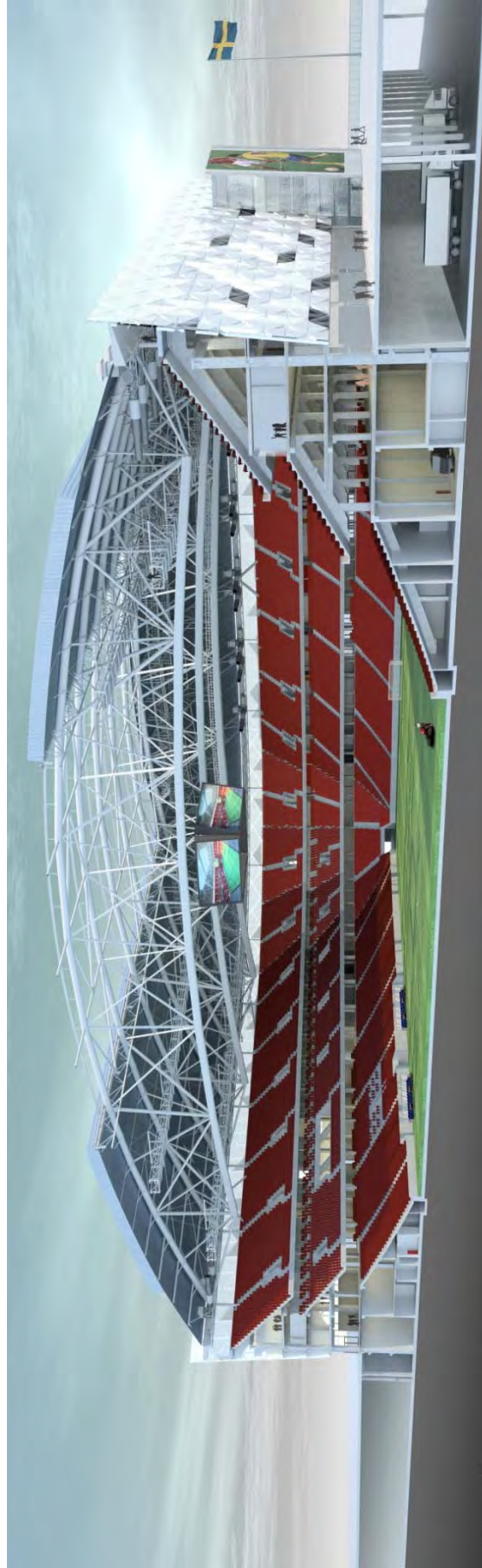




Lucas Oil Stadium
Indianapolis Colts



Football (NFL), Basketball (NCAA)
Capacity: 63,000 – 70,000



Swedbank Arena
Solna, Sweden

Soccer, Concerts
Capacity: 50,000 - 67,500

Permanently Fixed Roof

The form and appearance of the fixed roof option appears similar to the fully retractable and partially retractable configurations, however, there are no movable panels, therefore the structural system which supports the roof is simplified and much more conventional, and therefore less expensive to construct.

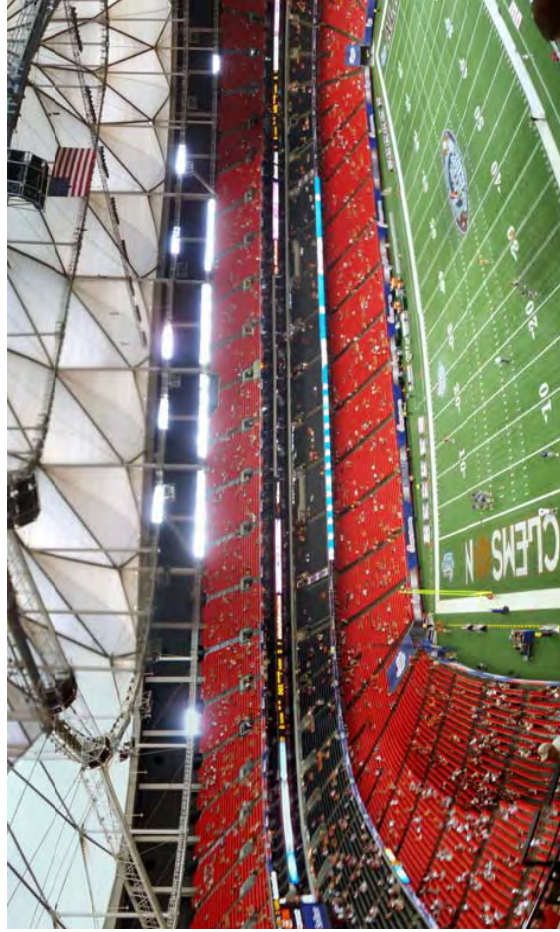
Poly-Carbonate translucent roof panels have also been suggested as an option in the fixed roof scenario, as well, so that significant natural light can penetrate the main seating bowl space. The translucent panels would be located in the two centremost panels and take on the approximate shape of the playing field below.



Georgia Dome, GA (71,228)
Tension/ Compression Ring



Tropicana Field, FL (45,369)
Tension/ Compression Ring



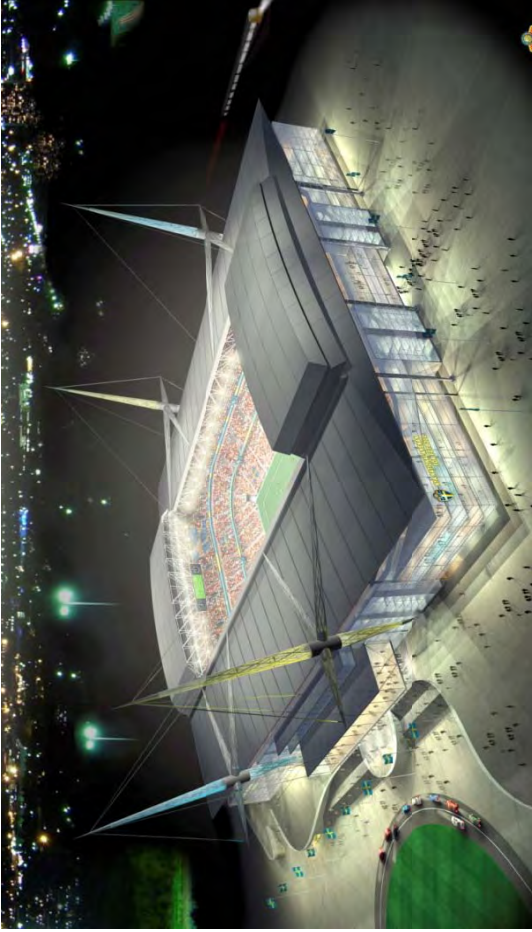


BC Place, BC (59,841)
Air-supported



Carrier Dome, NY (49,250)
Air-supported

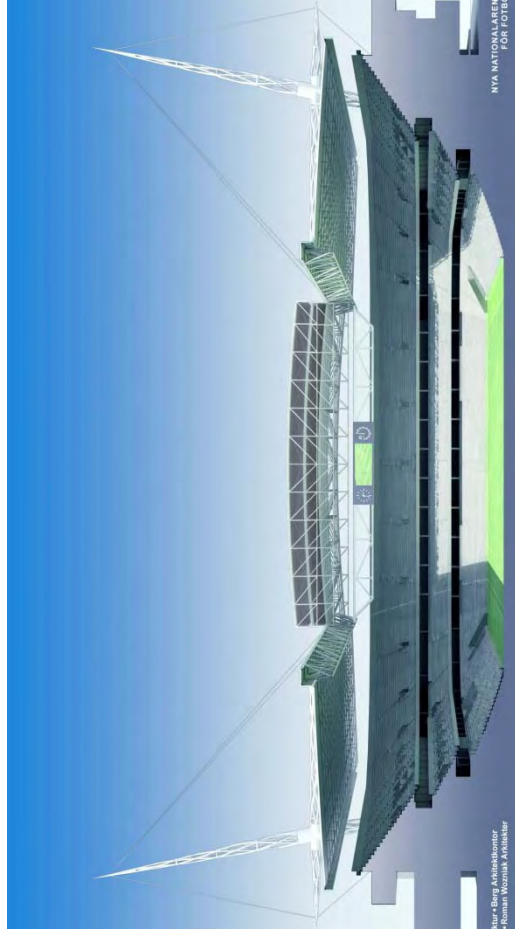




Swedbank Arena (Proposal)
External Tensile Structure



Alamodome, TX (65,000)
External Tensile Structure



Saskatchewan Multi-Use Facility



4. ARCHITECTURAL DOCUMENTS

4.1 DESIGN NARRATIVE

Overview

SCI, along with their engineering team, have designed the following concept for the Saskatchewan Sports & Entertainment Spectator Facility, with a capacity for 33,000 patrons, expandable to 45,000 within the building envelope. The building is approximately 1 million square feet. Its overall dimensions are approximately 715 feet long in the East-West direction, by 550 feet wide in the North-South direction. The overall height of the building from grade to the highest point of the curved roof panels is 125 feet.

The building design was developed around the rectangular shape of the regulation CFL playing field, as well as the Major League Soccer pitch dimensions, which are the largest sport surface uses that are anticipated for the proposed facility. The seating layout, therefore, took on a similarly rectangular shape, as well as the adjacent public concourse circulation areas. The building design is comprised of four major floor levels, an Event Level, Main Concourse, Suite/Restaurant Level and Upper Concourse. A mezzanine floor located above the Event Floor houses the Club Lounge space. Mechanical service spaces and catwalk systems are located within the roof structure.

Building Form

The Rectangular form of the structure was a result of a response to the rectangular shape of the larger sports surfaces within, the CFL grid and the MLS grid. The roof shape is a gentle arc of large span trusses. The degree of arc is both functional, to shed rain, snow, ice, etc., but also intentionally shallow, so that the overall height of the building is kept relatively low. SCI consciously attempted to emphasize the 'Entertainment' aspect of the new Centre with its understated building form, and a 'non-stadium' look. We attempted to minimize the negative impact that could be caused by planting a large super structure within an existing context of relatively smaller scale buildings. The orientation of the large vaulted roof panels works well with the surrounding context, especially the strong East-West directionality of the main rail lines. The exterior form and design of the spectator facility recalls the grand train stations in Europe, with huge clear spans and extensive glazed walls at each end.

Exterior Materials

The main cladding material proposed is red brick along the main North and South facades of the larger mass of the spectator structure. The East and West 'gables' are clad in a combination of pre-finished corrugated metal paneling and glazed curtainwall system. The Atrium structure is treated with a 'historical' look, with brick pier construction and large 'warehouse' type storefront windows. The colour of the Atrium brick matches the existing brick colours found on the buildings along Dewdney Avenue. Clerestory glazing along the upper North and South facades along with the large East and West glass gables will allow a significant amount of controlled natural light into the concourses and bowl area. Optional

large translucent poly-carbonate roof panels over centrefield will allow natural light into the central event area when the roof is in the fully closed position.

Event Level

The lower level is the Event level, which contains the actual event surface/playing field area along with all of the 'Back of House' functions for the building, such as the operations loading zones, media truck and production areas, food & beverage delivery and storage areas, operations storage areas, team and officials dressing rooms, home team and visiting CFL football club locker areas, staff locker areas etc. The event surface has been recessed below grade approximately 25 feet in order that the main concourse area above can be accessed directly from grade. The recessed concept diminishes the overall scale of the building by, in effect, 'burying' the event level in the ground, thereby reducing the overall height of the building exposed above grade level.

Large trucks and other service vehicles can access the event level via a large vehicle ramp which is located to the west side of the facility, and takes vehicles from grade level down to the event level. Large trucks or other service vehicles also have the ability to drive onto the event surface in order to set up concerts, trade shows or other events.

Spectator access has also been provided to the event level via large open stairs, escalators and elevator service from the main entry level for events or uses which require the occupancy of the event floor. Food and Beverage service points along with public washrooms are located strategically to accommodate the event floor population.

Main Concourse

The Main Concourse level services the seating and viewing areas associated with the lower seating bowl, and can be accessed from the 'Atrium Lobby', which wraps around the North-East corner of the Multi-use Facility, or from many other Entry points, at grade, around the building perimeter. The Atrium area is a three storey space, which acts as a large entrance lobby, crush space, ticket lobby and indoor gathering space. The exterior form of the Atrium will also act as a buffer between the large scale of the rectangular multi-use building and the smaller scale buildings along the North side of Dewdney Avenue known as the Warehouse district. It is estimated that approximately half the event population will enter from the Dewdney Avenue area at the North side of the facility, while the other half will approach from downtown, from the south side of Saskatchewan Drive. Patrons entering the site from the south, have the option of going directly into the facility at the East end of the South building face, through a large glass 'portal', or continuing over a platform above the rail lines and down a festival promenade which connects to a large plaza area immediately fronting the east façade of the Atrium structure. The Atrium space allows direct access to the Main Concourse, and also houses major vertical circulation at the North and East sides of the facility, whereby the public can move from the atrium space up to the suite level or beyond to the upper concourse level.

A large Roughrider retail store is located at a very prominent North-East corner of the complex, accessible from the Atrium Lobby or from the interior side of the Main Concourse. The main ticketing area is located across the lobby from the retail, such that ticket windows face the Atrium Lobby as well as the building exterior near Dewdney Avenue. As part of our master plan concept for the potential adjacent development to the spectator facility, SCI envisioned a large public square just to the East of the Sports & Entertainment Facility, which could service large pre and post event functions, gatherings, special events, as well as provide community space for non-event related functions.

Amenity space is distributed evenly about the Main Public Concourse with a concentration of food & beverage service areas in each corner of the building, creating a 'food court' effect. A main Club seating area for 2,000 patrons is located at the North side lower bowl with supporting lounge space on the mezzanine below; which allows direct access to the prime viewing seats at centre field. A sports bar concept is located at the North end of the lower seating bowl.

Suite Level

Forty Private Suites, four large Group Sales Suites and a Restaurant are the main hospitality spaces located at the Suite Level, above the Main Concourse level. The Suites circulation corridors overlook the double height Main Concourse area below, which, with extensive glazing to the exterior will provide abundant natural light and space for the patrons. The media broadcast, written press, play camera, video control and league officials' program space is also provided at this level, mainly along the south side of the seating bowl. The media spaces have direct vertical access to the media truck parking, production areas, and home and visiting team locker rooms below on the event level.

Upper Concourse

The uppermost public floor level in the facility is the Upper Concourse level. It services the upper seating areas at the north and south sides of the bowl. The upper concourse is a horseshoe shape with no floor slab across the west end of the facility. This space along with a large section at the east end of the building is reserved for the future seating expansion. The Upper Concourse also provides direct access to food & beverage and public washroom facilities for the patrons inhabiting this level.

Washroom ratios for the entire building are above typical building code requirements, aimed at minimizing line-ups and waiting times. The proposed number of concession service points are also above industry standards.

Interior Materials

The main flooring material will be a polished concrete for a majority of the public areas, with a combination of carpet and floor tile being used in the VIP areas, suites, lounges, bar and restaurant. The cast in place concrete structure of the main stadium facility will be exposed, with strategic cladding of columns and

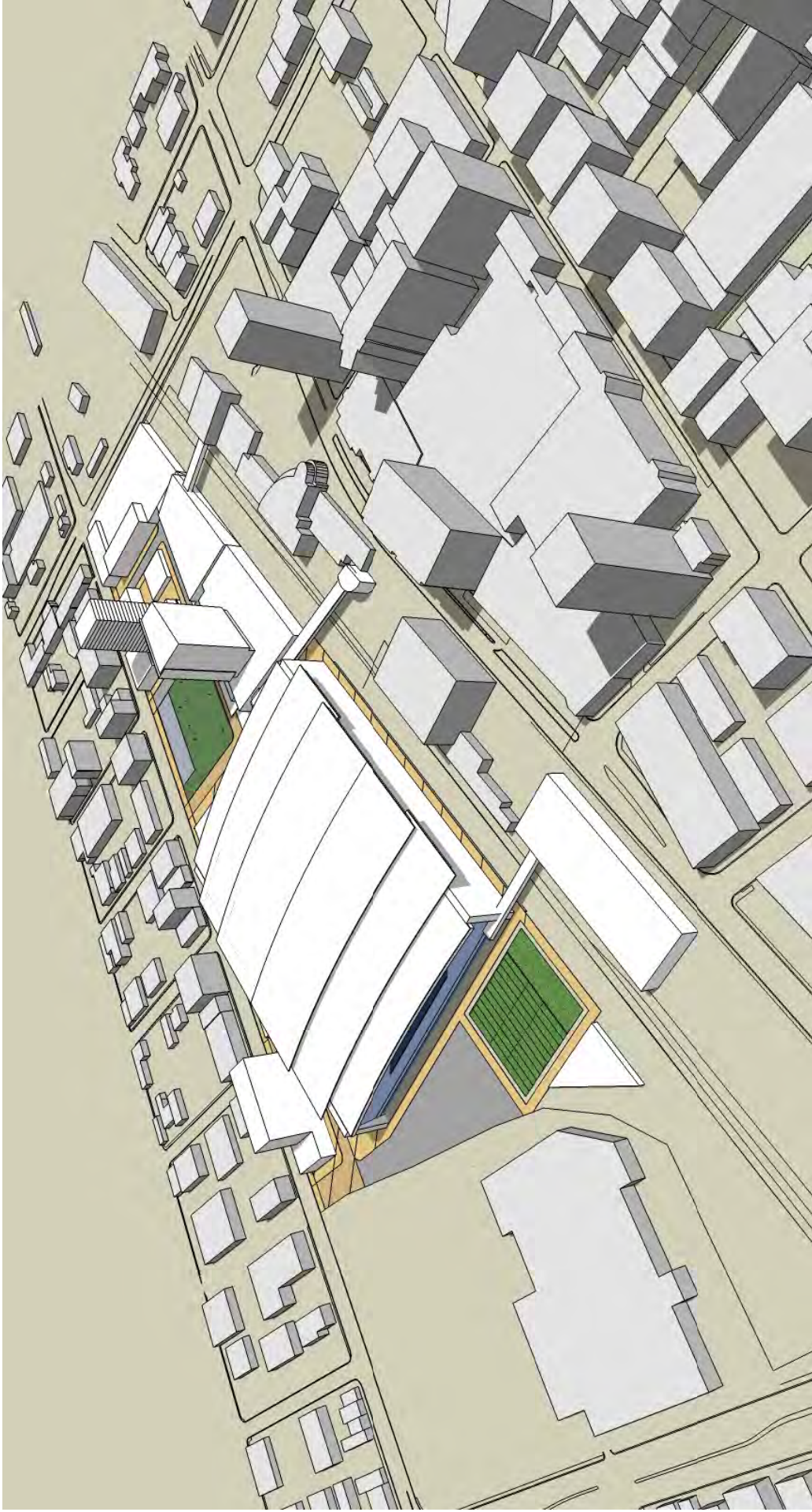
special ceilings. The Atrium building will be finished in a more historic/industrial mode, to acknowledge the surrounding Warehouse district context. The majority of walls at the Event, Main Concourse and Upper Concourse levels will be painted concrete block with exposed ceilings. The Suite level and Hospitality area partitions will be painted drywall construction with finished ceilings. The contemporary Spartan look at the interior will be consistent with a sustainable design approach for the project.

Retractable Roof

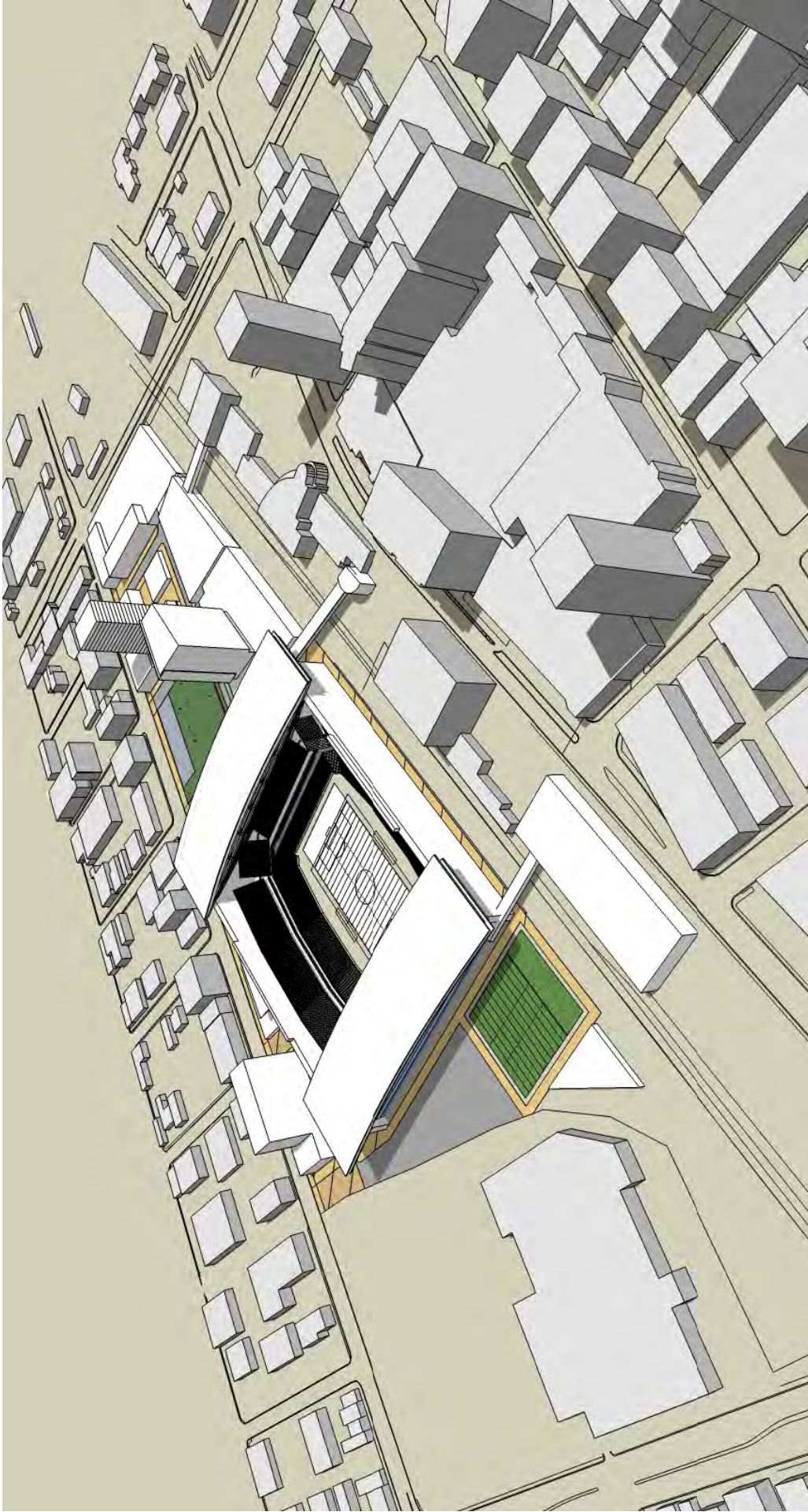
The fully retractable roof concept is comprised of a system of arched roof panels, six in total, two fixed, four movable. The two centre panels can move away from each other and glide over adjacent panels which also move, each towards its respective end zone. The movable panels provide support for each other which allows the thickness of each panel to be approximately 8 feet, relatively thin. As the roof opens, the four movable panels come to rest in a stacked position, two in each end zone, resting overtop of each of the fixed panels. The North and South walls provide support in the form of a large beam and track for the arched roof panels, along which they commute from the closed to the open position and back again. The movement is enabled by a series of electric motors, cables and tracks. The Western half of the roof can move independently of the Eastern half, allowing for a multitude of combinations of 'openness' depending on the event mode.



Bowed Top Truss
6 Panels



Bowed Top Truss
6 Panels



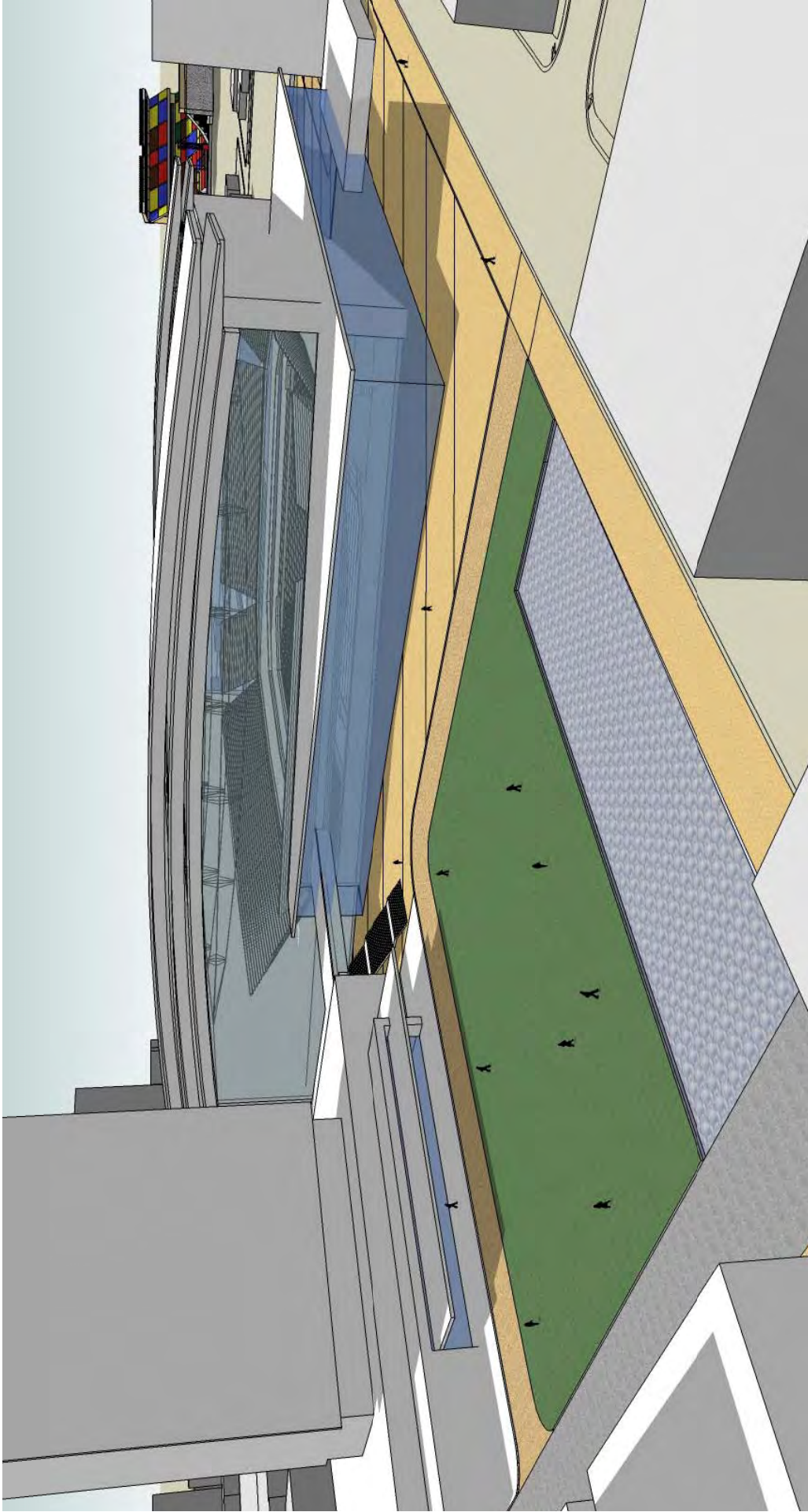
Bowed Top Truss
6 Panels



Bowed Top Truss
6 Panels

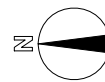
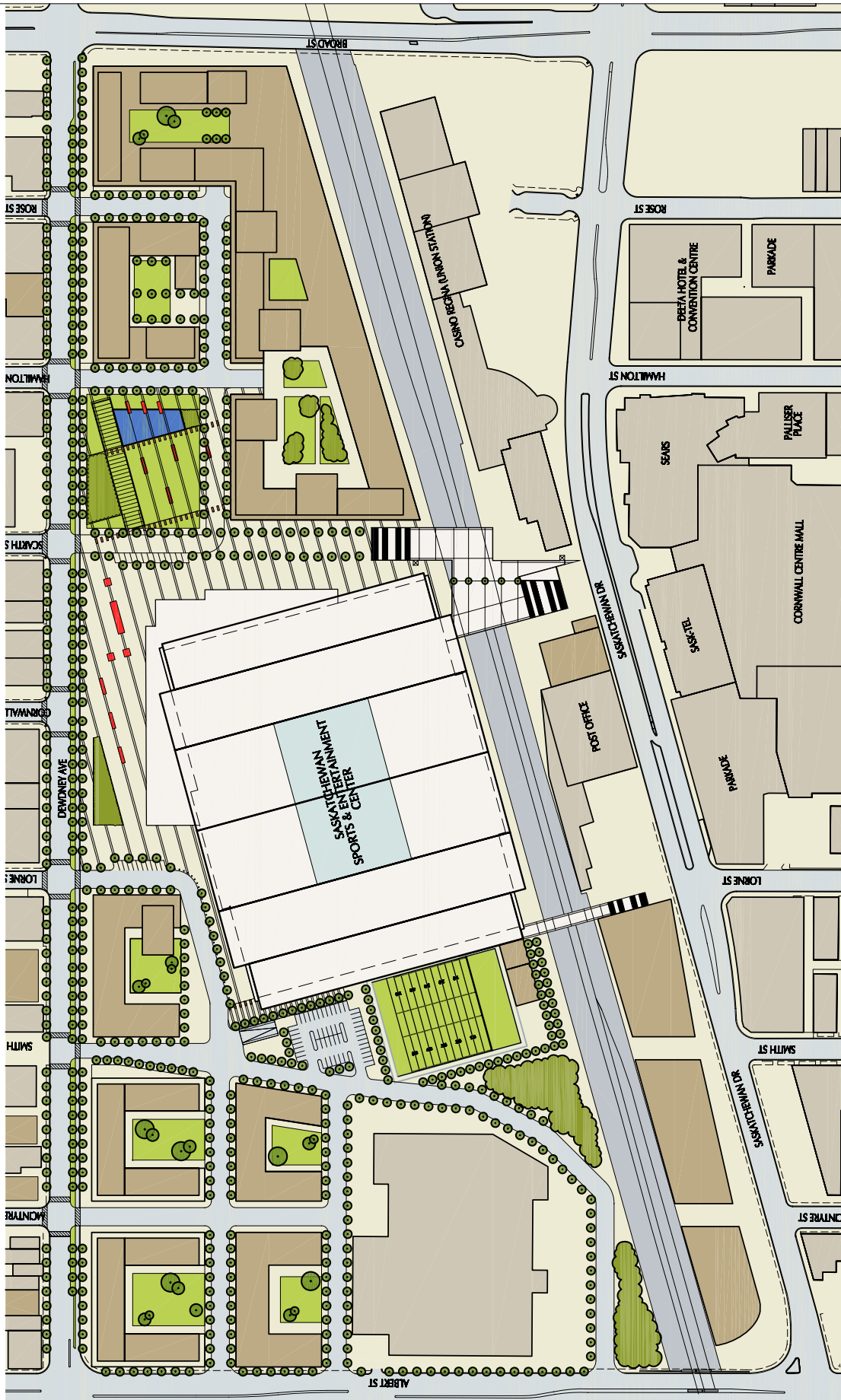


Bowed Top Truss
6 Panels



Bowed Top Truss
6 Panels

4.2 DESIGN DRAWINGS



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SITE PLAN

SCALE: AS NOTED

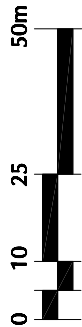
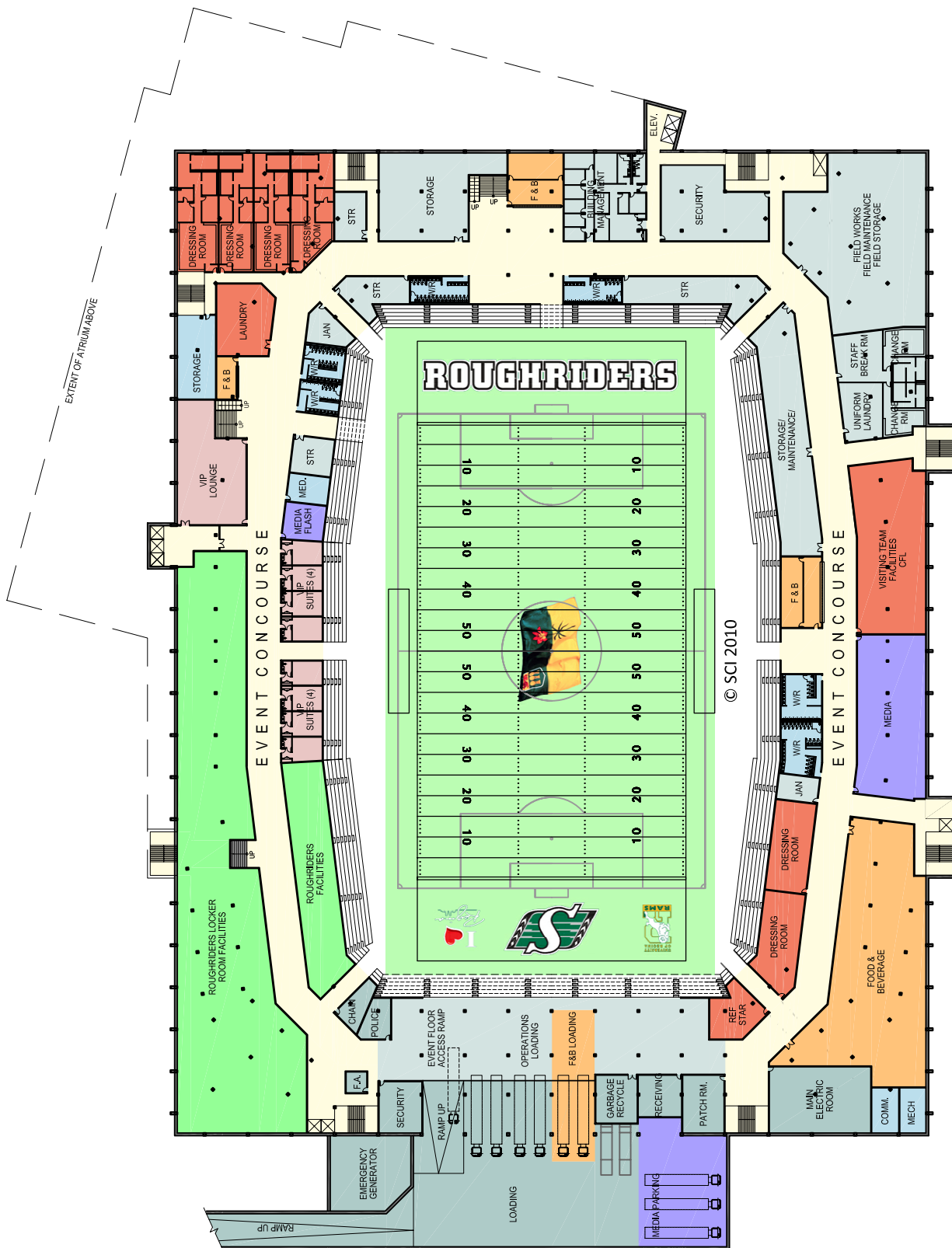
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DWG. #
0.0

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EVENT LEVEL PLAN
 SCALE: AS NOTED
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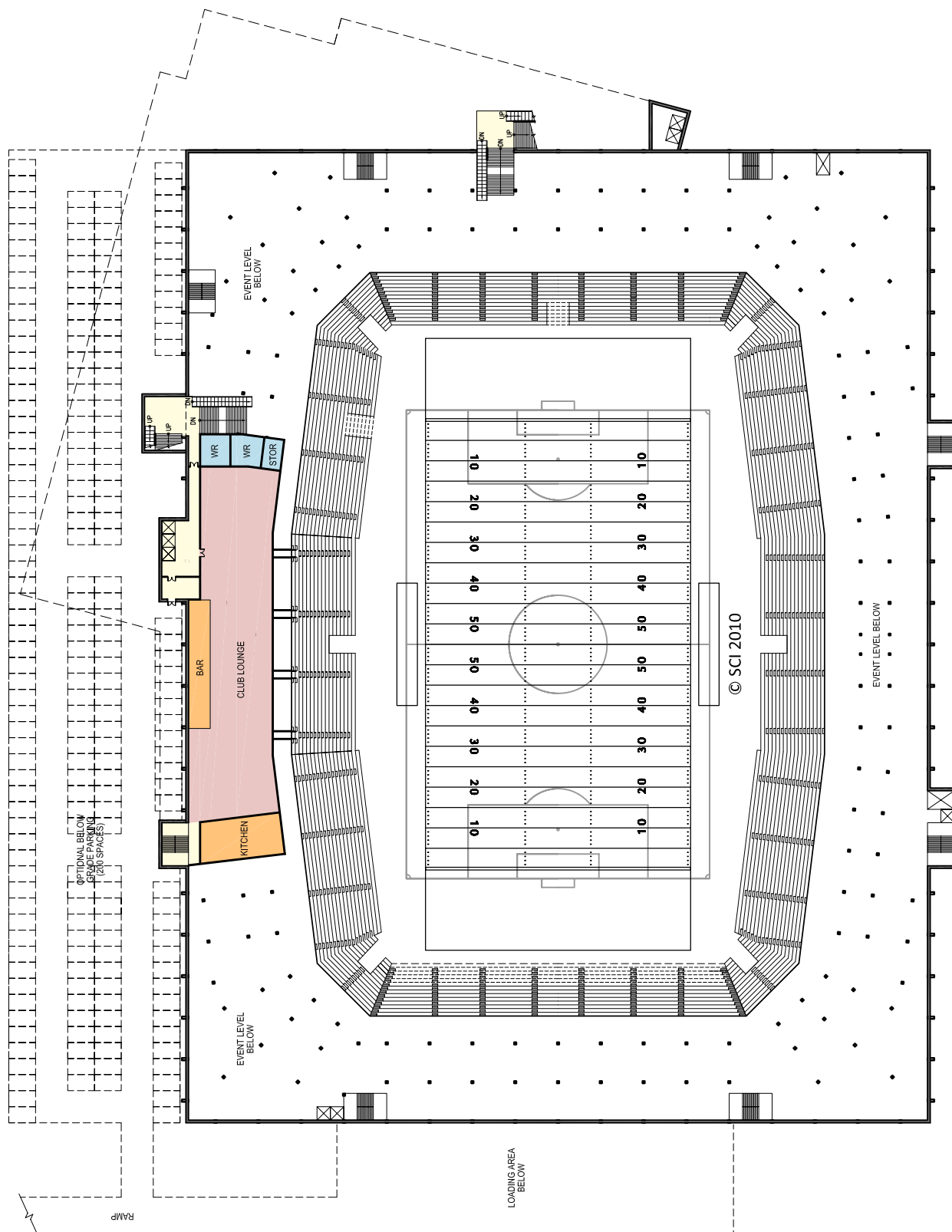
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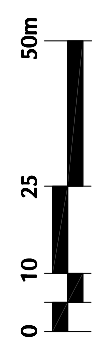
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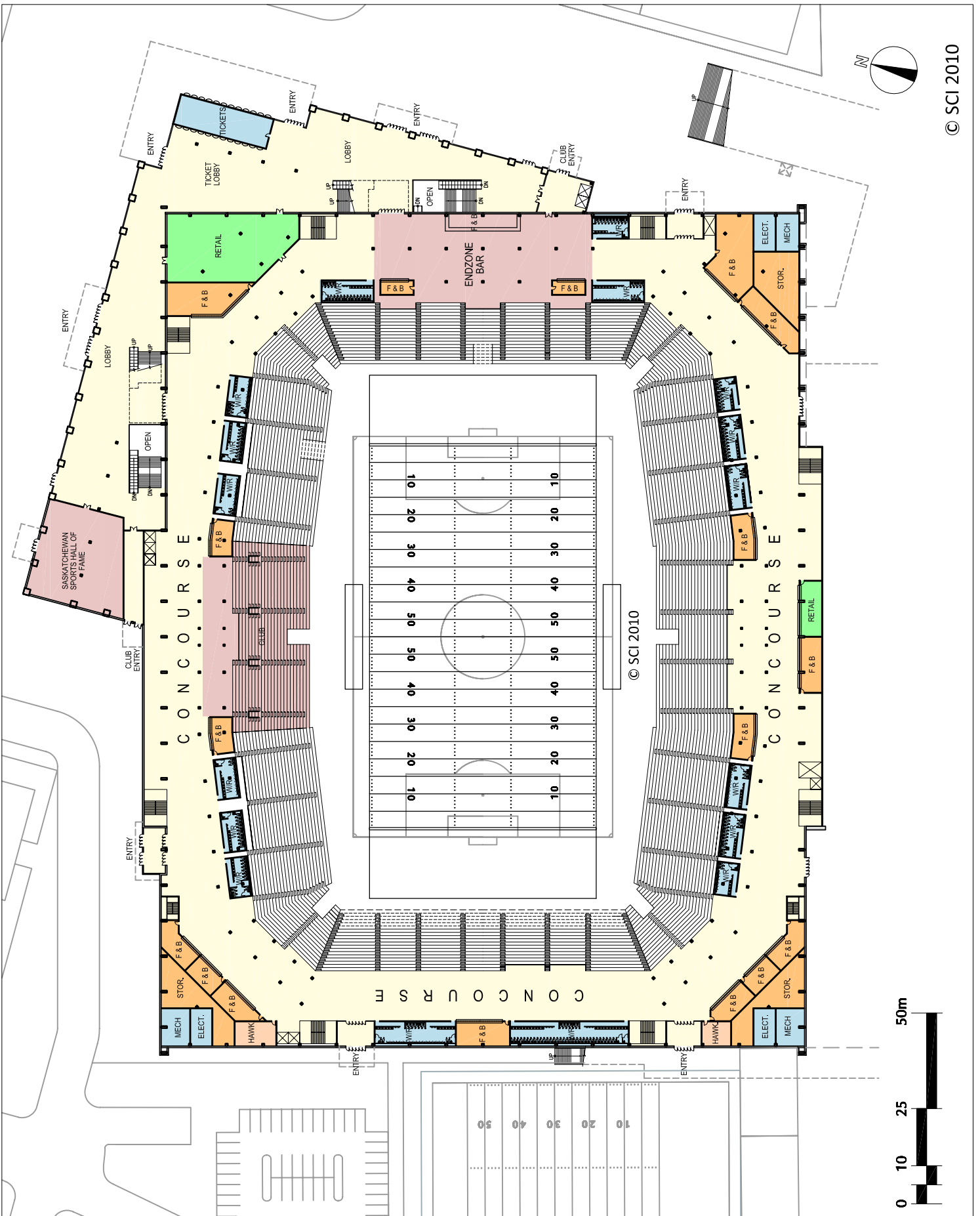
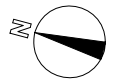


CLUB MEZANINE PLAN
 SCALE: AS NOTED
 FEBRUARY 2010

DWG. #
2.0

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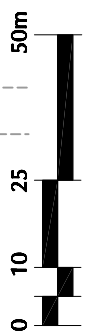
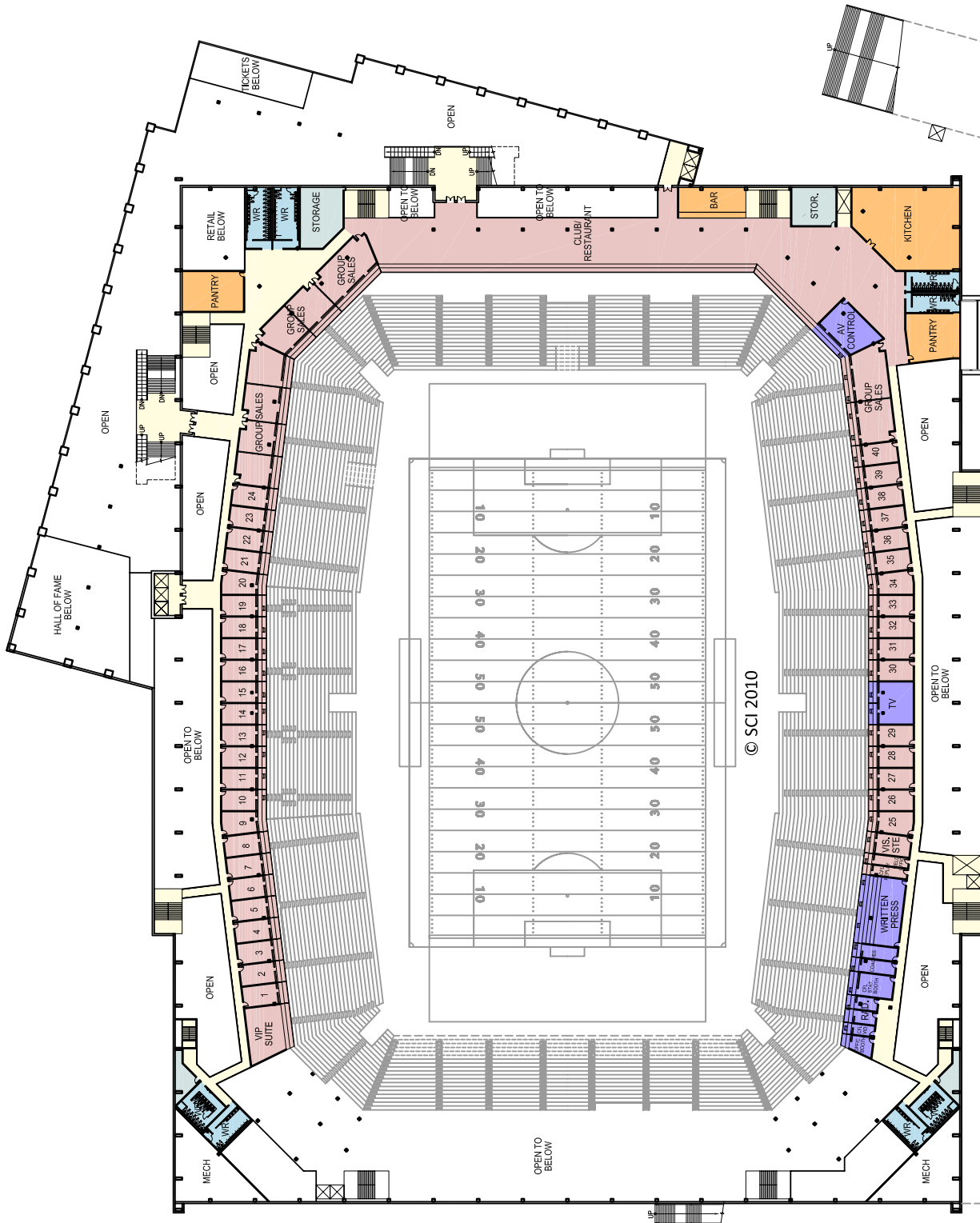
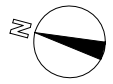


MAIN CONCOURSE PLAN
 SCALE: AS NOTED
 FEBRUARY 2010

DWG. #
3.0

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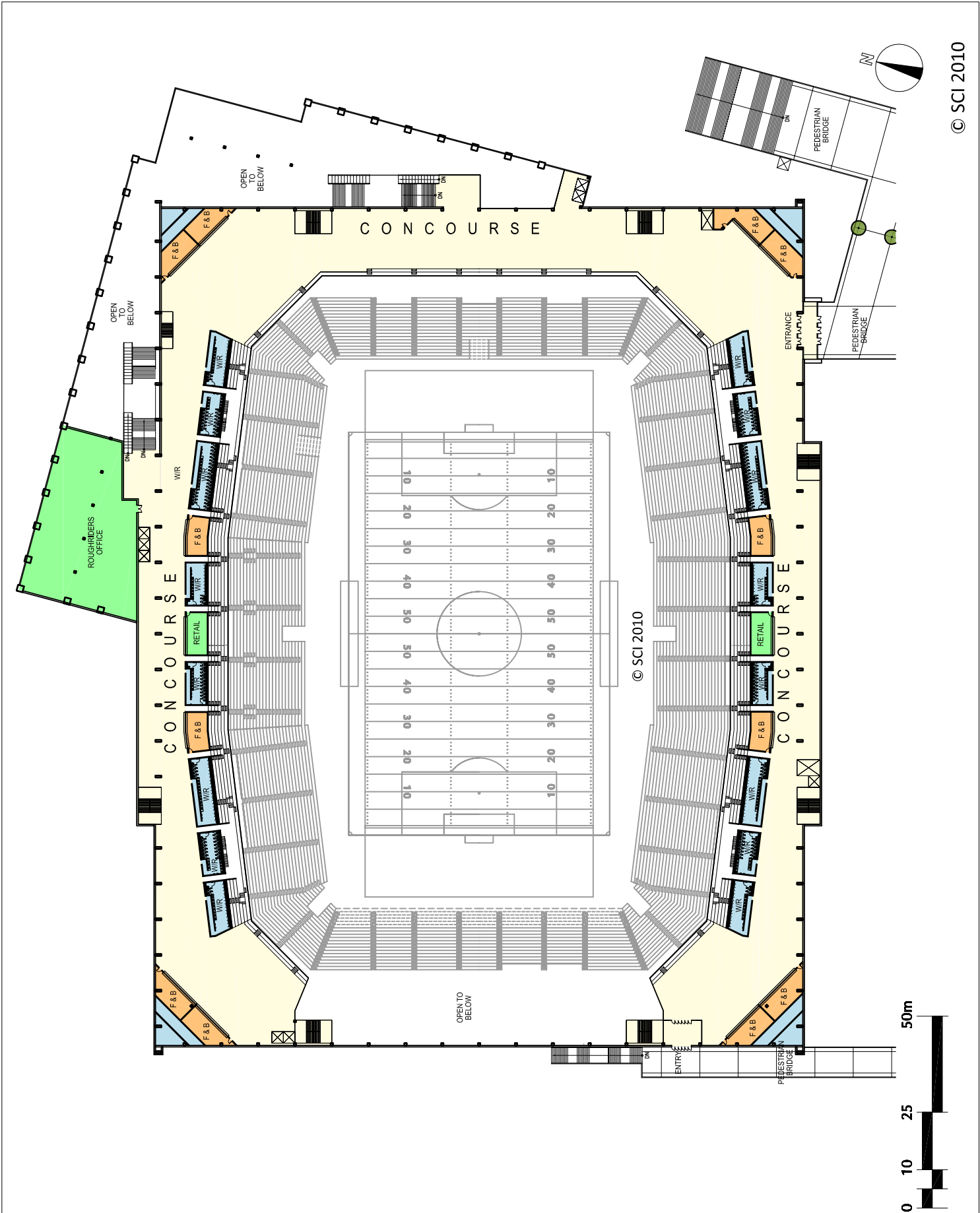


SUITE LEVEL PLAN
 SCALE: AS NOTED
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DWG. #
 4.0

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UPPER CONCOURSE PLAN
 SCALE: AS NOTED
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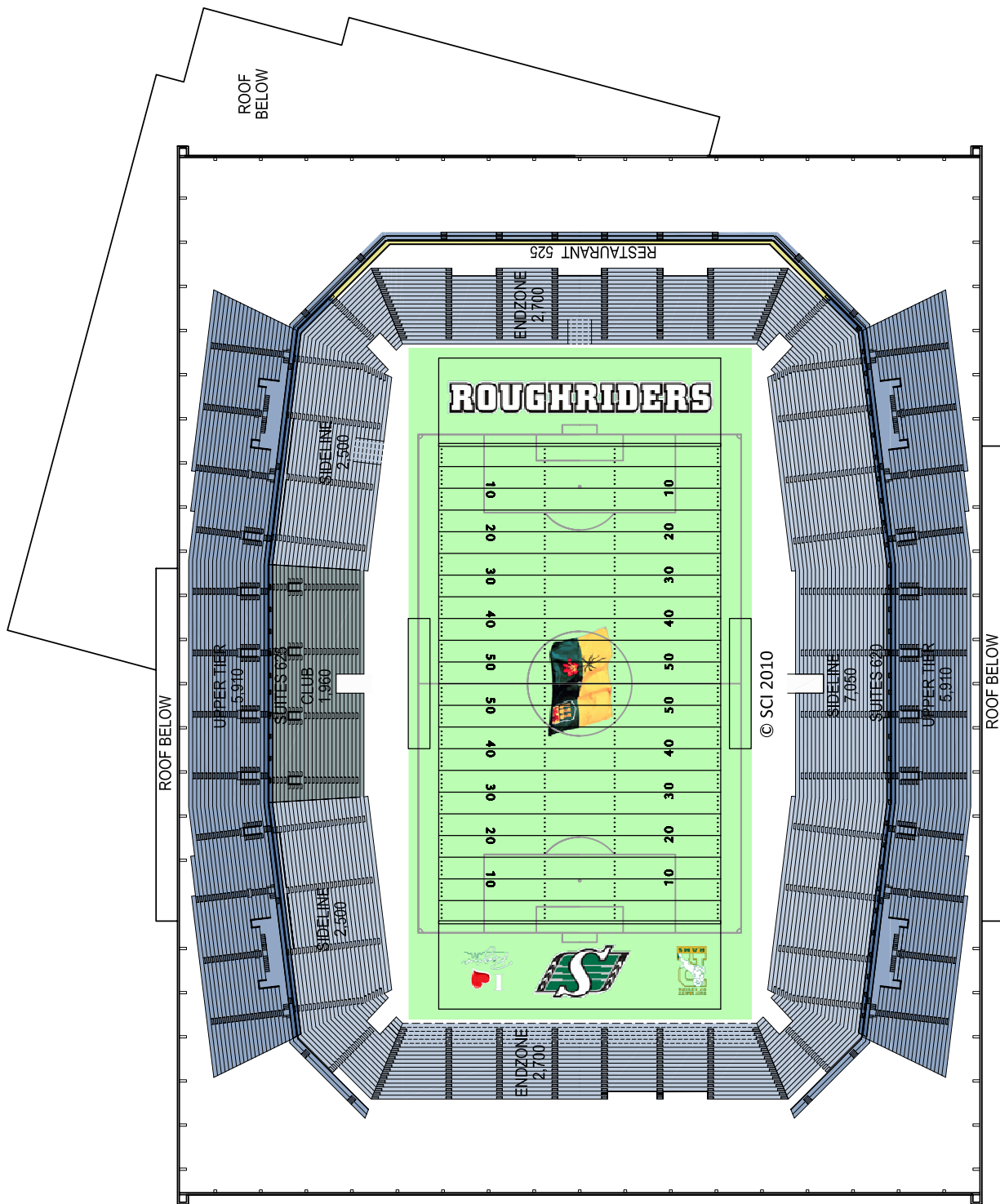
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DWG. #
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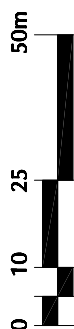
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33,000 CAPACITY



SEATING PLAN - PHASE 1
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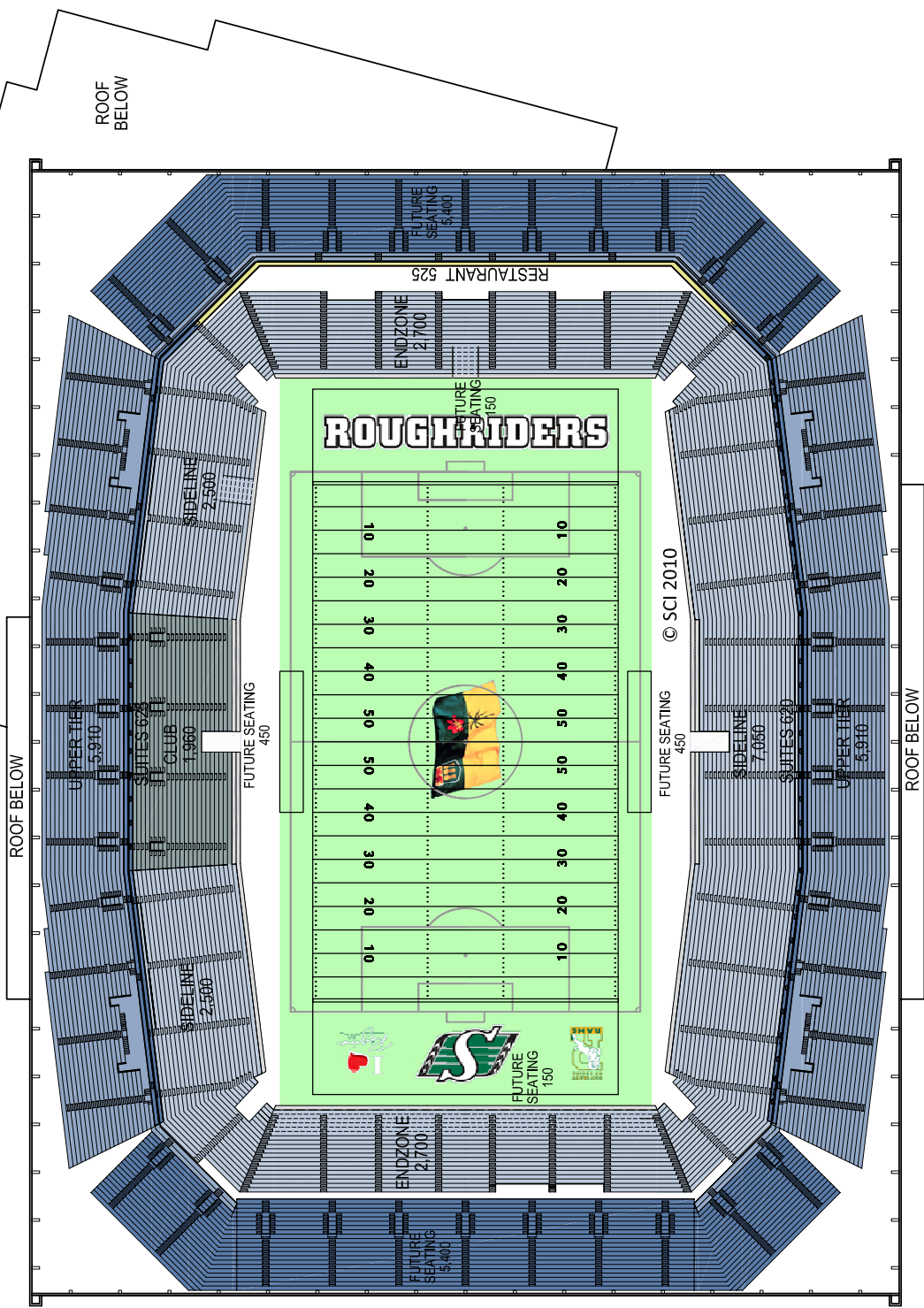
DWG. #
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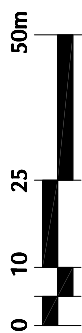
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45,000 CAPACITY



SEATING PLAN - PHASE 2
 SCALE: AS NOTED
 FEBRUARY 2010

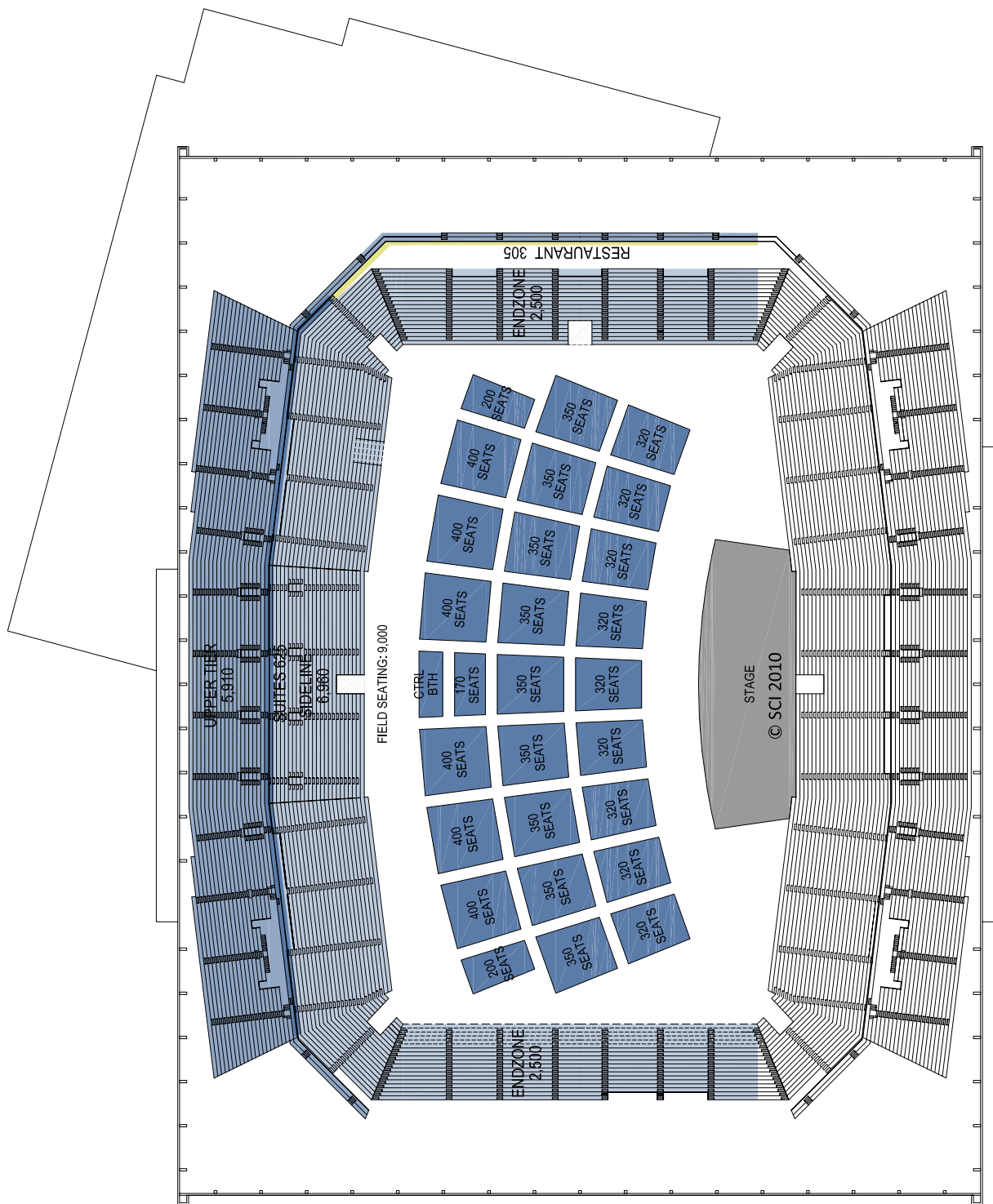
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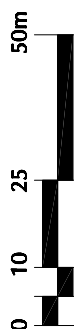
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27,800 CAPACITY



SEATING PLAN - CONCERT 1
 SCALE: AS NOTED
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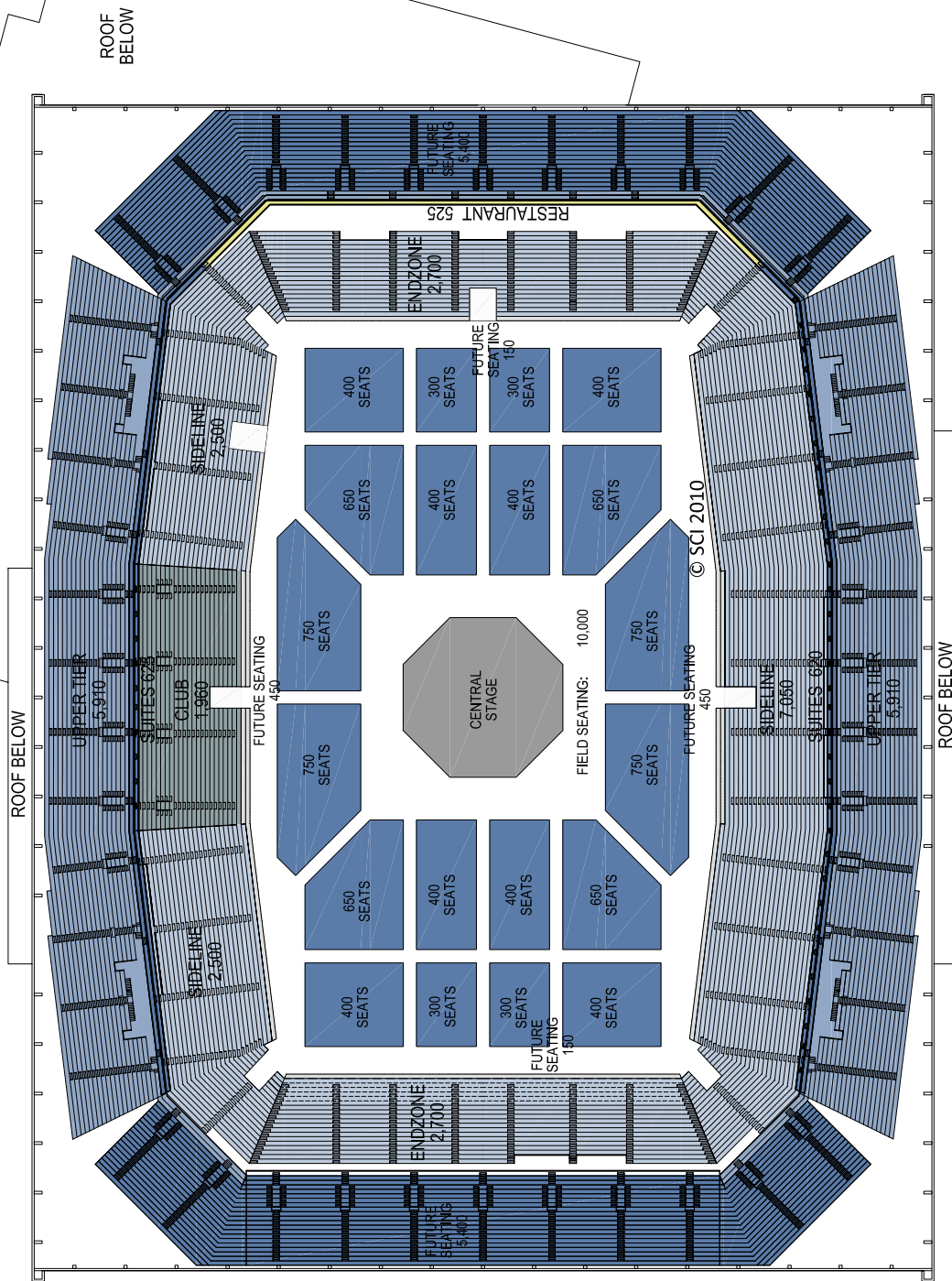
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SASKATCHEWAN
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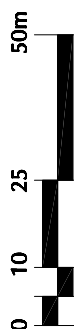
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55,000 CAPACITY



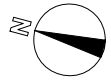
SEATING PLAN - CONCERT 2
 SCALE: AS NOTED
 FEBRUARY 2010

DWG. #
 6.3

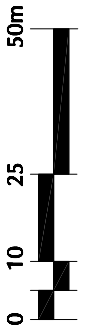
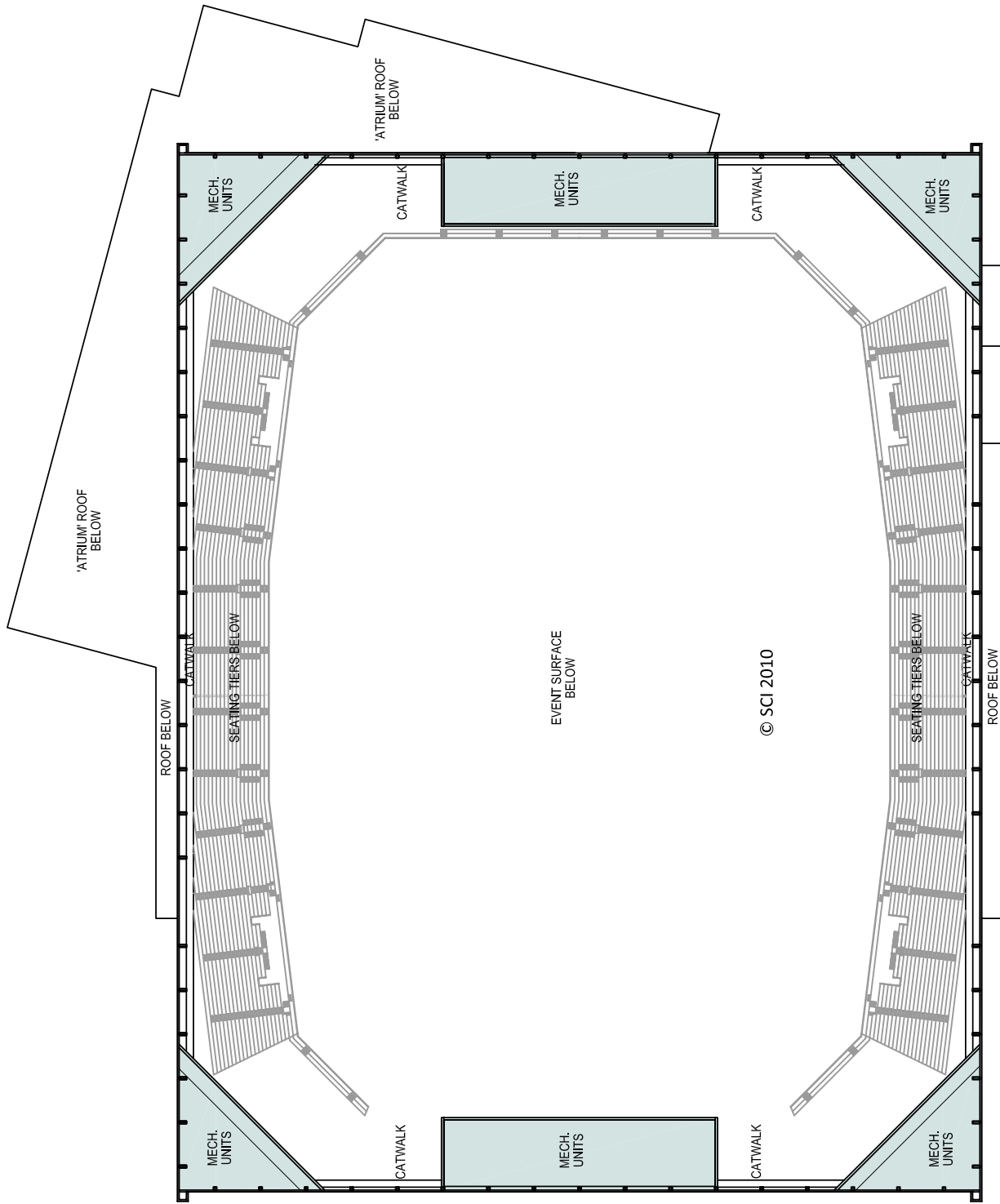
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MECHANICAL PLAN

SCALE: AS NOTED

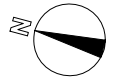
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DWG. #
7.0

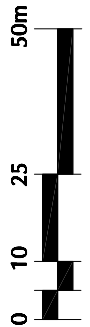
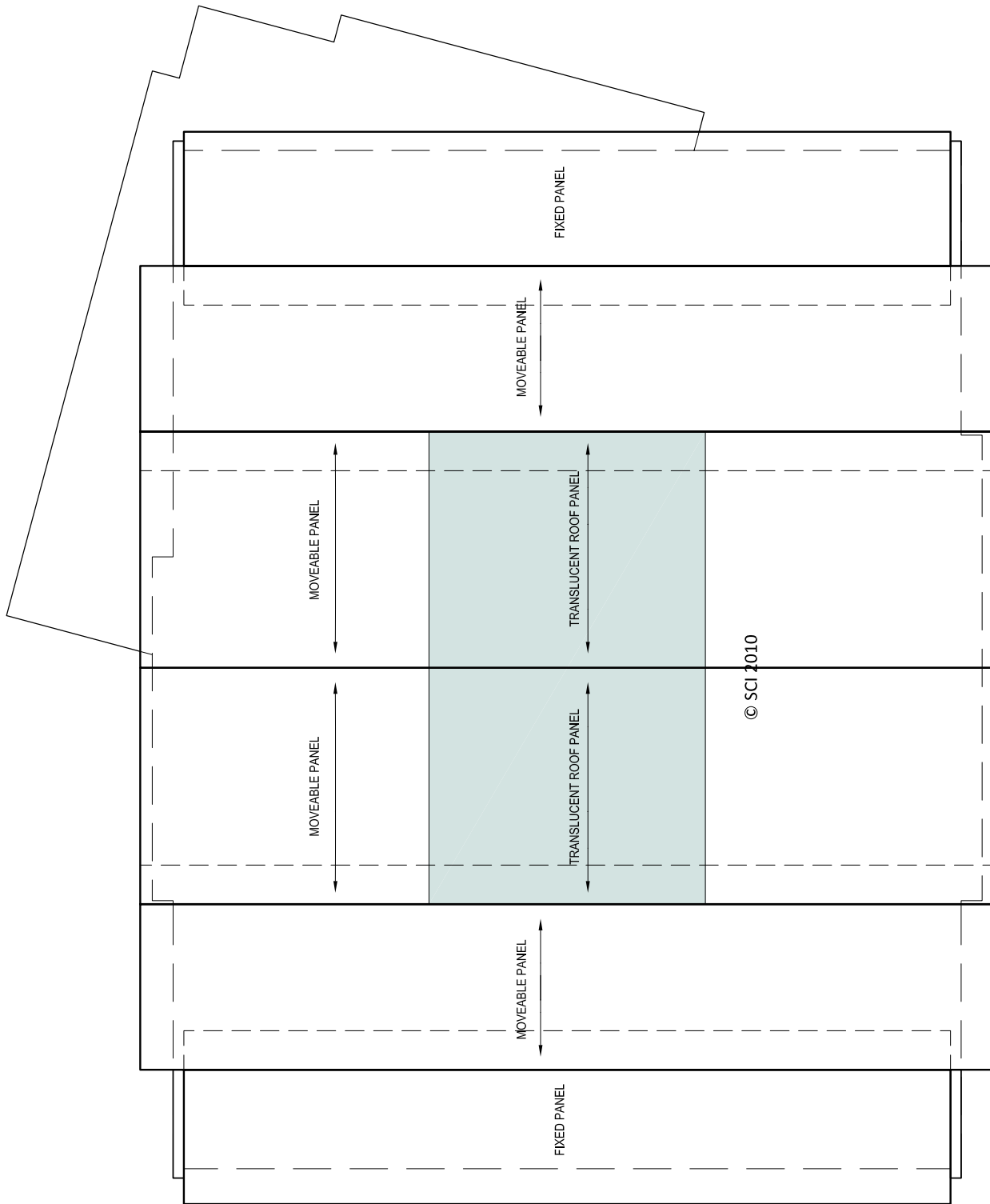
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ROOF PLAN

SCALE: AS NOTED

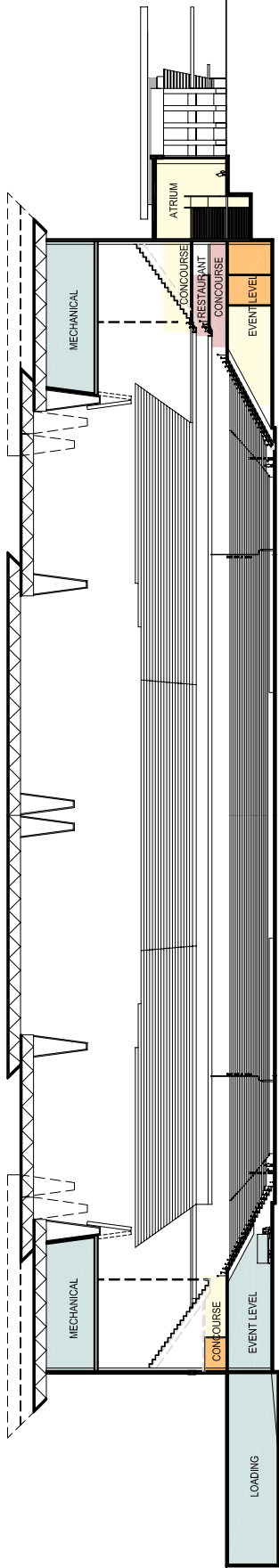
FEBRUARY 2010

DWG. #
8.0

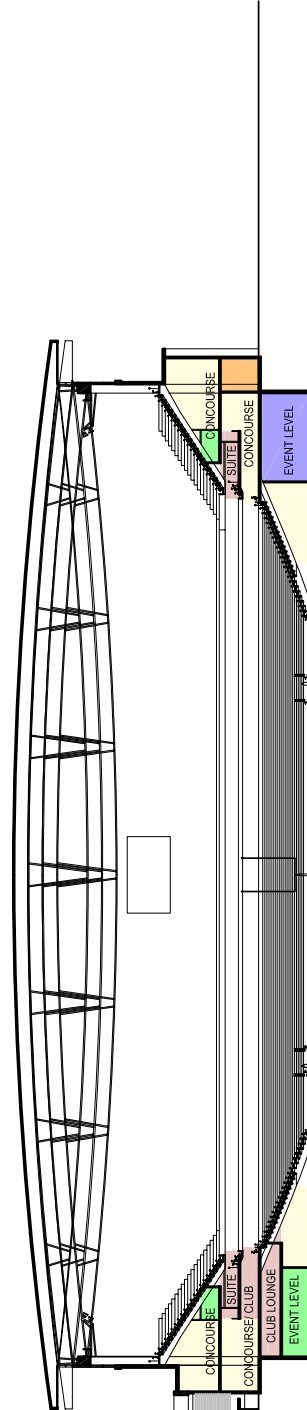
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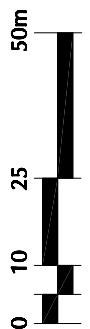
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EAST - WEST SECTION



NORTH - SOUTH SECTION



SECTIONS

SCALE: AS NOTED

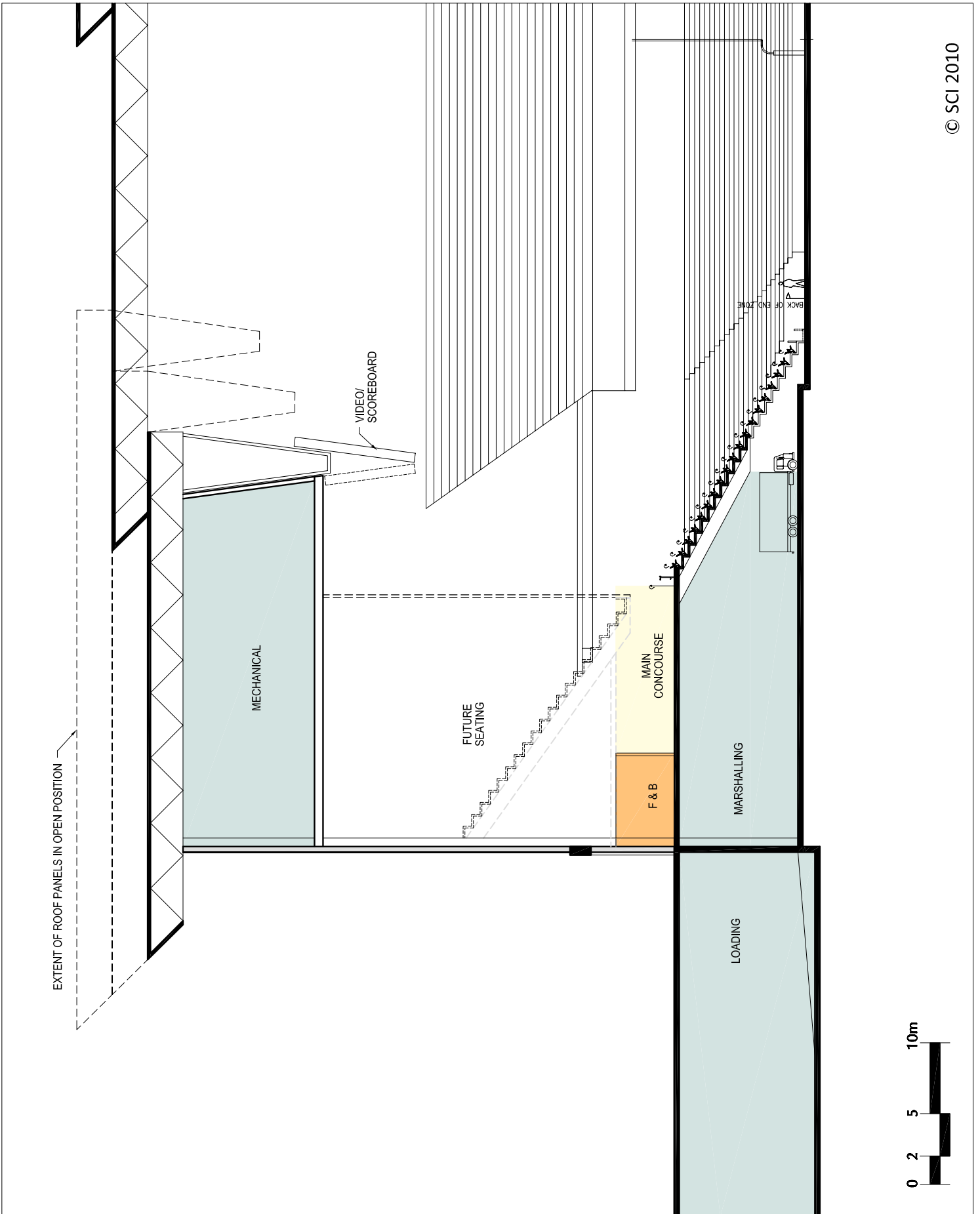
FEBRUARY 2010

DWG. #
9.0

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SECTION - WEST END

SCALE: AS NOTED

FEBRUARY 2010

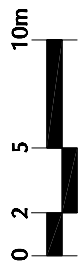
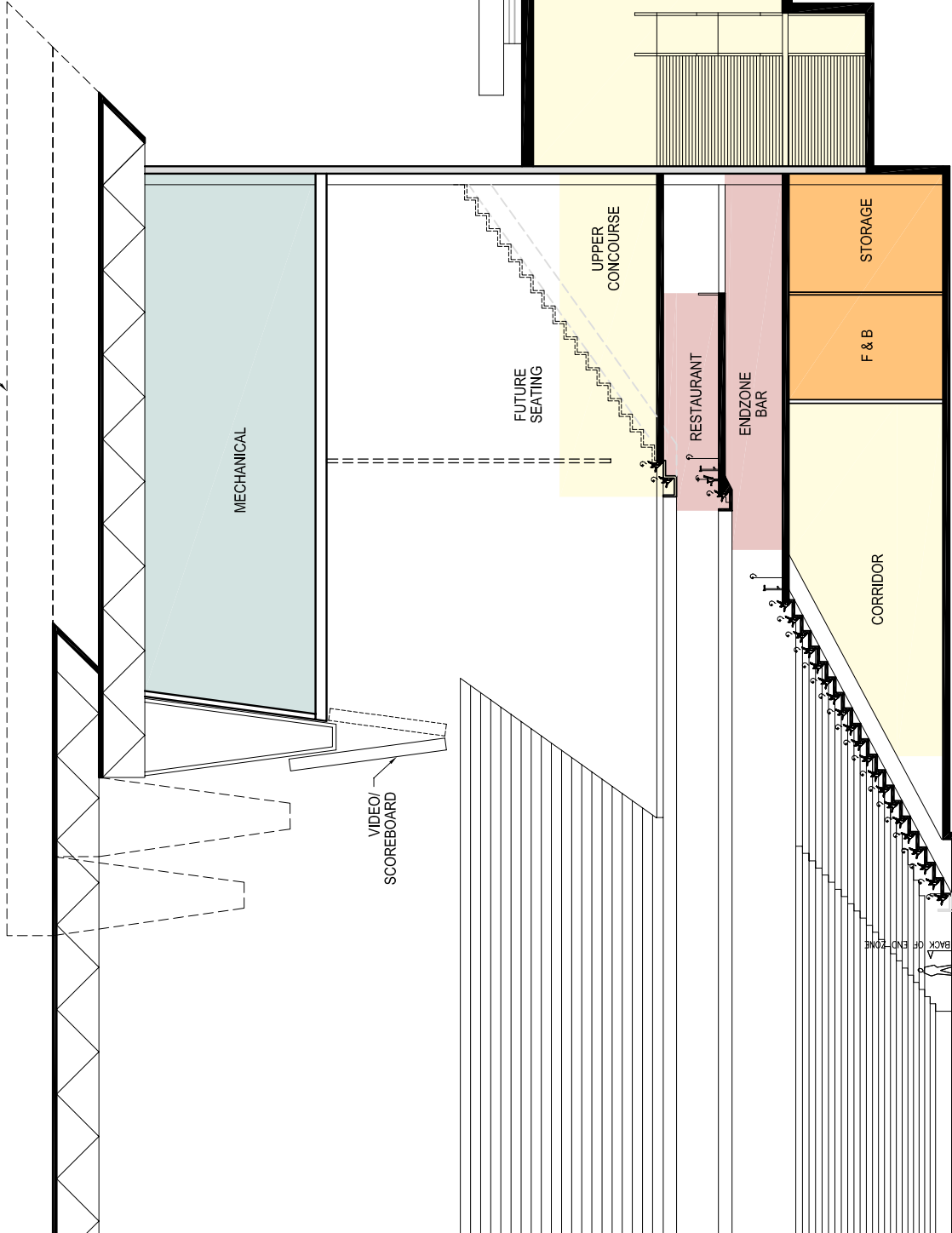
DWG. #
9.1

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EXTENT OF ROOF PANELS IN OPEN POSITION

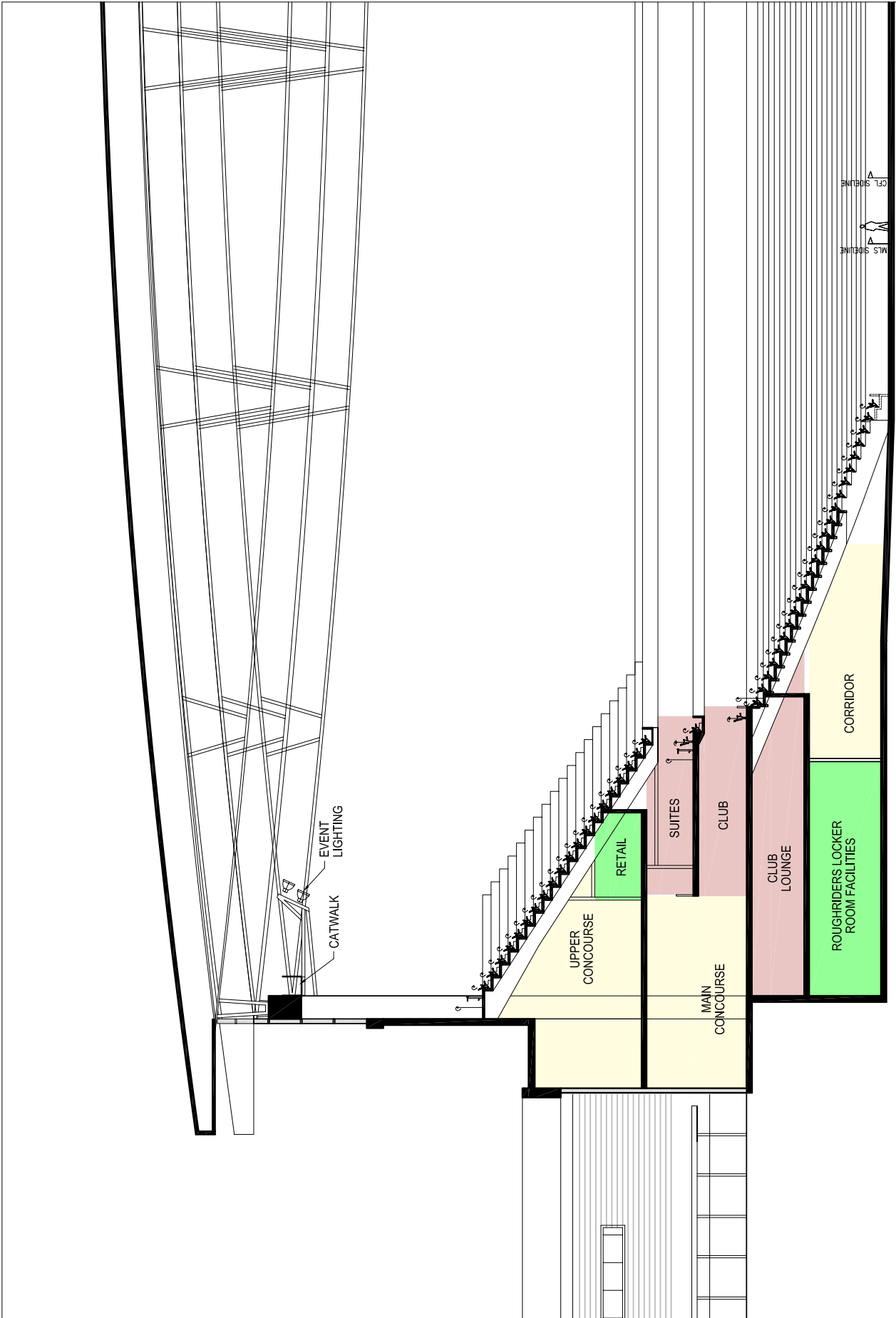


SECTION - EAST END
 SCALE: AS NOTED
 FEBRUARY 2010

DWG. #
 9.2

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SECTION - NORTH END

SCALE: AS NOTED

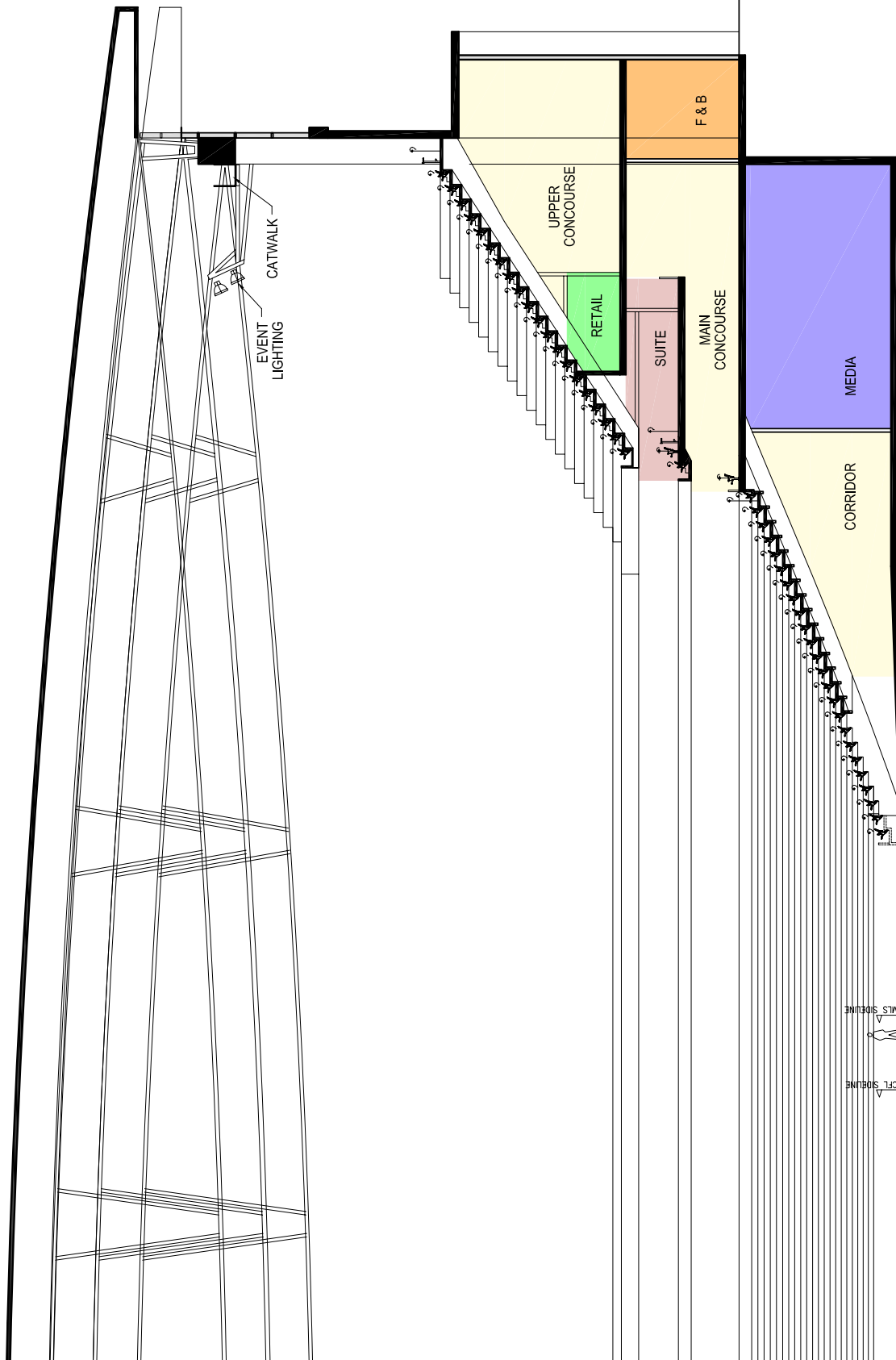
FEBRUARY 2010

DWG. #
9.3

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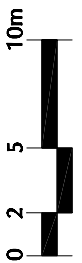


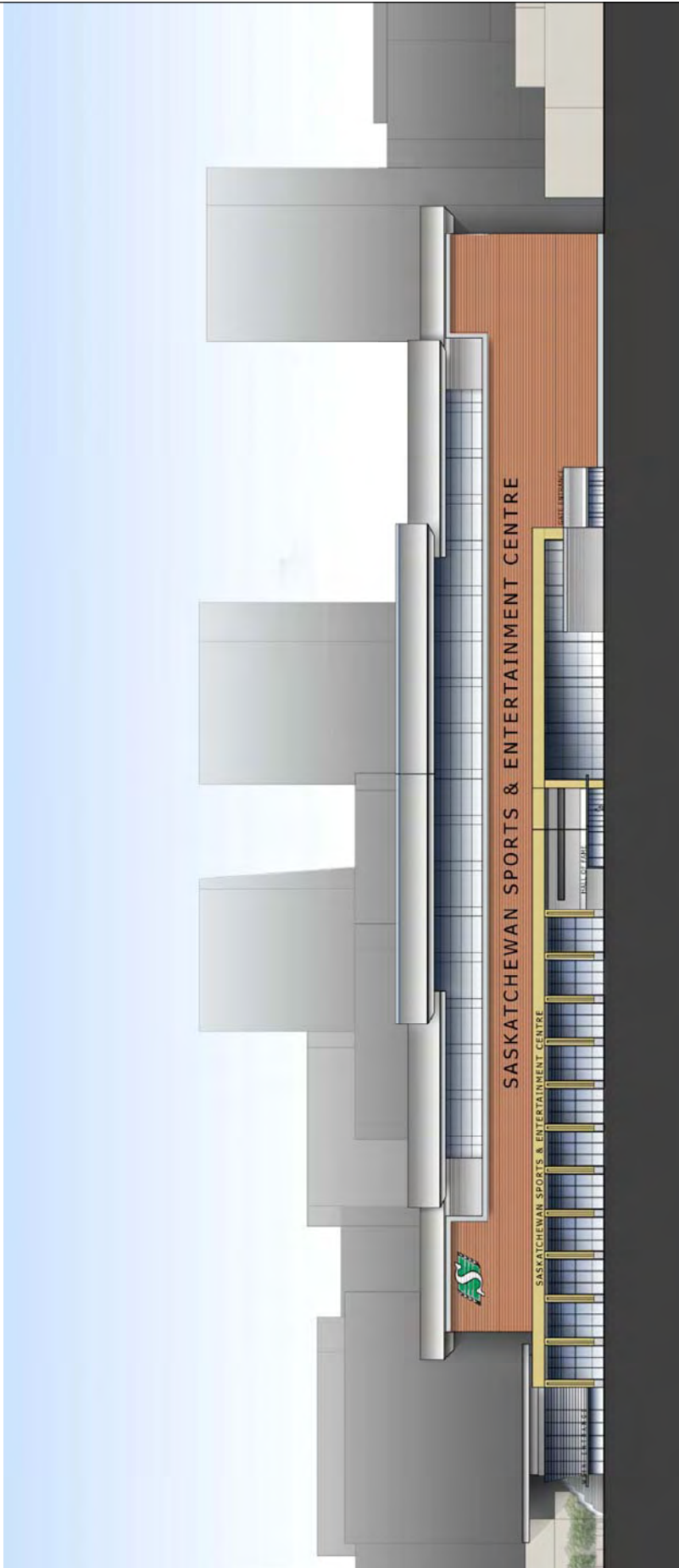
SECTION - SOUTH END
 SCALE: AS NOTED
 FEBRUARY 2010

DWG. #
 9.4

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NORTH ELEVATION

SCALE: AS NOTED

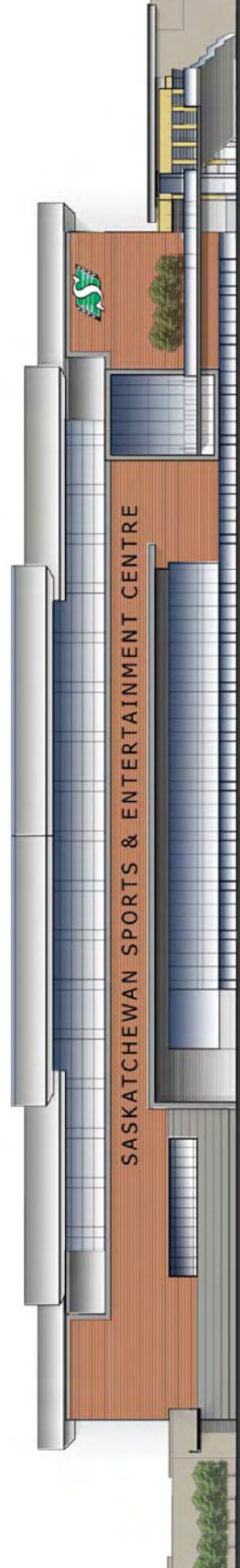
FEBRUARY 2010

DWC. #
10.0

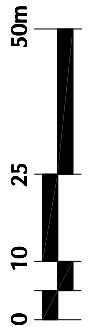
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SASKATCHEWAN SPORTS & ENTERTAINMENT CENTRE



SOUTH ELEVATION

SCALE: AS NOTED

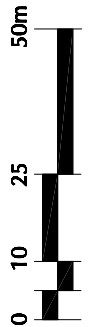
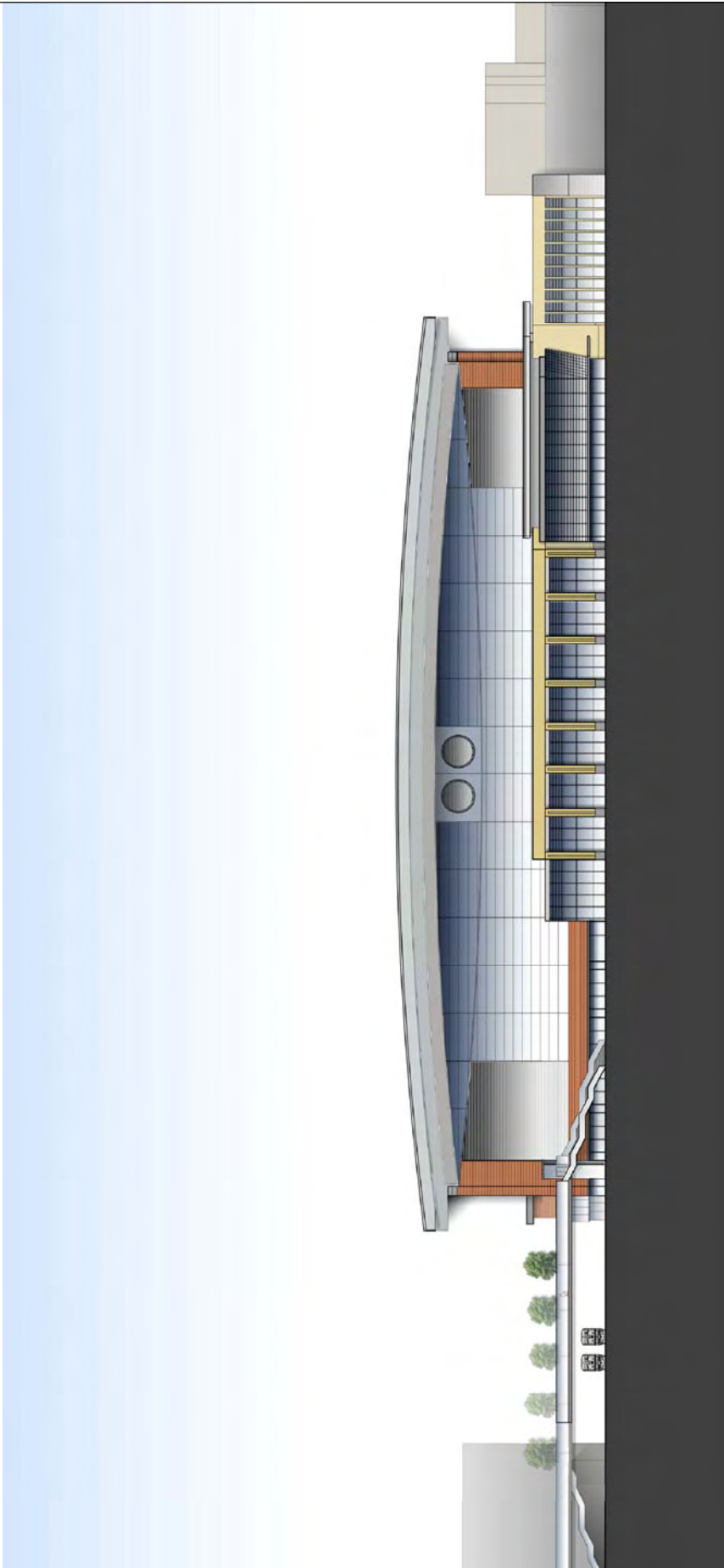
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DWC. #
10.1

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EAST ELEVATION

SCALE: AS NOTED

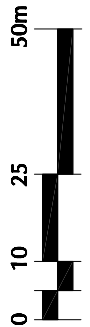
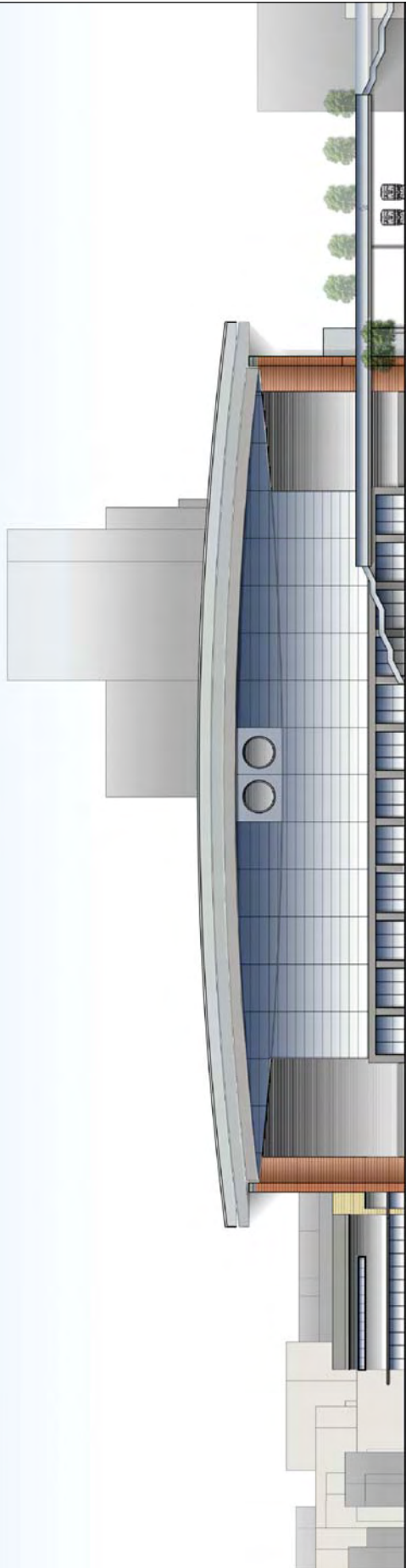
FEBRUARY 2010

DWG. #
10.2

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WEST ELEVATION

SCALE: AS NOTED

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DWC. #
10.3

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NORTH EAST CORNER

SCALE: N.T.S.

FEBRUARY 2010

DWG. #
11.0

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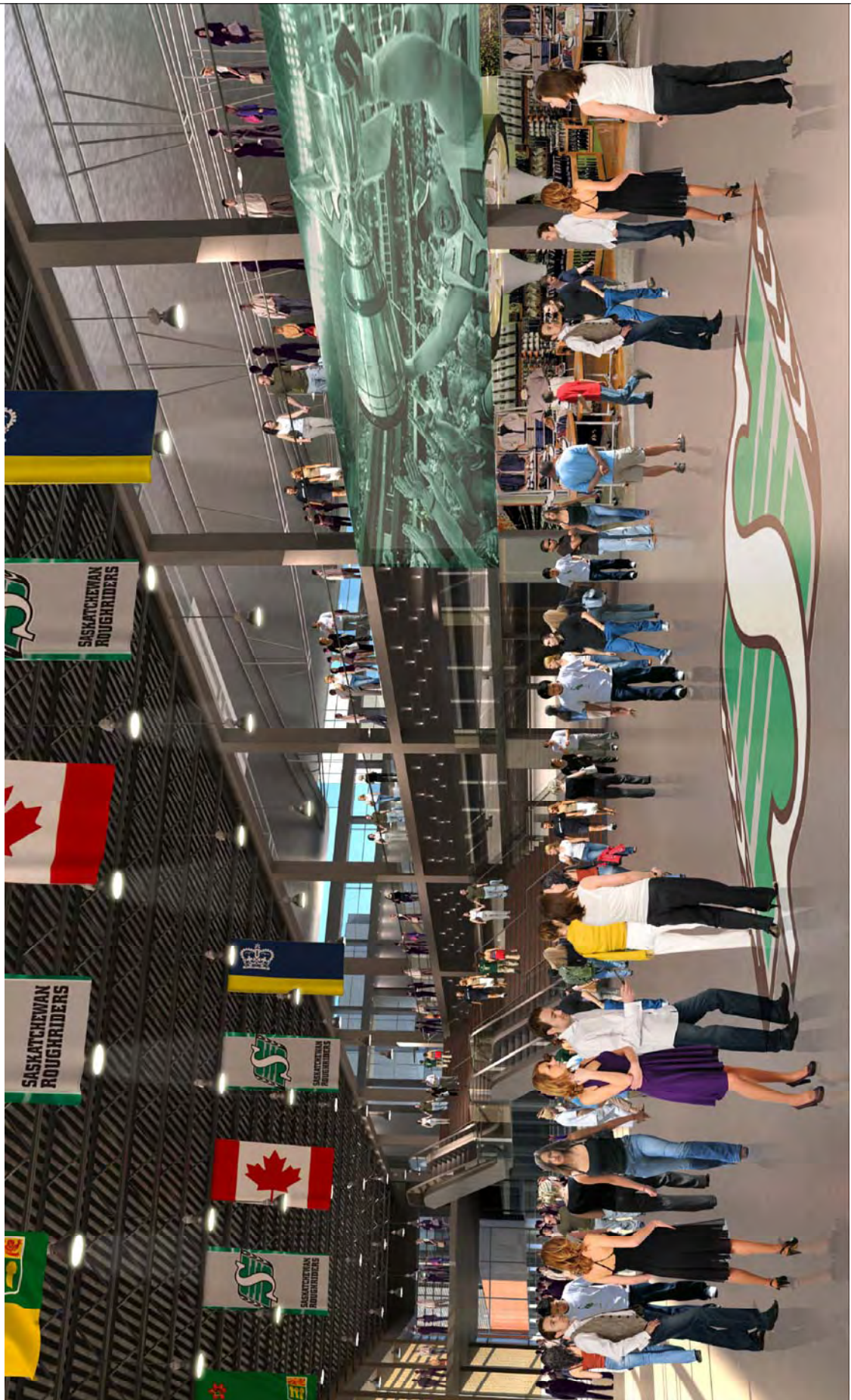
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SOUTH EAST CORNER
 SCALE: N.T.S.
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DWG. #
11.1

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INTERIOR CONCOURSE

SCALE: N.T.S.
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DWG. #
11.2

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INTERIOR CONCOURSE

SCALE: N.T.S.

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11.3

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NORTH-EAST CORNER

SCALE: N.T.S.

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11.4

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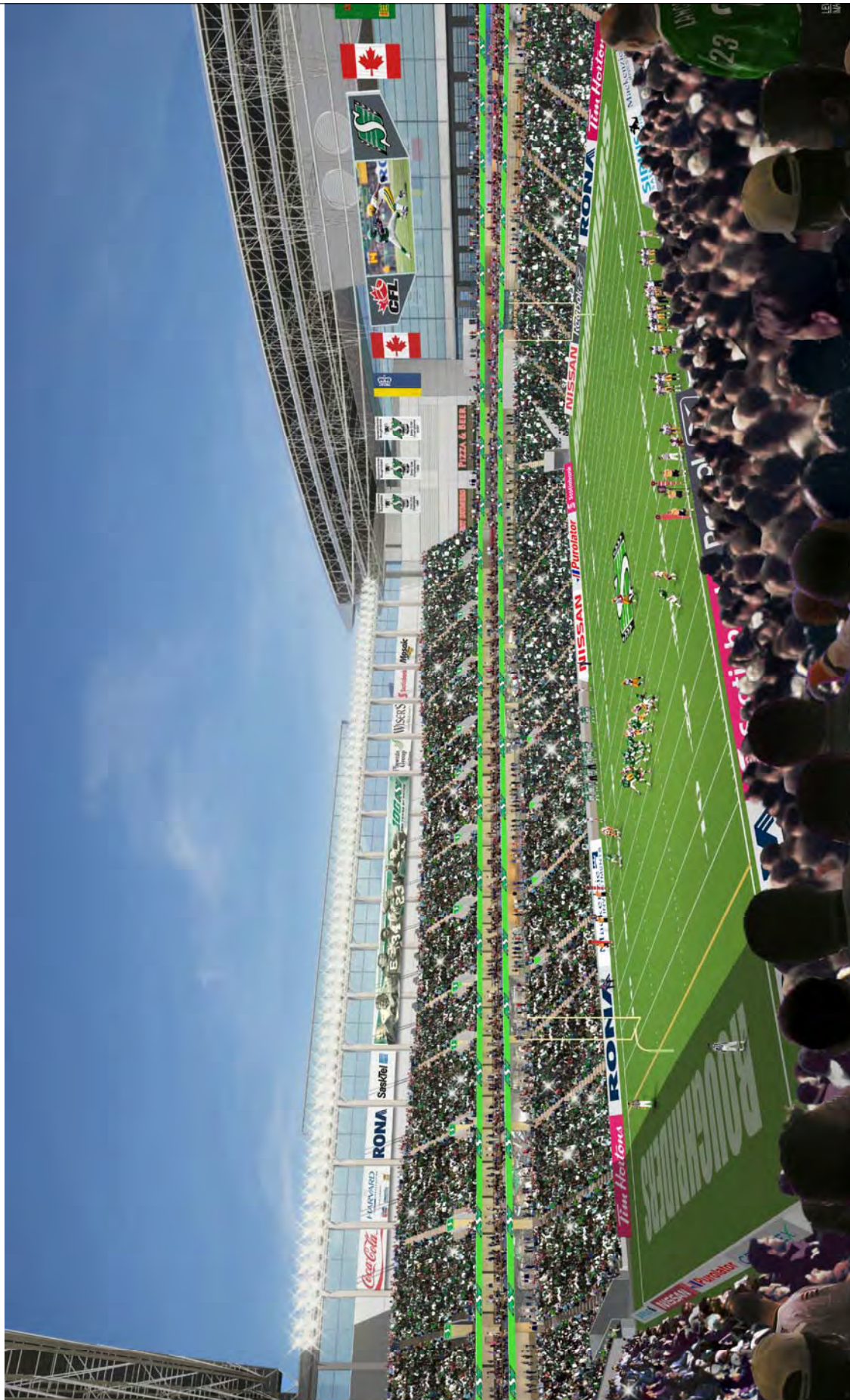
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SOUTH-EAST CORNER
 SCALE: N.T.S.
 FEBRUARY 2010

DWG. #
11.5

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FOOTBALL EVENT

SCALE: N.T.S.

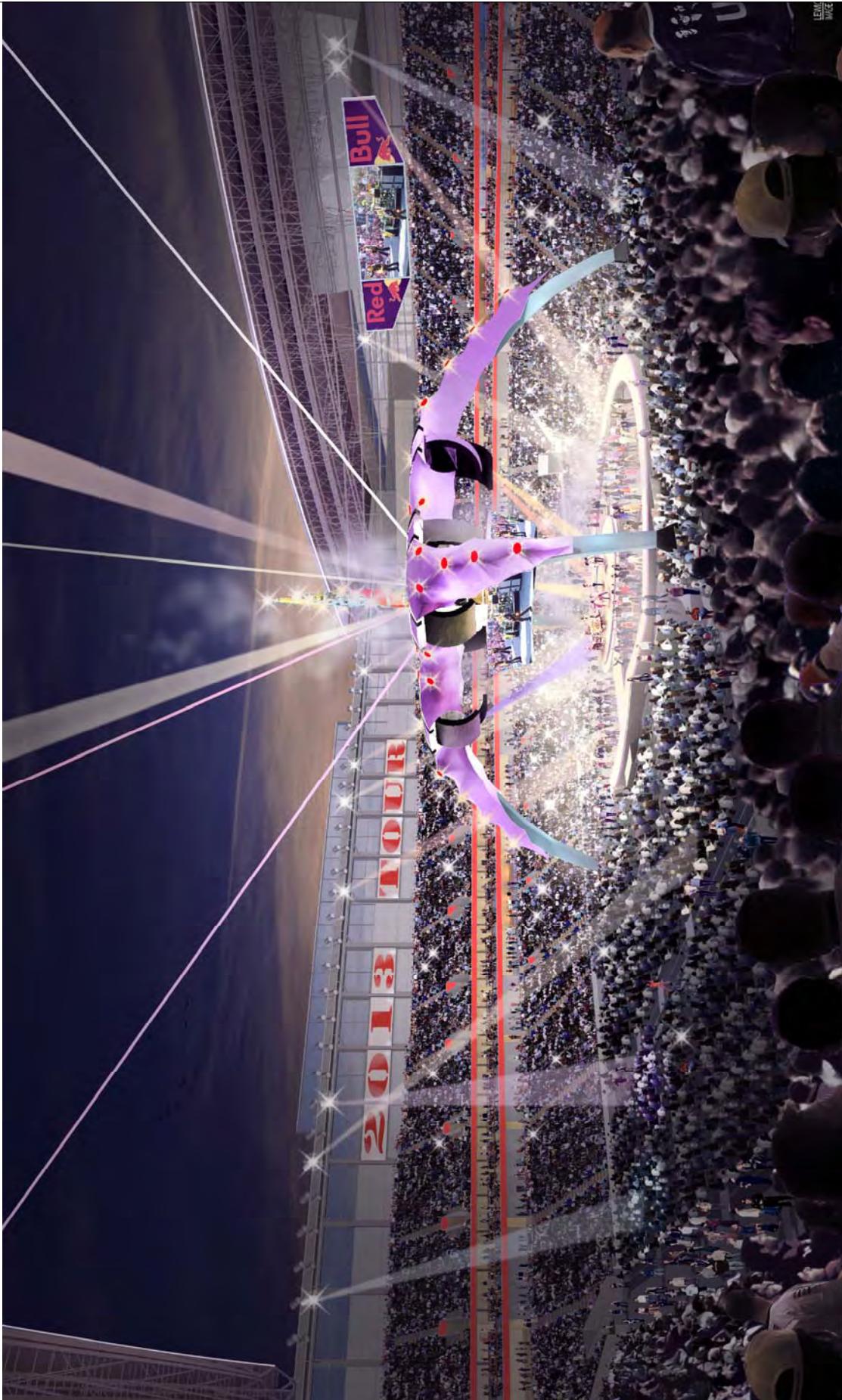
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DWG. #
11.6

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CONCERT EVENT

SCALE: N.T.S.

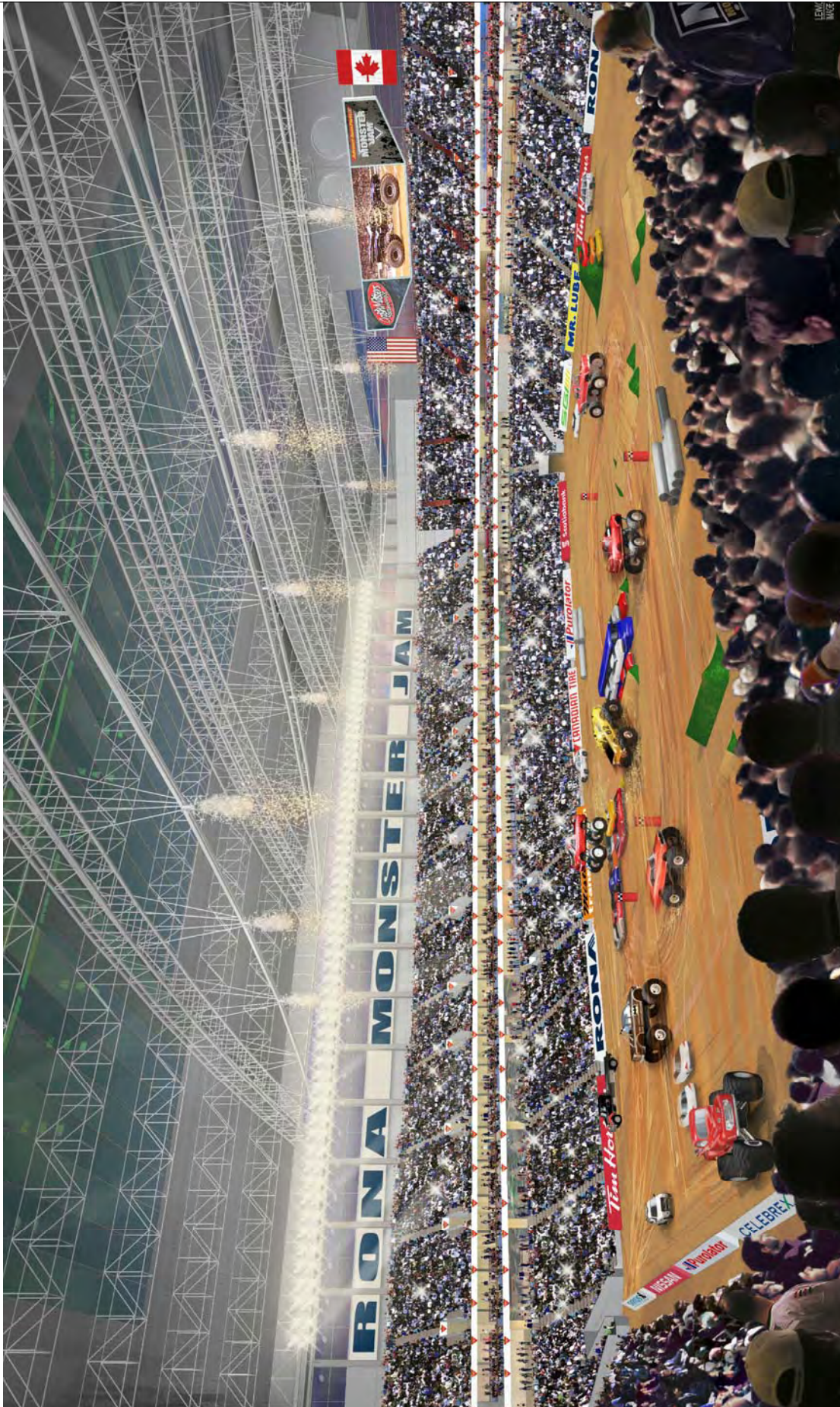
FEBRUARY 2010

DWG. #
11.7

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MONSTER TRUCK EVENT

SCALE: N.T.S.

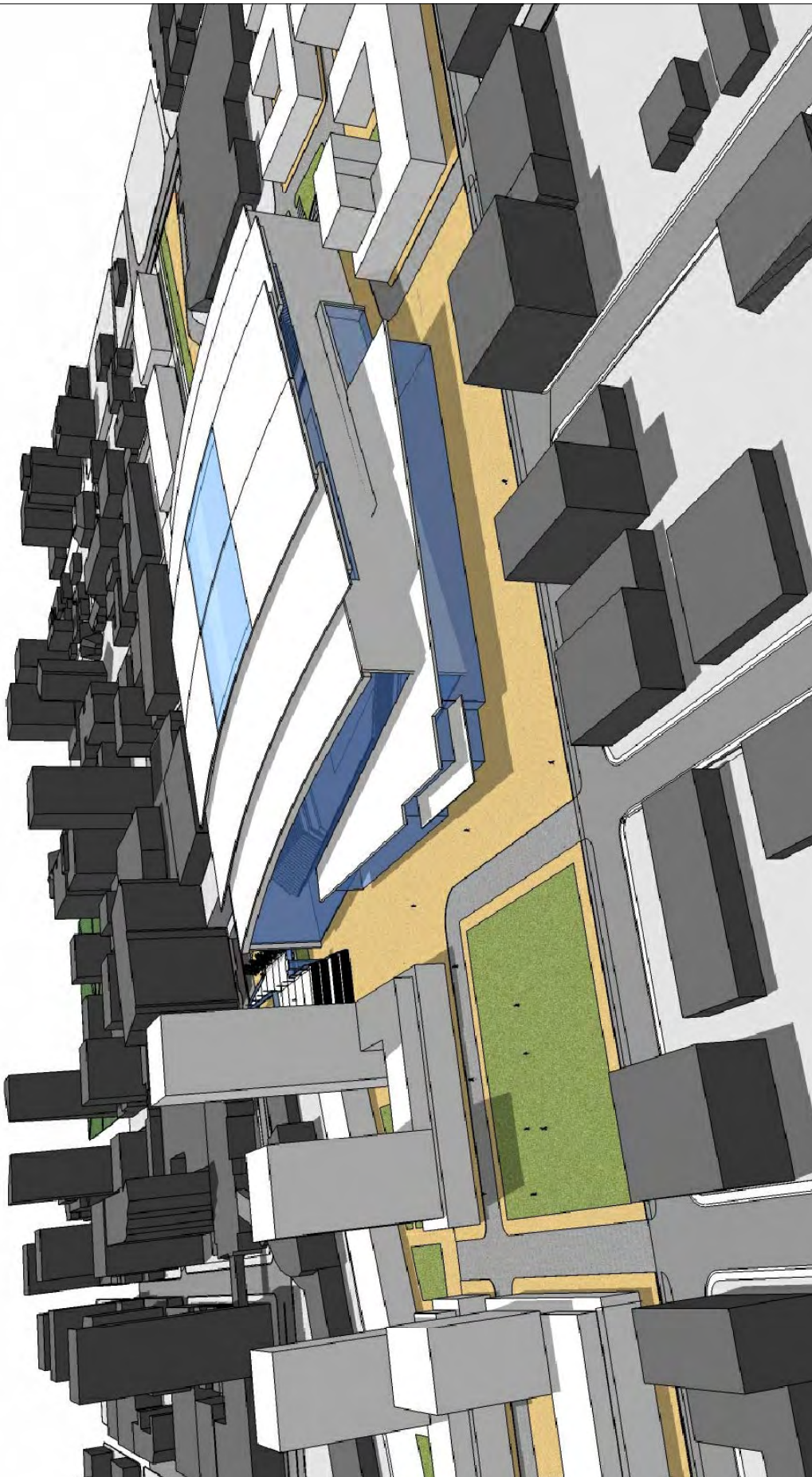
FEBRUARY 2010

DWG. #
11.8

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NORTH-EAST AERIAL VIEW

SCALE: N.T.S.

FEBRUARY 2010

DWG. #
11.9

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SOUTH-EAST AERIAL VIEW

SCALE: N.T.S.

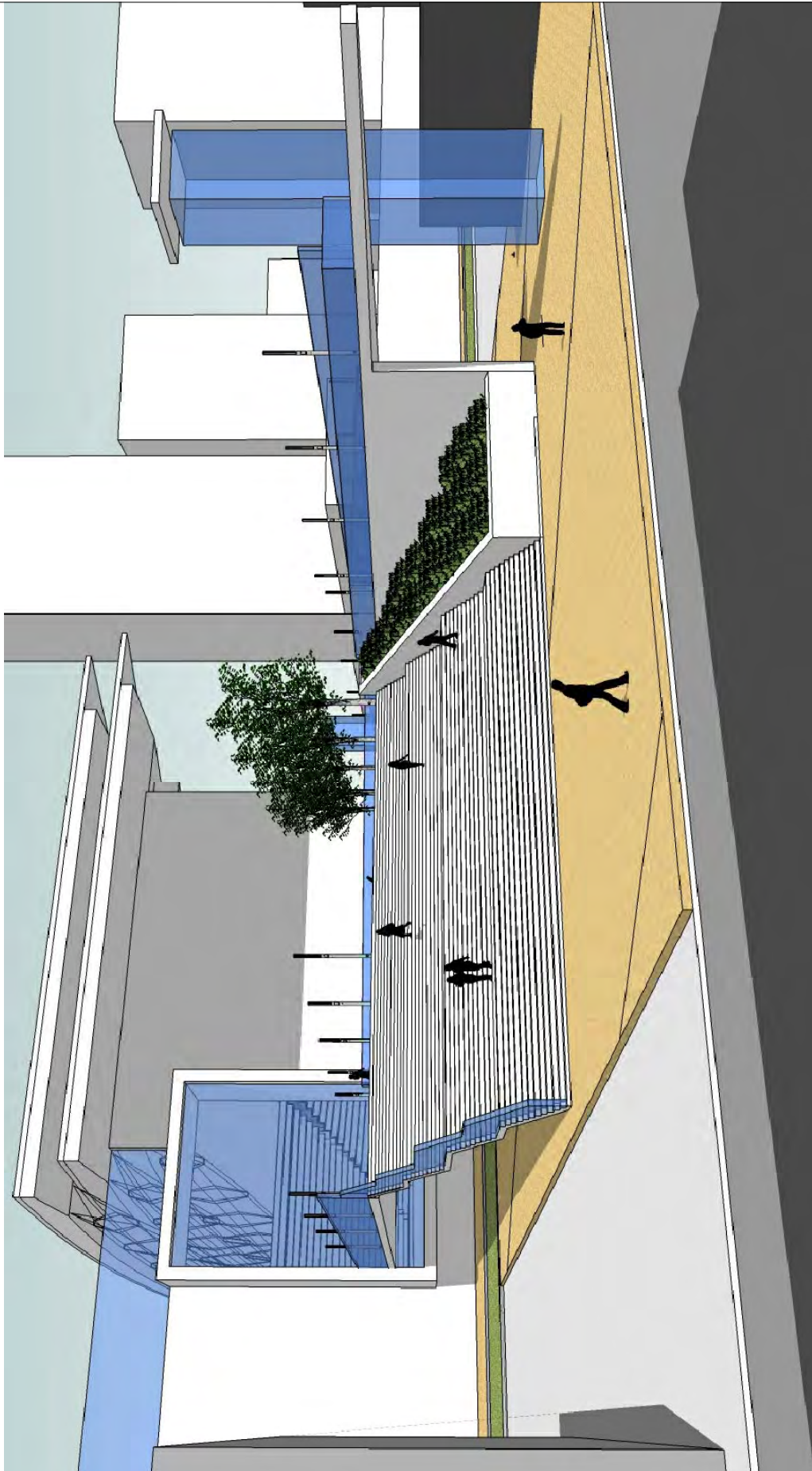
FEBRUARY 2010

DWG. #
11.10

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SOUTH ENTRANCE VIEW

SCALE: N.T.S.

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DWG. #
11.11

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4.3 TECHNICAL INFORMATION

PART 1: SEATING AREAS

1.1 Seating Area	Subtotal		
1.1.1	Seating: The Spectator Viewing Capacity("SVC")(plus or minus 2%) includes all seats and designated standing positions including General Seating; Club Seating; Suite Seating; Accessible Seating (and attendant seating); Hospitality, Group Sales and Corporate Sponsor Suites; Loges; Media seating 1st row of seating approximately 1.5m (5') above playing field		
1.1.2	Sightline Criteria: Each spectator shall have a clear view of the playing surface above the spectators in the 2nd preceding row. Sightlines along the sides of the facility shall be taken to the field surface, assuming a FIFA-regulation field width of 68m. Sightlines along the goal lines shall be taken to a height of 1m above the playing surface at the back of the CFL endzone.		
1.1.3	Upper Bowl - General Seating & Standing Positions	11,700	Minimum Chair Width: 19" (bench with backs) Minimum tread depth: 840mm (33") Maximum number of seats between aisles: 24 (28 at last row in corners)
1.1.4	Lower Bowl - General Seating & Standing Positions	17,260	Minimum Chair Width: 19" (individual seats with backs) Minimum tread depth: 840mm (33") Maximum number of seats between aisles: 24 (28 at last row in corners)
1.1.5	Club - Seating & Standing Positions	1,960	Minimum Chair Width: 20" (individual seats with backs) Minimum tread depth: 840mm Maximum number of seats between aisles: 24
	Accessible Seating - All seating levels	310	Minimum requirement per National Building Code: 90 Recommended: 1% of total seating for Wheelchairs and companions
1.1.6	Private Suites - Seating & Standing Positions	720	Minimum Chair Width: 22" (padded seat and back)
1.1.7	Group Sales Suites - Seating & Standing Positions	270	Minimum Chair Width: 20" (padded seat and back) Standing Room positions included in overall SVC.
1.1.8	Media & Coaches	255	Minimum tread depth: 1600mm
1.1.9	Restaurant - Seating & Standing Positions	525	
1.2	Total Spectator Viewing Capacity- Field Events	33,000	-
1.2.1	SVC on-field	12,000	Approx. 0.6m ² per person (sitting)
1.2.2	SVC Concerts	45,000	
1.3	Roof		
1.3.1	All seating areas to be covered, with potential for retractable roof over playing field area.		
1.4	Additional Seating		
1.4.1	Design capability to later expand in the corners and behind both goals to up to approximately 45,000 seats		

PART 2: PUBLIC AREAS

Stadium Areas	Subtotal (m2)	Totals (m2)	Area (ft2)	Remarks
2.1 Suites		2,300		Calc. excludes seating area
2.1.1 Suites	1,400		15,064	All suites to accommodate built-in counter/buffet, fridge, sink, storage, flat-screen TV., stereo, tel/data
2.1.2 Group Sales Suites	900		9,684	Same amenities as Suites, described above
2.2 Concourses/Entrances		16,400		
2.2.1				Building to have 4 major general spectator entrances, 2 vip club seat / private Suite Entrances. Spectator Entrances to provide convenient, direct access to seating, washrooms, and concessions; Minimum area indicated. A larger concourse may be required based on exit width, stacking at concessions, etc.
2.2.2 General Concourse	15,220		163,552	0.52m2 (5.5 sf.) per person general concourse
2.2.3 Club Concourse	1,372		12,912	0.7m2 (7.5 sf.) per person general concourse
2.3 Washrooms		3,777		
2.3.1				Fixture counts based on 50% and 50% female occupants in the building. If possible, change-over flexibility of male / female washrooms to be provided (i.e. washrooms with all WC's) to be incorporated to a maximum of 20% of total required fixtures; men's fixtures shall be 75% urinals. Fixture ratio of 1:70 for 33,000 spectator capacity in general concourses; will meet NBC requirements for 45,000 spectator capacity event.
2.3.2 General Concourse	2,140		29,601	214 men's @ 1/70 (56 sinks), 214 women's @ 1/70 (111 sinks)
2.3.3 Suite Level	200		2,152	20 men's @ 1/35 (7 sinks), 20 women's @ 1/35 (8 sinks)
2.3.4 Club Concourse	70		1,463	7 men's @ 1/50 (2 sinks), 7 women's @ 1/50 (2 sinks)
2.3.5 Family Washrooms	40		430	Evenly distributed throughout concourses
2.3.6 Event Level	650		6,994	35 men's per code (18 lav), 70 women's per code (35 lav)
2.4 Concessions		2,604		
2.4.1				Concessions shall be provided, evenly distributed throughout the facility at a ratio of 1 fixed point of sale (p.o.s.) per 200 spectators Exhaust Hoods and ductwork shall be provided for corner concession spaces only. Adequately sized sanitary lines, water, gas, and electric service will be provided at each concession space. Refer to mechanical and electrical performance specifications for further details.
2.4.2 General Concourse	1,390		20,810	Even distribution throughout the facility; current plans allow for 1:200 ratio for 45,000 spectator event.
2.4.2 Event Level	570		6,133	
2.4.4 Hawkers' Rooms	100		1,076	Even distribution throughout the facility
2.5 Stadium Retail		592		
2.5.1 Retail Kiosks at Each concourse	72		775	Even distribution throughout the facility
2.5.2 Retail Store	430		4,627	Flagship Rider Store - Street level access and high profile location <i>Refer to detailed Saskatchewan Roughriders Football Club (SRFC) Program, attached</i>
2.5.3 Jersey Store	-		968	Onsite Production of Custom Jerseys - likely connected to Rider Store
2.6 Ancillary Development		465		
2.6.1 Roughrider Hall of Fame	450		5,003	Destination facility - <i>Refer to detailed Saskatchewan Roughriders Football Club (SRFC) Program, attached</i>

PART 3: SERVICE AREAS

Stadium Areas	Totals (m2)	Area (ft2)	Remarks	
3.1 Media	1,560			
3.1.1	Event level Media facilities shall be clustered as much as possible to minimize circulation space and wiring infrastructure.			
3.1.2	Radio Broadcast Booths	30	323	Space for 4 each booth; each booth to be equipped with cue light, which is activated by the timekeeper when commercial breaks can occur
3.1.3	Television Broadcast Booth	90	968	Space for television broadcast crew of 8 - 10 persons
3.1.4	Written Press Box (1 Room - 75 occupants)	145	1,560	75 viewing positions with desk, power, and tel/data connection
3.1.5	Washrooms	30	323	At Media Level and Event Level
3.1.6	Servery - Upper Level	30	323	At Media Level and Event Level
3.1.7	Flash Interview/Mixed Zone	75	807	Adjacent to field access doorway - Event Level
3.1.8	Press Conference Room (1 Room - 100 occupants)	170	1,829	Dias at one end of room; sound system, seating for 100; will also serve as Meeting Room; Movable walls to allow more Media workroom space
3.1.9	Media Workrooms (1 Room - 30 occupants)	75	807	Will also serve as Meeting Room
3.1.10	Patch Room	115	1,237	Adjacent to media truck parking
3.1.11	Studio/Multipurpose Rms	75	807	Moveable partition walls; large room to also serve as Meeting Room (4m height required for lighting and equipment)
3.1.12	TV Production	120	1,291	
3.1.13	AV Control Booth	115	1,237	Space to accommodate PA announcer, sound system operator, game operations director, Videoboard operator
3.1.14	Media Trucks (2)	490	5,272	2 permanent spaces with bulkhead, 2 alternate spaces w/ conduit
3.2 Food & Beverage	1,410			
3.2.1	Central Storage	1,045	11,244	Event Level to include office space for Food & Beverage Operations.
3.2.2	Pantries	240	2,582	Suite Level
3.2.3	Break Rooms	40	430	Event Level and Concourse Level
3.2.4	Staff Change Rooms	85	915	Event Level
3.3 Operations/Event Staff and Ticketing	1,035			
3.3.1	Security/Building Control	220	2,367	
3.3.2	Ticket Offices	290	3,120	20 windows, incl. offices, WR, staff area, vault room & storage
3.3.3	Event Staff Change Rooms	160	1,722	Gender separated change rooms
3.3.4	Uniform Laundry/Storage	150	1,614	shared by all building users; infrastructure for six (6) commercial washers and six (6) commercial dryers
3.3.5	Staff Break Rooms	50	538	
3.3.6	Police Office	60	646	
3.3.7	Janitor Closets	80	861	Each Level; even distribution throughout facility
3.3.8	First Aid (1x25)	25	269	Easy access to emergency vehicles; WC, sink, storage area

3.4 Offices		1,295		
3.4.1	Lobby	100	1,076	Shared by all offices, including meeting rooms, reception area, servery, and washrooms. Included in Staff Area at Event Level.
3.4.2	Building Management	235	2,529	Included in Staff Area at Event Level.
3.4.3	Football Team	960	10,330	<i>Refer to detailed Saskatchewan Roughriders Football Club (SRFC) Office Program, attached</i>
3.5 Loading/Maintenance/Storage		7,510		
3.5.1	A minimum of 2 loading docks with dock levelers, and 1 stationary loading dock is recommended. Access for team buses, emergency vehicles, and truck with trailer for concert setup required at Event Level			
3.5.2	Loading/Marshalling Area	970	10,437	2 loading docks with dock levelers; space should be designed to allow trucks to drive directly onto event surface
3.5.3	Garbage Rooms	50	538	Each Level; provide a minimum of two (2) trash chutes 1 to 1.05 m (40-42") in diameter from facility concourses to level of garbage storage
3.5.4	Receiving/Holding	50	538	Adjacent to loading dock
3.5.5	Compactor/Recycling	255	2,744	Exterior access required for waste pick-up
3.5.6	Field Maintenance Room	400	4,304	
3.5.7	Workshops	185	1,991	
3.5.8	Storage	400	4,304	
3.5.9	Event level circulation	3,750	40,350	24'-0" wide corridor
3.5.10	Loading	1,450	15,602	
3.6 Vertical Circulation		4,330		
3.6.1	Service Elevators (1) x 4,500 lb. (1) x 15,000 lb.	90	968	.25m/s (50 fpm), refer to Performance Specifications for additional information
3.6.2	Passenger Elevators (4x2500lb.)	180	1,937	.5m/s (100fpm), refer to Performance Specifications for additional information
3.6.3	Stairs	4,060	43,686	Allowance for space to meet code
3.7 Mechanical/Electrical		3,430		
3.7.1	Main Electrical Room	350	3,766	
3.7.2	Electrical/Comm. Rooms	100	1,076	
3.7.3	Communications Entrance	30	323	1@20, 1@15
3.7.4	Comm. Equipment Room	30	323	
3.7.5	Water Meter/Fire Pump	35	377	5x7m
3.7.6	Mechanical Room (Air)	2,700	29,052	3x 60 at event level, 2 x 30 at suite level
3.7.7	Steam/Hot Water Room	35	377	7x10 m
3.7.8	Gas Meter		-	Included in loading area
3.7.9	Cooling Tower	150	1,614	8x8m yard or rooftop

3.8	CFL Officials / Game Operations	185		
3.8.1	Home & Visiting Team Coaches ("Spotters") Booths	50	538	at Media Level; minimum of 2 coaches per booth; infrastructure for headsets to connect to team bench phones; TV in each booth.
3.8.2	CFL Officiating Supervisors Booth	20	215	Space for 3 persons; privacy from remainder of press box; infrastructure for TV, direct telephone connection to off-field officials' booth and timekeeping bench at field level.
3.8.3	CFL Instant Replay Booth	15	161	Space for 3 persons; privacy from remainder of press box; infrastructure for 2 TV monitors; direct telephone connection to timekeeping bench at field level
3.8.4	CFL Off-Field Officials Booth	15	161	Space for 3 persons - timekeeper, scorer, 20-second clock operator; direct telephone connection to off-field officials' booth and timekeeping bench at field level.
3.8.5	CFL Statisticians Area	30	323	Space for 7 persons; infrastructure (power and data connections) to a minimum of 3 laptop computers
3.8.6	CFL / Club Video Coordinator	10	108	Space to shoot high-quality game footage; ideally located at centre field with sightlines to entire field
3.8.7	Visiting Team VIP Suite	45	484	Private location large enough to accommodate a minimum of 4 visiting club executives / VIPs

PART 4: TEAM AND PERFORMER AREAS

Stadium Areas	Subtotal (m2)	Totals (m2)	Area (ft2)	Remarks
4.1 Visiting Team Facilities		1,645		
4.1.1	Team Locker Room Facilities shall be located on the same side of the stadium as the Media box to allow direct vertical access. Visiting CFL Locker Room divides to (2) "standard" locker rooms, allowing total of (4) "standard" locker rooms for tournaments such as soccer, lacrosse, etc.			
4.1.2	Standard Dressing Rooms - Multi-Purpose for cheerleaders, community use, etc.	800	8,608	FIFA compliant dressing rooms for 30 people each with two of them finished at a generally higher level than the other two. (The latter two should be designed so that they can be further split into 2 dressing rooms each of 15 people for indoor soccer winter usage.) Each room shall include: 3 Massage Tables; adjacent to dressing space; 10 showers, 5 sinks, 1 foot-basin, 1 sink for cleaning boots, 3 WCs, 3 urinals, 2 hair dryers; Coaches' office / Dressing Room with WC, sink, and shower
4.1.3	Visiting CFL Team Dressing Room	600	6,456	Dressing room divisible into 2 separate areas with 25 lockers each; each area to include 8 showers, 3 lav, 3 WCs, 3 urinals; trainers' room to be included; space for seven (7) team coaches, and training room for six (6) taping tables
4.1.5	Medical Examination Room	25	269	To FIFA standards; to accommodate exam table, 2 stretchers. Shower, sink and WC shall be provided
4.1.6	Referee/Star Dressing	120	1,291	Lockers and seating for 18, to accommodate table, massage table, refrigerator, white board, tele/data connection; entrance to field separate from player entrance
4.1.7	Referee/Star Dressing	50	538	Lockers and seating for 4, to accommodate table, massage table, refrigerator, white board, tele/data connection; additional room required for gender separation
4.1.8	Chain / Stick Crew	50	538	Lockers and seating for 4
4.2 HomeTeam Facilities		3,300		
4.2.1	Team Locker Room Facilities shall be located on the same side of the stadium as the Media box to allow direct vertical access.			
4.2.2	CFL Team	3,300	35,508	for 52 players; incl. 12 showers, 5 lav, 3 WC, 5 urinals; Trainers Area with hot and cold therapy tubs; equipment Managers' area - <i>Refer to detailed Saskatchewan Roughriders Football Club Program, attached</i>
4.2.5	Strength & Conditioning Area	-	-	incl. 120 s.f. Office, 120 s.f. Counseling and Assessment Room - shared by Home Teams
4.2.6	Exercise Room Storage	-	-	adjacent to exercise room
4.2.7	Equipment Storage Rooms	-	-	
Subtotal			51,838	
Gross up factor (15%)			7,776	
TOTAL		59,614	557,777	does not include seating areas or field surface

PART 5: ATHLETIC SURFACES**5.1 Playing Field**

5.1.1		Artificial turf playing surface with permanent CFL lines stitched in, for a playing field of 65 x 110 yards plus 20 yard endzone at each end.
5.1.2		Extent of artificial turf will be allow FIFA compliant field of 68 meters x 105 meters, with additional turf apron of 5 meters which thus has a total surface width of 78 meters. Playing Surface is flat (no crown).
5.1.3		Field level access required for emergency vehicles and semi-trailers for concert setup. Minimum height of 5m
5.1.4		Provide power for lighting and electrical to meet CFL football broadcast requirements
5.1.4		Provide 9m (30') grid of recessed utility boxes at event floor for data and power for convention and trade-show occupancies; utility boxes shall be watertight

5.2 Lighting, Video / Scoreboard, and Sound System

5.2.1		Lighting and sound system to provide coverage in full compliance with CFL, FIFA, and MLS regulations
5.2.2	Lighting	1,000 lux for National and International Competition
5.2.3	Sound System	85 - 95 dB loudness; even distribution throughout seating bowl
5.2.4	Scoreboard	located at one end of stadium; appropriate size text and video for viewing distances

SASKATCHEWAN MULTI-USE FACILITY

SASKATCHEWAN ROUGHRIDERS FOOTBALL CLUB - BUILDING PROGRAM

SCI Stadium Consultants International

FEBRUARY 2010

SASKATCHEWAN ROUGHRIDERS FOOTBALL CLUB OFFICES

	Stadium Area	Area (sf)	Subtotals (sf)	Area (m2)	Subtotals (m2)	Remarks
1	Executive		700		65	
1.1	Office - CEO/President	200		19		
1.2	Office - Executive Asst.	150		14		
1.3	Office - Player Career Devprmt	150		14		
1.4	Meeting Room	200		19		Seating for 8
2	Sales and Marketing		1,690		157	
2.1	Office - VP	180		17		
2.2	Office - Director of Retail Sales	150		14		
2.3	Office - Accounting - retail	120		11		
2.4	Office - Accounting Rep/ Group Sales	150		14		
2.5	Office - Corporate Partnerships/ Game Day	150		14		
2.6	Office - Community Relations/ Events Coord	150		14		
2.7	Office - Marketing Admin Services	120		11		
2.8	Office - Manager Facility and Stadium Ops	150		14		
2.9	Office - spare	120		11		
2.10	Meeting Room	200		19		Seating for 8
2.11	Storage	200		19		
3	Financial Service/ Human Resources		1,020		95	
3.1	Office - CFO	180		17		
3.2	Office - Finanacial Analyst	150		14		
3.3	Office - Manager Finance	150		14		
3.4	Office - HR Administrator	120		11		
3.5	Office - Accountant	120		11		
3.6	Meeting Room	150		14		Seating for 6
3.7	Storage	150		14		
4	Communications / Media Relations		1,390		129	
4.1	Office - Director of Communications	180		17		
4.2	Office - Communications Coordinator	150		14		
4.3	Office - Communications Assistant	120		11		
4.4	Office - Customer Service Representative	120		11		
4.5	Office - Season Ticket Agent	120		11		
4.6	Meeting Room	250		23		
4.7	Media assembly/ briefing area	250		23		Adjoining Meeting Room. NOTE: Can this be accommodated within the Roughriders Media area?
4.8	Storage	200		19		
5	General/ Common Areas		1,900		177	
5.1	Reception / Waiting	500		46		
5.1	Large Meeting Room	300		28		
5.1	Small Meeting Room	180		17		
5.1	General Storage	200		19		
5.1	Staff Coffee / Lunch Area	200		19		
5.1	janitor / Service	120		11		
5.1	Washrooms	400		37		To be verified
	Subtotal		6,700		623	
	Grossing Factor (50%)		3,350		311	
	TOTAL AREA		10,050		934	

SASKATCHEWAN MULTI-USE FACILITY

SASKATCHEWAN ROUGHRIDERS FOOTBALL CLUB - BUILDING PROGRAM

SCI Stadium Consultants International

FEBRUARY 2010

SASKATCHEWAN ROUGHRIDERS FOOTBALL CLUB - TEAM SPACES

Stadium Area	Area (sf)	Subtotals (sf)	Area (m2)	Subtotals (m2)	Remarks
A Football Operations		1,180		110	
a.1 Office - VP Football Ops/General Manager	200		19		
a.2 Office - Director Football Admin	180		17		
a.3 Office - Director Player Personnel	180		17		
a.4 Office - Exec Asst Football Ops	120		11		
a.5 Meeting Room	150		14		
a.6 Storage Room	150		14		
a.7 Washrooms	200		19		
B Coaching Staff		1,930		179	
b.1 Head Coach	200		19		
b.2 Offensive Coordinator	180		17		
b.3 Defensive Coordinator	180		17		
b.4 Assistant Coaches (7 @150)	1,050		98		
b.5 Meeting Room	200		19		Room for 10
b.6 Copier / Supply Room	120		11		
C Equipment/Video/Support		4,030		375	
c.1 Office - Equipment Manager	180		17		
c.2 Office - Equipment Assistant	120		11		
c.3 Equipment Workroom	300		28		
c.4 Equipment Storage	1,500		139		
c.5 Laundry Process	650		60		
c.6 Office - Manager Video Systems	180		17		
c.7 Workstation - Video Assistant (2 @100sf)	200		19		
c.8 Video Production area/ Processing	300		28		
c.9 Video Catalogue / Storage	300		28		
c.10 Video Equipment Storage	300		28		
D Team Areas		12,450		1,157	
d.1 Player Locker Room	3,200		297		
d.2 Coaches Locker Room	800		74		
d.3 Player Shower / WR / Grooming	1,750		163		
d.4 Steam / Sauna	500		46		
d.5 Coaches Shower / WR / Grooming	300		28		
d.6 Media Interview / Flim Room	1,000		93		
d.7 Team Meeting - Offense	500		46		
d.8 Team Meeting - Defense	500		46		
d.9 Classrooms (3 @300 s.f.)	900		84		Seating for 15 each room
d.10 Player & Family Lounge	1,800		167		
d.11 Washrooms / Family Change Room	400		37		
d.12 Kitchen	400		37		Seating for 15 each room
d.13 Storage	400		37		
E Medical & Therapy		2,690		250	
e.1 Office - Team Doctor	200		19		
e.2 Office - Athletic Therapist	200		19		
e.3 Office - Asst Athletic Therapist	150		14		
e.4 Exam Room (2 @ 120 sf)	240		22		
e.5 Training Room	1,500		139		
e.6 Hydrotherapy	400		37		
F Training and Fitness		7,400		688	
f.1 Weight Room / Training Centre	5,400		502		
f.2 Player Lounge	1,000		93		
f.3 Nourishment	500		46		
f.4 Storage	500		46		
Subtotal		29,680		2,758	
Gross-up Factor (15%)		4,452		414	
TOTAL AREA		34,132		3,172	

SASKATCHEWAN ROUGHRIDERS - PUBLIC AREAS

	Stadium Area	Area (sf)	Subtotals (sf)	Area (m2)	Subtotals (m2)	Remarks
6	Retail Store		4,630		430	
6.1	Retail Sales Area	3,000		279		
6.2	Sales Counter	300		28		
6.3	Storage	800		74		
6.4	Office - Store Mgr.	180		17		
6.5	Office - Store Supervisor	150		14		
6.6	Staff Area / Coffee	200		19		
7	Roughrider Hall of Fame		5,000		465	
7.1	Exhibit and Display Area	3,000		279		
7.2	Theatre (video presentation)	1,500		139		
7.3	Storage and workshop	500		46		

SASKATCHEWAN MULTI-USE FACILITY

Regina, Saskatchewan

OUTLINE SPECIFICATIONS

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ARCHITECTURAL PERFORMANCE SPECIFICATIONS

01010 1. GENERAL REQUIREMENTS

- 1.1. Work shall be fabricated and installed in accordance with the best practice by craftsmen skilled in the work of the respective trades.
- 1.2. Perform work in conformity with all by-laws and regulations of the municipality, province or other authorities having jurisdiction.
- 1.3. References to standards and specifications shall be to latest published editions.
- 1.4. The building shall be designed in accordance with the National Building Code, NFPA 101 Life Safety Code (where applicable) and local bylaws and regulations.
- 1.5. The manufacturer's latest printed instructions shall be complied with in the methods and materials to be used in the installation of the work.
- 1.6. Observe and enforce all construction safety measures, as contained in Provincial and local statutes and codes, and requirements of authorities having jurisdiction.
- 1.7. Provide all fastenings, anchors and accessories required for the fabrication and erection of the work. Exposed fastenings, when required, shall be of the same texture, colour and finish as the work in which they occur.
- 1.8. In general, anchors in exterior walls shall be non-corrosive
- 1.9. Where a component or assembly is required to be fire rated, the rating shall be as determined or listed by one of the following testing authorities, as appropriate:
 - Underwriters' Laboratories of Canada.
 - Factory Mutual Laboratories
 - The National Building Code of Canada
 - Warnock Hersey International.
- 1.10. Provision shall be made for expansion and contraction due to temperature changes, within components, products and assemblies and between adjacent components, products or assemblies.
- 1.11. A soil investigation will be prepared for the site, and will be available to the Contractor (pending).
- 1.12. The Owner is not responsible for the correctness of the site information or the soils report.
- 1.13. It is the intent of the project to achieve LEED Silver certification, under the LEED Canada-NC Version 1.0 standard (to be provided as a separate price).

01400 2. QUALITY CONTROL

- 2.1. A program of quality control will be instituted for the purpose of maintaining quality and compliance with Contract Documents.
- 2.2. The contractor will be required to do inspection and testing to monitor and confirm that work is in compliance with the specifications and applicable codes.
- 2.3. In addition to inspection and testing required by laws, codes, ordinances and regulations, inspection and testing will be required for the following:
 - Fill and compaction
 - Concrete
 - Structural steel
 - Waterproofing
 - Roofing.
- 2.4. Inspectors required to provide laboratory services shall meet "recommended Requirements for Independent Laboratory Qualification."
- 2.5. Properly prepared shop drawings and samples shall be submitted for review prior to fabrication.

01500 3. TEMPORARY FACILITIES

- 3.1. Protect existing adjacent areas. Provide and maintain proper guard devices, for the prevention of accidents.
- 3.2. Provide temporary facilities necessary for the completion of the work, including water, power, heat, washroom facilities and offices.
- 3.3. Provide formwork, scaffolding, ladders, cranes, derricks, tackle, gangways, planks, fans, screens, gantries, tarpaulins, tools and machinery required for the proper execution of the work.
- 3.4. Maintain access to and ensure that operations of adjacent buildings and properties adjoining the Work are not disrupted.
- 3.5. During construction the site shall be maintained tidy and free from accumulated waste, debris, snow and ice.

01700 4. CONTRACT CLOSEOUT

- 4.1. At completion of project, as-built drawings in digital format AutoCad, maintenance instructions and warranty forms shall be submitted.
- 4.2. At completion, remove all surplus products, tools, construction machinery and equipment. Remove waste products and debris and leave work clean and suitable for occupancy. Clean all finished surfaces.

02100 5. SITE WORK

- 5.1. Repair existing sidewalks, curbs and roadways damaged due to work of this contract.

02200 6. EXCAVATION, BACKFILLING AND SITE GRADING

- 6.1. Excavation, backfill and compaction shall be carried out as recommended by soil investigation report.
- 6.2. Provide excavation and grading as required by building and site.
- 6.3. Excavate to depths as required to accept the building and services and to obtain bearing support as predicated by soils report and as required by the structural, mechanical and electrical consultants.
- 6.4. Remove excavated, unusable material and material not required as backfill, from the site.
- 6.5. Keep excavations free from water at all times.
- 6.6. Grade site as required for paving and landscaping. Grade to slope away from the building and to catch basins.
- 6.7. Backfill under exterior concrete walks and slabs on grade shall be clean angular crushed natural stone, or natural river sand and gravel free from silt, clay, loam or organic matter, minimum 150 mm (6") deep.
- 6.8. Provide a minimum of 200 mm (8") of clean angular crushed natural stone, compacted to 98% SP density under interior slabs on grade.
- 6.9. Fill required to raise grades to design elevations under landscaped areas shall be clean, excavated or imported soil.
- 6.10. Place backfill in 150 mm (6") layers and compact.
- 6.11. When excavating adjacent to or near existing structures, care shall be taken to maintain stability of the existing foundations.

02775 7. CONCRETE PAVING

- 7.1. Refurbish existing curbs, gutters and sidewalks to City of Regina standards.

02800 8. ATHLETIC TURF SYSTEM

- 8.1. Provide permanently installed artificial grass system, FieldTurf, AstroTurf, or approved equal, with removable turf-protection panels.
- 8.2. Provide Option for artificial grass system capable of being removed in segments to expose concrete surface of event floor,

03300 9. CONCRETE

9.1. Concrete shall comply with CSA A23.1/A23.2/A23.3-94.

03345 10. CONCRETE FLOORS

- 10.1. Interior slabs on grade shall be 25 MPa concrete with wire mesh reinforcing placed on granular fill and moisture barrier; refer to structural specifications.
- 10.2. Exposed concrete floors shall be cured with a liquid cure and seal.
- 10.3. Exposed concrete floors shall have a smooth level burnished finish and those not scheduled to receive a finish shall have a clear, 40% silane sealer, Chem-Trete BSM40, or approved equal.
- 10.4. Coloured concrete shall have Chromix Admixture by L.M. Scofield Company, or similar approved colour additive.
- 10.5. Concrete floor surfaces to receive carpet, or thin set applied tile and resilient flooring shall have a fine textured non-burnished finish. Cure and seal with compound compatible with adhesives to be used.
- 10.6. Concrete surfaces to receive waterproofing shall slope to drains at rate of 6 mm to 300 mm (1/4" to 12"), shall be trowelled and be free of ridges, pits and other surface irregularities. Cure using non-staining membrane.
- 10.7. Provide concrete pads and curbs to support equipment, including but not limited to mechanical and electrical items.
- 10.8. Ramps and stairs shall be provided with non-slip aggregate surface.
- 10.9. Provide non-metallic hardener at rate of 5 kg/m² (1 lb/ft²) to floor slabs in loading area, ramps, event level service corridor, and event floor space.
- 10.10. Levels of concrete floors shall be to ASTM E1155 standards. Under waterproofing, toppings, resilient and seamless flooring, finish levels shall not vary more than 1.6 mm (1/16") in any running foot.

03400 11. PRECAST CONCRETE BLEACHERS

- 11.1. Provide precast concrete bleacher tiers, designed by a professional engineer in accordance with ACI 318.
- 11.2. Exposed surfaces shall be honed dense, smooth, even concrete, free of defects, profiles shall have accurate definition, faces shall be true, planed and well-defined. Seating tiers shall have minimum 2% slope from back to front edge.
- 11.3. Precast fabricator shall be fully experienced and recognized, whose plant and facilities are equipped for this type of work.

- 11.4. Bleacher slabs and risers shall be sealed with Silane 40% solids sealer, Iso-Flex 618 or approved equal.

04200 12. MASONRY - GENERAL

- 12.1. Masonry work shall comply with local building codes, and authorities having jurisdiction.
- 12.2. Masonry shall be erected in accordance with CAN3-S304 and CAN3-A371 Masonry Construction for Buildings, in particular the requirements for cold and hot weather construction. In hot weather protect freshly laid masonry from drying out too rapidly.
- 12.3. Reinforce masonry and anchor masonry as required by code. Connectors for masonry shall comply with CAN3-A370. Provide reinforcing to support wall mounted equipment, building components and fixtures.
- 12.4. Irregularity in mortar joints of walls exposed or painted in the completed work shall not be noticeable when viewed from a distance of 4.6 m (15'-0").
- 12.5. Provide control joints in masonry at a maximum spacing of 6m (20'-0").

04210 13. INTERIOR MASONRY

- 13.1. Where block will be left exposed provide light weight aggregate concrete block complying with CSA A165 and shall be autoclaved, bubble-cured. At corners and doorways bullnosed block shall be provided.
- 13.2. Reinforce masonry partitions. Typical reinforcement shall be 3.6 mm (9 ga.) galvanized truss type.
- 13.3. Provide masonry fire and smoke separations to ratings required by code and authorities having jurisdiction, constructed in accordance with ULC design.

04220 14. EXTERIOR MASONRY

- 14.1. Face brick to be anchored to backing concrete or concrete block with stainless steel ties, at 600mm (24") o.c. horizontally and 400 mm (16") vertically.
- 14.2. All exterior concrete block shall have integral colour.

05120 15. STRUCTURAL STEEL

- 15.1. Steel shall be designed in accordance with CAN/CSA s16.1. Welding shall be in accordance with CSA W47.1 and CSA W59.

05500 16. MISCELLANEOUS METALS

- 16.1. Provide lintels in masonry over openings not provided with precast lintels. At exterior walls, steel lintels shall be galvanized.
- 16.2. All metals and fabrications provided under this section shall be engineered by the contractor. All shop drawings shall bear the stamp of a structural engineer licensed in the Province of Saskatchewan.
- 16.3. Provide access ladders to roof areas as required to access equipment.
- 16.4. Support elements shall be provided for, but not limited to, the following:
aluminum entrances and screens
vanities and counters
handrails and grab bars occurring on gypsum board partitions
- 16.5. Provide galvanized trench drains and pit gratings.
- 16.6. Provide galvanized steel channel or HSS door frames at overhead doors.
- 16.7. Provide steel channel HSS support frames at rolling and sliding security shutters and movable partitions.
- 16.8. Provide bollards at overhead doors and equipment exposed to vehicular traffic, as well as at man-doors, stairs, and corners within the event level vehicle access corridor.
- 16.9. Provide steel drink rail supports at suite, media and other standing/bar stool viewing areas.
- 16.10. Provide galvanized steel corner guards on columns and walls at loading area.
- 16.11. Provide steel event lighting support frames as required, with service catwalk and access ladders to meet code requirements.
- 16.12. All steel exposed to exterior or conditions of high humidity and moisture is to be galvanized, unless otherwise noted to be stainless steel.
- 16.13. Provide lateral support for masonry partitions.
- 16.14. Welding shall be in accordance with CSA W59.

05510 17. RAILINGS & GUARDS

- 17.1. Railings shall be provided at stairs, ramps and vomitory steps, and as required by the National Building Code. Aisles in seating areas are to be provided with centre handrails.
- 17.2. Provide metal guards and railings at all locations required by applicable codes.
- 17.3. Guards, railings and balusters shall be steel pipe and solid steel rod construction, designed to meet loading requirements of applicable building codes and standards.

- 17.4. Railings shall be 38 mm (1-1/2") diameter steel, unless otherwise shown.
- 17.5. All exterior steel and steel exposed to levels of high humidity and moisture shall be hot-dipped galvanized.
- 17.6. Provide glazing shoe fabrication to contractor for casting-in to concrete and precast concrete where all-glass guards are required.
- 17.7. Provide removable or hinged guard sections at bottom of aisles. Removable guards shall be galvanized steel frame with tempered glass for top 300 mm (min.).

05800 18. EXPANSION CONTROL

- 18.1. The building shall be provided with expansion joints; assume every 50m. Interior finished areas shall be provide with flush mounted, extruded aluminum and thermoplastic expansion joint covers, by Construction Specialties, or approved equal.

06200 19. ROUGH AND FINISH CARPENTRY

- 19.1. Lumber shall comply with the official grading rules of NLGA for Dimension Lumber.
- 19.2. Lumber for blocking, cant strips and grounds shall be CLA No.2 Construction Grade Eastern Spruce or Jack Pine.
- 19.3. Plywood shall be B.C. Fir with minimum 5 ply, laminated with water resistant adhesive.
- 19.4. Provide rough carpentry, blocking, curbs and cants as required.
- 19.5. Provide fire treated plywood mounting boards for telephone and electrical equipment.
- 19.6. Wood in contact with masonry or concrete, or at exterior locations shall be pressure preservative treated.
- 19.7. Blocking and framing in ceiling spaces, partitions and bulkheads shall be fire retardant treated.
- 19.8. Millwork and finish carpentry shall comply with AWMAC Quality Standards for Custom Work.
- 19.9. Plastic laminate shall be general purpose and postformed in accordance with CSA A172.
- 19.10. Provide the following millwork with plastic laminate finish, unless shown otherwise:

Media Box Counters
 Interior Drink Rails (with solid rubber bullnose)
 Ticket Office Work Stations, Cabinets and Shelving

Guest Services Counter
First Aid and Trainer's Counter and Cupboard
Counter and Buffet Counter Top in Suites

- 19.11. Provide wood veneer cabinets and cupboards, coat closet and buffet in private suites.
- 19.12. Football Home team and Soccer Home Team Dressing rooms to be provided with wood veneer cubicles with clothes hooks, steel mesh shelves and ventilated storage compartment with hinged seat. Cubicles shall also include a lockable storage cubby.

06600 20. SOLID SURFACING

- 20.1. Provide solid surface material for the following locations, unless shown otherwise:

Washroom Vanities

07160 21. WATERPROOFING

- 21.1. Provide hot rubberized asphalt waterproofing membrane system under concrete slabs where there is built space below and at foundation walls enclosing built space (Monsey-Bakor 790-11 or approved equal).
- 21.2. Provide metallic or capillary waterproofing of elevator pits and mechanical pits.

07200 22. THERMAL INSULATION

- 22.1. Provide insulation between all heated and unheated spaces.
- 22.2. Wall insulation shall be part of the wall cladding system specified below and shall be provided to give a minimum overall 'R' value of 20.
- 22.3. Roof insulation shall be provided to give a minimum overall 'R' value of 30.
- 22.4. Provide continuous air/vapour barrier on interior (warm) side of insulation.
- 22.5. Provide 50 mm (2") of extruded polystyrene insulation vertically around perimeter of foundation walls, to a depth of 1200 mm.
- 22.6. Provide vapour barrier to connect window, door and other exterior wall systems to provide a continuous thermal and air/vapour barrier membrane.

07250 23. SPRAYED FIREPROOFING

- 23.1. Sprayed fireproofing shall be provided to attain fire protection ratings of structural steel and deck elements as required by applicable building codes and standards.

07550 24. ROOFING

- 24.1. Provide mechanically fastened PVC membrane roofing on R-30 rigid insulation on main building roof. Roof shall be ENERGY STAR ® compliant and high emissivity (emissivity of at least 0.9 when tested in accordance with ASTM 408). Colour as selected by Architect.
- 24.2. Low-level flat roofs shall be 4-ply built-up membrane roofing on rigid insulation, with stone ballast and precast pavers, installed in accordance with "Good Roofing Practice".
- 24.3. Flashing shall be prefinished aluminum, colour to be selected by Architect.
- 24.4. At roof expansion joint, provide curbs and looped membrane to tie into roofing membrane.

07900 25. CAULKING, SEALING AND FIRESTOPPING

- 25.1. Caulk and seal building as required to make it water and weather tight to the exterior and including but not limited to interior and exterior control joints, expansion joints, door frames and screens, louvers, heads of walls and items passing through walls.
- 25.2. Provide fire stopping and smoke seal at openings around penetrations and joints within fire separations and assemblies having fire resistance rating.
- 25.3. Fire stopping and smoke seal materials shall conform to ASTM E814, ULC and requirements of authorities having jurisdiction.
- 25.4. The VOC content of adhesives, sealants, and sealant primers used must be less than the VOC content limits of the State of California's South Coast Air Quality Management District (SCAQMD) Rule #1169, October 2003.

08100 26. HOLLOW METAL DOORS AND FRAMES

- 26.1. Generally doors shall be hollow metal, in pressed steel frame.
- 26.2. Fabricate doors and frames of primed steel roller levelled steel, welded construction, complying with SDI-100. Door skins shall be 1.2 mm (18 ga.) for hollow steel construction and 0.9 mm (20 ga.) for honeycomb core construction. Exterior doors and frames, and doors and frames to unheated areas shall be hot-dip galvanized. Interior doors and frames shall be wipe coat galvanized.
- 26.3. Frame members shall be 1.6 mm (16 ga.) minimum.
- 26.4. Provide Heavy Duty (16 ga.) doors at Dressing Rooms.
- 26.5. Provide fire rated and temperature rise ULC label bearing doors and frames as required by Authorities having Jurisdiction, in accordance with NFPA.

26.6. Provide sound deadening fill in all doors.

08200 27. WOOD DOORS

27.1. Wood doors shall comply with AWMAC Quality Standards of the Architectural Woodwork Manufacturers of Canada, and CAN/CSA O132.2.

27.2. Veneered wood doors shall have solid cores of wood block construction.

27.3. Provide 20 min. Warnock Hersey fire rating label on doors as required.

26.4 Veneer shall be 1.2 mm (0.50") thick plastic laminate complying with GP-S.

08330 28. ROLLING SHUTTERS

28.1. Provide manually operated rolling aluminum shutters at concession counters.

08360 29. OVERHEAD DOOR

29.1. Provide new rolling overhead electrically operated insulated metal doors at loading docks.

08410 30. ALUMINUM ENTRANCES AND SCREENS

30.1. Provide glazed, prefinished aluminum entrance framing and doors at new suite-fronts, and suite-level restaurant front.

30.2. Exterior aluminum doors and frames shall be thermally-broken.

30.3. Aluminum entrances shall be designed to withstand within acceptable deflection limitations their own weight, the weight of their glass, loads imposed by the motion of operable elements and the minimum design loads, and combination of loads, due to pressure and suction of wind.

08700 31. HARDWARE

31.1. Provide heavy duty, stainless steel architectural hardware for interior and exterior doors.

31.2. Hardware for fire-rated doors shall meet ULC and code requirements.

31.3. Provide automatic swinging door operators for handicapped as required by code.

31.4. Locks shall be Grand Master keyed.

08800 32. GLASS AND GLAZING

- 32.1. Provide tempered safety glass in doors and sidelights or wired glass where a fire rating is required.
- 32.2. Provide tempered glass guards in recessed steel glazing shoes where required to maintain sightlines. Glass guards systems, including shoes and necessary attachment to the building structure shall be designed by the glazing contractor to resist structural loading of guards as required by the building code.

09250 33. DRYWALL

- 33.1. Drywall (gypsum board) shall be on galvanized metal stud.
- 33.2. Use moisture resistant drywall gypsum board in all other moist areas including but not limited to washrooms.
- 33.3. Gypsum board shall comply with CSA A82.27, and generally shall be 15 mm (5/8") thick.
- 33.4. Studs for extra high partitions shall be designed by an engineer.
- 33.5. Non-load bearing steel studs shall be in accordance with CAN/CGSB.
- 33.6. Extend studs to underside of deck or structure above, unless shown otherwise.
- 33.7. Drywall work shall comply with CSA A82.31, and the Drywall Construction Handbook.
- 33.8. Provide drywall ceilings where indicated.
- 33.9. Provide drywall partitions in office areas and on suite level.
- 33.10. All metal components of drywall assemblies shall be galvanized.
- 33.11. Accessories shall comply with ASTM C1047.
- 33.12. Provide fire rated partitions to ULC Designs requirements.
- 33.13. Provide sound attenuation blankets in partitions where required, to achieve STC ratings appropriate to use of area.

09300 34. CERAMIC TILE

- 34.1. Provide porcelain floor tile on floor and walls in dressing room washrooms.
- 34.2. Provide 2"x2" porcelain tile on floor and walls in all showers.
- 34.3. In shower rooms and stalls provide waterproof membrane to floors and walls before application of tile.

09510 35. ACOUSTIC TILE CEILINGS

- 35.1. Refer to Room Finish Schedule.
- 35.2. Provide suspended lay-in acoustic tile, installed in accordance with ASTM C636, in office spaces and suites.
- 35.3. Acoustic tile ceiling panels shall be mineral fibre, non-combustible, 610 mm x 610 mm (24" x 24" x 5/8") Fissured Medium Texture by Armstrong or other approved manufacture.
- 35.4. Exposed Tee bar shall be 25 mm x 38 mm (1" x 1-1/2") by Donn Products. Main Tees and cross tees shall be uniform 38 mm (1-1/2") depth.
- 35.5. Office spaces shall have suspended t-bar and lay-in acoustic tile ceilings.
- 35.6. Suite level ceilings shall be acoustic tile with drywall bulkheads.

09660 36. RESILIENT FLOORING

- 36.1. Vinyl composite tile shall be 300 x 300 mm x 3 mm (12" x 12" x 1/8") thick and conforming to CSA A126.1. Colours to be later selected.
- 36.2. Sheet resilient flooring shall be 2 mm thick, "Astro 20" by Mondo.
- 36.3. Apply tile in accordance with manufacturer's instructions, using water resistant adhesive, rolled to ensure adhesion.
- 36.4. Base shall be 100 mm (4") high Rubber Cove Base in colours as later selected.
- 36.5. Interior stairs shall have heavy duty, square edge, rubber stair treads.
- 36.6. Adhesive for resilient flooring materials shall be waterproof type, of type recommended by resilient flooring manufacturer.

09680 37. CARPET

- 37.1. Carpet shall be 32 oz/yd² cut pile or level loop, nylon tiles with rubber backing.
- 37.2. Install carpet using adhesive method.
- 37.3. Carpet systems shall meet or exceed the requirements of the Carpet and Rug Institute's Green Label Indoor Air Quality Test Program.

09900 38. PAINTING

- 38.1. Paint all surfaces areas with three coats top line, highest quality paint in accordance with best painting practice.
- 38.2. Painting and finishing materials shall comply with or exceed requirements for Premium Grade Work.
- 38.3. Ceilings shall be painted except those having a factory applied final finish.
- 38.4. All exposed pipes, ductwork and mechanical shall be painted. Those in mechanical rooms shall be colour coded. All equipment shall be labelled.
- 38.5. Concourse walls not scheduled to remain exposed masonry shall be painted with epoxy paint.
- 38.6. Shower rooms shall have epoxy painted walls, where ceramic tile is not indicated.
- 38.7. VOC emissions from paints shall be in accordance with LEED Canada-NC Version 1.0 EQ Credit 4.2 for Low Emitting Materials; Paints and Coatings.

10150 39. TOILET PARTITIONS

- 39.1. Provide pre-finished, floor mounted, solid plastic toilet partitions.
- 39.2. Partitions shall be Normandie by Hadrian, or other approved manufacturer.
- 39.3. Provide toilet partitions for barrier free stalls as required by code.

10200 40. ARCHITECTURAL LOUVRES

- 40.1. Provide architectural, aluminum louvres at exterior of building as required for mechanical equipment and to tie into overall design of the building. Colour to be PPG Duranar XL, or equal.
- 40.2. Louvres shall be provide with bird screens and insulated blank-off panels.

10800 41. WASHROOM ACCESSORIES

- 41.1. Provide recessed and surface mounted washroom accessories as follows:
 - 1. Wall mounted electric hand dryers in washrooms.
 - 2. Stainless steel toilet tissue dispenser at each toilet.
 - 3. Stainless steel napkin disposal at each Women's toilet.
 - 4. Stainless steel sanitary napkin dispenser in each Women's Washroom.
 - 5. Counter mounted soap dispenser at each basin in vanities.
 - 6. Conceal mounted stainless steel grab bars as required by code, at water closet for handicapped.

7. Provide heavy duty stainless steel soap dish at each shower.
8. Provide heavy duty towel bars and robe hooks in shower rooms.
9. Provide semi-recessed hand dryers in Dressing Rooms, mounted for use as hair dryer.
10. Provide mirrors over vanities.

10990 42. MANUFACTURED SPECIALTIES

- 42.1. Metal lockers shall be provided at the Visiting Team Dressing Rooms by "Locker Solutions" or equal, c/w coat rod, 2 hooks, lockable security box, and footlocker. Visiting Team lockers shall be 42" wide x 24" deep.

11480 43. EQUIPMENT

- 43.1. Provide 4 - 30,000 lb. capacity hydraulic dock levellers.

12700 44. STADIUM SEATING

- 44.1. Provide stadium seating as indicated on Building Program.
- 44.2. Suite seating shall be fully upholstered (suitable for outdoor installation), equal to Seda "Business Box" or Hussey – "Quattro" or Irwin "Marquee".
- 44.3. Club seating shall be equal to Seda "Toronto" or "Hussey - Medallion" or Irwin "Patriot" with upholstered seat and back inserts.
- 44.4. General seating shall be plastic seat and back, equal to Seda "Toronto" or Hussey "Medallion" or Irwin "Patriot".
- 44.5. Seating shall be typically riser mounted. Provide floor mounted chairs only where riser mount is not possible.
- 44.6. All seats shall be provided with cupholders.

14240 45. ELEVATORS

- 45.1. Provide (1) 4500 lb capacity service elevator serving 4 levels (Event, Main Concourse, Suite Level, Upper Concourse).
- 45.2. Provide (1) 15,000 lb capacity service elevator serving 4 levels (Event, Main Concourse, Suite Level, Upper Concourse).
- 45.2. Provide (7) 2500 lb hydraulic passenger elevators, three (3) serving 5 levels (Event, Club Level, Main Concourse, Suites, Upper Concourse) and four (4) serving 4 levels. (Event, Main Concourse, Suite Level, Upper Concourse).

END OF ARCHITECTURAL OUTLINE SPECIFICATION

ABBREVIATIONS	
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ABBREVIATIONS APPLYING TO DRAWINGS, SPECIFICATIONS AND SCHEDULES

When the following abbreviations are used in the Contract Documents they shall have the meaning listed.

A BOLT	Anchor Bolt	APT	Apartment
AC	Alternating Current	APPROX	Approximate
ACT	Acoustic Tile	ARCH	Architectural
ACPL	Acoustical Plaster	ASB	Asbestos
AD	Door or Area Drain	ASB CEM	Asbestos Cement
ADD	Addendum	ASF	Acrylic Stucco Finish
ADH	Adhesive	ASPH	Asphalt
AFC	Air Fan Coil Unit	ASPH PVG	Asphalt Paving
AIFB	Asphalt Impregnated Fibreboard	AT	Ashtray
ALUM	Aluminum	ATT	Asphalt Traffic Topping
AMT	Agglomerate Tile	@	At
ANOD	Anodized	AUTO	Automatic
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BE	Baked Enamel	BLK	Block
BED	Bedroom	BM	Bench Mark
BFD	Barrier Free Door Hardware	BR	Brick
BH	Borehole	BRP	Brick Paver
BHD	Bulkhead	BRZ	Bronze
BIPD	Bi Parting Doors	BSMT	Basement
BLDG	Building	BTU	British Thermal Unit
		BTWN	Between
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C	Cedar	CLR	Colour
CABT	Cabinet	CLT	Clay Tile
CARP	Carpet	CO	Clean Out
CB	Catch Basin	COL	Column
CBD	Chalkboard	COL.	Colour(ed)
C CONC	Coloured Concrete	CONC	Concrete
CEM	Cement	CONC BLK	Concrete Block
CER	Ceramic	CONST	Construction
CGWG	Cast Georgian Wire and Glass	CONT	Continuous
CHAN (C)	Channel	CONTR	Contractor
CI	Cast Iron	CONV	Convactor
CIP	Cast-In-Place	CORR	Corridor
CJ	Control Joint	CRS	Courses
CL	Centre Line	CT	Ceramic Tile
CLOS	Closet	CU	Cubic
CLG	Ceiling	C/W	Curtain Wall
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DAMPG	Damp-proofing	DIM	Dimension
DB (db)	Decibel	DIV	Division
DC	Direct Current	DL	Dead Load
DET	Detail	DML	Demolition
DF	Drinking Fountain	DPC	Damp-proof Course
DG	Door Grille	DSHWR	Dishwasher
DIA (Ø)	Diameter	DWL	Dowel
		DWG	Drawing
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E	East	EQ	Equal
EA	Each	EXIST	Existing

ABBREVIATIONS	
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ELE	Elevator	EXP	Expansion
ELEC	Electric	EXP AG	Exposed Aggregate
ELEV	Elevation	EXP'D	Exposed
EMW	Elastomeric Membrane Waterproofing	EXP STR	Exposed Structure
EPX	Epoxy	EXT	Exterior
EPX PT	Epoxy Paint	EXTR	Extruded
		EW	Elastomeric Waterproofing

FA	Fire Alarm	FL	Floor
FB	Face Brick	FP	Fabric Panel
FD	Floor Drain	FR	Fire Rated
FG	Foot Grille	FS	Full Size
FHC	Fire Hose Cabinet	FT (')	Feet (or Foot)
FHR	Fire Hose Rack	FTG	Footing
FIN	Finish	FUT	Future

GA	Gauge	GL	Glass
GALV	Galvanized	GR	Grille
GBLK	Glazed Block	GR	Ground
GCT	Glazed Ceramic Tile	GRAN	Granite
GCM	Galvanized Corrugated Metal	GS	Galvanized Steel
GFS	Garage Floor Sealer	GWB	Gypsum Wallboard
GI	Galvanized Iron	GYP	Gypsum
		GYPL	Gypsum Lath

HAGL	Heat Absorbing Glass	HGT or H	Height
HALUM	Hardcolour Aluminum	HM	Hollow Metal
HB	Hose Bib	HOR	Horizontal
HCONC	Hardened Concrete	HSGL	Heat Strengthened Glass
HDWR	Hardware	HVAC	Heating Ventilating and Air Conditioning

ID	Inside Diameter	INS	Insulation
IN (")	Inch	INSUL GL	Insulating Glass
INDN	Induction	INT	Interior
		INVT	Invert

JAN	Janitor	JT	Joint
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KAL	Kalemein	KIT	Kitchen
KD	Knock Down	KP	Kick Plate

L	Length	LCB	Lightweight Concrete Block
LAM	Laminate	LH	Left Hand
LAMGL	Laminated Glass	LHR	Left Hand Reverse
LAV	Lavatory	LINO	Linoleum
LB	Pound	LL	Live Load
LBR	Lumber	LONG	Longitudinal
		LSSJ	Long Span Steel Joist

MAT	Material	MIRR	Mirror
MAX	Maximum	MISC	Miscellaneous
MC	Medicine Cabinet	ML	Melamine

ABBREVIATIONS	
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MECH	Mechanical	MLC	Metal Linear Ceiling
MET	Metal	MO	Masonry Opening
METACT	Metal Acoustical Tile	MPL	Maple
METL	Metal Lath	MR	Marble
MH	Manhole	MSNRY	Masonry
MIN	Minimum	MWP	Membrane Waterproofing
MILLWKW	Millwork		

N	North	NIC	Not in Contract
NAT	Natural	NO	Number
NGAS	Neoprene Gasket	NOM	Nominal
NHYP	Neoprene - Hypalon	NS	Non-slip
		NTS	Not to Scale

OBS	Obsure	OH	Overhead
OC	On Centre	OHD	Overhead Door
OD	Outside Diameter	OPNG	Opening
OFF	Office	OPP	Opposite
		OWSJ	Open Web Steel Joist

PCONC	Precast Concrete	POL	Polished
PDO	Power Door Operator	PPGL	Polished Plate Glass
PDS	Parking Deck Sealer	PPT	Prime Painted
PGWG	Polished Georgian Wired Glass	PREFAB	Prefabricated
PERF MAT	Perforated Metal	PROJ	Projection
PFL	Pedestal Floor	PS	Pressed Steel
PFT	Porcelain Floor Tile	PSF	Pounds per Square Foot
PL	Plate	PSI	Pounds per Square Inch
PLA	Plaster	PT	Paint
PLAM	Plastic Laminate	P.T.	Pressure Treated
PLAS	Plaster	PTD	Paper Towel Dispenser
PLF	Pounds per Lineal Foot	PTDD	Paper Towel Dispenser/Disposal
PLGL	Plate Glass	PTERR	Precast Terrazzo
PLYD	Plywood	PTN	Partition
PM	Pressed Metal	PVC	Polyvinyl Chloride
PMT	Painted Metal	PWT	Porcelain Wall Tile

QT	Quarry Tile	QTZ	Quartz
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R	Radius	RENOV	Renovation
R	Rubber	REV	Revision
RB	Rubber Base	RH	Right Hand
RCB	Rubber Cove Base	RHR	Right Hand Reverse
RSF	Rubber Sheet Flooring	RI	Rigid Insulation
RD	Roof Drain	RLG	Railing
REC	Recessed	RM	Room
REF	Reference	RSF	Resilient Sheet Flooring
REFLGL	Reflected Glass	RT	Rubber Tile
REINF	Reinforced	RWL	Rainwater Leader

S	South	SMF	Sprayed Mineral Fireproofing
SAB	Sound Attenuation Blanket	SND	Sanitary Napkin Dispenser

ABBREVIATIONS	
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SC	Special Coating	SNDU	Sanitary Napkin Disposal Unit
SCHED	Schedule	SP	Spandrel
SEAL	Sealer	SPT	Special Paint
SECT	Section	SPEC	Specification
SFL	Seamless Flooring	SS	Slop Sink
SGL	Safety Glass	SSM	Solid Surfacing Material
SH	Shower	SST	Stainless Steel
SHGL	Sheet Glass	ST	Steel
SHTHG	Sheathing	STD	Steel Deck
SIM	Similar	STN	Stain
SL	Slab	STR	Stair
SLD	Sliding Door	STRUC	Structural
SLNT	Sealant	STUC GLAZ	Stucco Glazed
SLT	Slate	SUSP	Suspend
		SUSPD	Suspended

T&G	Tongue and Groove	TP	Toilet Partition
TB	Thermal Barrier	TPH	Toilet Paper Holder
TEL	Telephone	TR	Transom
TELB	Telephone Booth	TRAV	Travertine
TEMP	Temperature	TT	Traffic Topping
TEMPGL	Tempered Glass	TWR	Tower
TER	Terrazzo	TXF	Textured Finish
TMBR	Timber	TYP	Typical

U	Unfinished	UR	Urinal
UCT	Unglazed Ceramic Tile	U/S	Underside
URE	Urethane	USSG	United States Steel Gauge

VAN	Vanity	VCT	Vinyl Composition Tile
VB	Vapour Barrier	VOL	Volume
VERT	Vertical	VS	Vinyl Stucco
VCB	Vinyl Cove Base	VWC	Vinyl Wall Covering

W	West	WEATHST	Weathering Steel
w.	Wide	WG	Wired Glass
W/	With	WI	Wrought Iron
WC	Water Closet	WM	Wire Mesh
WD	Wood	WPG or WP	Waterproofing
WDC	Waste Disposal Unit	W/S	Weather-stripping
WD VNR	Wood Veneer	WWT	Window Washing Track

YD	Yard
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Z	Zinc
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End of section

SASKATCHEWAN MULTI-USE FACILITY

Stadium Consultants International

0913

OUTLINE ROOM FINISH SCHEDULE	8-Feb-10
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BACK-OF HOUSE AREAS

STAFF LOCKER ROOMS	Floor Base Wall Ceiling Lockers Door & Frame	CONC CONC BLK T-BAR MET H.M.	VCT RCB PT ACT PREFIN PT
STAFF WASHROOMS	Floor Base Wall Ceiling Door & Frame	CONC CONC BLK T-BAR H.M.	VCT RCB EPX PT ACT PT
MEETING ROOMS/ PRESS CONFERENCE/ MEDIA WORKROOMS	Floor Base Wall Ceiling Kitchen Counter/Cabinets Door & Frame	CONC CONC BLK T-BAR MILLWK WD/H.M.	CARP CARP PT ACT PLAM WD VNR/PT
OFFICIALS / STARS DRESSING ROOM	Floor Base Wall Ceiling Benches Bench Brackets Lockers Door & Frame	CONC GWB/ CONC BLK T-BAR WOOD STEEL MET H.M.	PFT / CARP PFT / CARP PT ACT URE PT PREFIN PT
HOME TEAM DRESSING ROOMS & TRAINERS' AREA (DRY)	Floor Base Wall Ceiling Player Cubicles Coaching display Door & Frame	CONC CONC BLK ACT/GWB MILLWK MILLWK H.M.	CARP CARP PT PT WD VNR WD VNR/WHITEBD PT
HOME TEAM WASHROOM & TRAINERS' AREA (WET)	Floor Base Wall Shower Walls Shower Floor Shower Ceiling Ceiling Vanity Toilet Partitions Door & Frame	CONC CONC BLK CONC BLK CONC GWB T-BAR/GWB MILLWK SOLID PHENOLIC H.M.	PFT PFT EPX PT/MIRR CT PFT EPX PT ACT/PT SOLID SURFACE PREFIN PT

SASKATCHEWAN MULTI-USE FACILITY

Stadium Consultants International

0913

OUTLINE ROOM FINISH SCHEDULE	8-Feb-10
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VISITING TEAM DRESSING ROOMS	Floor Base Wall Ceiling Lockers Door & Frame	CONC CONC BLK T-BAR MILLWK H.M.	CARP CARP PT ACT PLAM PT
VISITING TEAM WET AREAS	Floor Shower Floor Shower Walls Base Wall Ceiling Vanity Toilet Partitions Door & Frame	CONC CONC CONC BLK CONC BLK GWB MILLWK MET H.M.	PFT PFT CT PFT EPX PT/MIRR PT PLAM PREFIN PT
OPERATIONS/SECURITY OFFICE	Floor Base Wall Ceiling Windows/Frame Door & Frame	CONC CONC BLK T-BAR MET H.M.	VCT RCB PT ACT PT PT
FIRST AID ROOM/MEDICAL SERVICES	Floor Base Wall Ceiling Millwork Door & Frame	CONC GWB/CONC. BLK T-BAR H.M.	VCT VCB EPX PT ACT PLAM PT
OFFICE AREAS / VIP AREA	Floor Base Wall Ceiling Door & Frame	CONC GWB T-BAR WD	CARP CARP PT ACT WDVR
SERVICE ROOMS	Floor Base Wall Ceiling Door & Frame	CONC CONC BLK CONC BLK EXP STR H.M.	SEAL PT PT PT PT

SASKATCHEWAN MULTI-USE FACILITY

Stadium Consultants International

0913

OUTLINE ROOM FINISH SCHEDULE	8-Feb-10
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JANITOR ROOM	Floor Base Wall Ceiling Door & Frame	CONC CONC BLK CONC BLK EXP STR H.M.	VCT RCB EPX PT PT PT
TICKETS OFFICE	Floor Base Wall Ceiling Counters, Shelving, Cupboards Door & Frame	CONC GWB T-BAR MILLWK H.M.	CARP CARP PT ACT PLAM PT
PANTRIES	Floor Base Wall Ceiling Door & Frame	CONC CONC.BLK/GWB ACT H.M.	VCT RCB PT WASHABLE PT
PRESS BOX/ MEDIA LOUNGE	Floor Base Wall Ceiling Counter Door & Frame	CONC GWB T-BAR MILLWK H.M.	CARP CARP PT ACT PLAM PT

PUBLIC AREAS

CONCOURSES	Floor Base Walls Ceiling Bulkheads Railings Monitor Brackets	CONC MASONRY MASONRY EXP STR GWB ST MET	SEALED EPX PT. EPX PT. PT PT PT PT
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SASKATCHEWAN MULTI-USE FACILITY

Stadium Consultants International

0913

OUTLINE ROOM FINISH SCHEDULE	8-Feb-10
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CONCOURSE WASHROOMS	Floor Base Wall Ceiling Vanity Toilet Partitions Urinal Screen	CONC CONC. BLK. CONC. BLK. EXP STR SOLID PLASTIC SOLID PLASTIC SOLID PLASTIC	SEALED PT PT MIRROR@VANITY PREFIN PREFIN PREFIN
CONCESSION/ KITCHEN	Floor Base Wall Ceiling Bulkhead Concession Counter Top Security Screen Door & Frame	CONC. CONC. BLK. CONC. BLK. ACT GWB MILLWK ALUM H.M.	EPX RCB EPX PT WASHABLE EPX PT SST ANNOD PT
SUITES	Floor Base Wall Ceiling Bulkheads Closet/Buffet Buffet Top Kitch. Cabinets/Cupboards Kitchen Counter Drink Rail Drink Rail Backsplash Support (Seating Area) Floor (Seating Area) Stairs (Seating Area) Railings Door & Frame	CONC GWB T-BAR GWB MILLWK MILLWK MILLWK MILLWK MILLWK MILLWK ST ST CONC. CONC. MET H.M.	CARP CARP PT ACT PT PLAM PLAM PLAM PLAM PLAM PLAM PT PT SEALED SEALED PT PT
SEATING BOWL	Vomitory Walls Vomitory Stairs Seating Tiers-Lower Aisle Stairs -Lower Tier Railings Guard Over Vomitory	CONC CONC CONC CONC ST ST	SEALED PT @NOSING PT @NOSING GALV GALV
TYPICAL EXIT STAIRS	Floor Stairs Base Wall Ceiling Railing Risers Stringers Door & Frame	CONC CONC MASONRY EXP STR ST CONC ST H.M.	SEAL SEAL PT PT GALV SEAL GALV PT

5. ENGINEERS' REPORTS

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Saskatchewan Multi-Use Facility

Preliminary Structural Budget Package Design Brief Rev. 05

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1 INTRODUCTION

- 1.1 This brief contains an outline specification which includes general design criteria and a description of the structural components for the structural work, for budget costing purposes only. The brief is to be read in conjunction with the renderings and preliminary working drawings listed in Appendix A and Appendix B.
- 1.2 The structural work shown is based on architectural drawings received December 2009, and soils data contained in the report received Clifton Associates Limited on October 22, 2009.
- 1.3 All information presented is under development and will be revised to suit final design and programme requirements.
- 1.4 In general, the drawings and sketches presented describe the main structural elements in a preliminary manner. Where appropriate, estimated material quantities have been included.
- 1.5 The cost of the following special structures and irregularities should be included in the budget cost estimate although their location and details have yet to be shown or finalized:
 - 1.5.1 The framing of mechanical and electrical rooms on the various floors, including pads, curbs, catwalks, lighting and scoreboard support structure etc.
 - 1.5.2 Framing of stairs, elevators and escalators between the various levels.
 - 1.5.3 Loading docks, ramps and related work.
 - 1.5.4 Supports to the perimeter cladding, glazing mechanical equipment / louvres and screens on roof areas.
 - 1.5.5 Outside structures such as retaining walls, planters, walks curbs, etc.
 - 1.5.6 Irregularities such as the framing of openings, curbs, slopes, trenches, pits and hangers for equipment and piping.
 - 1.5.7 Canopy structures.

2 PROJECT DESCRIPTION

2.1 General

The Regina Multi-Use facility is a 33,000 seat stadium to be used as a venue for football and soccer with the option to expand to 45,000 seats for special events using an additional 12,000 temporary seats at the stadium end. It will also host various other activities including concerts and conventions. Five levels have been proposed within the stadium; two below grade, one at grade, and two above. From the lowest level up, the following gives a description of each.

The Event level sits approximately 10 m below grade and will be the location of the field and other back of house areas including home/visiting team areas, mechanical/electrical rooms, loading areas, garbage facilities, storage and maintenance areas, and a restaurant/club.

On the north side of the stadium the Club level sits approximately 4 m below grade. This level, having an approximate area of 85x25 m, will consist of a restaurant/bar with a kitchen and restrooms.

The Main Concourse level sits at grade level and will consist mainly of concession, retail, ticket, and restroom areas. The three aforementioned levels will consist primarily of cast in place (CIP) concrete slabs, columns, raker beams, and precast seating areas.

The Suite level sits approximately 4 m above the Main Concourse level and consists of thirty-eight suites. There is also a proposed restaurant/bar at the east end with storage and mechanical areas.

The final level is the Upper Concourse level, sitting approximately 8 m above grade. The last two aforementioned levels will have the option of being comprised mainly of steel columns, concrete slab on composite steel deck floors, and steel raker beams or CIP concrete slabs on concrete columns with CIP concrete rakers. The general arrangement of the columns for all floor structures is a 9.3x9.3 m grid.

Adjacent to the stadium on the north east corner is a lower area generally beginning at grade (i.e. Main Concourse Level) with a height of approximately 15 m. At the Main Concourse Level this area will house the Hall of Fame, retail, and a club area. At the Upper Concourse Level the Roughriders main office will be placed on an area of approximately 30x35 m.

A loading area at the west side of the arena will be located at the Event Level and topped with a concrete roof.

Three roof design options are proposed: a fully retractable roof, partially retractable roof, and fixed (non-retractable) roof, with each consisting of a unique steel framing design. All three options are based on a similar roof geometry shown in SK-1 a/b/c in Appendix A. Refer to

sketches SK-2 a/b/c, SK-3 a/b/c, and SK-4 a/b/c, respectively, for renderings of the fully retractable, partially retractable, and fixed roof options.

2.2 Foundations

A geotechnical report by Clifton Associates Limited dated October 22, 2009 is available and the following is an overview of their recommendations.

2.2.1 Foundation Design

The proposed building will be supported on a deep piling system. Augered cast-in-place concrete piles extending approximately 6 m below the event level (16m below grade) down to sounds glacial till have been recommended. The resisting mechanism for the piles may be skin friction, for which skin friction coefficients have been provided, or belled/expanded bases, with an end bearing value of 2150 kPa. Center to center spacing for belled base piles should be designed as to avoid overlapping of the bells.

Grade beams must be constructed with a 150 mm void below to allow heaving soil an adequate space for movement. Soil heave on the underside of a grade beam may cause separation from the piles and cause distortion to the structure.

Based on field investigations, excavation conditions appear good, but may require sleeving due to the presence of sand or gravel lenses. Concrete for the piles should be placed within 2 hrs of excavation to avoid softening of the clay which may result in reduced pile capacities.

The frost depth in this area is estimated to be 1.8 m and will vary depending on air temperature, ground cover, type of fill and other factors. Exterior foundation elements are to be founded to this depth unless alternative frost protection measures have been taken, such as providing adequate insulation.

2.2.2 Slab on Grade Construction

Any grade supported slabs are to be preferably constructed on a uniform well constructed granular fill to minimize differential settlement. It is important to note that while vertical settlement is intended to be minimized, slight movements may cause potential for some cracking and loss of utility. If this level of performance is not acceptable, a structurally supported slab is recommended.

High plasticity clay was encountered at the site with high potential for heaving up to 150 mm. These areas are to be subcut and replaced with granular fill. Organic and soft material is to be removed to allow the subgrade to be proof rolled to determine the location of any soft areas. These areas should be excavated and filled with granular fill. All subgrade should be compacted to at least 95 percent of the maximum dry density as determined in accordance with the standard Proctor test.

2.2.3 Excavations

Significant dewatering should not be required for this site. This may change as a result of precipitation or water seeping from fractures/fissures within the soil.

At the anticipated excavation depth of approximately 10 m below grade, silty clay is encountered which is unable to support wheeled vehicles. A minimum of 900 mm graded pit run gravel over geotextiles or geogrids may be placed to alleviate this. Excavations are generally to be no steeper than 1 horizontal to 1 vertical (1:1).

Two shoring options were outlined. The use of a tangent pile wall generally limits the loss of ground when compared to a supported shoring system, however the use of tie back anchors will be limited by property restrictions. Alternatively, a diaphragm wall may be considered. This is constructed by excavating a trench and creating a wall with reinforced concrete. It is also possible to later use this wall as a structural component of the building.

2.2.4 Sulphate Attack Potential

The potential for sulphate attack at this site has been classified as severe. This classification is a result of the soil containing greater than 0.1 percent sulphates by dry weight of soil. Per the recommendation of the Geotechnical Report, Sulphate Resistant (Type HS) cement must be specified for all concrete in contact with the native soil. However, care should be taken in assessing the potential for leaching/leakage of sulphates through any non-native soils (i.e. engineered fills etc.) in determining where Type HS cement will be used.

2.3 **Superstructure - Bowl**

2.3.1 General

The proposed structure will consist of a slab on grade at the event level. Structure up to and including the main concourse level will consist of CIP structural concrete slabs on concrete columns arranged in a 9.3x9.3 m grid. The seating raker beams will be CIP concrete from the event level to the main concourse level with precast concrete seating tiers. Levels above the main concourse level will be composite concrete slab on deck floors supported by steel columns in a 9.3x9.3 m grid. Steel raker beams are to be used to support precast concrete seating at any level above the main concourse. An alternative option to the levels above the Main Concourse Level is to use CIP concrete for slabs, columns, and raker beams.

The building extension beyond the north east corner of the stadium has a small floor area framed with concrete on composite steel deck on steel beams and columns or as an alternative, CIP concrete slabs on CIP columns. The roof construction in this area will be steel deck on steel beams or OWSJ with steel columns.

The loading area located at the west end of the stadium will have a slab on grade at the Event Level. A concrete slab with beams will form the roof approximately 9 m above the Event Level. A proposed grid of 1000x1000 mm columns was used to estimate the depth and size of beams and

slab needed, however this layout is subject to change based on turning radii needed for trucks. The preliminary layout is a 350 mm CIP concrete slab with 2200 mm deep by 1500 mm wide beams.

Refer to Appendix B, sketches SK-5 to SK-14 for typical bay plans for the event level, club level, main concourse level, suite level, and upper concourse level, respectively. Areas with higher loads (mechanical, electrical rooms, etc.) may require thicker composite slab as a result of higher design loads. SK-15 and SK-16 show typical sections of the stadium.

Three roof framing options are proposed with respective steel allowances.

2.3.2 Lateral Stability

Concrete shear walls combined with steel X-bracing and moment frames will provide lateral stability to the building. Shear walls will be located at stairs, elevators, and where they are architecturally acceptable to continue in one line from foundation to upper concourse level. Steel X-bracing and moment frames will be used above the upper concourse level. All bracing components will be evenly distributed as to minimize any torsional effects.

2.3.3 Expansion and Separation Joints

Expansion and separation joints are added to reduce the effects of concrete shrinkage and cracking, which is particularly important for structures with exposed concrete. They will be strategically placed in areas where cracking is most likely to occur. The location of these joints requires co-ordination with the architect to accommodate both structural and architectural considerations. For preliminary purposes, the proposed layout for expansion joint is to divide the stadium into four quadrants.

2.3.4 Seating

The sketches included indicate areas of permanent seating. Cast in place concrete rakers will form the support for precast seating tiers from the event level to the main concourse level. Any rakers above this are to be steel with pre cast seating tiers. Approximate thicknesses for the seating units will be 100 mm for treads and 150-200 mm for risers. Actual thicknesses and final configuration of the precast units will be determined in conjunction with the Contractor. The framing within vomitories, steps, stairs, etc. will also consist of precast units.

2.4 **Superstructure - Roof**

Each of the retractable main roof options will be comprised of main structural box girder trusses spanning in one or both directions across the entire stadium. Secondary framing in the form of steel beams, open web steel joists (OWSJ) or custom trusses will run orthogonally to the main members to support the roofing and deck. Different configurations for primary and secondary framing were considered to achieve an optimized design resulting in efficient use of steel. The fixed roof option will have main trusses spanning the width of the structure with steel beam purlins forming the secondary framing.

At all joints between movable roof panels, adequate seals will be an integral aspect of the design to keep the building weather tight. Continuous air inflatable bladders (2 per joint) are anticipated but all state of the art technology should be considered as part of the detailed design.

The following provides details for each of the three roof options.

2.4.1 *Option 1 - Fully Retractable Roof Option*

The fully retractable roof option consists of six roof panels; the two end panels are fixed with the remaining four retracting to opposite ends. SK-17 shows the roof framing plan and elevations of the roof. For further clarification a typical truss is shown in SK-18 and SK-19. The main truss girders (T1, T2 and T3 on SK-17) span across the stadium providing support to the secondary trusses (T4 on SK-17) as well as stability to the overall roof. They are comprised of rods forming the tension members and a stabilizing box truss acting as the compressive member. Light OWSJ run between the secondary trusses creating the support for the roofing and deck. The secondary trusses (T4) will also act as the support system for the rails which create the retractable path for the panels. Trusses will be located at the perimeter of the structure acting as the main truss retractable mechanism wheel supports.

2.4.2 *Option 2 - Partially Retractable Roof Option*

As shown in SK-20, the partially retractable roof consists of four main box truss girders; two spanning each axis of the stadium. Around the perimeter of the trusses OWSJ infill and support roofing and steel deck. Four panels are located at the center opening which will retract to opposite sides of the stadium and stack. SK-21 shows the main trusses, two panels of one end and joists of the roof structure. The location of the rail system to support the retractable panels will run along T1.

2.4.3 *Option 3 - Fixed (Non-retractable) Roof Option*

The fixed roof option consists of arch trusses at 12 to 14 m spacing as shown in SK-22. Steel beam purlins span between the trusses and support the deck. Plan chevron bracing will provide lateral stability to the roof and bridging lines will provide stability to the trusses as well as a path for shear travel between adjacent levels.

2.4.4 *Roof Retracting Mechanism*

2.4.4.1 *Partially Retractable Option*

The partially retractable roof has four proposed moving panels which stack at opposite ends of the stadium. Independent pulley systems will be provided for

each panel consisting of cables which will pull the front end of the panel along the linear track resulting in the back wheels being pushed along the track until the resting position is reached.

2.4.4.2 Fully Retractable Option

The fully retractable option consists of four moving panels moving to opposite ends of the stadium as described in section 2.4.1. Each side of the main truss girders on panels 1 and 2 will have motorized wheels which will push the truss in the needed direction. Rails are typically located along the panels on the support trusses (T4 on SK-17) and will provide support paths for the back ends of adjacent panels as they roll towards the resting position. Perimeter girders located on the perimeter of the structure will provide the support for the front end of the panels.

2.4.5 Adjacent Roofs

Any structure not below the main roof described above will consist of a 76 mm steel deck on steel beams or OWSJ.

2.4.6 Roof Bracing

All roof options will be braced with a system of horizontal X-bracing.

3 GENERAL CRITERIA AND ASSUMPTIONS

3.1 General:

All design and construction to conform to the requirements of the National Building Code of Canada, 2005 Edition.

3.2 Geotechnical Information:

Geotechnical Design Report by Clifton Associates Limited, dated October 22, 2009.

3.3 Design Criteria/Design Loads:

Refer to Appendix C.

3.4 Fire Ratings:

The structure is anticipated to require a 2 hour fire rating to meet code requirements.

4 RISK ASSESSMENT

The following is a list of items or particular aspects of this project and the related design process which we feel create risk or exposure to the Owners:

4.1 Schematic Design

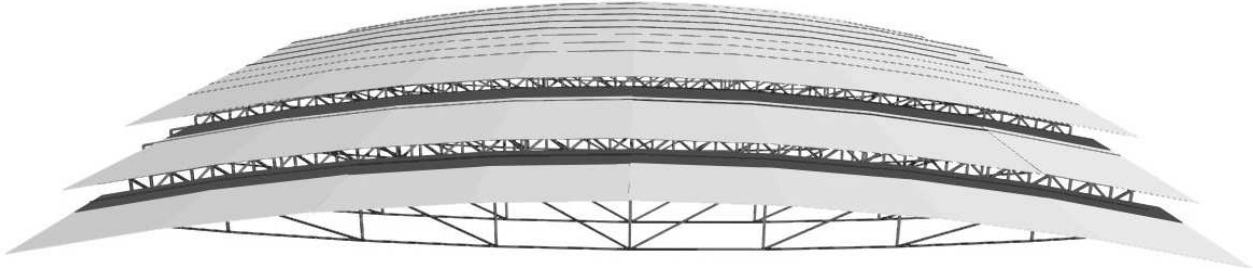
The schematic design for the project has not been signed off. We have, however, proceeded to produce preliminary sketches based on our understanding of the present schematic design. The risk here is that modifications will affect the structural sizing and quantities presented here.

4.2 Input regarding the following elements of the project has not yet occurred. There may be requirements which affect the structural design and cost:

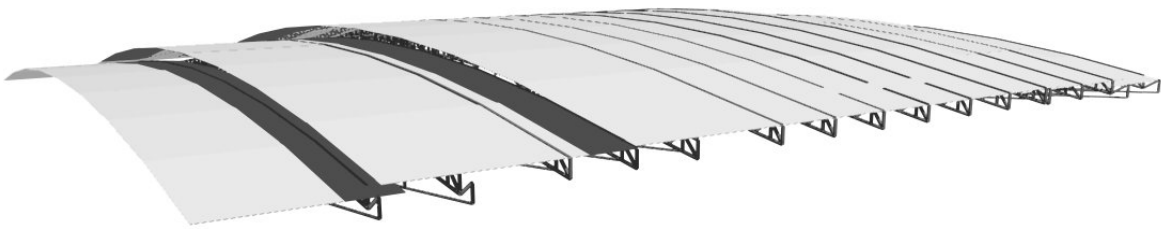
- Window washing requirements
- Elevator requirements
- Acoustic requirements
- Fire protection requirements

APPENDIX A
RENDERINGS OF PROPOSED ROOFS

a.



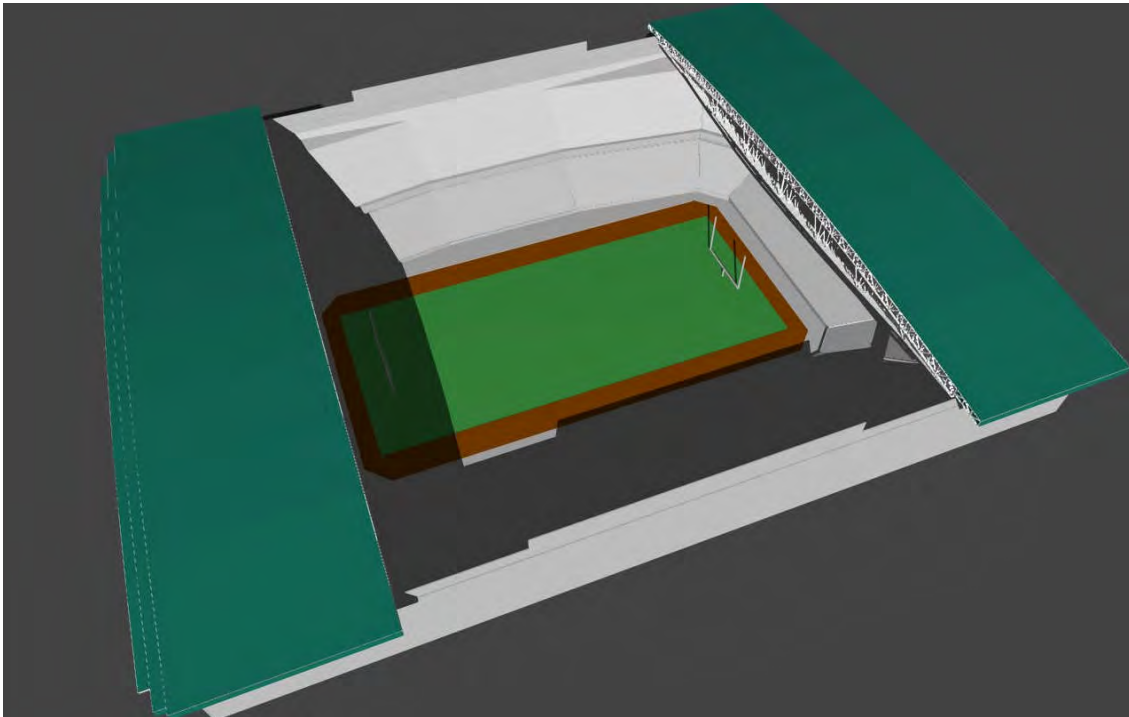
b.



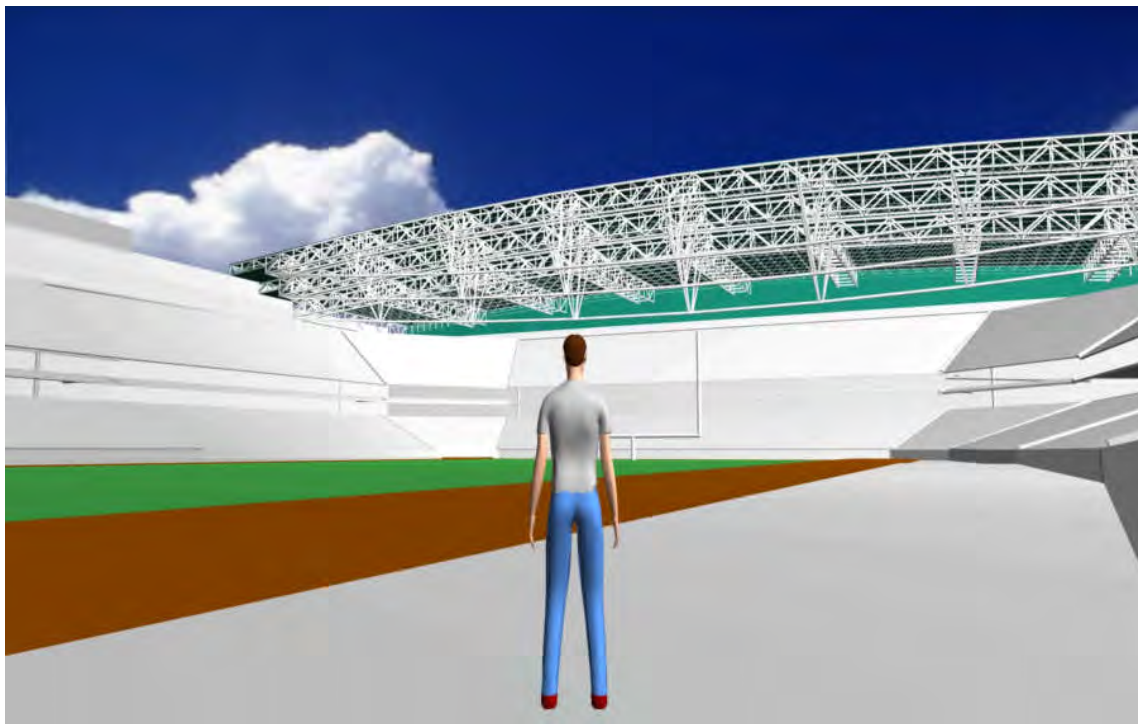
c.



SK-1 a/b/c General Stepped Roof Geometry

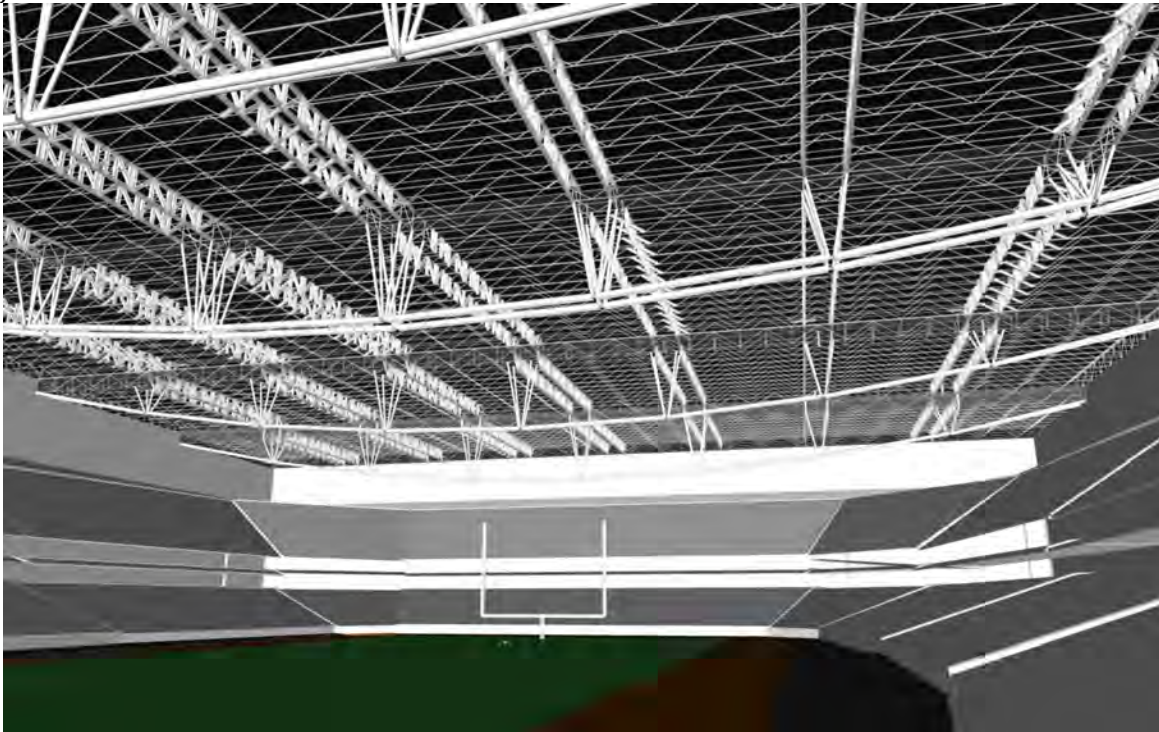


a. Exterior view of roof retracted



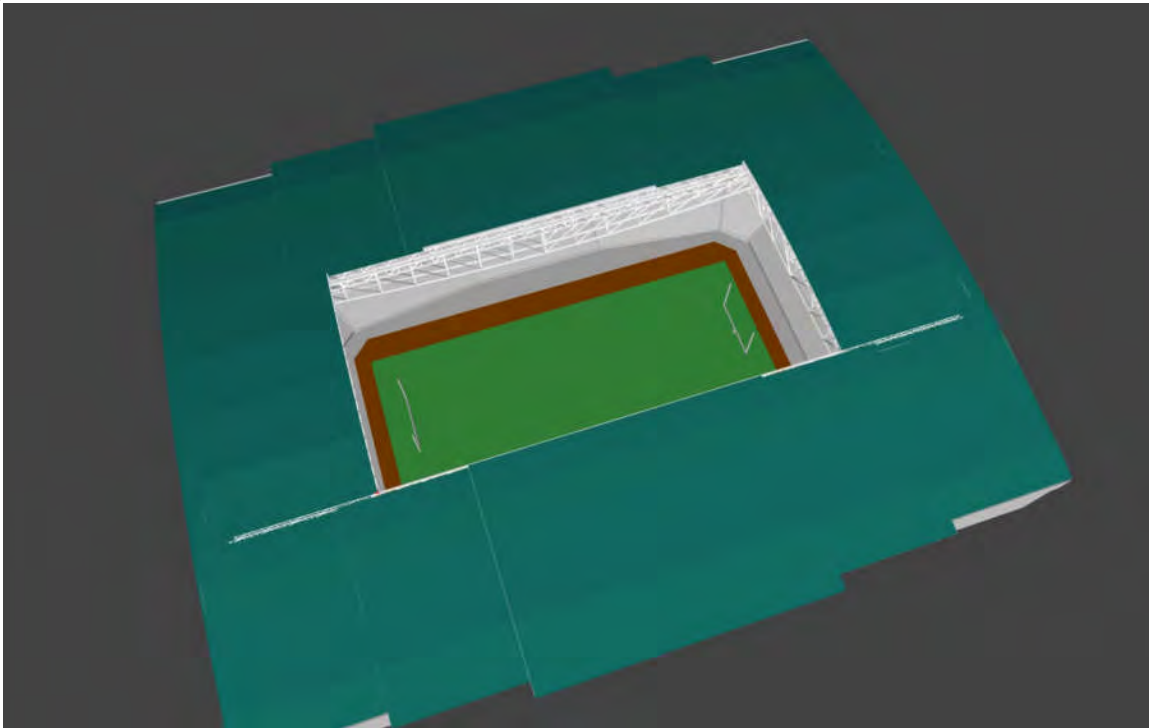
b. Interior view of roof fully retracted

SK-2 a/b Option 1 - Fully Retractable Roof Option

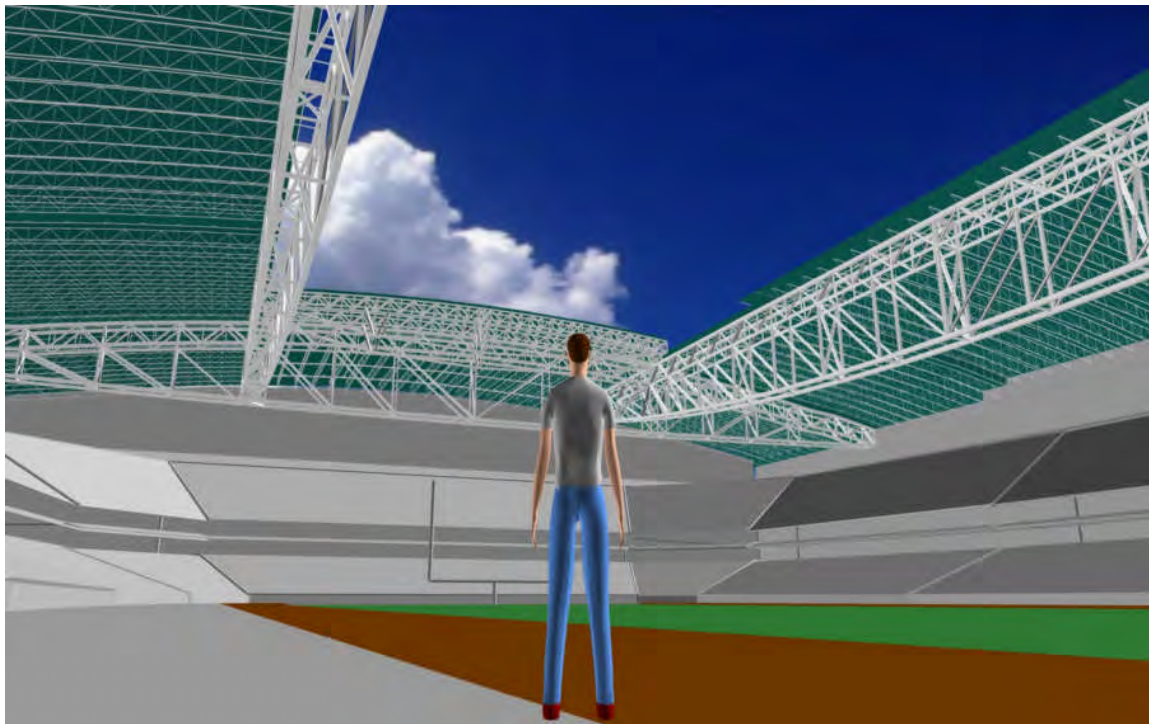


c. Interior view of roof closed

SK-2 c Option 1 - Fully Retractable Roof Option

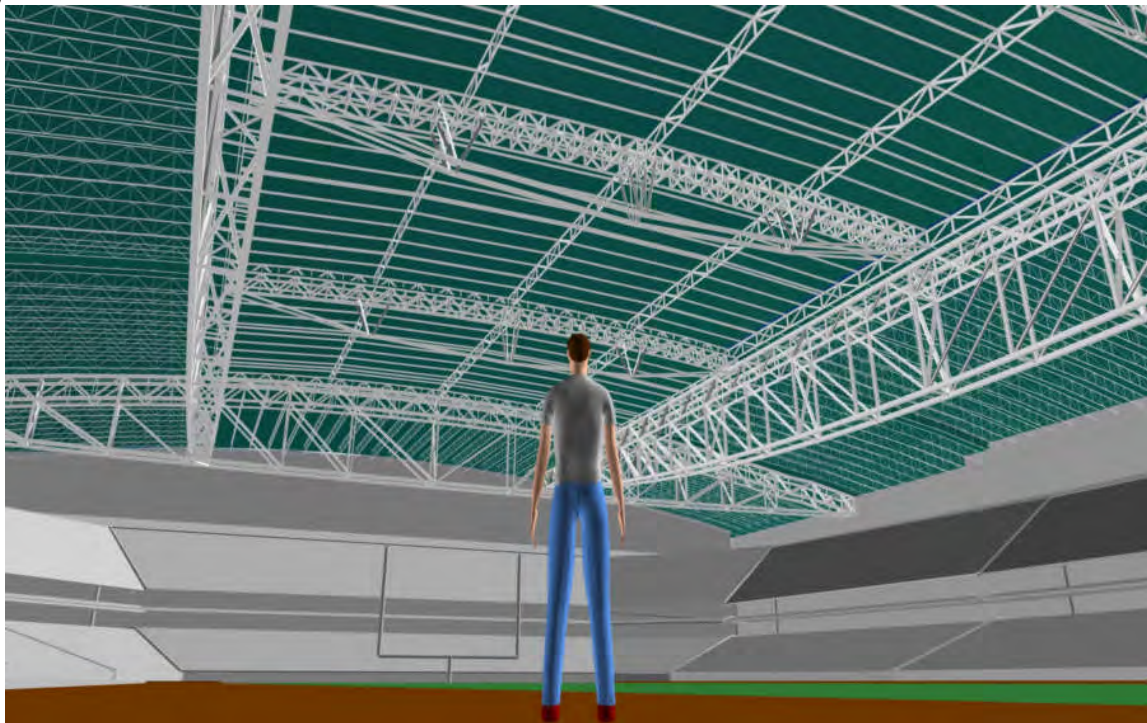


a. Exterior view of roof retracted



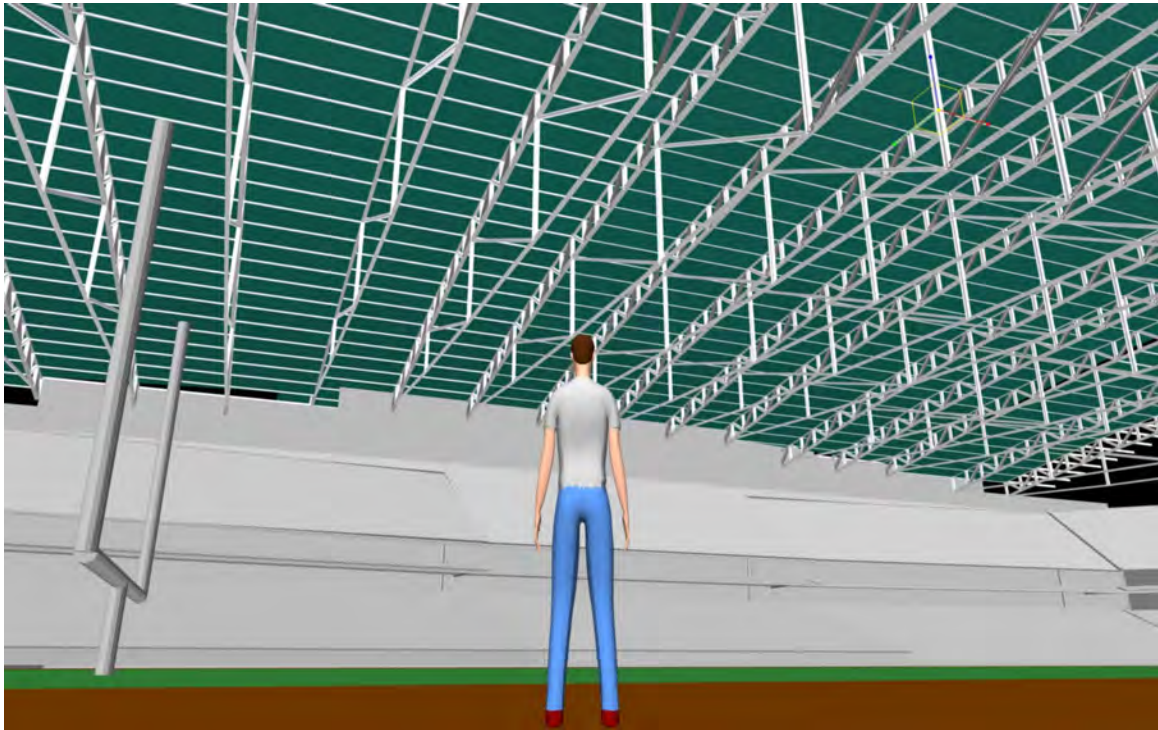
b. Interior view of roof fully retracted

SK-3 a/b Option 2 - Partially Retractable Roof Option

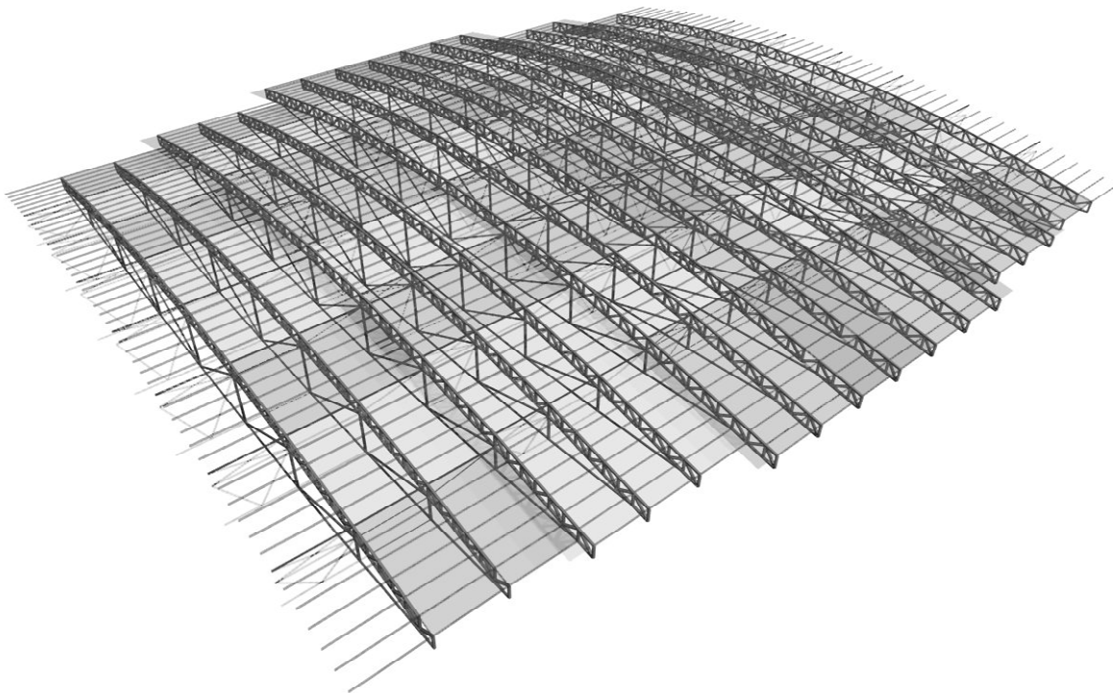


c. Interior view of roof closed

SK-3 c Option 2 - Partially Retractable Roof Option



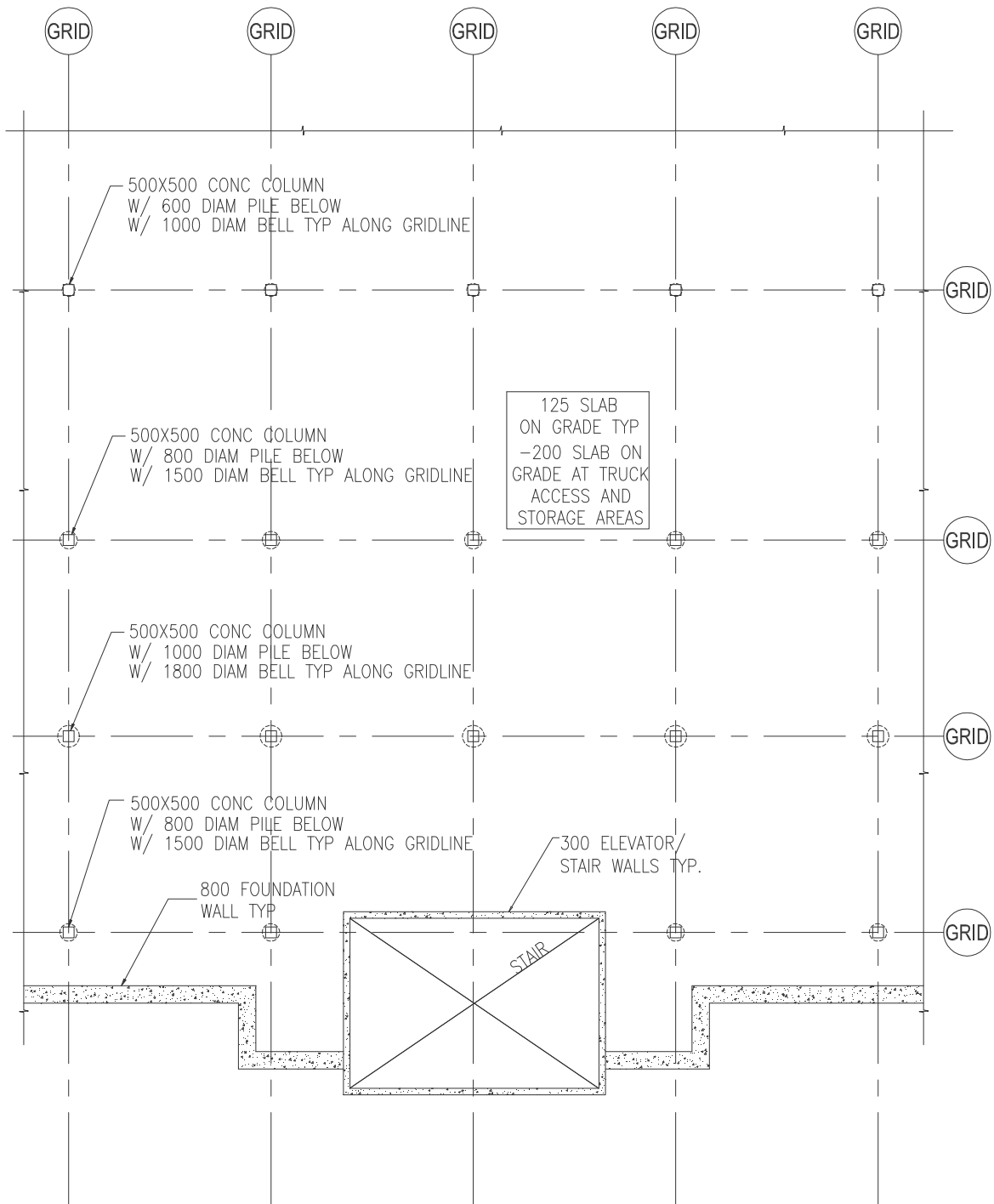
a. Interior view



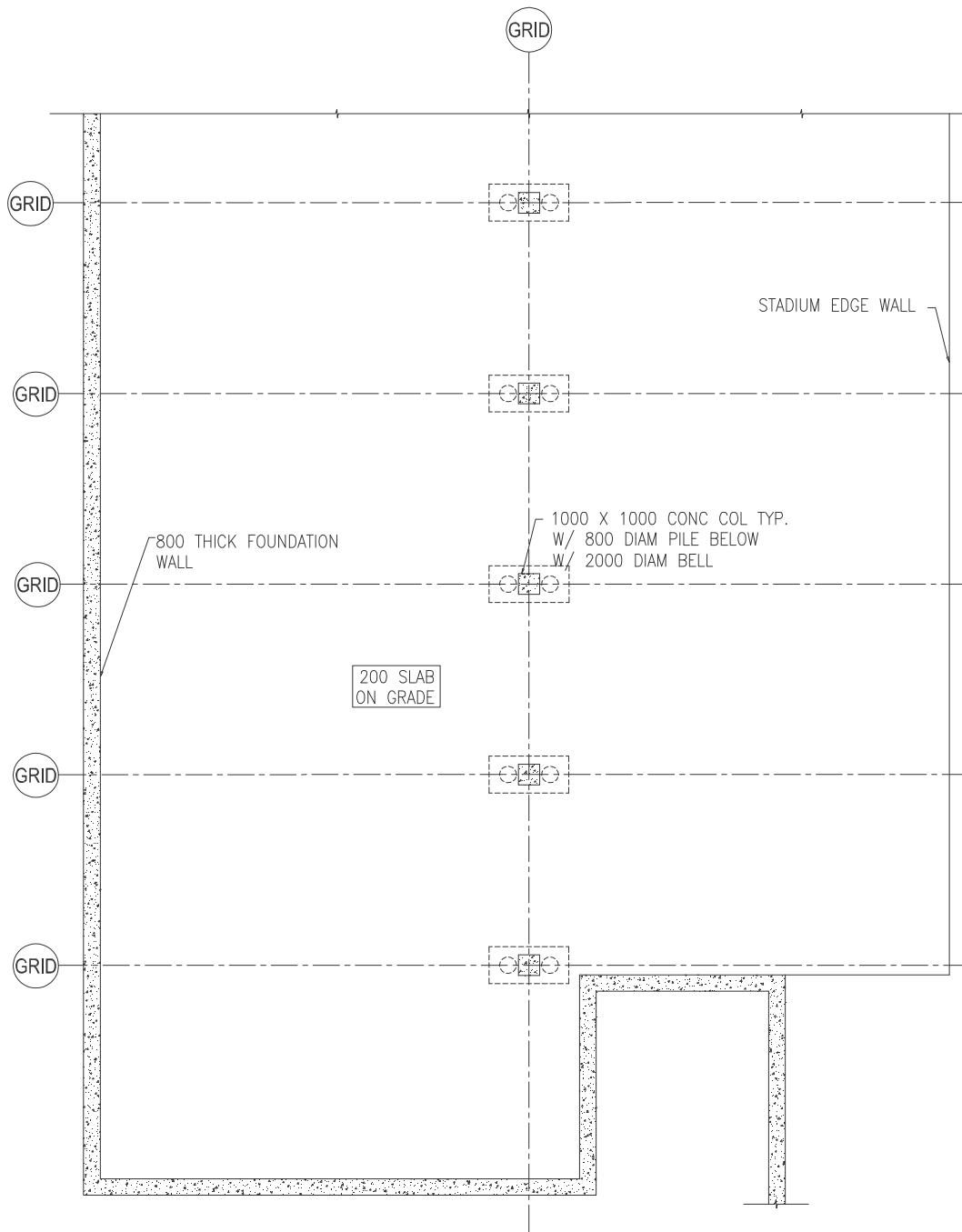
b. Exterior view of roof framing with transparent deck

SK-4 a/b Option 3 - Fixed Roof Option

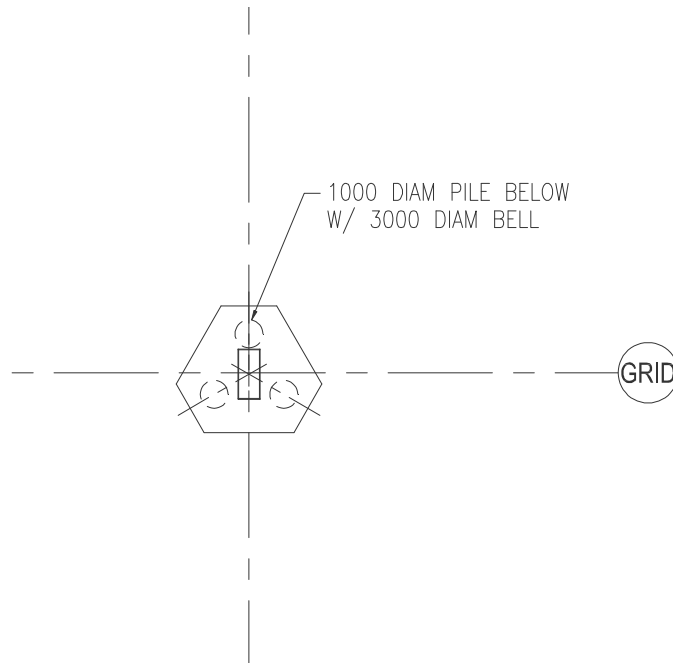
APPENDIX B
STRUCTURAL SKETCHES



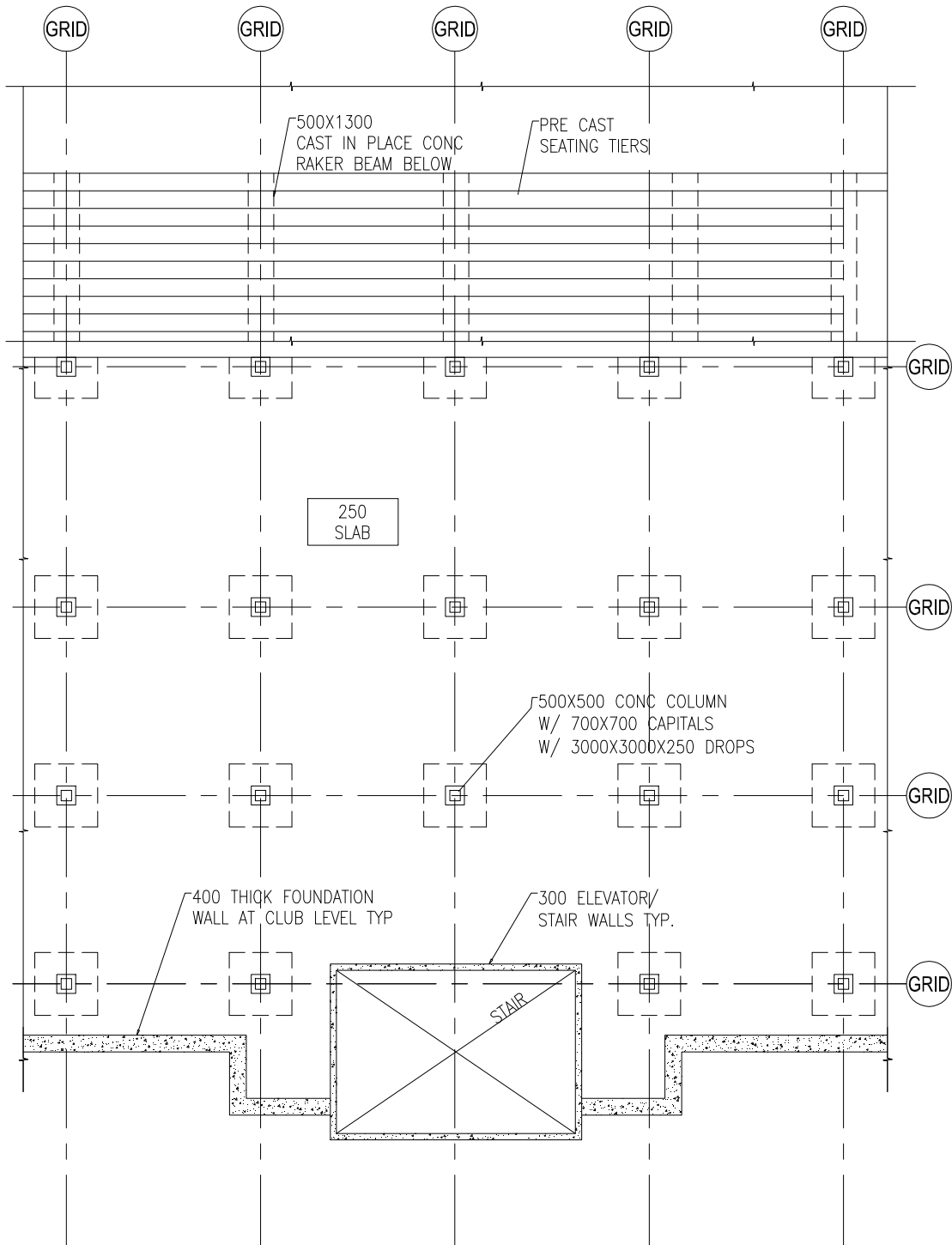
SK-5 000 - Event Level Plan



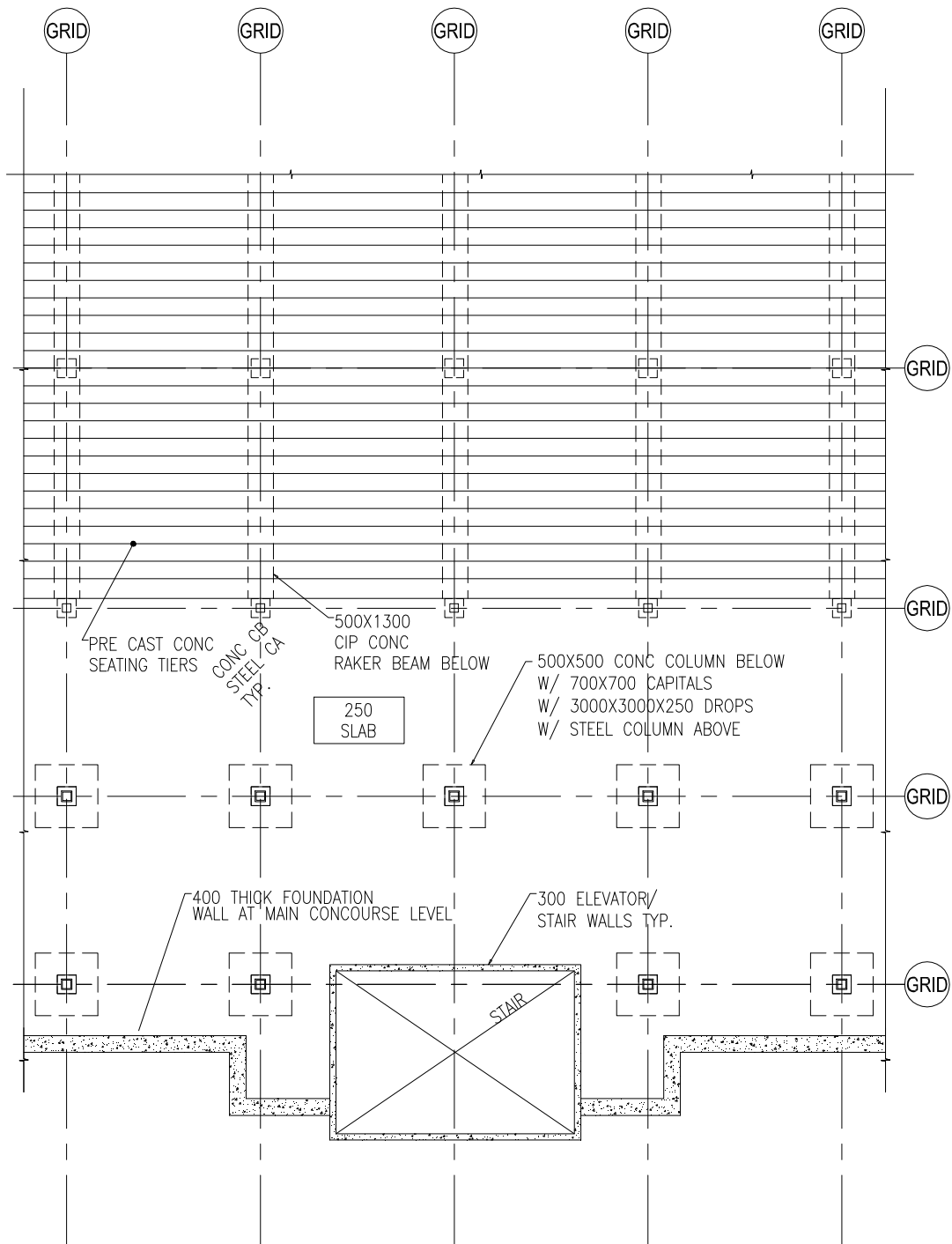
SK-6 000 – Loading Area Event Level Plan



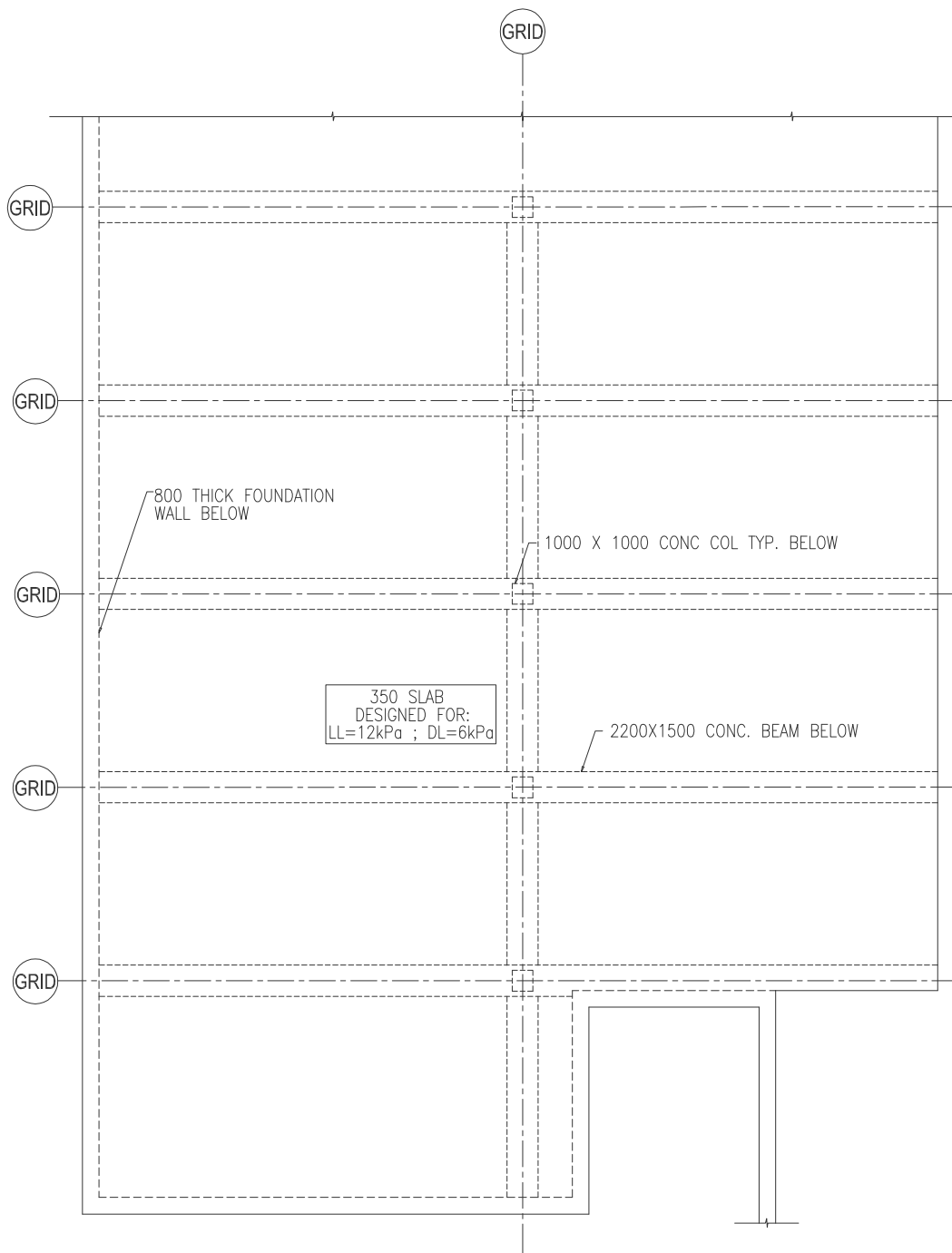
SK-7 000 – Event Level Plan – Typical Pile Group for
Column Supporting Truss on Fixed and Partially Retractable Roof



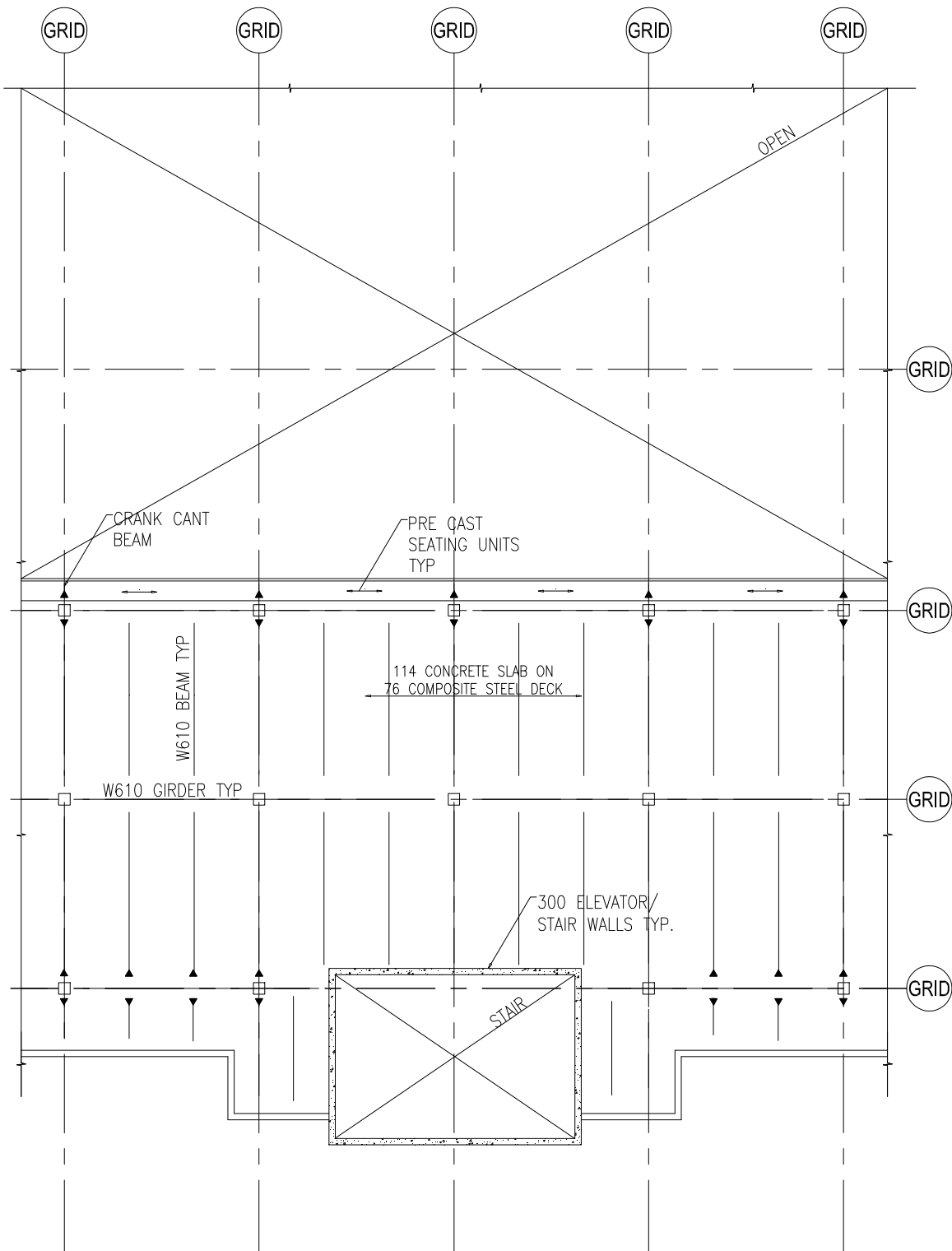
SK-8 100 - Club Level Plan



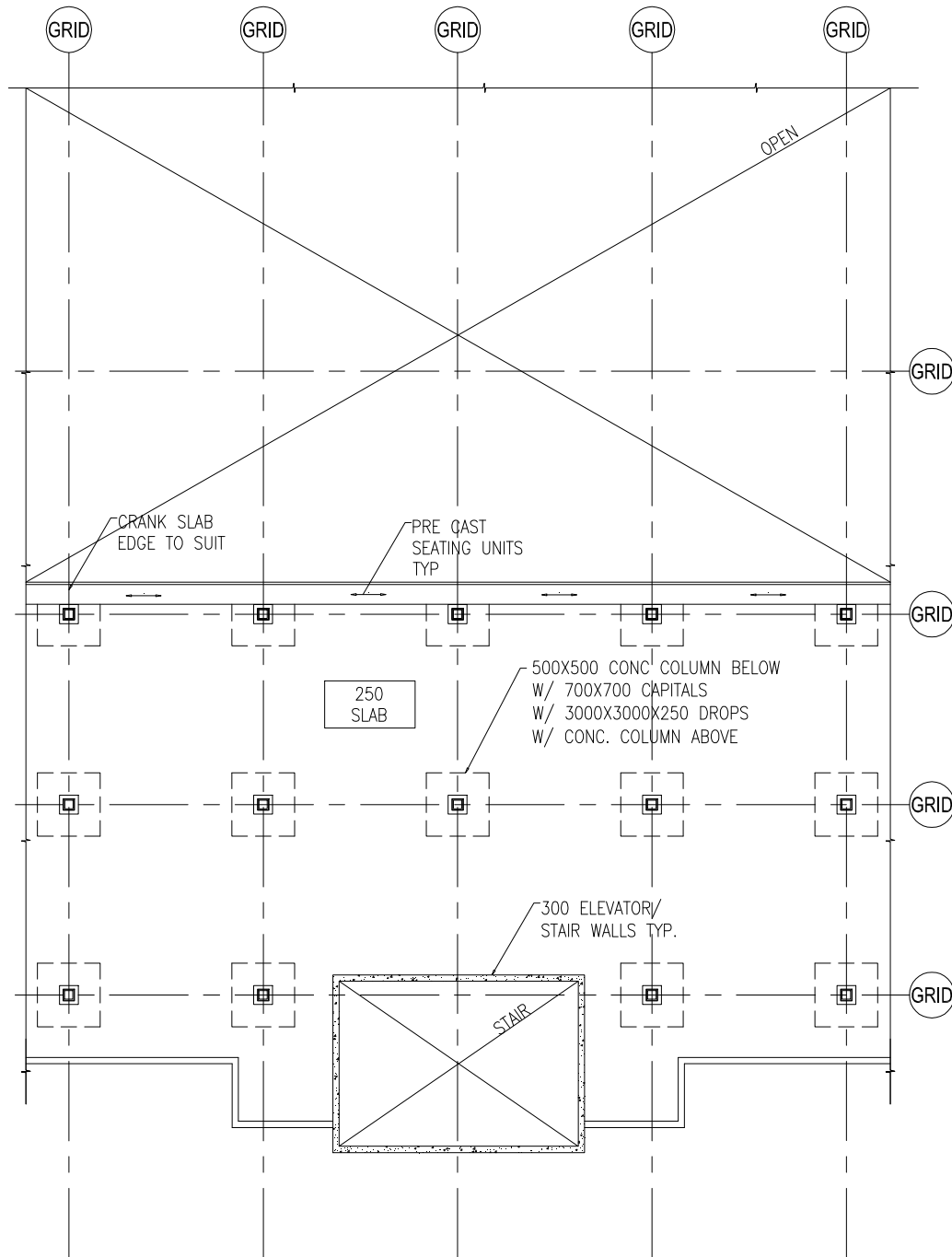
SK-9 200 - Main Concourse Plan



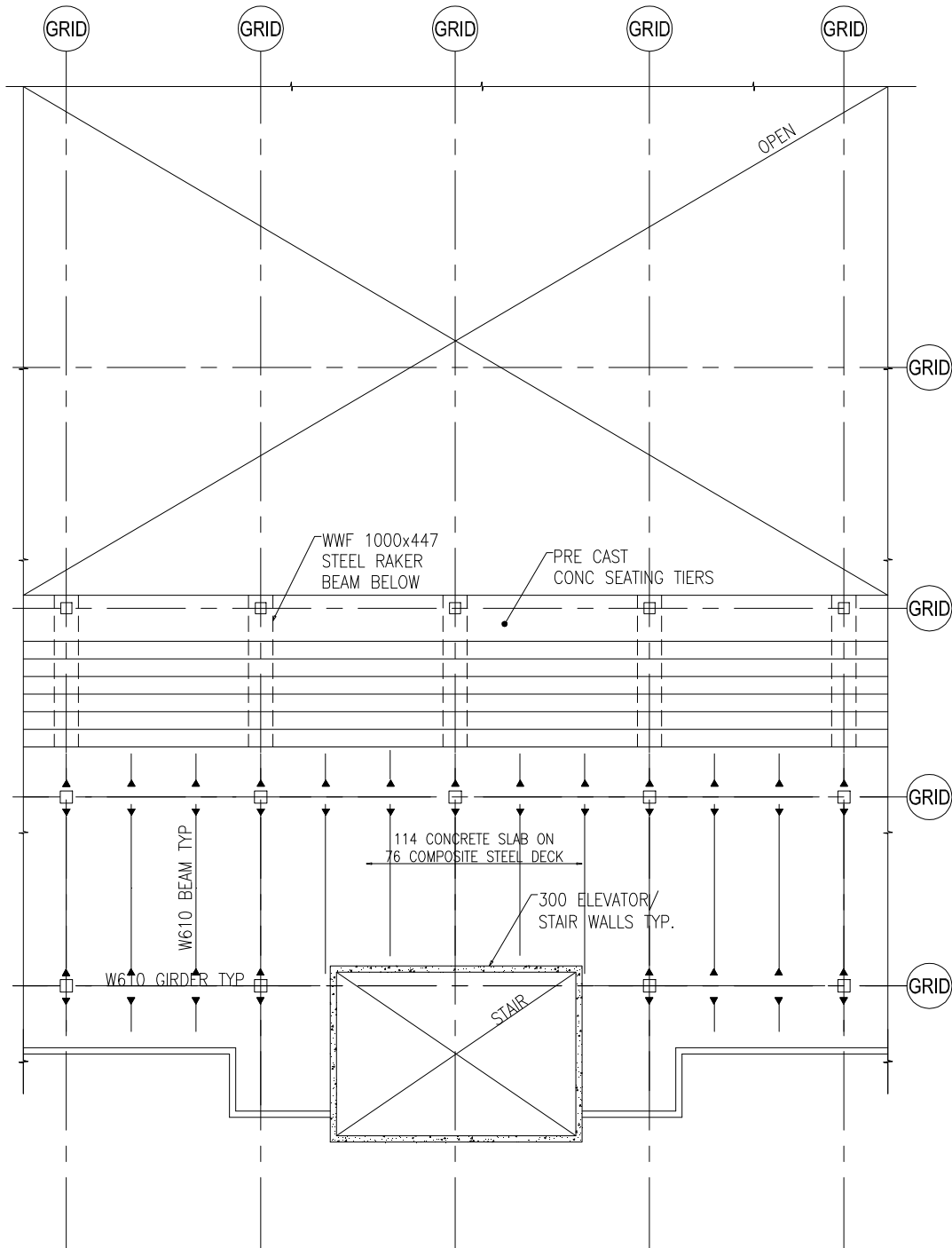
SK-10 200 – Loading Area Main Concourse Plan



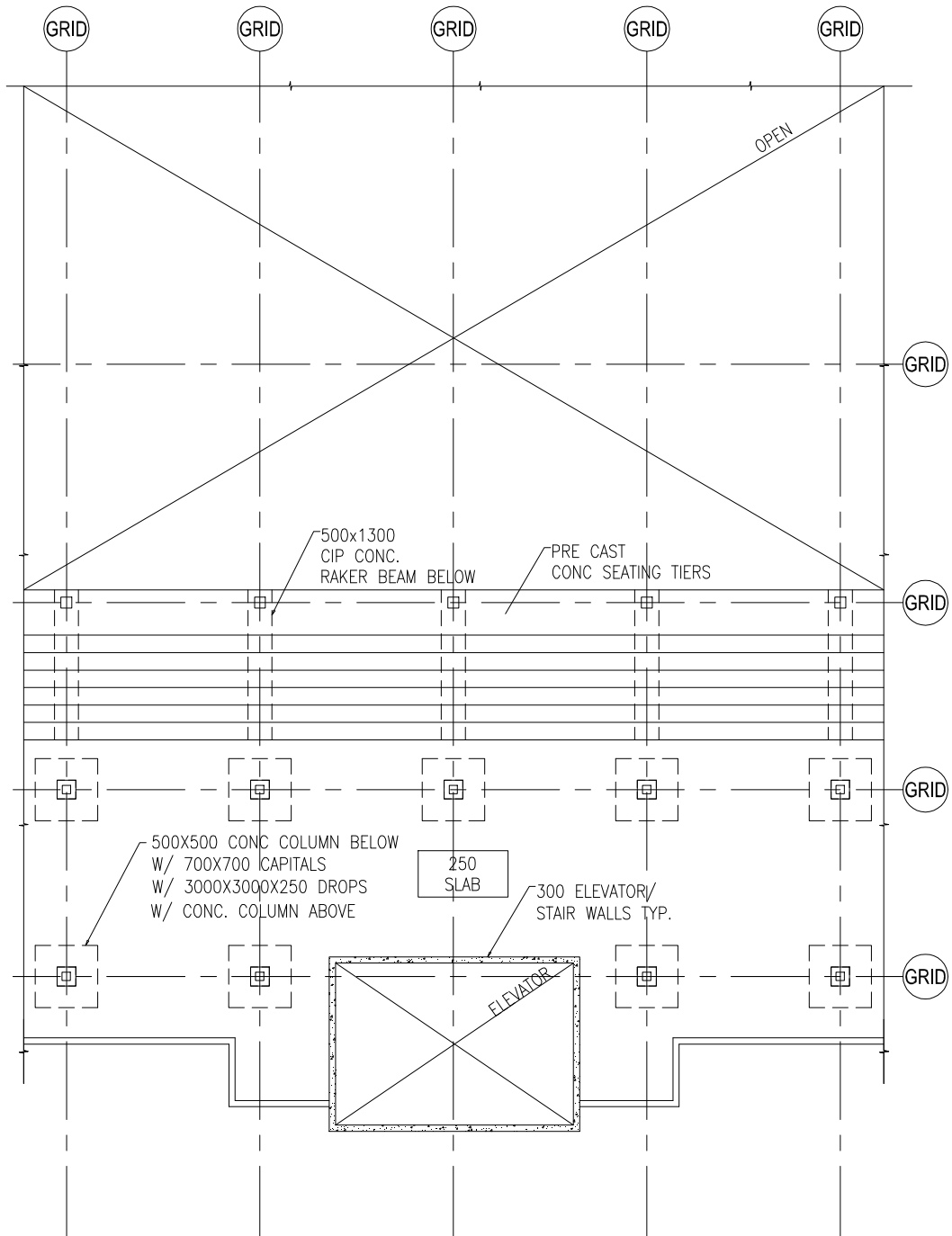
SK-11 300 - Suite Level Plan (Steel Framing Option)



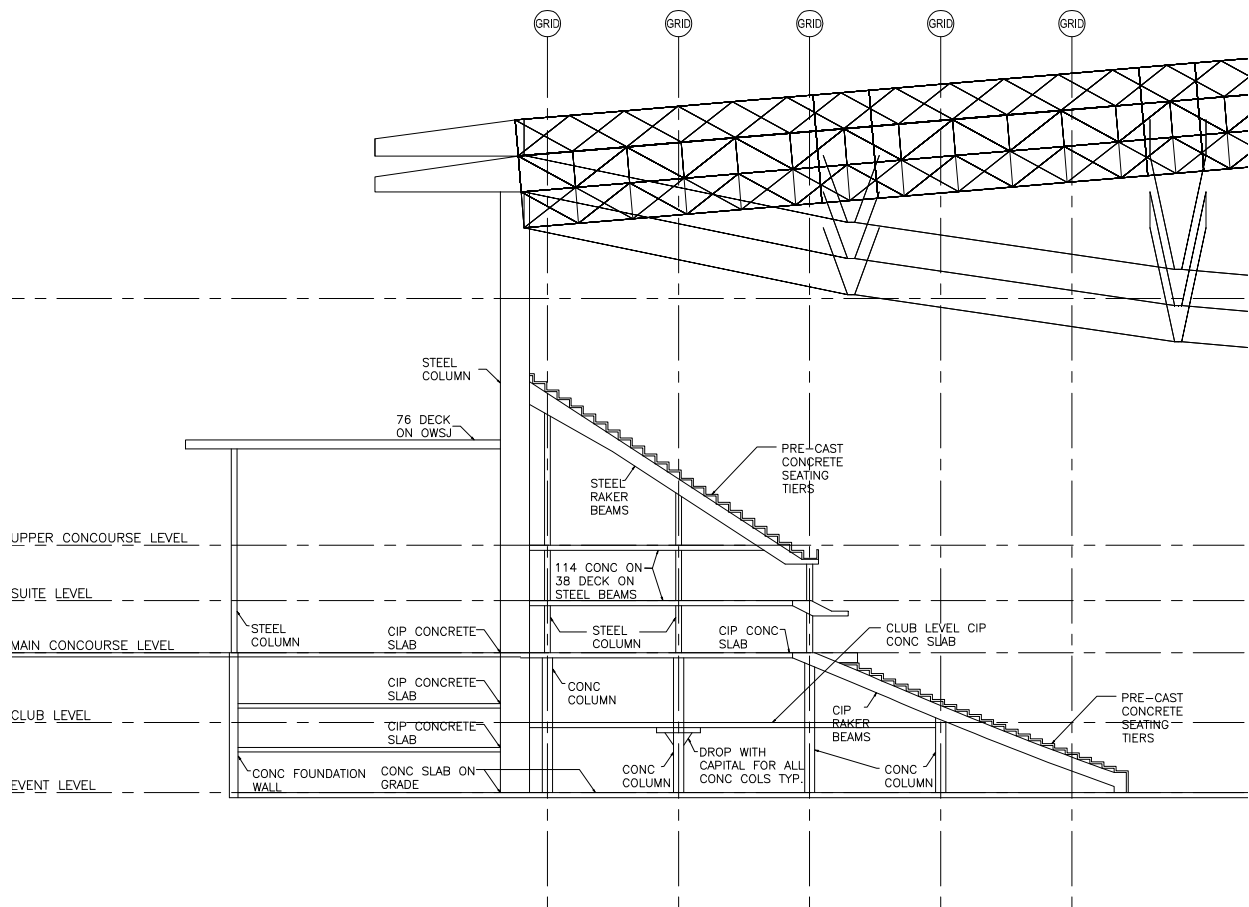
SK-12 300 - Suite Level Plan (CIP Concrete Framing Option)



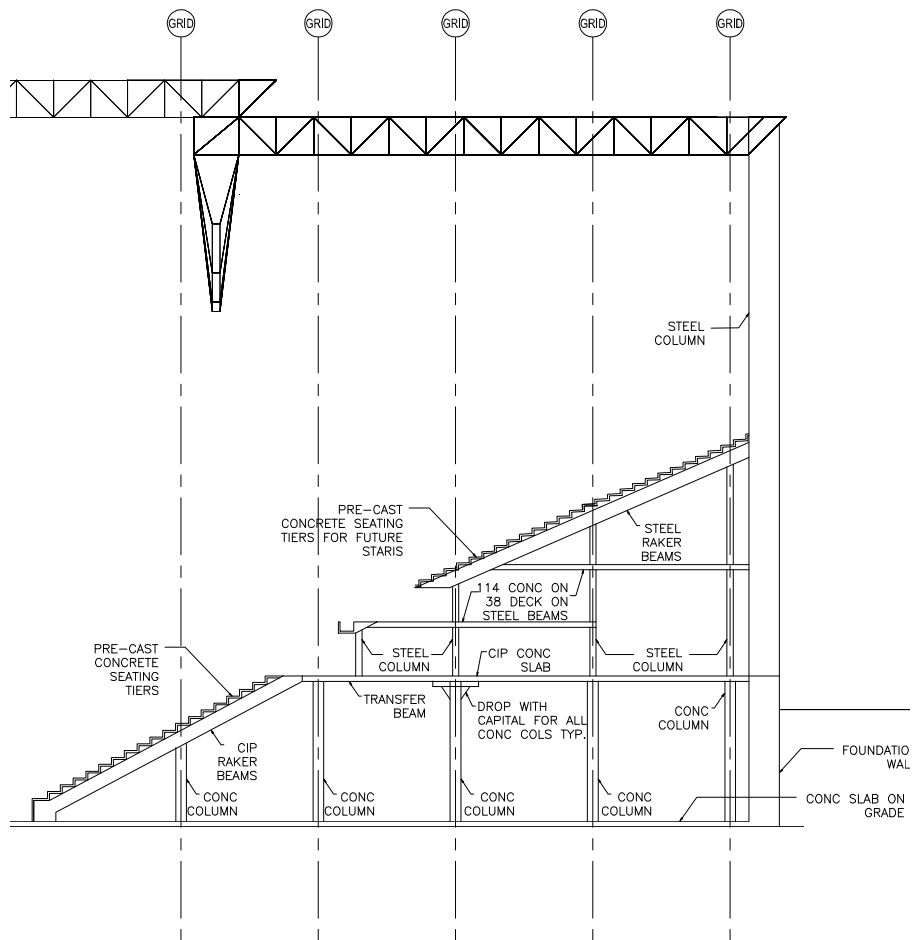
SK-13 400 - Upper Concourse Level Plan (Steel Framing Option)



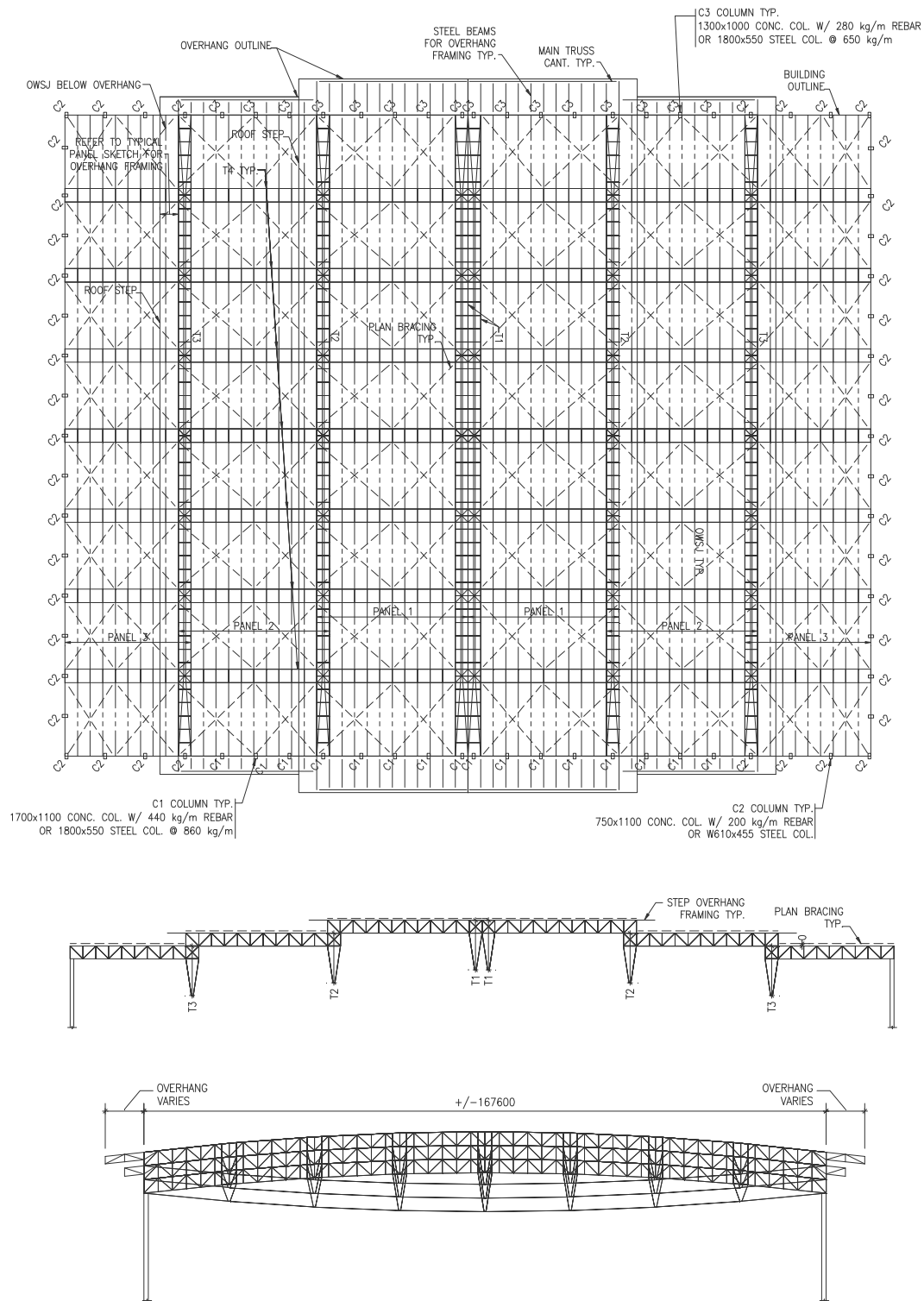
SK-14 400 - Upper Concourse Level Plan (Concrete Framing Option)



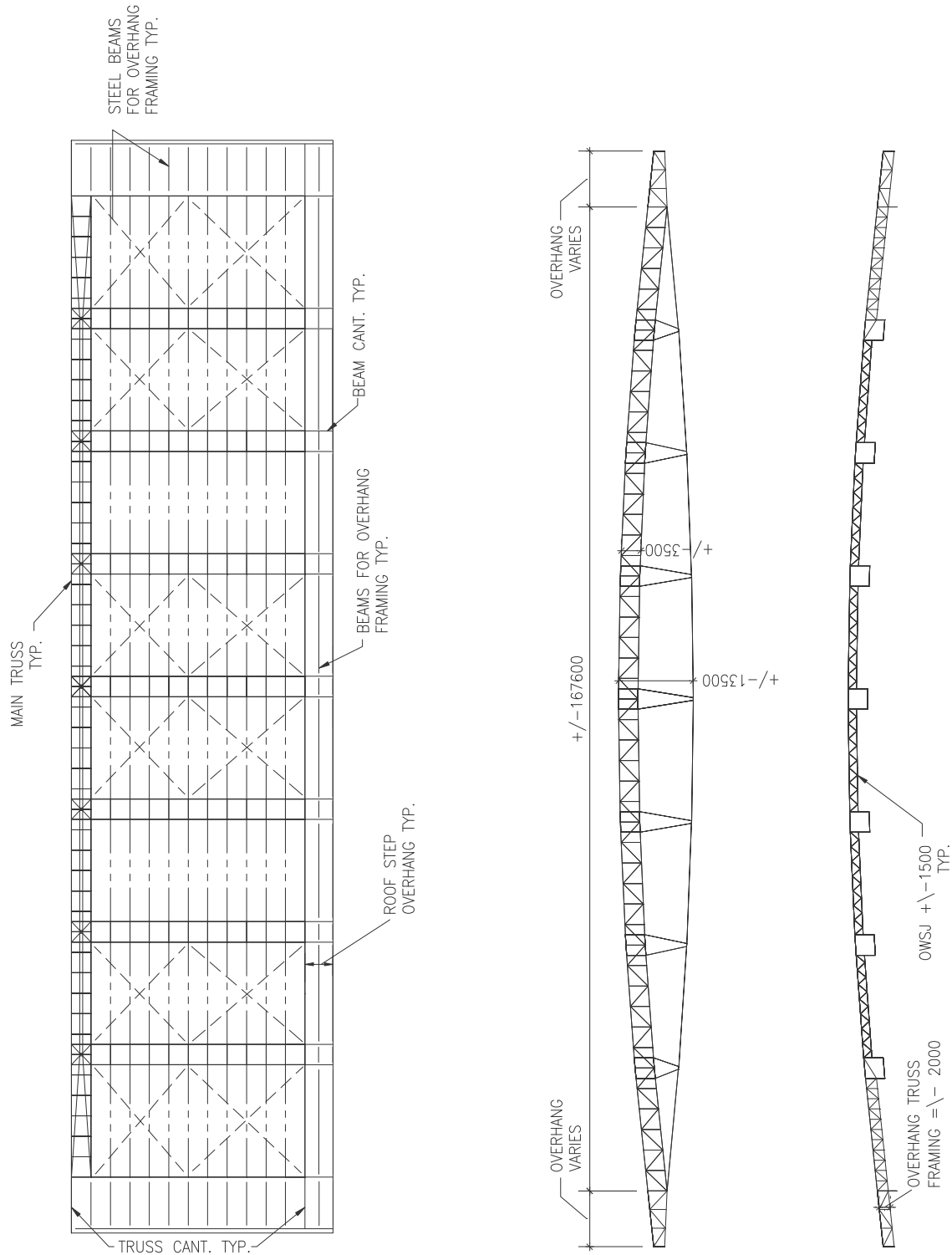
SK-15 North End Stadium Section with Fully Retractable Roof



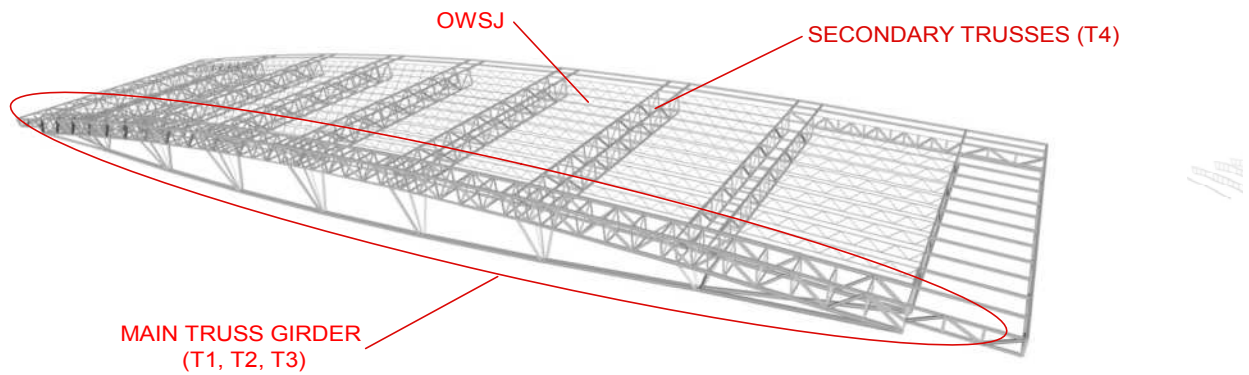
SK-16 West End Stadium Section with Fully Retractable Roof



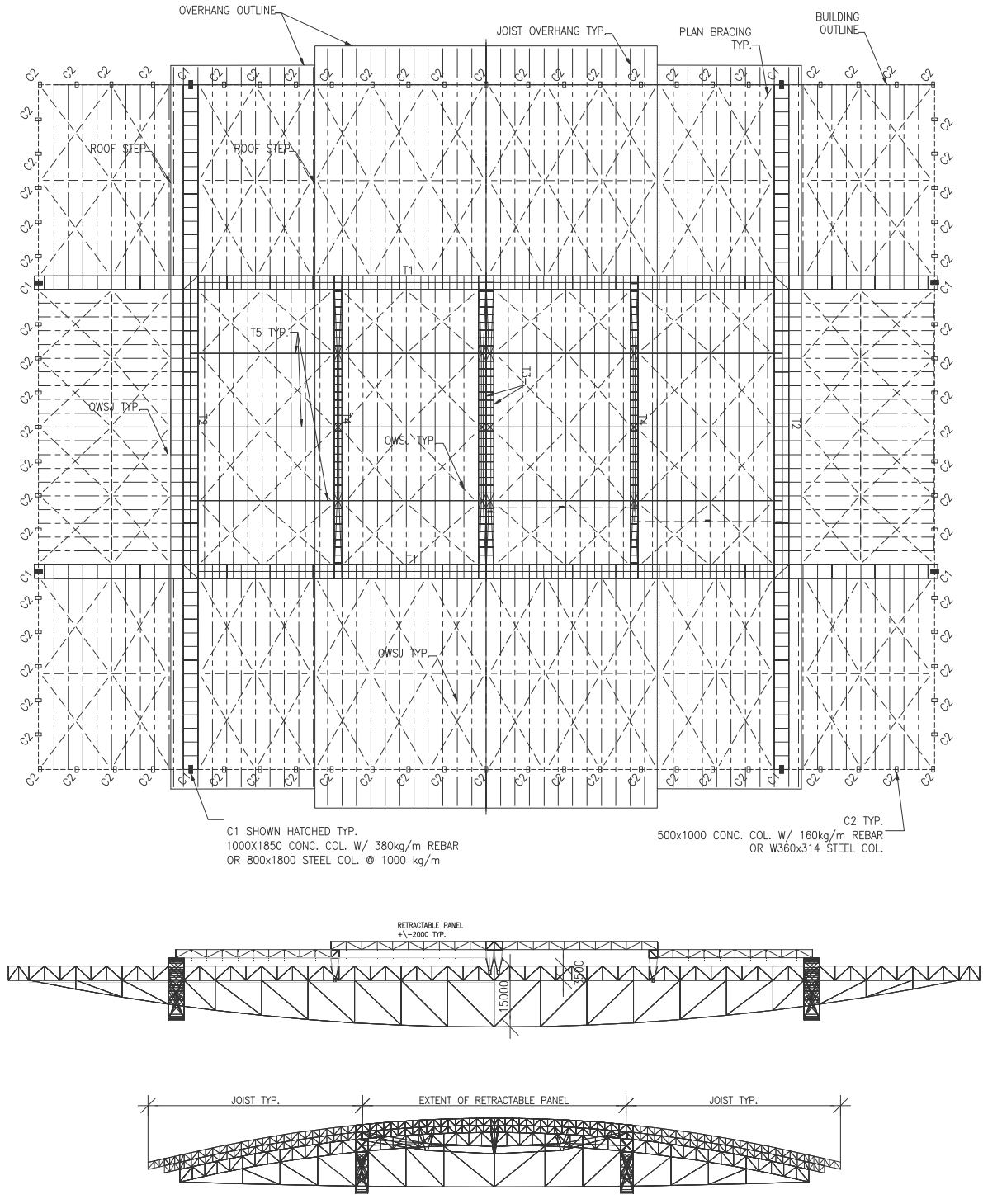
SK-17 Option 1 - Fully Retractable Roof Framing Plan



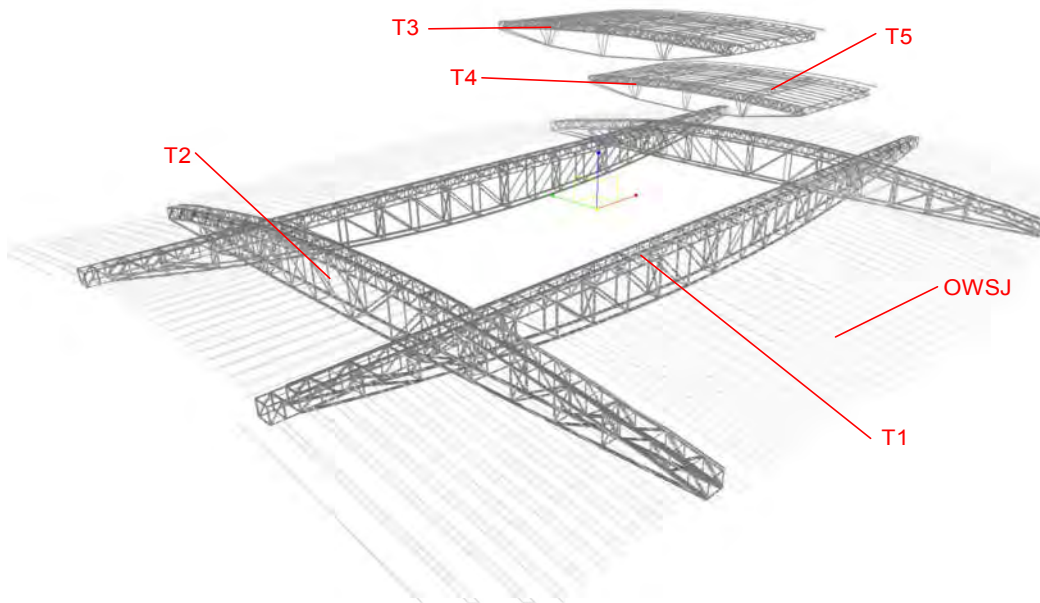
SK-18 Option 1 - Fully Retractable Roof – Typical Panel



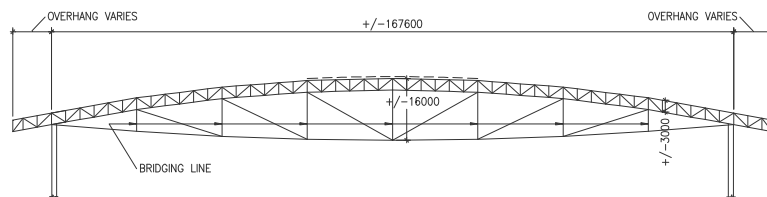
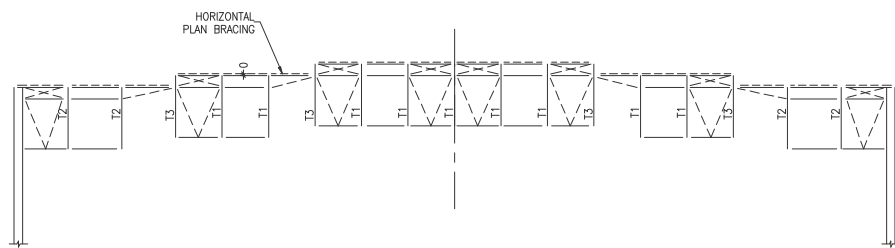
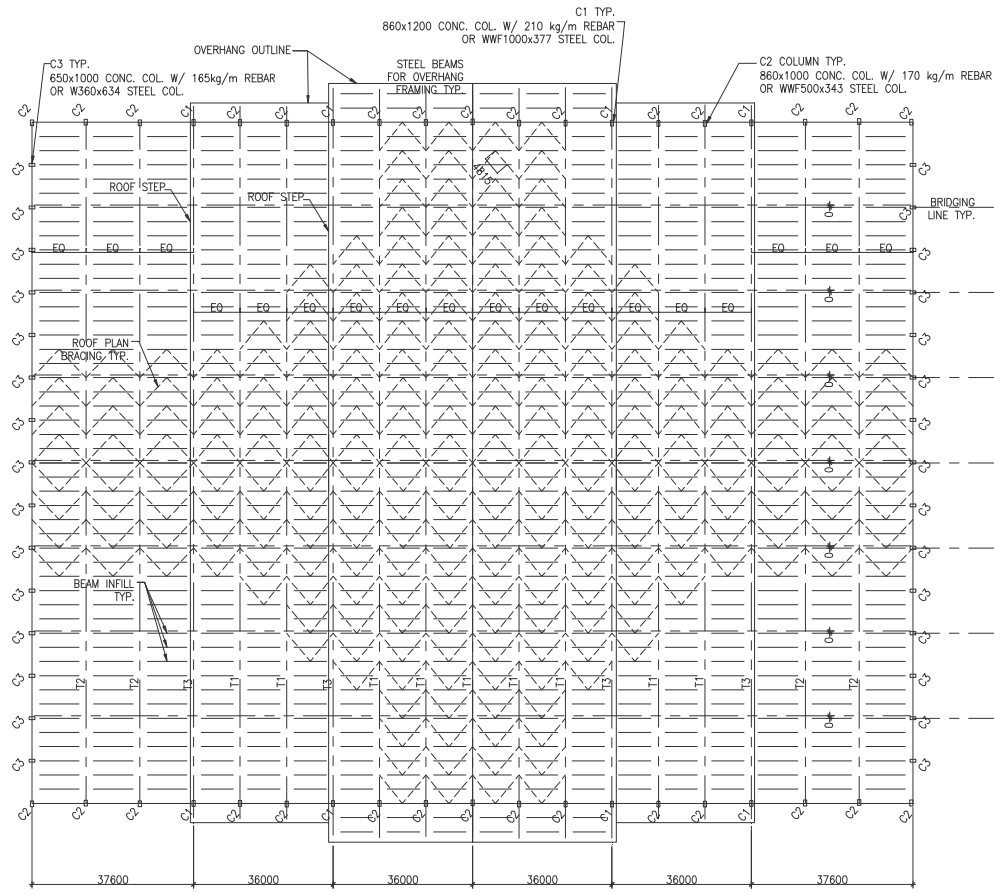
SK-19 Option 1 - Fully Retractable Roof – Typical Panel



SK-20 Option 2 - Partially Retractable Roof Option



SK-21 Option 2 - Partially Retractable Roof Framing



SK-22 Option 3 - Fixed Roof Option Roof Framing

APPENDIX C
STRUCTURAL DESIGN CRITERIA

A. DESIGN CRITERIA

1. Applicable Codes:

All structural elements shall be designed in accordance with the requirements of the National Building Code of Canada-2005 (NBCC).

2. Structural Steel:

In general, details and design of structural steel shall be in accordance with the Canadian Institute of Steel Construction, "Handbook of Steel Construction", latest edition, and CAN/CSA-S16-01- "Limit States Design of Steel Structures".

3. Concrete:

Limit States Design shall be used in accordance with Canadian Standards Association A23.3-04- "Design of Concrete Structures", and CSA A23.1/A23.2-04- "Concrete Materials and Methods of Concrete Construction/Methods of Testing for Concrete".

B. DESIGN LOADS

1. Uniformly Distributed Live Loads:

STADIUM

Fixed Seats Area (Stadium bowl including balconies and loges)	4.8	KPa
Aisles, Corridors and Lobbies	4.8	KPa
Semi Permanent Seating Areas	4.8	KPa
Retail	4.8	KPa
Stairways	4.8	KPa
Offices	4.8	KPa
Concession/Vending Area	9.6	KPa (locally)
	4.8	KPa (main members)
Light Storage Areas	7.2	KPa
Heavy Storage Areas	12.0	KPa
Loading Dock	12.0	KPa or OHBDC
Office Floors with Business Machine Equipment	7.2	KPa (or actual weight)
Telephone Exchange Rooms	7.2	KPa
Catwalks	2.0	KPa
Mechanical Rooms on Stadium Floors	7.2	KPa
Mechanical Rooms in Stadium Roof	7.2	KPa
Plaza	12.0	KPa or OHBDC
Roofs	1.33	KPa (+ snow drift as reqd.)
Parking (passenger cars)	2.4	KPa
Railings & Parapets:		
lateral - for means of egress	*3.0	KN/lin. m
- elsewhere	*0.75	KN/lin. m
vertical	*1.50	KN/lin. m
or	*1.0	KN point load in any direction

2. Partial Loading:

The full intensity of the reduced live load applied only to a portion of the length of a member is to be considered if it produces a more unfavourable effect than the same intensity applied over the full length of the member.

3. Live Load Reduction

As permitted by the Saskatchewan Building Code.

4. Concentrated Live Loads:

Floor shall be designed to support the uniformly distributed live loads prescribed above, or the following concentrated loads, whichever produces the greater stresses. The indicated concentration shall be assumed to occupy an area of 750mmx750mm unless otherwise indicated, and shall be so located as to produce the maximum stress conditions in the structural members.

<u>Location</u>	<u>Concentrated Load</u>
Office Floor Areas	9.0 KN
Scuttle & Skylight Ribs, Accessible Ceilings	1.0 KN
Stair Treads (on an area of 26 sq.cm centre of tread)	1.35 KN
Garages	11.0 KN
Sidewalks or vehicular driveway subject to trucking	54.0 KN
Fire Truck	80.0 KN

All concentrated loads above may be assumed to be non-concurrent with uniform live loads.

Should actual conditions occur (e.g. equipment loads) producing higher concentrated loads than those tabulated, the structure shall be designed for the higher load.

5. Impact Loads:

Elevators:

All moving elevator loads shall be increased one hundred percent (100%) for impact.

Machinery:

Elevator Machinery	100%
Machinery Shaft or motor drive	20%
Reciprocating Machinery	50%
Hangers for Floors or Balconies	33%

6. Wind Pressures

Wind pressures shall be calculated as per the Saskatchewan Building Code and information/data gathered from wind tunnel tests for this particular project.

7. Superimposed Dead Loads

OFFICE BUILDING

Partition	1.00 KPa
Suspended Ceiling and Mechanical	0.50 KPa

Floor Finish:

VCT	0.15 KPa
Quarry tile, Terrazzo	0.60 KPa
Wood flooring	0.34 KPa
Roofing (built-up)	0.50 KPa (to be confirmed)
Stone concrete	23.5 KN/cu.m

STADIUM

Hung Ceilings and Lighting	0.25 KPa
Suspended mechanical (typical floor)	0.50 KPa
Suspended mechanical (directly above mech.rm. & service level)	2.5 KPa
Fixed partitions	actual weight
Movable partitions	1.0 KPa

C. PRECAST SEATING DESIGN CRITERIA PARAMETERS

1. Design criteria:
 - a) Loading
 - L.L. = 4.8
 - P.L. - .5 KPa Mechanical
 - Vibration to NBC supplement
 - b) Spans
 - Approximately 9.3 m typ.
 - c) Concrete Strength
 - 30 MPa
 - d) Bearing Conditions
 - Grouted and fixed on end with horizontal movement allowed at other end
 - 100 mm bearing length required
2. Configuration of seats
 - Units may be single, double or triple; with triple presently being shown on drawings.
3. Fastening of seats
 - Attached to vertical face of units
 - Vertical steel in vertical leg to be set back 50 mm from seat face
4. Design of units
 - By precast sub-contractor, based on performance criteria set by Contractor Consultant
5. Junctions between ends of units
 - 14 mm gap
6. Steps for stairs
 - In vomitory - precast
 - On seating units in aisles - cast-in-place
7. Diaphragm action
 - None
8. Finishes
 - Seal in the field

- 9. Fire Rating Requirements
 - One hour separation
 - One hour rating
 - May increase to two hours over isolated areas

- 10. Vomitory Walls
 - Cast-in-place for lateral stability

APPENDIX D
STRUCTURAL QUANTITIES ESTIMATE

Representative member sizes and reinforcement requirements are shown on the drawings. The reinforcement is being shown at this time to give a general overview of the size, length of bars and detailing requirements only. The reinforcing steel estimate is to be based, in part, on the preliminary quantities provided below and on plan. The Contractor should review these quantities in conjunction with similar previous projects to determine the actual reinforcement budget.

I. CAST-IN-PLACE CONCRETE

1. Refer to the drawings for size and thickness of typical elements.

II. CONCRETE REINFORCEMENT

a)	Slab on Grade:	10 kg/m ²
b)	Foundation Walls:	55 kg/m ³
c)	Shear Walls:	75 kg/m ³
d)	Columns:	250 kg/m ³
e)	Slabs: (excluding loading area slab at west side of stadium):	28 kg/m ³
f)	Slabs: (slab at west side of stadium):	37 kg/m ³
g)	Beams (including girders & rakers):	150 kg/m ³
h)	Beams (slab beams at loading area at west side of stadium)	350 kg/m ³

III. Structural Steel for Framing

1. The steel weight for composite deck framing is 70kg/m². Include 30 kg/m² for steel cladding support.
2. The steel weight for roofing at the north east lower roof area is 60 kg/m².

IV. ROOFS

- note all truss weights have a connection allowance incorporated.

1. Option 1 - Fully Retractable Roof (Refer to SK-17 for member locations):

Truss 1 (x2)	- 500 tonnes each
Truss 2 (x2)	- 890 tonnes each
Truss 3 (x2)	- 850 tonnes each

Truss 4 (typ.)	- 665 kg/m
Perimeter Girders	- 805 kg/m
Joists	- 20 kg/m ²
Horizontal Bracing	- 6kg/m ²
Miscellaneous	- 10 kg/m ²

2. Option 2 - Partially Retractable Roof (Refer to SK-20 for member locations):

Truss 1 (x2)	- 1820 tonnes each
Truss 2 (x2)	- 1760 tonnes each
Truss 3 (x2)	- 85 tonnes each
Truss 4 (x2)	- 140 tonnes each
Truss 5 (typ.)	- 510 kg/m
Joists	- 40 kg/m ²
Horizontal Bracing	- 6 kg/m ²
Miscellaneous	- 10 kg/m ²

3. Option 3 - Fixed Roof (Refer to SK-22 for member locations):

Truss 1	- 235 tonnes each
Truss 2	- 270 tonnes each
Truss 3	- 365 tonnes each
Purlins	- 20 kg/m ²
Horizontal Bracing	- 7 kg/m ²
Bridging	- 7 kg/m ²
Miscellaneous	- 10 kg/m ²

4. Columns Supporting Stadium Roof Structure:

Columns typically on the perimeter of the stadium supporting the fully retractable stadium roof option are subjected to high loads in the form of seismic shear producing large moments on the section. This is a result of the long unbraced length they span essentially producing a cantilevered member. Refer to SK-17 for typical column sizes and weights.

Columns along the perimeter of the partially retractable roof are not exposed to seismic loads which result in bending since the seismic shear is transferred directly to the lateral bracing system of the stadium. There are however high axial loads resulting from the large tributary areas the main trusses pick up and transfer back to the columns. Refer to SK-20 for typical column sizes and weights.

Typical fixed roof option columns are shown in SK-22.

5. Roof Moving Mechanism:

Add an allowance of 200 tonnes of steel for the roof moving mechanism.

MECHANICAL PERFORMANCE SPECIFICATION

FOR

**SASKATCHEWAN MULTI-USE FACILITY
REGINA, SASKATCHEWAN**

PREPARED FOR:

**BBB ARCHITECTS
14 DUNCAN STREET, 4TH FLOOR
TORONTO, ONTARIO
M5H 3G8**

PREPARED BY:

**THE MITCHELL PARTNERSHIP INC.
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**OUR FILE NO. 09-1048-000
DATE: 12 FEBRUARY 2010**

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OUTLINE MECHANICAL SPECIFICATION

1.0 GENERAL

- .1 Provide complete plumbing, fire protection, heating, cooling, ventilation and control systems for all areas of the stadium complex.
- .2 Comply with federal, municipal and local codes and all authorities having jurisdiction.
- .3 Meet industry standards for equipment quality assurance.
- .4 All equipment shall be new, free from defect, and suitable for long lasting installation.
- .5 Arrange and pay for all permits and fees.
- .6 Incorporate smoke control systems required by the designated code consultant reports.
- .7 Project is to achieve LEED certification, final level to be determined by the owner. Provide all required equipment, services, assistance and record keeping required for the LEED application process. Assist in all commissioning activities in conjunction with the commissioning agent.
- .8 Provide all engineering calculations and design services to ensure mechanical systems meet the minimum performance requirements as outlined here in and as indicated on the associated mechanical design development drawings. Information shown on the concept design drawings is preliminary, for the purpose of budget development and must be confirmed, and updated by the engineer of record.

2.0 SITE WORK

- .1 Provide required domestic water, fire service, sanitary and storm drainage systems connected to available municipal services.
- .2 Include for trenching, bedding and backfilling for all utility services.
- .3 Include required catch basins and drainage to City storm sewers.
- .4 Provide sanitary and storm system retention tanks to regulate flow to city services. Sanitary discharge will be pumped. Some of the storm discharge will be pumped.

3.0 PLUMBING

- .1 Plumbing systems including domestic water and sanitary drainage shall be designed to accommodate the peak flow of all connected public use fixtures plus an accommodation for restaurant kitchens, change facilities, concessions and service areas.

- .2 Provide top quality vandal resistant fixtures and trim for all washroom areas.
- .3 Provide low flow fixtures to meet local codes, but not exceeding the following:

Waterclosets	-	maximum 4.8 litres per flush
Urinals	-	maximum 1.9 litres per flush
Lavatories	-	maximum 1.9 litres/minute
Shower Heads	-	maximum 7.6 litres/minute
- .4 Provide public washrooms with tempered warm water with uninsulated lines from tempering valve location. Urinal and waterclosets shall be syphon jet exposed flush valve arrangement. Urinals are to have exposed hard wired automatic flush valve. One water closet in each washroom and all lavatories shall be suitable for disabled person use. Lavatories shall utilize electronic sensor controls. One urinal in each washroom will be mounted at the appropriate height for use by a child.
- .5 Provide change room washrooms including referee/star rooms with vandal resistant waterclosets, lavatories, urinals and shower facilities. Provide exposed flush valves for urinals and waterclosets. Lavatories shall have separate hot and cold water supplies. Provide cold water gooseneck water supply at each lavatory in each change room, suitable for water bottle filling. Provide individual pressure balancing mixing valve and vandal resistant shower heads. Showers are not to have push button trim.
- .6 Concessions shall be provided at the demising line with a 32mm valved and capped domestic cold water supply, 100mm dia. sanitary waste, 32mm 5 psi valved and capped gas connection and 40mm vent pipe for extension into the facility during fitup. Concessions are to be provided as shell spaces. Kitchen areas are to be provided with 50mm domestic cold water capped connection, 100mm dia sanitary waste, 75 mm vent and 40mm 5 psi valved and capped gas connection for extension into the space during fit-up. Restaurants are to be provided as shell spaces.
- .7 Provide separate prices for concession and kitchen fit-out including all final connections to kitchen equipment.
- .8 Kitchen and concession area drainage shall pass through central grease interceptors provided as part of the base building. Heat trace all grease sanitary piping upstream of the grease interceptors. A kitchen interceptor shall pickup the nearby concessions on levels above. Water, vent and drain connections shall be provided to the kitchen area. Extend separately metered natural gas services to designated concession and restaurant areas to service tenant provided equipment.
- .9 Club and suite washrooms shall be equipped with water closets and lavatories with hot and cold water supplies to lavatory mixing valves. Fixture quality in the club and suite areas to be superior to public washrooms.

-
- .10 Provide a stainless steel bar sink and all water and drainage connections in each suite. Provide water and drainage rough-in for future dishwashers and ice machines.
 - .11 Showers shall utilize individual pressure balancing mixing valves and vandal resistant low flow showerheads. Provide hot and cold water to each shower in all dressing rooms. Provide floor drains at all shower exits to the dressing room.
 - .12 First aid areas shall be fully equipped with hot and cold water supplies to sinks, hose outlets and equipment connections.
 - .13 A complete storm water system shall be provided to drain each roof area; minimum two drains per roof area. Provide cleanouts in mains. Insulate horizontal mains complete with vapour barrier. Support and brace piping to prevent movement. Storm water systems to be designed and sized to accommodate local peak rainfall rates. Storm drainage from the main bowl roof is to be full flow drainage with no water retention on the roof.
 - .14 A complete sanitary drainage system shall include waste and vent connection to each plumbing fixture, as well as primed and vented floor drainage throughout. Each public, club and suite washroom shall have a floor drain positioned within a watercloset cubicle. Insulate horizontal mains complete with vapour barrier.
 - .15 Domestic hot water shall be provided for change rooms, suites, janitor rooms, and club/suite washrooms, by minimum five double wall immersion heat exchanger, storage water heaters (or high efficiency gas fired hot water heaters similar to AO Smith Clycone). Provide sufficient insulated storage tank capacity to optimize energy use. Provide a recirculation pipe system to maintain hot water delivery to all connected fixtures to less than one minute.
 - .16 Public washroom hot water will be provided from the main building domestic hot water system.
 - .17 Provide a natural gas distribution system to service each concession and each restaurant kitchen. Loads to be determined.
 - .18 Heat trace all water piping and drainage piping passing through areas which are unheated.
 - .19 Provide drainage from elevator pits complete with dedicated sanitary pumps rated for 60 USGPM where these drains can not be connected into the gravity drainage system.
 - .20 Provide all required sanitary and domestic water rough-in for all FFE equipment including but not limited to the following (equipment should be carried under the FFE budget):
 - .1 Water, backflow preventor and floor drain for ice machines
 - .2 Water and floor drains for therapy plunge pools

- .3 Water and drainage for steam room/sauna
- .4 Water and drainage for whirlpools
- .5 Sinks in all training rooms including water, drainage and venting (include the cost of the sink)
- .6 Provide all rough-in for change room area kitchenette.

4.0 FIRE PROTECTION

- .1 Provide fire protection to meet local building code and local fire department requirements including:
 - .1 Combined sprinkler/standpipe system.
 - .2 Fire extinguishers.
 - .3 Fire department siamese connections.
- .2 Perform flow test to verify local water supply before proceeding.
- .3 The bowl area is not to be sprinklered.
- .4 Design and provide a complete building sprinkler system meeting a minimum of NFPA and local authority requirements. All valves to be electrically supervised and trouble monitored by the fire alarm system.
- .5 Provide dry type sprinkler systems with accelerators in all areas exposed to the main bowl, garbage room, parking area and the loading dock areas. All other areas to have wet systems. Transformer room shall not be sprinklered. All dry sprinkler systems are to utilize galvanized piping. Provide accelerators where required due to zone sizes.
- .6 Provide concealed sprinkler heads in suites, suite corridors, entrance lobbies, ticket lobbies, in all lay-in-tile and drywall ceilings. Sprinkler heads shall be chrome or shall match colour of adjacent surfaces. Provide guards on sprinkler heads in change rooms, storage rooms, mechanical plant rooms, and change room corridors and other areas accessible to players.
- .7 Provide a complete fire standpipe system. Provide heat tracing or dry standpipe for all areas serviced by a dry sprinkler system.
- .8 Coordinate zone alarm and supervisory valve monitoring connections to the fire alarm system provided under Division 16 (Electrical). Sprinkler zones shall be consistent with the smoke control system zoning.
- .9 Provide portable fire extinguishers throughout the building to meet NFPA and local fire department requirements. Position extinguishers in cabinets in public accessible areas. All electrical and mechanical, and concessions shall be provided with multipurpose type fire extinguishers.

- .10 Fire extinguishers in kitchen and concession areas shall be provided as part of the fitup.

5.0 HEATING, VENTILATION AND AIR CONDITIONING SYSTEMS

- .1 Outdoor design conditions to be used as a basis for design are as follows:

Summer: 32.2°C DB, 22.2°C WB coincident
 Winter: -37.2°C DB, 5.0 m/s wind

Size wet cooling heat rejection equipment for 20.0°C wet bulb temperature and air cooled condensing equipment for 35.0°C entering air temperature.

- .2 All areas of the building shall be heated to maintain minimum 22.0°C. Dressing rooms shall have individual terminal hydronic heating coils under room thermostat control capable of maintaining 25.6°C.
- .3 Cooling to maintain 23.9°C shall be provided for all public areas, including main bowl, lobby area, dressing rooms, suites, viewing area, office area, press area, meeting rooms and other offices. Introduce cooling air into entrance vestibules.
- .4 All air handling systems which introduce outdoor air into spaces open to any part of the stadium bowl shall be capable of dehumidifying air to 9.4°C wet bulb maximum. Provide heating downstream of cooling coil to allow supply air temperature reset upwards to satisfy space, temperature and humidity conditions at part load as well as full load conditions.
- .5 Minimum outdoor air ventilation rates shall be provided at design conditions to meet ASHRAE 62-01 and the following requirements:

Main Arena Bowl:	3.54 L/s per person based on 48,070 people and intermittent occupancy
Private Suites:	10.0 L/s per person using transfer air from the main bowl
Lounges:	10.0 L/s per person based on 4.65m ² /person using transfer air from the main bowl and supplemental cooling and heating units.
Restaurants:	10.0 L/s per person based on 1.39m ² /person using transfer air from the main bowl and supplemental cooling as required.
Kitchens:	10 air changes per hour. Dedicated kitchen exhaust to NFPA 96 Standards as per hood requirements. Provision for makeup of kitchen exhaust hood. Negative pressurization to prevent migration of odours from food.
Washrooms:	Minimum 12.7 L/s/m ² exhaust. Transfer makeup from surrounding spaces.
Janitor Rooms:	Minimum 7.62 L/s/m ² or 47.2 L/s per room.

Change Rooms: Minimum 10.16 L/s/m² exhaust in washroom areas, makeup air with terminal heating coil ducted to each room @ 10 ACH with 15% excess exhaust.

Chiller Plant: To suit CSA B52 Refrigeration Code.

Concessions: Minimum 25.4 L/s/m² exhaust provision connected to general exhaust, or space and routing provision for NFPA 96 grease extract exhaust provided under concession fitup.

- .6 All mechanical equipment shall be selected and/or attenuated so that contributions of the mechanical equipment and systems to occupied spaces due to vibration and sound transmission shall not exceed the following maximums. All HVAC systems to incorporate silencers on supply air, return air and exhaust air duct connections to fans and equipment.

Bowl Seating,	
Change Rooms and Service Areas:	NC45
Private Suites and Office Areas:	NC35
Restaurants:	NC35

- .7 Air Handling Systems:

.1 The main arena bowl shall be fully air conditioned, including dehumidification and heating capability by six 48,000 L/s custom manufactured constant volume air handling units. Outdoor air shall be able to be modulated from zero (full recirculation to 100% outdoor air) under enthalpy controlled economizer, time schedule and operator control. Minimum ventilation based on maximum occupancy for each of six air handlers to be 28,320 L/s. Provide constant volume air handling units incorporating sensible heat recovery, cooling, dehumidification and heating, and ducted supply to each corner of the stadium through a common ring duct arrangement. Supply air registers shall not direct air at the playing field or at spectator seating. Primary air supply conditions shall be under control of six pairs of temperature and humidity sensors located at throughout the bowl, using discriminatory control. Design heating and cooling capacities of each of these units to handle 28,320 L/s outside air at design conditions. Air handling unit pre-heat coils shall be 50% glycol. Air handling unit cooling shall be chilled water coils. Air handling unit reheat for dehumidification shall be hot water coils. Heat recovery coils shall be provided with a glycol run around loop to all heat recovery coils in general and washroom exhaust systems.

Bowl return air shall be extracted from each end of the arena. Ten inline/sidewall exhaust fans shall be provided over around the bowl to enable smoke exhaust and general exhaust over stage areas during concert performance. Each fan inlet shall be ducted to a horizontal inlet with sound attenuation.

- .2 Four VAV custom manufactured air conditioning, heating and dehumidifying air handling units shall be provided to serve all concourse and circulation levels. Each concourse system shall be 25,960 L/s. Each concourse air handler to be capable of free cooling under enthalpy controlled economiser, with minimum outside air levels set to zero as concourse units obtain their ventilation from the arena bowl. Distribution ducts to the upper concourse levels shall be equipped with modulating dampers under local temperature sensor control. The main unit thermostat shall be located on the main concourse level. Supply air shall be ducted to multiple outlets at a regular spacing throughout each concourse level.
- .3 The main arena concourse level shall incorporate general exhaust ventilation from washrooms, at 12.7 L/s/m², from each concession at 25.4 L/s/m² and from the general concourse area itself in two locations per level, with makeup air allowance from the main bowl supply air system. A central kitchen exhaust system will be provided as part of the base building with ductwork stubbed into each concession space for distribution during the fit-out. The concourse general exhaust systems are interconnected to the concourse supply ductwork such that the ductwork will be converted to 100% outdoor air supply or exhaust during smoke control mode. In addition, projection unit heaters shall be distributed about the concourse to provide heating at exterior door entries.
- .4 Hot water air curtains are to be provided at each entrance from outdoors. Air curtains are to be provided with controls to activate the units when the doors are open.
- .5 Heating shall be provided to all office zones with high glazing by perimeter hydronic radiation.
- .6 The dressing room and service area shall be provided with two separate 13,000 L/s 100% outdoor air makeup air rooftop unit that provides hot water heating, chilled water cooling and heat pipe heat recovery from the exhaust air. Air supply shall be distributed to each dressing room and a local thermostat shall control a terminal heating coil to elevate dressing room temperatures to warmer levels.
- .7 Dressing rooms shall be exhausted from the watercloset and shower areas. Install aluminum grilles and aluminum exhaust ductwork from fan to grilles. Slope ductwork near grilles to prevent water accumulation in the ductwork and to drain duct through grilles. Seal ducts. General exhaust and washroom exhaust are not to be interconnected until just prior to entering the unit and must include a backdraft damper to avoid cross contamination.
- .8 The restaurant shall be provided with a dedicated air handling unit and ductwork extended into the space for extension by the tenant. Air handling unit to be provided with cooling coils, heating coils and 100% outdoor air economiser and dehumidification capability.

Restaurant is also to be provided with a dedicated 100% outdoor air make-up air unit which will be interconnected with the kitchen exhaust system. A dedicated kitchen exhaust system with ecology unit, fan and ductwork to space for distribution by the tenant.

- .9 Each suite shall be individually air conditioned and heated using individual fan coils. Fan coils to be 2 pipe switch-over connected to a separate secondary hydronic loop. Connect each suit air conditioning unit to a contact on the sliding door to the bowl area to shut off cooling on the unit when the door has been left open.
- .10 Provide dedicated chilled water Liebert computer room air handlers for the computer/IT room.
- .11 The main electrical room shall incorporate a thermostatically controlled exhaust fan and air. If the location of the electrical room makes the use of outdoor impractical provide a dedicated chilled water air handler to cool the electrical room.
- .12 The stadium bowl shall be provided with ten emergency only exhaust fans to be staged to run from a high CO level (100 ppm) signal or on smoke control venting signal. Fans to provide an exhaust capacity as recommended by the life safety report from the stadium bowl under smoke venting operation. Provide both CO and CO₂ sensors in two locations in the arena and use to automatically increase the outdoor air supply from operating air handling unit(s) when levels rise above 35 ppm CO or 800 ppm CO₂.
- .13 Main concourse exhaust shall be operable in a smoke venting mode, in conjunction with air supply to the stadium bowl, utilizing the supply air ductwork to distribute the exhaust pickup. A supplemental smoke exhaust fan shall be provided to increase concourse exhaust capacity to maintain minimum exhaust rates as recommended by the life safety report, from the concourse, and suite levels.
- .14 Suite washroom exhaust fans to be suitable for smoke exhaust to remove smoke from the suites.
- .15 Provide team laundry facility with washing machine water connections and dedicated dryer exhaust together with room exhaust ventilation. Provide required make-up air for dryer and general exhaust.
- .16 Duct systems shall be constructed to latest SMACNA Standards. Ductwork shall be sized to maintain a maximum of 10.16 m/s on supply ductwork, and 6.1 m/s on return ductwork or a maximum of 0.82 pascals/m of duct. Duct systems utilized for smoke exhaust shall be sized to maintain a maximum of 15.24 m/s. Kitchen grease extract systems where provided must meet NFPA 96 requirements.

- .17 Equip all exterior fan/duct openings with tight sealing smoke damper grade motorized damper and interlock to associated fans. All exterior wall openings shall have fixed weatherproof louvres, provided under the architectural sections.
- .18 Two VAV custom manufactured air conditioning, heating and dehumidifying air handling units shall be provided to serve all office and press areas. Each system shall be 10,000 L/s. Each air handler to be capable of free cooling under enthalpy controlled economiser, Provide distribution ductwork to all areas with terminal VAV boxes for all interior spaces and VAV boxes with hot water reheat for all perimeter spaces.
- .19 Provide central general exhaust systems to serve all back-of house and storage areas.
- .20 Provide a minimum of four central kitchen ecology systems to serve the concourse concessions. As part of the base building work provide the four ecology systems including filters and fans and extend welded kitchen exhaust ductwork into each concession space where it will be left capped for extension by the tenant during fit-out. All make-up air for the concessions will be provided from the concourse and bowl area. ALL KITCHEN EXHAUST DUCTWORK ON BOTH SIDES OF THE ECOLOGY UNITS IS TO BE WELDED NFPA 96 COMPLIANT DUCTWORK.
- .21 Provide a dedicated make-up air and exhaust for the underground parking areas. Provide a CO monitoring system linked to the make-up air and exhaust.
- .22 Provide gas fired infrared radiant heaters in the loading dock area adjacent to each loading door. Provide a CO monitoring system and exhaust dedicated for the loading area.
- .23 Provide a refrigerant exhaust and monitoring system compliant with CSA B52 in the chiller room.
- .24 Provide capped chilled water connections to be connected to the water cooled condenser of the cold whirlpool.
- .25 Provide unit heaters throughout the building in back of house spaces and mechanical spaces as required.
- .8 Heating Plant:
 - .1 Provide a hydronic heating plant consisting of not less than five (4+1) "near" condensing, high efficiency watertube boilers, each sized for 10,000 MBH output. Boiler plant will be designed with N+1 redundancy. Provide primary heating pumps, one per boiler, and N+1, secondary variable speed pumps for distribution to air handling units, building radiation and unit heaters. In order to meet minimum

LEED energy criteria, several condensing boilers may be required, to allow for condensing efficiencies in shoulder seasons.

- .2 Provide 50% glycol secondary pumping systems for the pre-heat coils on all arena bowl and air handlers. Secondary glycol systems to be complete with shell and tube heat exchanger connected to the main building heating system.

- .9 Cooling Plant:
 - .1 Provide a hydronic cooling plant consisting of not less than two 1200 TR and two 600 TR water cooled centrifugal chillers. Provide N+1 primary chilled water pumps and N+1 variable speed secondary pumps for distribution to air handling units and suite fan coils. Provide N+1 condenser water pumps matched to the chiller capacities.
 - .2 Provide VFD induced draft, cross-flow cooling towers sized to match each chiller. Both small towers to be capable of winter operation.
 - .3 Provide two 300 TR plate and frame heat exchangers for winter free cooling of areas not served by air-side free cooling HVAC systems with their own condenser water and chilled water primary duplex pumps.

- .10 Heat Recovery:
 - .1 Provide two 50% glycol heat recovery coil systems, to serve half of the stadium bowl air handling units. Heat recovery exhaust coils are to be provided on the associated washroom and general exhaust systems at each end of the facility.
 - .2 Provide N+1 circulators and automatic controls to enable or disable the heat recovery run-around loops based on potential heat recovery conditions.

- .11 Provide a separate switch-over two-pipe variable flow hydronic loop to suit fan coil units.

6.0 INSULATION

- .1 Ductwork: All air conditioning supply air ducts and warm air heating ducts, fresh air intake and the final 10 feet of exhaust air ducts inside the building shall be insulated with 1" glass fibre insulation. Vapour barrier shall be provided on cold ducts.
- .2 Piping and Equipment: Insulate chillers, heat exchangers, storage tanks and pumps. Insulate all domestic hot, cold tempered, recirculation, and heated water inside the building with the exception of cold water lines feeding concourse washrooms. Vapour barrier and rigid insulation blocks at hanger locations shall be provided on insulated cold piping systems.

7.0 CONTROLS

- .1 Provide a web based automated electronic control and monitoring system incorporating direct digital controls and distributed processing. The building control and monitoring system (ECMS) is to be integrated with the lighting, fire and security systems. The ECMS will be interfaced to all key systems to provide key status and alarm information, and to enable remote start/stop of all mechanical equipment based on time schedule or operator override entry. Provide front end in control room with computer, printer and colour dynamic graphics showing real-time information about the systems. Provide a system capable of trending and remote web-login.

8.0 DIESEL GENERATOR AND FUEL OIL SYSTEM

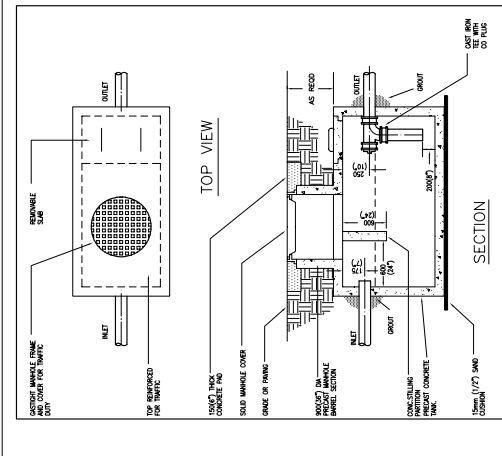
- .1 Provide a complete fuel oil piping system with main storage tank, day tank, duplex fuel oil pumps, controls, gauges and all required accessories
- .2 All fuel oil piping, equipment and installation must comply with all CSA standards and local regulations.
- .3 Provide complete generator room ventilation including muffler, combustion exhaust, make-up air intake and damper, recirculation dampers and exhaust dampers and louvers.
- .4 Provide hot water unit heater to maintain generator room at 21°C.
- .5 Provide fill and vent terminals outdoors.
- .6 All controls and alarms are to be wired to the BAS.

9.0 MOTORS, STARTERS AND WIRING FOR MECHANICAL EQUIPMENT

- .1 Provide all starters and motor control centres for all mechanical equipment. Provide all load side power wiring and all control wiring associated with mechanical equipment and systems installations. Meet Division 16 standards. Power shall be:

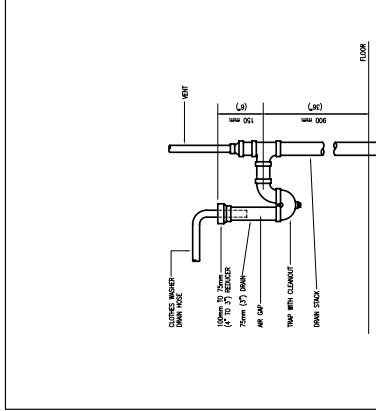
120V/1 phase/60 Hz for motors under 0.37 KW
575V/3 phase/60 Hz for motors 0.37 KW and over

END OF MECHANICAL OUTLINE SPECIFICATION

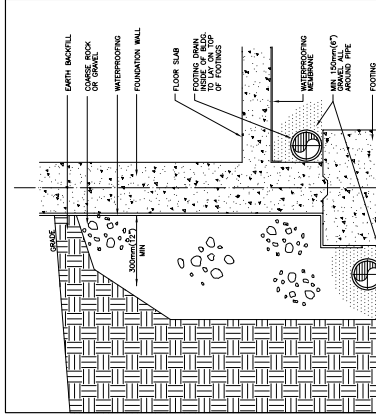


7 OIL INTERCEPTOR
W-109
N/S

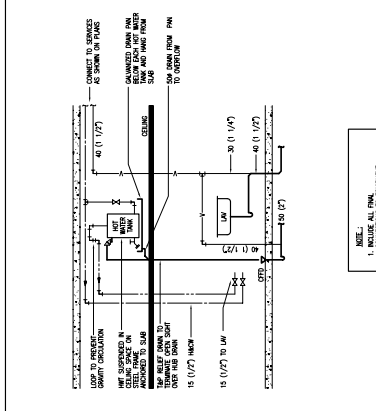
5 DRAIN FOR CLOTHES WASHER
W-109
N/S



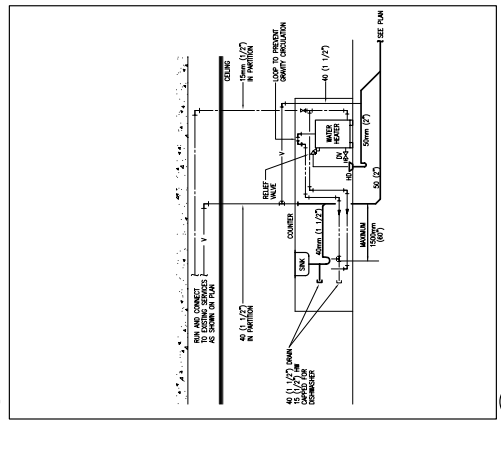
3 FOOTING DRAIN TILE
W-109
N/S



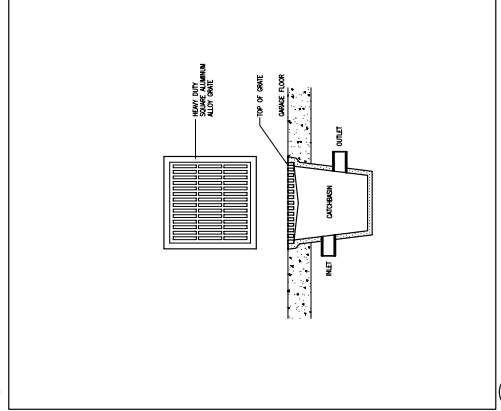
1 HOT WATER TANK IN CEILING SPACE
W-109
N/S



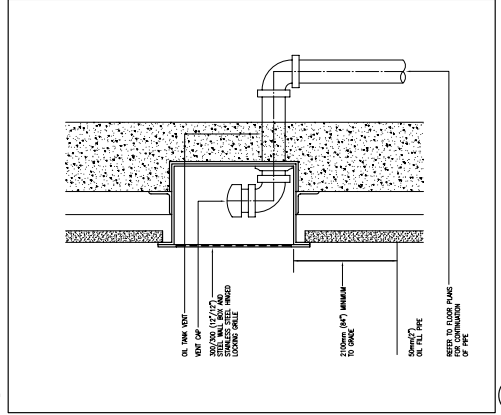
1 ISSUED FOR BIDDETING 15 JAN 10 S.O.
NO. DESCRIPTION DATE CHK
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TAMIP Consulting Engineers
11/01/10 - 224 P



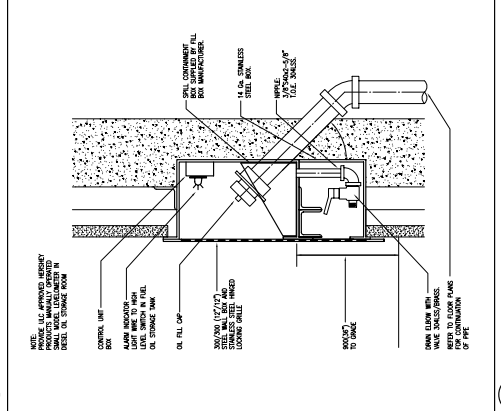
6 HOT WATER TANK UNDER COUNTER
W-109
N/S



6 PRECAST GARAGE CATCHBASIN
W-109
N/S



1 OIL TANK VENT IN WALL BOX
W-109
N/S



2 FUEL OIL FILL CONNECTION
W-109
N/S

SASKATCHEWAN
MULTI-USE FACILITY

DWG. TITLE: DETAILS - 5

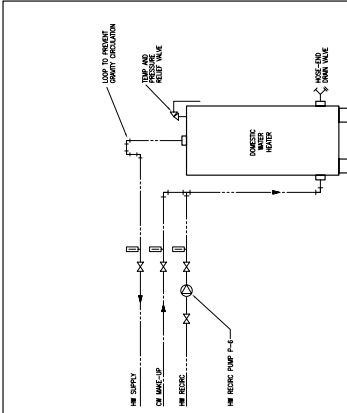
SCALE: INTS
PROJ. NO.: M-105
REV.:

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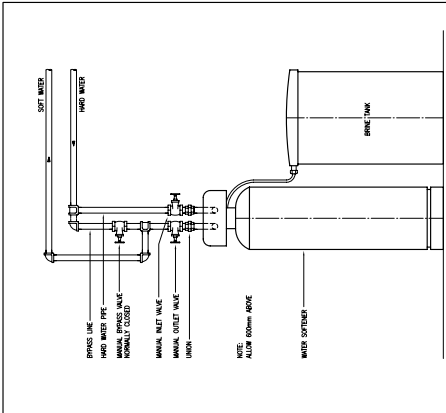
DATE: 09-11-08-000

DRAWN: CAD
DATE: DEC 09
CHECKED: S.O.
DATE PLOTTED:

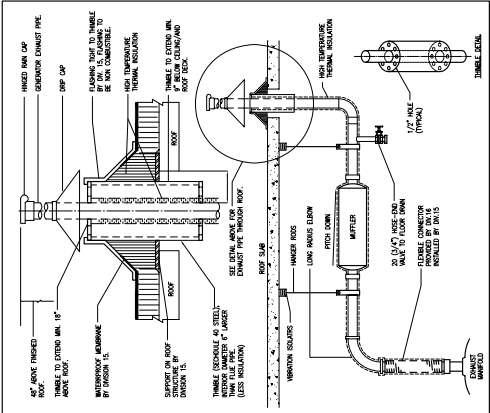
PROJECT: NORTH



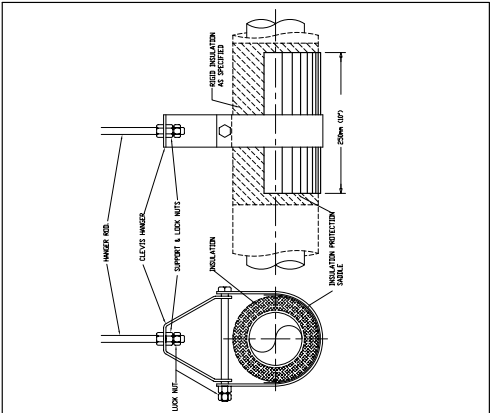
5 HOT WATER TANK PIPING WITH RECIR. PUMP
M-109 NTS



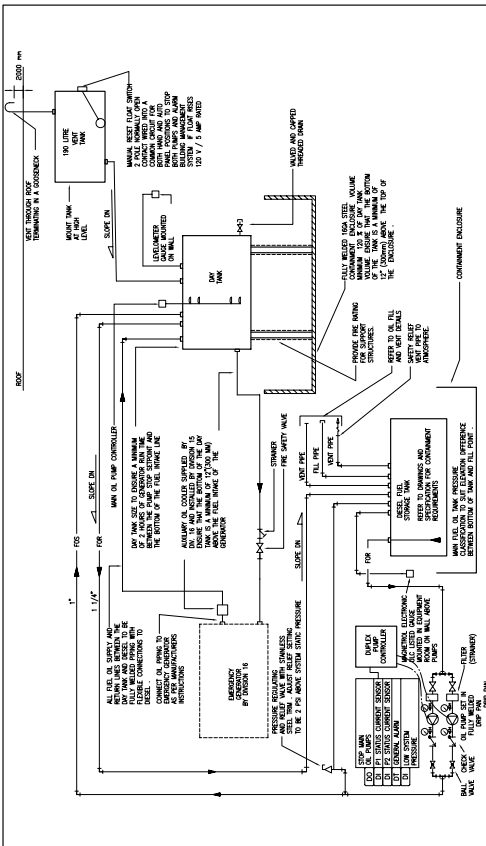
3 WATER SOFTENER PIPING
M-109 NTS



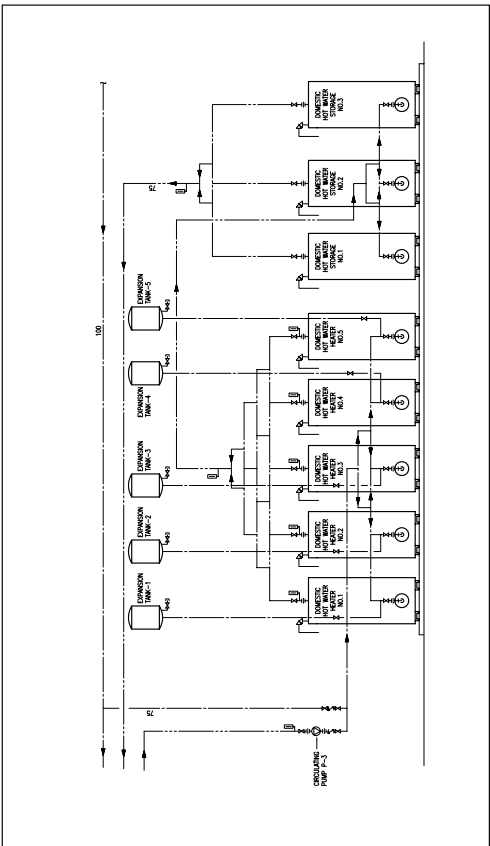
6 EMERGENCY GENERATOR EXHAUST PIPE THROUGH ROOF
M-109 NTS



4 PIPE HANGER
M-109 NTS



1 OIL PIPING TO EMERGENCY GENERATOR
M-109 NTS



2 DOMESTIC HOT WATER TANKS SCHEMATIC
M-109 NTS

NO.	DESCRIPTION	DATE	CHK.
1	ISSUED FOR BIDDING	15 JAN 10 S.O.	CHK

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DATE: 09-11-08-000
DRAWN: CAD
DATE: DEC 09
CHECKED: S.O.
DATE PLOTTED:
PROJECT: NORTH

SASKATCHEWAN MULTI-USE FACILITY
DWG. TITLE: DETAILS - 6
SCALE: NTS
DWG. NO.: M-106
REV. NO.: M-106

03/2009/03-1046-000 SASKATCHEWAN STATION/MECH/120-M-122-09-1046-000 CONTROLS.dwg 11/07/10 - 237 P

DRAWN	DATE	PROJECT	NORTH	REV.
09-1046-000	DEC 09	S.O.	DATE PLOTTED	M-121
				SCALE
				INTS
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1. ISSUED FOR BIDDETING 15 JUN 10 S.O.

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1. LOBBY SUPPLY SYSTEM

M-121/ NTS

SEQUENCE

WHEN SYSTEM IS OFF ALL VALVES AND DAMPERS ARE IN NORMAL POSITION. WHEN SYSTEM IS ON ALL VALVES AND DAMPERS ARE IN NORMAL POSITION. ON START UP, FRESH AIR SHALL BE SUPPLIED TO THE LOBBY. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED.

2. DRESSING ROOM 100% OA SYSTEM

M-122/ NTS

SEQUENCE

WHEN SYSTEM IS OFF ALL VALVES AND DAMPERS ARE IN NORMAL POSITION. ON START UP, FRESH AIR SHALL BE SUPPLIED TO THE DRESSING ROOM. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED.

3. KITCHEN MAKE-UP SYSTEM (HEATING/COOLING)

M-123/ NTS

SEQUENCE

WHEN SYSTEM IS OFF ALL VALVES AND DAMPERS SHALL BE IN NORMAL POSITION. ON START UP, FRESH AIR SHALL BE SUPPLIED TO THE KITCHEN. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED.

4. EXHAUST FAN WITHOUT DAMPERS

M-124/ NTS

SEQUENCE

WHEN SYSTEM IS OFF ALL VALVES AND DAMPERS SHALL BE IN NORMAL POSITION. ON START UP, FRESH AIR SHALL BE SUPPLIED TO THE EXHAUST FAN. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED.

6. GENERATOR ROOM VENTILATION

M-125/ NTS

SEQUENCE

WHEN SYSTEM IS OFF ALL VALVES AND DAMPERS SHALL BE IN NORMAL POSITION. ON START UP, FRESH AIR SHALL BE SUPPLIED TO THE GENERATOR ROOM. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED.

7. SMOKE EXHAUST FAN

M-126/ NTS

SEQUENCE

WHEN SYSTEM IS OFF ALL VALVES AND DAMPERS SHALL BE IN NORMAL POSITION. ON START UP, FRESH AIR SHALL BE SUPPLIED TO THE SMOKE EXHAUST FAN. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED.

9. CONTROL OF VARIABLE SPEED PUMPING

M-127/ NTS

SEQUENCE

ON START UP, FRESH AIR SHALL BE SUPPLIED TO THE VARIABLE SPEED PUMPING. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED.

8. CONTROL OF COOLING TOWER CHEMICAL FEED

M-128/ NTS

SEQUENCE

WHEN SYSTEM IS OFF ALL VALVES AND DAMPERS SHALL BE IN NORMAL POSITION. ON START UP, FRESH AIR SHALL BE SUPPLIED TO THE COOLING TOWER CHEMICAL FEED. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED.

10. CONTROL OF INDUCED DRAFT COOLING TOWER

M-129/ NTS

SEQUENCE

WHEN SYSTEM IS OFF ALL VALVES AND DAMPERS SHALL BE IN NORMAL POSITION. ON START UP, FRESH AIR SHALL BE SUPPLIED TO THE INDUCED DRAFT COOLING TOWER. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED.

11. VAV SYSTEM

M-130/ NTS

SEQUENCE

WHEN SYSTEM IS OFF ALL VALVES AND DAMPERS ARE IN NORMAL POSITION. ON START UP, FRESH AIR SHALL BE SUPPLIED TO THE VAV SYSTEM. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED. ON SHUT DOWN, FRESH AIR SHALL BE STOPPED.

03/2009/03-1046-000 SASKATCHEWAN STATION/MECH/120-M-122-09-1046-000 CONTROLS.dwg 11/07/10 - 237 P

NO.	DESCRIPTION	DATE	CHK
1	ISSUED FOR BIDDETING	18 JAN 10	S.O.

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TAMIP Consulting Engineers
 1000 UNIVERSITY AVENUE
 SASKATCHEWAN, S4N 1W1
 CANADA

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09-1046-000

DRAWN: CAD

DATE: DEC 09

SCALE: S.O.

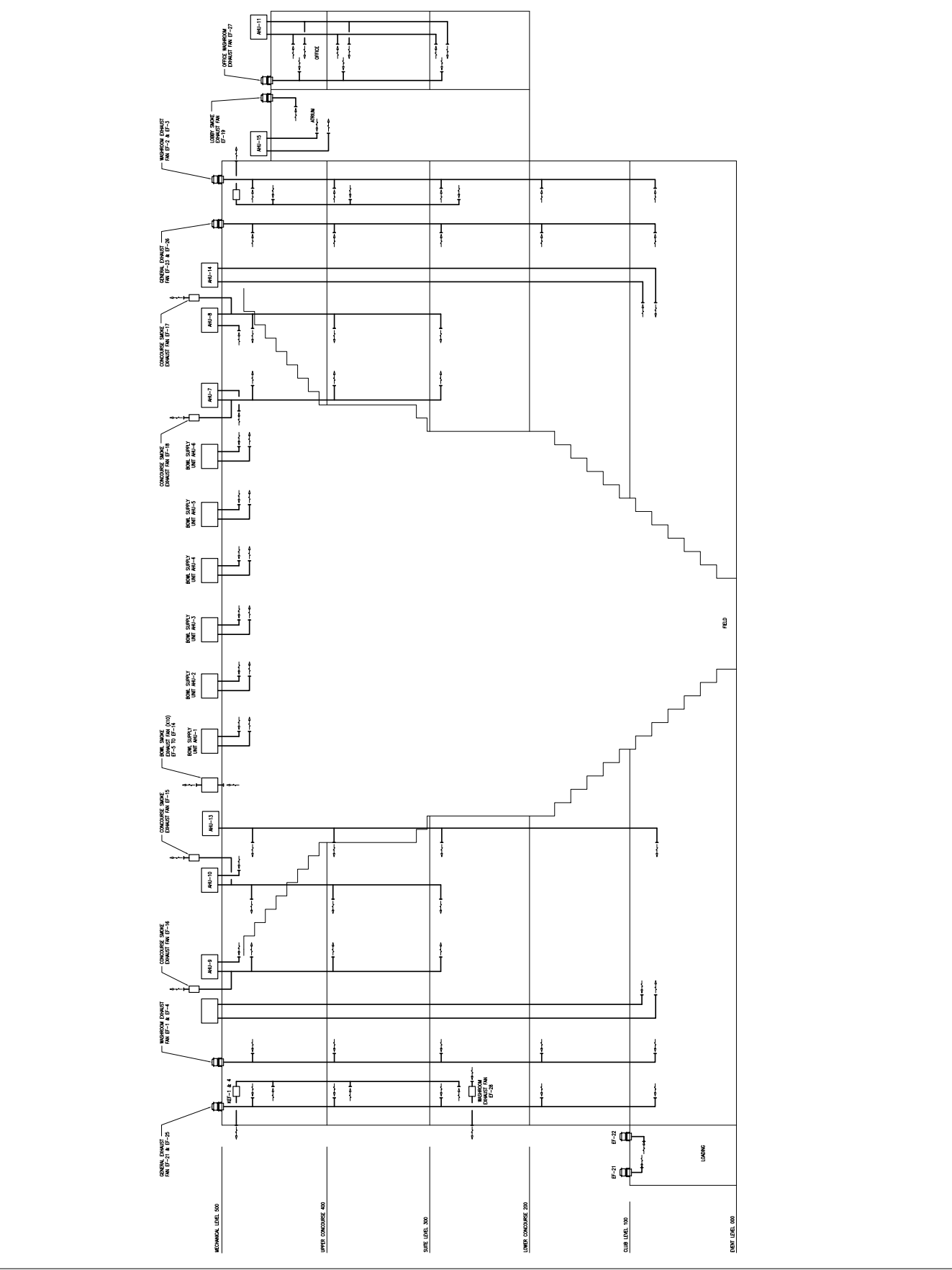
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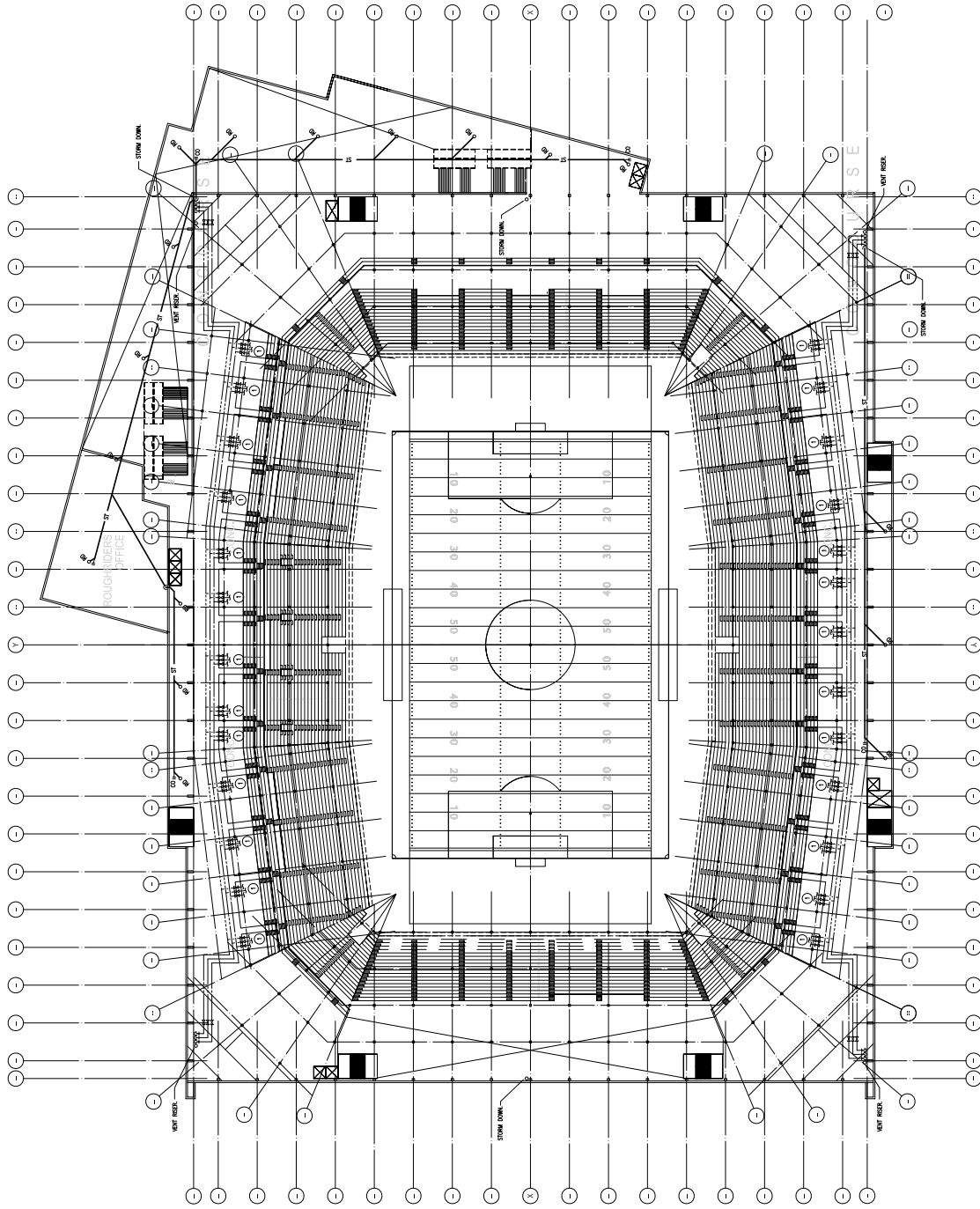
PROJECT: NORTH

**SASKATCHEWAN
 MULTI-USE FACILITY**

DWG. TITLE: HVAC SCHEMATIC

SCALE	DWG. NO.	REV.
INTS	M-140	
PROJ. NO.		





1. VENT RISER
 2. STORM DOWN
 3. OUT RISER
 4. VENT RISER
 5. STORM DOWN
 6. OUT RISER

NO.	DESCRIPTION	DATE	CHK
1	ISSUED FOR BIDDETING	15 JAN 10	S.O.

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 C.A.D.: _____
 DATE: DEC 09
 S.O.: _____
 DATE PLOTTED: _____
 PROJECT: NORTH

**SASKATCHEWAN
 MULTI-USE FACILITY**

DWS: TITLE
 UPPER CONCOURSE LEVEL
 PLUMBING AND DRAINAGE

SCALE	DWG. NO.	REV.
1:500	M-250	

REVISIONS	
NO.	DESCRIPTION
1	ISSUED FOR BIDDETING
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100	ISSUED FOR BIDDETING

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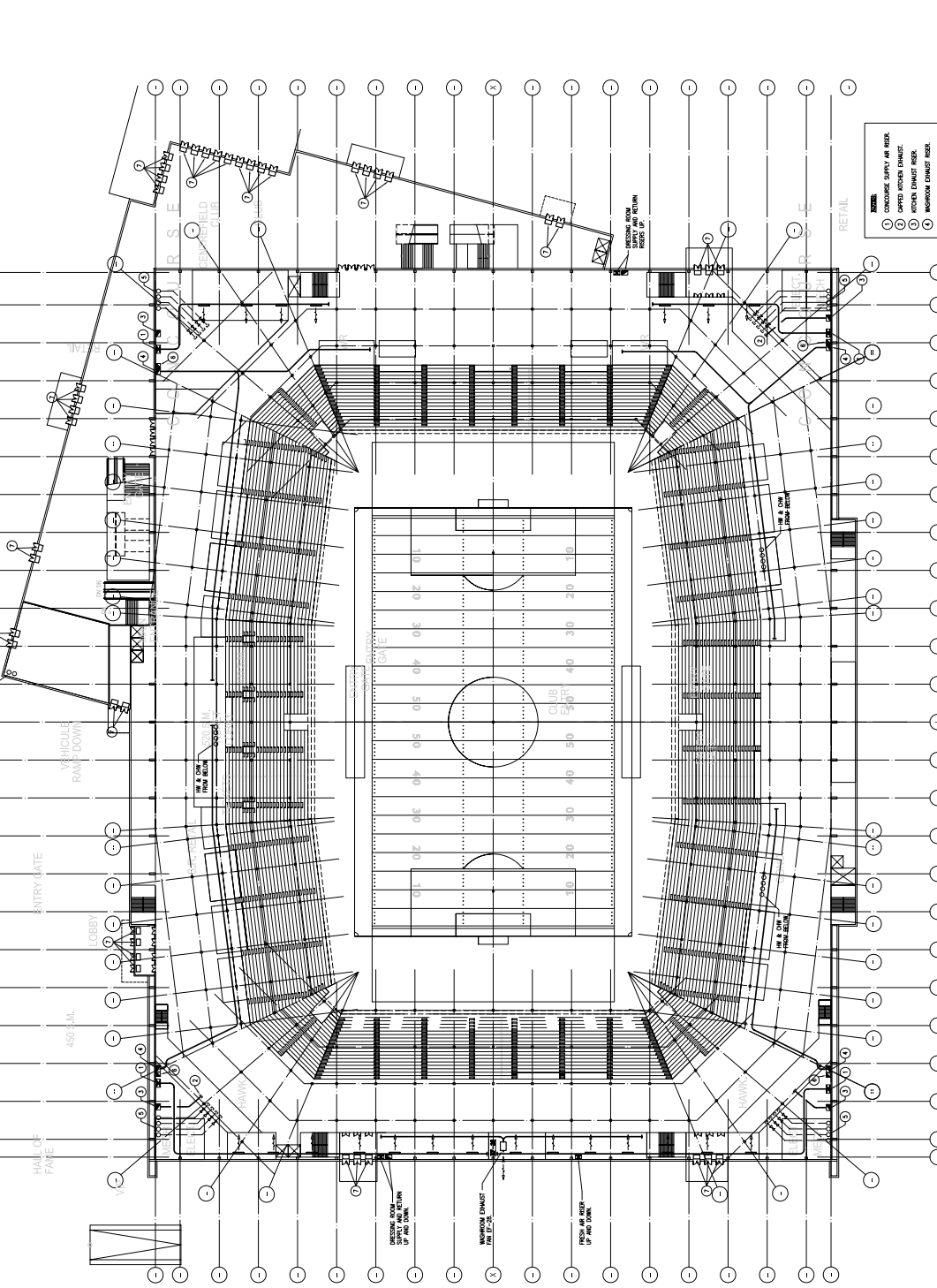
CONSULTANT
TAMIP Consulting Engineers
 1000 - 10th Avenue West
 Calgary, Alberta T2C 1P5
 Phone: (403) 243-8888
 Fax: (403) 243-8889
 Email: info@tamip.com

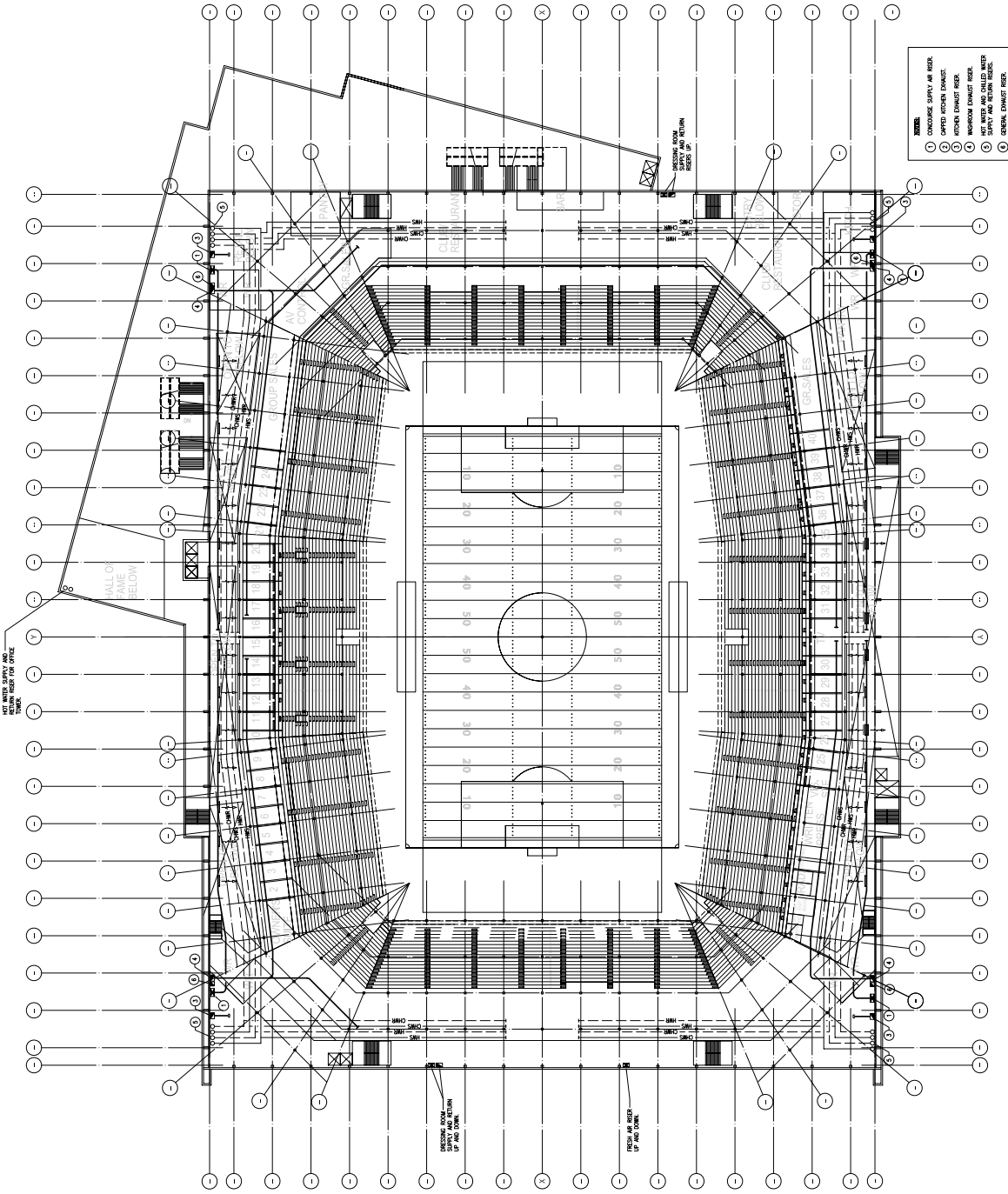
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 DATE: DEC 09
 PROJECT: S.O.
 DATE PLOTTED: _____
 PROJECT: NORTH

PROJECT: SASKATCHEWAN MULTI-USE FACILITY
 DRAWING TITLE: MAIN CONCOURSE LEVEL HVAC

SCALE: 1" = 500'
 PROJ. NO.: M-330
 REV. NO.: _____





- LEGEND:**
- ① CONDENSED SUPPLY AIR REGISTER
 - ② DIFFUSED RETURN EXHAUST REGISTER
 - ③ RETURN EXHAUST REGISTER
 - ④ MECHANICAL EXHAUST REGISTER
 - ⑤ RETURN AIR CHILLED WATER COIL REGISTER
 - ⑥ GENERAL EXHAUST REGISTER

NO.	DESCRIPTION	DATE	CHK
1	ISSUED FOR BIDDING	18 JAN 10	S.O.

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CAD	_____
DATE	DEC 09
DESIGNED	_____
S.O.	_____
DATE PLOTTED	_____



**SASKATCHEWAN
 MULTI-USE FACILITY**

DWG. TITLE
 SUITE LEVEL
 HVAC

SCALE	DWG. NO.	REV.
1:500	M-340	
PROJ. NO.		

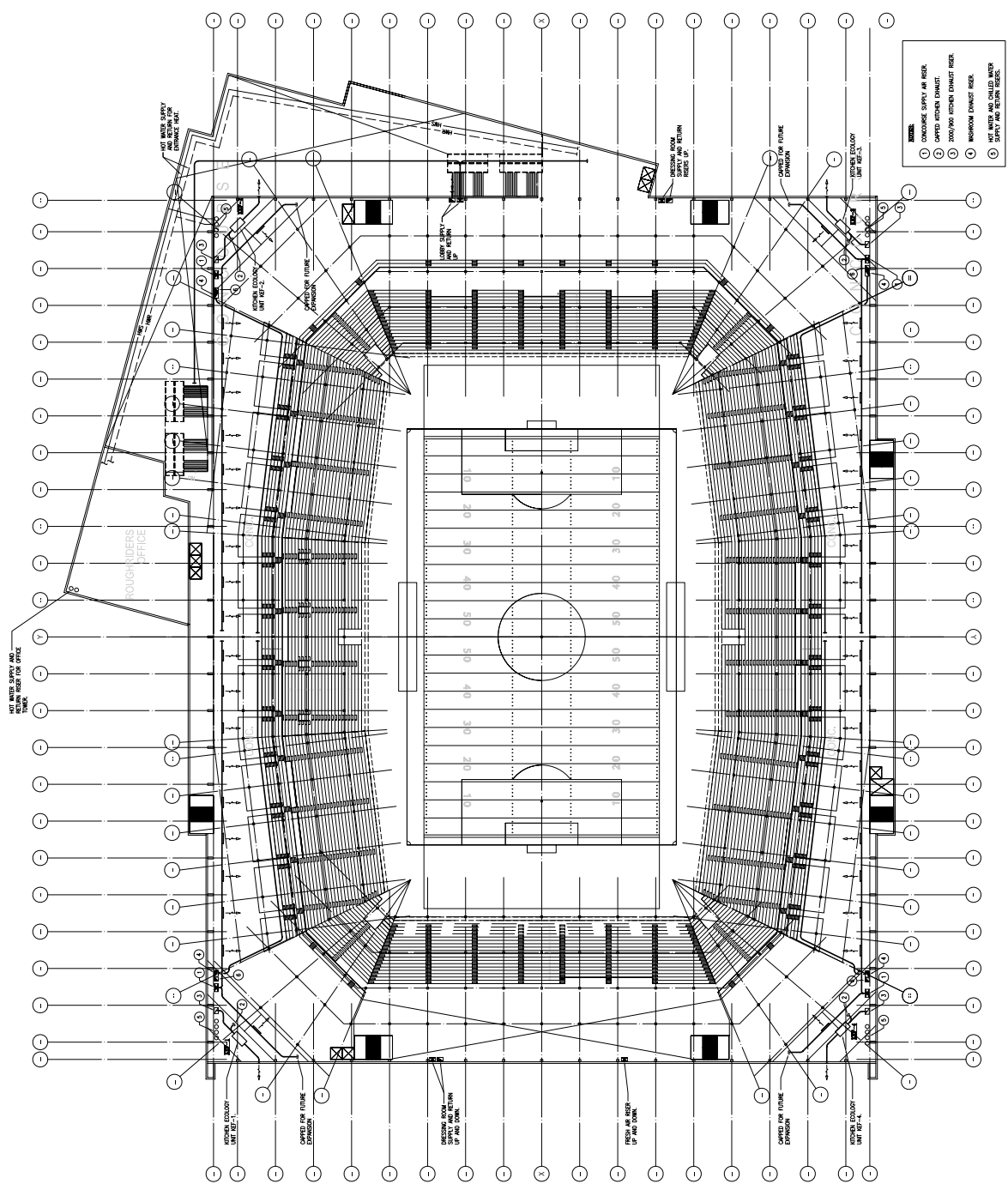
NO.	DESCRIPTION	ISSUED FOR	S.O.	DATE	CHK
1	ISSUED FOR BUDGETING		15 JAN 10		CHK

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 C.A.D.: _____
 DATE: DEC 09
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 S.O.: _____
 DATE PLOTTED: _____
 PROJECT: NORTH

SASKATCHEWAN MULTI-USE FACILITY
 DWG. TITLE: UPPER CONCOURSE LEVEL HVAC
 SCALE: 1:500
 DWG. NO.: M-350
 PROJ. NO.: _____
 REV.:





Smith + Andersen

4211 Yonge Street Suite 500 Toronto Ontario M2P 2A9
416 487 8151 f 416 487 9104 smithandandersen.com

ELECTRICAL OUTLINE SPECIFICATION

FOR

SASKATCHEWAN MULTI-USE FACILITY
FEASIBILITY STUDY

TO

STADIUM CONSULTANTS INTERNATIONAL
14 DUNCAN STREET
TORONTO ONTARIO

OUR PROJECT NUMBER:

09248.000

DATE:

FEBRUARY 11, 2010

1. ELECTRICAL PROJECT OVERVIEW

- 1.1. The stadium will be the home of the Saskatchewan Roughriders CFL Football team. It will also be used for FIFA soccer events, concerts, and trade shows.
- 1.2. The stadium is to be located South of Dewdney Avenue, between Smith and Broad Streets in the City of Regina Saskatchewan.
- 1.3. The electrical service authority is SaskPower.
- 1.4. The 101,345 square meter facility features a football field, retractable roof, forty private suites and 4 group suites, Roughriders Hall of Fame, concessions and retail kiosks, media area including a television production studio,
- 1.5. The distribution system has been sized to accommodate future seating for up to 50,000 spectators.

2. DESIGN STANDARDS

- 2.1. The Electrical systems will be designed in accordance with the following Codes and Standards:
 - Electrical Safety Code
 - National Fire Protection Authority (NFPA)
 - Standard for the installation of Fire Alarm Systems CAN/ULSS524-06
 - National Building Code 2006
 - Illumination Engineering Society (IES) Guidelines
 - “Basic” and “Prescriptive” standards set by ASHRAE 90.1-1989 “Energy Efficient Design of New Buildings”
 - The Model National Energy Code For Buildings (MNECB)
 - Local Ordinances and Authorities
 - Institute of Electrical and Electronic Engineers (IEEE) standards
 - Sustainability compliance to be in the “spirit of LEED”,
 - SaskPower requirements
 - CSA 282-05 Emergency Electrical Power Supply for Buildings

3. DESIGN BASIS

- 3.1. The design for the distribution system capacities is based on the following demand power densities:
 - Interior Lighting at .8 watt per square foot (excluding field).
 - Event lighting estimated at 600 kW.
 - Power and Systems at .5 watts per square foot (excluding field).
 - Mechanical systems at 3.5 watts per sq. ft.
 - Scoreboard system estimated at 480kW.

- 3.2. The building is to be designed as a LEED silver building, utilizing energy efficient lighting and lighting controls.
- 3.3. The electrical systems for the facility will be designed to meet the needs of the CFL and to accommodate FIFA and other events. The design will be reasonably flexible in nature to facilitate the ongoing reconfigurations a public facility normally undergoes, and also to assist in the many different cultural and sporting event uses.
- 3.4. As a primary focus, safety to the public and the working staff has been set as the highest priority. The electrical design will follow above average and good engineering practices and will meet or exceed the current Electrical Safety Code, as well as all local and provincial laws and by-laws having jurisdiction.
- 3.5. Along with the forecasted building life, consideration has been placed towards sustainability, reliability, simplicity of operation, design longevity, environmental impact, acoustics, aesthetics and reserve for future modifications.

4. INCOMING POWER SUPPLY

- 4.1. The incoming High Voltage service, HV Switchgear and transformers will suit the requirements of the Regina Multi-use facility, the local utilities and FIFA for a twin power supply.
- 4.2. The Facility is fed from off the local SaskPower electric distribution network. The main incoming 25 kV service will be provided by SaskPower to accommodate a total estimated demand load of 5500 kW.
- 4.3. The electrical contractor will provide concrete pads and concrete encased ductbanks to the property line for primary feeders.
- 4.4. SaskPower will provide three 2000 kVA outdoor padmount transformers and switching cubicles. One 2000 kVA transformer will be located at the southeast end of the stadium. Two 2000 kVA will be located at the southwest end of the stadium. SaskPower will provide and install the primary cables and terminations of the primary cables at both ends, as well as the secondary cables at the transformers.
- 4.5. SaksPower are providing a loop system which will accommodate the provision for a twin power supply for FIFA events. Provisions for temporary generators will be available to carry the loads in the event of transformer failure.

5. POWER DISTRIBUTION

- 5.1. The Electrical Contractor will provide three 347/600 volt 3PH 4W service entrance switchboard switchboards , one at the south end of the facility, and two at the west end of the facility.
- 5.2. Each switchboard will be rated at 2400 amps, 600/347volt, 3phase, 4wire solidly grounded neutral. All service entrance equipment will be rated to withstand the available short circuit current and will be rated to 100% continuous duty.
- 5.3. The main service equipment will be placed in dedicated electrical rooms.

- 5.4. The system will be distributed throughout the Facility to the various locations and floors. Feeders will be separated to assist in circuit recognition and fault isolation.
- 5.5. A complete interior distribution system will be provided for the Facility. Distribution system is to be designed to separate lighting loads, receptacle loads, concession, retail, technical and HVAC loads.
- 5.6. Generally each floor will have a dedicated distribution feeds and areas such as concessions, and mechanical rooms will also be equipped with localized panels to simplify the system.
- 5.7. All system sources will be available at the main bus for ease of maintenance and isolation, and the system will use moulded case circuit breakers for safety, isolation, selective trip and maintenance reasons.
- 5.8. All distribution equipment will be capable of providing a minimum of 25% overall spare capacity within the physical space of the equipment.
- 5.9. The electrical distribution system will be protected from the disruptive effects of lightning strikes, current surges, voltage surges, over voltage, under voltage and harmonic currents. Integrated surge protective devices (SPD) are to be provided in switchboards, panel boards, and motor control centres
- 5.10. Power factor correction shall be provided.
- 5.11. The main switchboards shall include main breakers for permanent and temporary power, with an interlock between. Main breakers in switchboard are to be draw out design and shall have a short time rating to allow selective tripping. Circuit breakers with an instantaneous override trip are not acceptable.
- 5.12. Metal enclosed indoor assemblies are to be of sprinkler proof construction complete with drip shield, gasketed doors and gasketing around component openings and suitable in all respects for use in the electric service provided.
- 5.13. All phase bus conductors shall be silver plated copper and be mounted on insulators.
- 5.14. Ground bus conductor shall be silver plated copper and be directly fastened to a bare metal surface of each vertical section, of a size sufficient to carry the rated 2-second current of the assembly.
- 5.15. 600V systems are to be high resistance grounded to allow the system to operate under a single fault condition. A monitoring system shall be provided to identify the total system ground current, identifying the feeder and phase on which a ground fault has occurred and causes an alarm to sound.
- 5.16. Separate switchboards are to be provided for Normal/standby and emergency distribution systems.
- 5.17. Harmonic mitigating transformers are to be provided for non-linear loads for audio systems, technical and broadcast equipment. Dedicated distribution panels with isolated ground and isolated ground receptacles are to be provided. Each circuit is to be equipped with an insulated ground conductor.

- 5.18. Electrical panels feeding receptacles that provide power for electronic office equipment and other power-sensitive equipment are to be equipped with all mode transient voltage surge suppression (TVSS) with noise filtering.
- 5.19. To protect lighting ballasts and lamps from premature failure caused by internally generated transient's within the building, each lighting panel will be equipped with level 2 surge suppression devices.
- 5.20. A minimum 10% of breakers are to be spare, and 30% spaces are to be provided in each panel.
- 5.21. Moulded case circuit breakers are to be provided for safety, isolation, and selective trip and maintenance reasons.
- 5.22. Flush or surface wall mounting enclosures are to be provided to suit panelboard and provide drip shields for surface mounted types.
- 5.23. A dedicated, full size neutral is to be provided for non-linear load circuits.
- 5.24. All floor mounted equipment to be set on 100 mm high concrete housekeeping pads 100 mm wider and longer than the equipment base dimensions. For equipment not designed for base mounting, where required, provide galvanized steel "C" channel support members flange bolted to housekeeping pads. Provide galvanized steel "C" channel frames and brackets for all surface wall mounted equipment not specifically designed for surface wall mounting, unless otherwise specified.
- 5.25. Electrical equipment in public areas to be tamperproof and vandal resistant.
- 5.26. Electrical systems and distribution equipment are to be located in secure, dedicated vaults, rooms and closets with sufficient clearance, access routes and access panel to allow for the installation, removal and replacement of equipment and to provide maximum flexibility for power distribution to floor area served.
- 5.27. Rooms housing electrical distribution equipment shall not contain communications equipment, mechanical equipment, ducts, pipes, shafts or mains unless the equipment is serving the room. Electrical equipment will not be located below Janitor rooms, water closets or other rooms with fluids, and shall only be located in mechanical equipment rooms if required to service mechanical equipment. All electrical equipment is to be suitably protected from leakages from the sprinkler system.
- 5.28. Coordination study and report on primary and secondary protection devices and transformers to be provided.
- 5.29. Loads to be balanced across phases.
- 5.30. Equipment is to be tested, commissioned and set into operation.
- 5.31. Power for visiting team buses will be provided with two dedicated 30amp, 120/208volt, 3phase, 4wire power connection receptacles. These outlets will be contained within a locked weatherproof stainless steel enclosure.
- 5.32. TV broadcast truck power will be provided with two 200A disconnect switches with cam-lock connectors fed from technical distribution system.

- 5.33. Stage audio power for sound systems will be provided via a dedicated 600amp, 120/208volt, 3phase, 4wire power panel. Stage visual power for lighting systems will be provided via a dedicated 400amp, 120/208volt, 3phase, 4wire power panel fed from technical distribution system. Audio and Visual panels are to be a minimum 3 meters apart.
- 5.34. On the event level, 4 locations points will be equipped with trade show power outlets each with 1 – 60amp 208volt 3phase twist lock outlet designed to facilitate a total of 89 trade show booths within the core of the stadium by use of traditional pipe and drape type distribution methods.
- 5.35. In addition to the power outlets, the following loose equipment will be provided so that the operational staff can set up for trade shows without the need to call in electricians:
- 5.36. Provision of 4 new PDU distro type panels to have connection capabilities for 24 twist lock cords and be complete with individual circuit over current protection,
- 5.37. 4 x 150 feet long, 60amp, main PDU feeder extension cords with twist lock ends,
- 5.38. 18 x 150 feet long, 20amp, 1 circuit, branch cable assemblies with quad duplex at each end capable to service 4 booths,
- 5.39. 8 x 200 feet long, 20amp, 1 circuit, branch cable assemblies with quad duplex at each end capable to service 4 booths,
- 5.40. The “plug and play” system above allows the operator the ability to set up for trade shows without the need to hire a qualified electrician.
- 5.41. All event audio power connections will be automatically disconnected during a second stage fire alarm event and will need to be manually reconnected to prevent damage to equipment from surges.

6. GENERATOR SYSTEM

- 6.1. The standby power consists of a permanent generator for all life safety and non-life safety loads as well as provision in the distribution system for temporary generator for FIFA other special events.
- 6.2. The standby power generator will be sized for the total estimated emergency load of 1250 kW including 25% future capacity without any need to load shed or synchronize power systems including:
- 6.3. Elevators
- 6.4. Fire pump
- 6.5. Emergency lighting for egress and service rooms
- 6.6. Essential mechanical equipment
- 6.7. Fire Alarm system

- 6.8. Security System,
- 6.9. Exit lights
- 6.10. Smoke control
- 6.11. Communications equipment
- 6.12. PA equipment
- 6.13. Standby power will be sustained for a continuous period no less than 24 hours without re-fuelling.
- 6.14. The standby generator system power is delivered into the system via normal/emergency transfer switch scheme. Separate transfer switches with manual bypass are to be provided for life safety and non-life safety systems. During utility failure, the transfer switches will select the alternate available source and transfer the load onto the system.
- 6.15. Generator is to be equipped with critical grade silencers and mounted on spring isolators or floating floors to minimize objectionable noise and vibration.
- 6.16. The temporary generator will provide uninterrupted, continuous power for the event lighting as well as team, media, and public areas as required by FIFA or for special events such as the Grey Cup to mitigate broadcast disruption and spectator enjoyment during events.

7. GROUNDING SYSTEM

- 7.1. A ground grid with 4/0 copper conductors and 3m long ground rods are to be provided near the building.
- 7.2. A 2400mm long copper ground bus will be located in the Main Electrical Room with two runs of #4/0 bare stranded copper conductor back to the building ground system and also one #3/0 bare stranded copper conductor to building water main.
- 7.3. A ground bar will be provided in each electrical room connected to the main grounding system in the main electrical room with #4/0 copper cables.
- 7.4. All transformer neutrals will be connected to the grounding bar and a common cable connected back to the system ground.
- 7.5. Grounding will be provided following IEEE 1100 and Electrical Safety Code standards.
- 7.6. Separate bare, stranded, copper wire conductors will be provided for ground bus electrodes interconnections, metal structures, electrical equipment, duct systems, motors, starters, control panels, and outdoor lighting.
- 7.7. A separate communication grounding system consisting of ground bus and copper ground conductor will be provided in communication rooms.
- 7.8. A separate technical grounding system will be provided for distribution equipment serving scoreboards, media outlets and sound systems.

8. MISCELLANEOUS POWER SERVICES

- 8.1. Switches and receptacles are to be specification grade.
- 8.2. Receptacles are to be wired maximum 4 per circuit in offices, 6 per circuit in service rooms and circulation areas.
- 8.3. At the camera locations, dedicated 20amp 120volt T-slot duplex outlets will be provided, fed from technical power panels.
- 8.4. Dedicated 20amp, 120volt, GFI protected duplex receptacles in weatherproof stainless steel enclosures will be provided at convenient locations around the facility for event, maintenance and small stage use. These outlets will be controlled by the low voltage lighting control system to control power usage.
- 8.5. Elevator machine power supply, wiring, lighting, life safety and receptacle systems for machine room, pits and secondary levels, power, security, music, communication and life safety provisions for cabs, and conduit and wiring to and for associated control and equipment will be provided.
- 8.6. Outlets are to be provided throughout for convenience and owners use and equipment including:
 - 8.6.1. For portable equipment and food carts in public concourses, sized to suit requirements of equipment.
 - 8.6.2. Isolated ground receptacles in administration and ticket offices, generally two per occupant.
 - 8.6.3. Special outlets for owners equipment such as battery chargers and office equipment.
 - 8.6.4. Dedicated 30amp, 208volt twist lock outlets will be provided at follow spot locations.
 - 8.6.5. In media areas, wiring channel with two sections and one power outlet and data outlet for each occupant.
 - 8.6.6. Power connections for exterior, advertising and way finding signage.
 - 8.6.7. GFI receptacles on dedicated circuits in team areas.
 - 8.6.8. Connections to hand dryers, hair dryers and specialty equipment.
 - 8.6.9. Power and CATV outlets for television monitors in public washrooms, team dressing rooms, coaches offices, admin offices, ticketing, and in concourses at 12m centres, 2400 AFF.
 - 8.6.10. In team areas for team equipment and at each locker.
 - 8.6.11. Power connections to ATM's, overhead doors, barrier free doors, scoreboards and auxiliary boards, audio equipment and auto sinks, toilets and urinals.

9. FIRE ALARM SYSTEM

- 9.1. A two stage fire alarm system with the capability of voice communications will be provided throughout the Facility.
- 9.2. The fire alarm has the following features:
 - 9.2.1. Actuation of any alarm initiating device on first stage to:

- .1 Cause electronic latch to lock-in alert state at central control unit and data gathering panel/transponder.
 - .2 Indicate zone of alert at central control unit and at remote annunciator.
 - .3 Cause audible devices throughout building to sound at 20 strokes per minute.
 - .4 Transmit signal to fire department via central station.
 - .5 Cause air conditioning and ventilation fans to shut down or to function to provide required control of smoke movement.
 - .6 Cause fire doors and smoke control doors, if normally held open, to close automatically.
 - .7 Cause elevators to return to floor of egress, or to alternate floor, as required.
 - .8 Send a visual alert signal to arena event control room to warn of possible shut down of event.
- 9.2.2. If first stage alarm is not acknowledged within 5 min, system to automatically go into second stage. Actuation of any alarm initiating device on second stage to:
- .1 Cause audible signalling devices to sound in alarm tone throughout building.
 - .2 Acknowledging alarm: indicated at central control unit.
 - .3 Possible to silence signals by "alarm silence" switch at central control unit, after 60 s period of operation.
 - .4 Subsequent alarm, received after previous alarm has been silenced, to re-activate signals.
 - .5 All lighting will be brought to full power through the lighting control system.
 - .6 Interface with smoke control system. The system will have individual fan on/off/auto controls which will be operated manually or automatically
- 9.2.3. Resetting alarm or supervisory device not to return system indications/functions back to normal until control unit is reset.
- 9.2.4. Voice communications capability throughout the Facility
- 9.2.5. Strobe signal circuits in areas of low audibility
- 9.2.6. Egress interface into the PA, AV and auxiliary connections
- 9.2.7. Smoke control system interface
- 9.3. Fire strobes are to be provided throughout in areas of low audibility and in public areas such as washrooms and corridors as required by code
- 9.4. An interface is to be provided with the PA and AV systems to disconnect sound systems during an alarm and only allow for manual reset of the sound systems.
- 9.5. All lighting will be brought to full power through the lighting control system
- 9.6. Interface with smoke control system. The system will have individual fan on/off/auto controls which will be operated manually or automatically
- 9.7. Actuation of any supervisory device to:
- .1 Cause electronic latch to lock-in supervisory state at central control unit and data gathering panel/transponder.

- .2 Indicate respective supervisory zone at central control unit and remote annunciator
 - .3 Cause audible signal at central control unit to sound.
 - .4 Activate common supervisory sequence.
- 9.8. Manual pull stations are to be provided with pull-type with covers to prevent false alarms in public areas.
- 9.9. Smoke detectors are to be located at the top of stairwells, in service rooms and in the main concourse as well as all areas required by code.
- 9.10. Circuits to be loaded to no more than 80% capacity.
- 9.11. The system will include individual fan on/off/auto controls at the main fire alarm annunciator location. The controls will automatically operate the exhaust fans during a level one fire alarm event. Manual override will be provided to fire fighting personnel during emergencies.
- 9.12. Remote annunciators are to be provided at strategic locations.

10. MECHANICAL/ELECTRICAL COORDINATION

- 10.1. Motor starters will be supplied and installed by the electrical contractor. Starters will be grouped into motor control centers or starter racks where feasible. Power wiring (line side and load side) shall be by the electrical contractor. Power wiring to the starter will be by the electrical contractor.
- 10.2. Variable speed drives will be supplied and installed by the mechanical contractor. Power wiring (load and line) will be by the electrical contractor.
- 10.3. Control wiring shall be by the mechanical contractor.
- 10.4. All fire alarm wiring shall be by the electrical contractor. All smoke detectors including duct-mounted smoke detectors, integral with the fire alarm system, shall be supplied and installed by the electrical contractor.
- 10.5. Motors for 1/2 hp capacity and larger are to be 600V 3 phase.
- 10.6. Reduced voltage starters are to be provided for 208 volt 10 hp motors, and 600 volt, 30 hp motors.

11. LIGHTING SYSTEMS

- 11.1. The lighting system will provide a quality visual environment, as prescribed by LEED, to IESNA Guidelines and to meet functional criteria of each specific lighting task, to complement the building, enhance the architecture and deliver acceptable illumination levels for the comfort and safety of the users.
- 11.2. Luminaires will be selected and located so that illumination required is primarily directed to the desired location, with minimal direct glare or reflection.

- 11.3. Fluorescent luminaires in suspended ceilings must be independently suspended from the ceiling slab. For each luminaire, provide a minimum of two (2) cable supports secured to ceiling slab and to luminaire.
- 11.4. Lighting in Lobbies, public areas, VIP areas, and all other architecturally sensitive areas is to be enhanced using decorative luminaires.
- 11.5. Luminaires exposed to outdoor environments are to be sealed and gasketed, suitable for cold weather start.
- 11.6. Lighting is to be provided under upper cabinets, locally switched.
- 11.7. Lamp sources are to be minimized. Lamps are to be maximum life, low mercury, energy efficient T5 or T8, compact fluorescents, CMH, metal halide and LED 3500 degree K and high CRI values. Incandescent lamp use will be avoided.
- 11.8. Lighting in all areas to be designed and located to provide ease of maintenance.
- 11.9. The Stadium event luminaires are to be will be provided on a catwalk structures at the perimeter. Stadium event luminaire shall be a floodlight for operation of clear metal halide 1500, 1800, or 2000W lamps from a nominal 347 volt, 60 Hz power source. Luminaire shall be capable of starting and operating the lamp within the limits specified by the lamp manufacturer. Luminaire shall be a Philips Arena Vision or approved equal to meet FIFA and CFL lighting requirements for televised events: 1600 lux horizontal and 1500 lux vertical to the main camera. The system shall be connected so that the temporary generator shall operate the luminaires during FIFA or special televised events to avoid disruption.
- 11.10. 1000W incandescent luminaires in the Stadium will be provided to meet emergency lighting levels on the field and the stands only. They will be controlled by dimmers.
- 11.11. Computer modelling is to be provided for all event lighting, work lights and emergency lighting to determine optimal quantity and locations.
- 11.12. Exterior Pole lighting, bollards, wall mounted luminaires, recessed step lighting, and canopy mounted lighting will provide safe egress, security, and compliment the building's architecture while providing optimal uniformity ratios and "full cut-off" optics to avoid wasted up-lighting and maintaining a dark sky.
- 11.13. Banner lighting is to be provided at pole lights and on the building, respecting dark sky considerations.
- 11.14. Night Lighting is not required in the building except in areas that may be occupied or patrolled during off hours, such as main circulation areas and security station in the main lobby area.
- 11.15. Exit Lights are to be LED type, with LED's connected in multiple circuits so that failure of one circuit or one LED does not severely degrade faceplate illumination and are to be consistent with the level of finishes for a given area;
- 11.16. All exit signs in public areas are to be vandal resistant, assembled and installed with tamperproof fasteners

- 11.17. Exterior exit signs are to be weatherproof and vandal resistant.
- 11.18. Exit signs in finished public areas are to be edge lit type.
- 11.19. Battery Emergency Lighting and Remote Lamps are to be sized to accommodate the entire connected load for continuous duty. Vandal resistant emergency remote heads integral with emergency battery units are to be provided in mechanical and electrical service rooms, and in access from the generator room to the exterior.

12. LIGHTING CONTROL SYSTEM

- 12.1. The system will incorporate a computerized controlled system of all lighting circuits throughout the Facility. Centralized control will be provided at the main security desk and the media room.
- 12.2. Unless disallowed by code, all luminaires are to be controlled by low voltage lighting control system.
- 12.3. Switches in individual rooms are to be low voltage type.
- 12.4. All areas or rooms shall be equipped with on-off control unless noted otherwise.
- 12.5. Occupancy sensors and daylight sensors are to employ the latest technology and shall be equipped with over-ride control.
- 12.6. The low voltage control of lighting equipment will be “user friendly” with programmable security levels, fire alarm access and energy consumption totalling capability.
- 12.7. Perimeter lighting adjacent to windows and areas with skylights are to be controlled by daylight sensors to allow complementary use of natural light and to reduce energy consumption by dimming luminaires.
- 12.8. Multilevel switching of HID lighting systems is to be provided where practical.
- 12.9. The lighting control system will have the following features:
- 12.10. Energy savings by fully controlled system
- 12.11. Automated exterior lighting control
- 12.12. Daylight sensors to control areas of high sunlight exposure for further energy savings,
- 12.13. Reduction of lamp replacements
- 12.14. Maintenance savings and longer lamp life
- 12.15. Reduced operations costs lowering Hydro consumption
- 12.16. Interface to building second stage fire alarm system to provide instant on to all lighting circuits
- 12.17. Interface to security system to activate lighting in specific zones by card reader

- 12.18. The exterior lighting control system will incorporate a high degree of day lighting intelligence and sunlight recognition. Generally, independent areas of the site will be turned on as specific set points in daylight (luminance) are met.
- 12.19. All security lighting turns off at dawn. A manual override for all exterior lighting groups will be provided at the main security desk.

13. CONDUIT AND WIRING

- 13.1. The exact locations and routing of services shall be designed to clear each other as well as any obstructions. All junction boxes, pull boxes and similar products, particularly such products located above suspended ceilings, must be designed in locations which provide easy access for servicing and/or removal.
- 13.2. Conduits and conductors are to be designed to be concealed in all finished areas, and concealed to the degree made possible by finishes in partially finished and unfinished areas. Conduit may be exposed in unfinished areas such as Electrical and Mechanical Rooms, unless otherwise specified.
- 13.3. Exposed conduits are to be coordinated with building structure and systems of other divisions to run parallel and at right angles to building walls, partitions, and ceilings; installed as high as possible and avoid interference with other systems and equipment.
- 13.4. Where conduit is to be embedded within structural concrete it is to be coordinated with practices and methods approved by the Structural Consultant.
- 13.5. Conduits shall be provided for all conductors except armoured cable and copper sheathed mineral insulated conductors, and except where cable tray, duct or similar raceway materials are provided. Unless otherwise specified or required, conduit shall be as follows:
- 13.5.1. For main distribution wiring in electrical rooms and for concealed conduit in exterior walls – rigid galvanized steel;
- 13.5.2. For exposed conduit outside the building to surface mounted “FS” boxes and for semi-exterior areas such as loading docks – rigid galvanized steel;
- 13.5.3. For branch circuit conductors in concrete slabs – rigid PVC with insulated ground conductor;
- 13.5.4. For interior conduit larger than 50 mm diameter containing distribution conductors or communication system conductors (fire alarm, telephone, etc.) except as noted above – EMT with separate insulated ground conductor;
- 13.5.5. Provide manufactured expansion joints in rigid PVC, plastic conduit at spacing as recommended by the conduit manufacturer;
- 13.5.6. Minimum conduit size throughout is to be 20mm. Where the sizes of branch circuit conductors are to be increased to suit length of run and voltage drop, increase the conduit size to suit;
- 13.5.7. Ensure that all conduit systems which are left empty for future wiring are clean, clear, capped and properly identified at each termination point. Provide end bushings and suitable fish wires in all such conduit;
- 13.5.8. Two 40 mm diameter empty conduits to a ceiling space junction box (in ceiling spaces above and below) from flush mounted panelboards.

- 13.5.9. Flexible galvanized steel conduit connected to suitable boxes on either side of building expansion joints
- 13.6. Separate raceways, conduits, pull boxes and back boxes for all other related systems including but not limited to:
 - 13.6.1. Controls and Instrumentation
 - 13.6.2. Intercom System
 - 13.6.3. Door Control System
 - 13.6.4. CCTV System
 - 13.6.5. Master Clock System
 - 13.6.6. Telephone System/Structured Cabling System
 - 13.6.7. Audio-Visual Equipment
 - 13.6.8. Mobile radio systems
 - 13.6.9. Advertising signage
 - 13.6.10. Scoreboards and auxiliary boards,
 - 13.6.11. Coaching intercommunications
 - 13.6.12. Point of sale
 - 13.6.13. Instant replay system
 - 13.6.14. Broadcast system
- 13.7. All systems equipment is to be mounted on fire-rated FS wood plywood backboards.
- 13.8. All dedicated ground circuits must contain separate neutral and ground conductors (i.e. common neutral configuration is unacceptable).
- 13.9. Conductors shall be copper XLPE rated R90 – RWU90 to suit specific application minimum 12 AWG, and #10 AWG for runs longer than 15 m. Conductors from panelboards to wiring devices shall be sized for a 2% voltage drop
- 13.10. An outlet box or back box is to be provided for each lighting fixture, wiring devices, telephone outlet, fire alarm system component, communications systems components and any other such outlet. Outlet or back boxes must not be installed “back-to-back” in walls and partitions and are to be staggered and sealed against noise transmission. The size and arrangement of outlet boxes shall suit the device which they serve.
- 13.11. Outlet boxes flush mounted in interior construction, surface mounted in concealed interior locations, and surface mounted in exposed interior locations where the connecting conduit is EMT, shall be stamped and galvanized steel outlet boxes unless otherwise noted.
- 13.12. Outlet boxes for surface mounted exterior lighting, receptacles, and other devices boxes flush mounted in exterior building surfaces, boxes mounted in interior device locations where the connecting conduit is rigid, and boxes in perimeter wall where insulation and vapour barrier is present, shall be “FS” or “FD” series cast boxes
- 13.13. Outlet boxes in underground plastic conduit systems shall be rigid PVC plastic outlet boxes.

- 13.14. Outlet box for switches connected to normal and emergency power and which share a common faceplate shall be barriered boxes.
- 13.15. All pull boxes and junction boxes must be accessible after the work is completed and located on “as-built” record drawings.
- 13.16. Access door sizes shall suit the concealed work for which they are supplied, and wherever possible, they are to be of a standard size for all applications, but in any case they shall be minimum 250 mm x 250 mm.

14. VOICE/DATA SYSTEM

- 14.1. The information technology infrastructure system will be designed and installed utilizing high standards and flexibility in mind.
- 14.2. All voice and data equipment/electronics (data switches, phone system, point of sale equipment, phone sets and UPS power supplies) are to be provided by the City. All cabling, devices and racks to house the equipment are to be provided by the electrical contractor.
- 14.3. All the building’s systems will be designed to follow guidelines set out by the communication industry and will be built to good practice. Communications systems will be designed to handle future restructuring with minimal disruptions to the operations of the Facility.
- 14.4. The building will be cabled to accommodate a high technology VOIP voice over internet protocol system.
- 14.5. The voice and data systems will be delivered to the various hub locations using 6 strand fiber optic cable and further distributed horizontally utilizing CAT 6 technology for both voice and data. All horizontal voice and data cabling will be terminated onto patch panels. All patch panels will reside in 19” racks and/or wall mounted terminal cabinets.
- 14.6. Since voice & data cabling will be combined where possible, each cable will be tested and verified to provide a minimum of 1.0 Gig speed.
- 14.7. Cabling at workstations and patch panels are terminated using Category 6 modular jacks. Jacks at workstations are secured in quad port faceplates (color to be determined). Modular jacks in each telecommunications room are secured in 48 port patch panels.
- 14.8. All cabling will be installed within the 90m design guidelines for permanent link per ANSI/EIA/TIA 568-B.1.
- 14.9. Cable pathways shall be provided to ensure that free air cables are not exposed to public sight. Pathways consist of the conduit stubs from outlets into ceilings to zone conduit, cable tray or directly to communications room.

15. CATV SYSTEM

- 15.1. The CATV system will be designed to distribute televised broadcast throughout the Facility. The system shall be capable of supporting local signal suppliers or satellite communications.
- 15.2. The system will consist of horizontal secondary feeds distributed to the final locations.
- 15.3. HD digital RG59 coax cable will be utilized as the secondary final destination lines
- 15.4. Cable pathways shall be provided to ensure that free air cables are not exposed to public sight. Pathways consist of the conduit stubs from outlets into ceilings to zone conduit, cable tray or directly to communications room.
- 15.5. Broadcast system bulkheads will be provided at all camera locations and at strategic locations throughout the facility. Broadcasters' equipment including cables and cameras are not provided by the electrical contractor.

16. COMBINED PA & SOUND SYSTEM

- 16.1. The PA Sound system will be capable of providing service to all areas of the Facility. The system will be capable of zone selection and will interrupt all audio systems within the zone being paged. Control will be provided at the main administration room.
- 16.2. Throughout the Facility, the PA Sound system will be installed in: the soccer field; public lobby; the dressing rooms, sports office and public washrooms.
- 16.3. The sound systems will carry two types of signal:
 - .1 Event program, which may include event-oriented voice (e.g., singing, announcements) and music (e.g., pre-recorded or live music, electronic cheerleading), according to the requirements for each area.
 - .2 Voice paging, which selectively overrides event program, normally used for event management or stadium operations. The sound systems will accommodate different paging signals for each area, simultaneously.
- 16.4. Ceiling and wall mounted loudspeakers, backboxes and paging attenuators for moderate level paging and event program, will be used to cover the areas. The system comprises a constant voltage distribution system, zoned as required.
- 16.5. Using paging microphones, which can be plugged in at the user input panel location the Administration Office, pages may be made that will access the loudspeakers in the Facility, according to programming for that mic/zone combination.
- 16.6. A page overrides any event program currently playing in the destination zone.
- 16.7. Cable pathways shall be provided to ensure that free air cables are not exposed to public sight. Pathways consist of the conduit stubs from outlets into ceilings to zone conduit, cable tray or directly to communications room.

17. SECURITY SYSTEMS

- 17.1.1. A security system will be provided with building perimeter monitoring and CCTV camera surveillance. The system will be intrusion monitored off site during holidays and days of non-operation.
- 17.1.2. The perimeter monitoring system will consist of door contacts, break glass detection and motion detection within the critical areas. The system will be armed and disarmed through localized zoned keypads.
- 17.1.3. The CCTV camera surveillance will incorporate color camera system to monitor the lobby and soccer field. A digital recorder will provide a minimum of one week backup to a computerized network hard drive system.
- 17.1.4. The security system has the following features:
 - .1 Secure perimeter system
 - .2 Off site monitoring provision
 - .3 CCTV camera surveillance system with computerized hard drive backup
- 17.2. All cables are to be in conduit. Pathways consist of the conduit stubs from outlets to zone conduits or directly to communications room.
- 17.3. Security system to be integrated with the lighting control system to activate lighting in specific zones by card reader.

18. EQUIPMENT IDENTIFICATION

- 18.1. Engraved Lamacoid identification nameplates indicating the identifying the equipment, voltage characteristics, capacity and source of supply, and with sub-nameplates clearly identifying each cell or component and its service as required are to be secured to all electrical equipment with stainless steel screws.
- 18.2. Equip large multiple cell or component apparatus such as sub-stations, switchboards and distribution panels with main nameplates identifying the equipment, voltage characteristics, capacity and source of supply, and with sub-nameplates clearly identifying each cell or component and its service.
- 18.3. Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring. Maintain phase sequence and colour coding throughout. Colour code: to CSA C22.1. Use colour coded wires for fire alarm and communication cables, matched throughout. Outlet boxes for flush floor mounted devices shall be concrete tight formed galvanized steel fully adjustable flush floor boxes.

19. LIGHTNING PROTECTION

- 19.1. A complete lightning protection is to be provided if required by building insurers.

END OF ELECTRICAL OUTLINE SPECIFICATION

Project Memo

February 12, 2010

TO: Chris O'Reilly

FROM: Maurizio Darini, Martin Murray

cc: Lawrence Lippold

**BBB Architects Toronto Inc.
Saskatchewan Multi-Use Facility**

Moveable Roof Machinery

1. Introduction

The following report describes the machinery required for operating a movable roof system for the Saskatchewan Multi-Use Facility. The costs for the moving roof machinery, engineering, design and build, installation, start up, and commissioning are estimated for budgetary purposes.

2. Retractable Roof Mechanism

The following is a description of the proposed retractable roof machinery. The machinery for both the partially and fully retractable options are similar in operation and machine design. The partially retractable roof will be smaller but, have the same components and fundamental design as the fully retractable roof. The fully retractable mechanisms is described in the following write up and sketches.

The proposed mechanism is also very similar to one that was designed by Hatch in 1996 for the Arizona Diamondback's Major League Baseball stadium in Phoenix Arizona. The Arizona Stadium is a fully retracting roof with 6 moving panels. The roof opens and closes in four and a half minutes has a minimum number of moving parts and has achieved up to 600 open and closes in a single year. The design's simplicity makes it highly reliable with low annual maintenance requirements compared to other moving roof systems.

For the proposed design there are 4 moving roof panels. Table 1 is a list of the major mechanical assemblies and their respective estimated weights. Figure 1 shows a plan view and various sections of the proposed layout (fully retractable option only).

If you disagree with any information contained herein, please advise immediately.

Table 1 : Assemblies and Weights

ASSEMBLIES	QTY	UNIT WEIGHT (TONNES)	TOTAL WEIGHT (TONNES)
LOWER BOGIES	8	27	216
LOWER RAILS	4	25	100
CORNER SHEAVES	4	10	40
END SHEAVES	2	6	12
UPPER BOGIES	36	1	36
UPPER RAILS	36	4.5	162
WINCH DRIVES	2	75	150

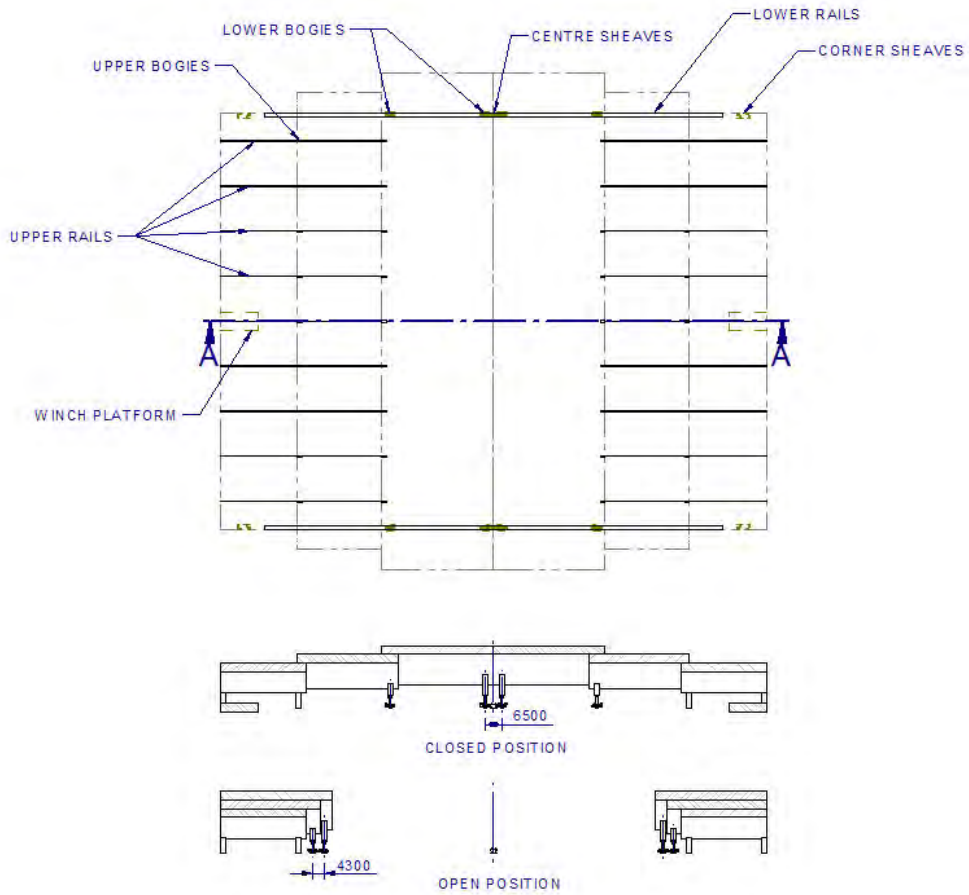


Figure 1 : Plan and Sections

Each moving roof panel rides on two fully equalized lower bogies that support the front end of the roof at the main truss and nine upper bogies that support the back end of the panel. The lower bogies ride along a pair of rails that are mounted on top of the North and South walls of the stadium. Either the North or South lower bogies will be pin-connected to the panel in order to allow the panels to thermally expand/contract with changing ambient temperatures. The upper bogies ride along single rails, one for each upper bogie that are mounted on the roof panel below. Panel one rides on panel two and panel two rides on the fixed panel.

The moving roof panels are actuated by a series of wire ropes that pull on the lower bogies to either open or close the roof. Since the upper bogies are not actuated, they simply support the back end of each panel and follow its movement either open or closed. The wire ropes are driven by a winch system that consists of a single motor, gearbox and pair of mechanically synchronized rope drums. Two winch drives are required, one for each moving half of the roof and are mounted at the centre of the East and West ends of the stadiums. A series of corner and centre sheaves, are required to direct/guide the rope between the rope drums and lower bogies.

This roof drive system is simple with few parts and reliable with low annual maintenance costs.

2.1 Lower Bogies

The lower bogies shown in Figure 2 consist of eight 36" diameter fully bogied, flanged, steel wheels mounted to each axle through spherical rolling element bearings. They are designed with side-guide rollers mounted between the two rails and uplift brackets in order to keep them from sliding or lifting off the rails respectively. Parking brakes will be used on select wheels to hold the roof when not in use. Two rope-ends will be attached to each lower bogie, one for pulling it in the closed direction and one for pulling it in the open direction. All rotating and pivoting pins/bushings will be designed to allow greasing during routine maintenance in order to allow for smooth and quiet operation.

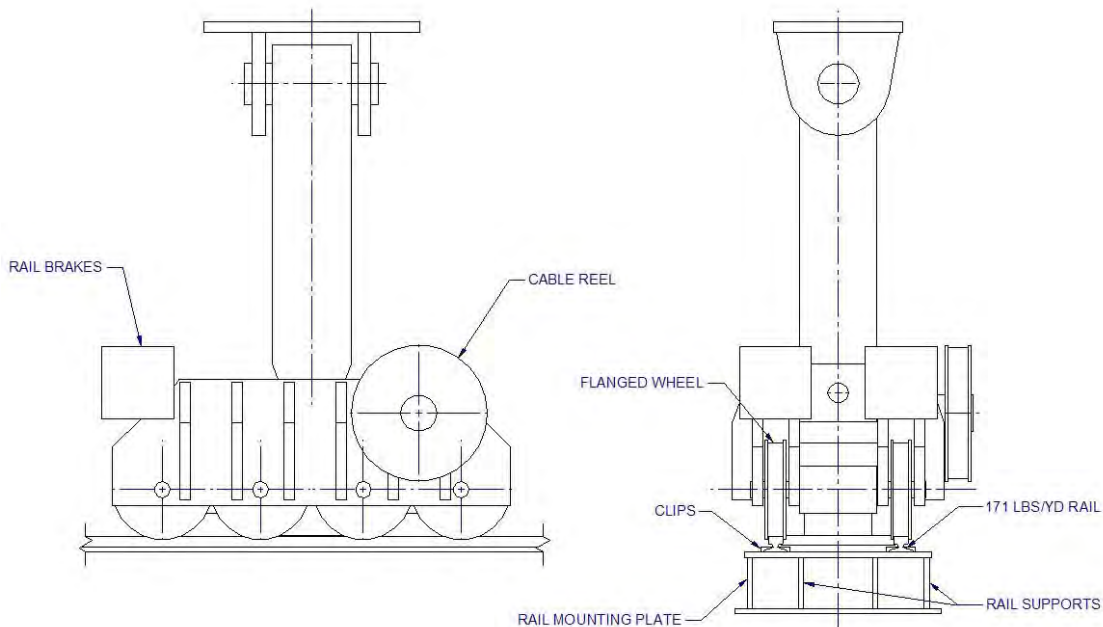


Figure 2 : Lower Bogie

2.2 Upper Bogies

The upper bogies shown in Figure 3 will consist of two fully bogied, flanged, 18" steel wheels mounted in-line rotating on spherical rolling element bearings. Each upper bogie will ride along a single rail that is mounted to the roof panel directly below. They will contain side-guide rollers at all corners to guide the bogie along the rail. The bogie frame will be attached to the roof panel via pivot pins that will allow relative movement for thermal expansion and alignment between the adjacent roof panels.

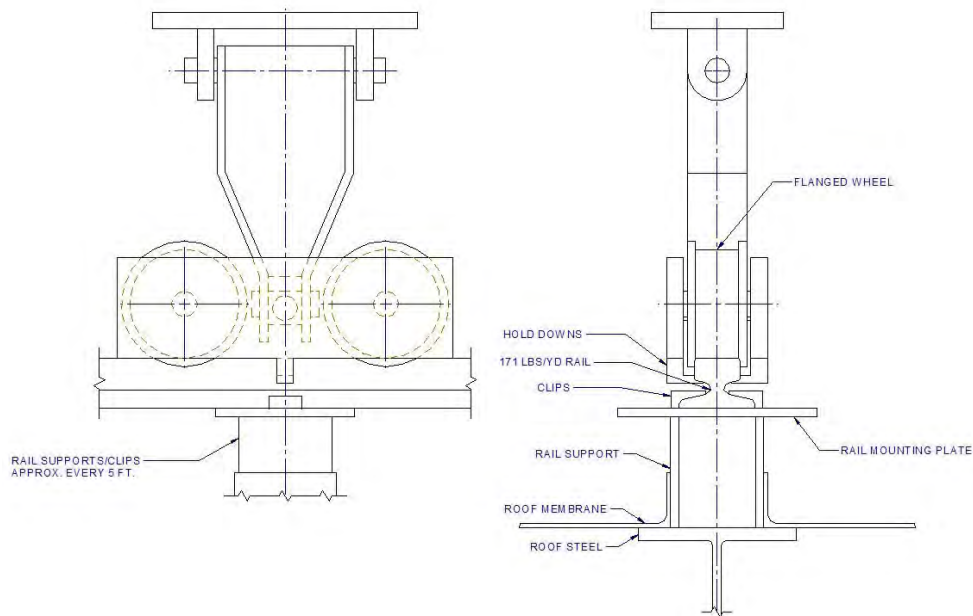


Figure 3 : Lower Bogie

2.3 Drive Mechanism

Each drive mechanism, one for the east side one for the west, consists of a single electric motor with VFD (variable frequency drive) control, a reduction gearbox and two wire rope drums, one for each moving panel. The rope drums are mechanically synchronized such that each roof panel traverses its prescribed distance in the same amount of time. Therefore the upper panel will move twice as fast as the panel below in order to complete its movement in the same amount of time. As well, the lower bogies of each panel are connected to the same drum so as to prevent the individual panels from skewing as they move. The ropes are turned 90 degrees between the drums and bogies by the corner sheaves, since the winch platforms are mounted at the centre of the East and West end of the stadium up inside the fixed roof panel. A pair of centre sheave assemblies mounted to the centre of the North and South walls of the stadium are used to turn the ropes 180 degrees allowing them to pull the lower bogies towards the closed position from the same winch platform.

3. Budgetary Cost

The following are budgetary estimates (+/- 30%) for the engineering, supply, installation and start up of the machinery for the fully retractable roof option Table 2 and the partially retractable roof option Table 3.

Table 2 : Fully Retractable Roof System

Engineering	\$ 6,500,000
Capital Cost	\$ 16,500,000
Installation & Start-up	\$ 900,000
TOTAL	\$ 23,900,000 (CDN)

Table 3 : Partially Retractable Roof System

Engineering	\$ 6,500,000
Capital Cost	\$ 11,000,000
Installation & Start-up	\$ 900,000
TOTAL	\$ 18,400,000 (CDN)

Note the partially retractable capital cost would be reduced by approximately 1/3rd. All other costs would remain the same.

MD:

Saskatchewan Multi-Use Facility – Feasibility Study
Preliminary Overview: Building Code Application

Prepared for:
Brisbin Brook Beynon Architects Inc.
14 Duncan Street, Fourth Floor
Toronto, ON M5H 3G8

29 January 2010

LARDEN MUNIAK CONSULTING INC.
BUILDING CODE & FIRE PROTECTION CONSULTANTS

4195 DUNDAS STREET WEST, SUITE 233
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Preliminary Overview: Building Code Application

INTRODUCTION

The purpose of this report is to provide a general overview of the application of major building code concepts and fire-protection measures that will be incorporated in the design of the Saskatchewan Multi-Use facility in Regina, Saskatchewan, relative to a schematic design prepared by Brisbin Brook Beynon Architects Inc. The 2005 National Building Code (NBC) is the primary building code reference for the project. The National Fire Protection Association (NFPA) 101, “Life Safety Code” will be applied for components of the building design which are not fully addressed in the NBC. Utilization of NFPA 101 concepts may reasonably be regarded as alternative solutions, as are addressed in the 2005 NBC, under objective-based concepts.

Although this report provides an initial overview of major life safety requirements of Part 3 of Division B of the NBC that would apply to the project, it is not intended to identify all details of code requirements.

This report has been prepared at the request of Christopher O'Reilly of Brisbin Brook Beynon Architects Inc., and is based on drawings dated 15 December 2009 prepared by that firm.

PROJECT DESCRIPTION

The Saskatchewan Multi-Use facility has been designed as an enclosed, 3-storey arena that will be used for purposes of viewing various sport, concert and entertainment events, as well as exhibitions and trade shows. The design proposal includes a retractable roof such that events may be considered open-air or enclosed, depending on whether or not the roof is open.

The building will include various uses that are supplementary to the use of the facility; these will include building services, concession stands, change rooms, lounges, restaurants and a retail component.

The project design will comply with the NBC, except that egress and exiting for the spectator seating in the main bowl will comply with the applicable requirements of NFPA 101 for an arena provided with smoke-protected assembly seating. There are a number of precedents for such application of NFPA 101 for arena structures constructed under Canadian building codes.

BUILDING CONSTRUCTION

Construction requirements for the project are based on occupancy classification, building area and building height.

The major occupancy classification is Group A, Division 3, Arena Building. The building will be considered to be 3-storeys in height; the Main Concourse (entry) level will be considered the first storey, the Suites Level the second storey, and the Upper Concourse the third storey.

Building area per NBC definition will be approximately 43,000 m².

Based on the factors described above, the new facility will be required to be designed in conformance with NBC Article 3.2.2.29., “Group A, Division 3, Any Height, Any Area, Sprinklered”. Under this article, the following requirements apply:

- noncombustible construction,
- 2 h rated floor assemblies,
- 1 h rated mezzanines,
- roof assemblies may be unrated, unless they support an occupancy,
- loadbearing elements are to have the same fire-resistance rating as the structure they support, and
- sprinklering of the building.

The design includes provision for future expansion of seating at the east and west ends of the building. These seating areas will not be considered as adding to the building in storey height.

Fire separations with appropriate fire-resistance ratings will be provided around rooms, shafts and spaces that are designated as requiring such separation in the building code; these may include stair and elevator shafts, rooms containing fuel-fired appliances or hazardous equipment, refuse and recycling storage rooms and vehicle storage rooms.

The main open bowl of the arena and associated concourses will be considered a single fire compartment. It is anticipated that NBC interconnected floor space provisions may not be fully applicable due to application of the smoke-protected seating concept under NFPA 101.

The flame-spread rating of interior finishes will be limited to 25 for walls and ceilings in exits and vertical service spaces. In other areas, the wall flame-spread rating will be limited to 150 and ceilings to a flame-spread rating of 25, with minor exceptions.

FIRE SUPPRESSION

Fire Department Access

In addition to NBC requirements, fire department vehicle access routes will be designed in consideration of local requirements and factors, including the size and capability of vehicles and the location of principal entrances to the building relative to public thoroughfares. Project designers will liaise with the Regina Fire Department to ascertain requirements for access to the building, hydrant location, approach by vehicles, siamese connections and other possible fire department concerns.

Sprinklers

The building will be provided with a fully supervised sprinkler system designed, installed and tested in accordance with NFPA 13, “Standard for the Installation of Sprinkler Systems”, as referenced in the NBC.

Standpipe System

The building will be designed with a standpipe system designed in accordance with NFPA 14, “Installation of Standpipe and Hose Systems”, and as otherwise required by the NBC. Hose connections will be located in exits, in accordance with NFPA 14.

Kitchen Hood Extinguishing Systems

Kitchen hood extinguishing systems, including exhaust ducts, will be installed in locations where commercial cooking occurs, in accordance with NFPA 96, “Ventilation Control and Fire Protection of Commercial Cooking Operations”.

FIRE ALARM SYSTEM AND VOICE COMMUNICATION

Fire Alarm

The project will be provided with a fire alarm system designed and installed in conformance with CAN/ULC S524-M, “Standard for the Installation of Fire Alarm Systems” and tested in conformance with CAN/ULC S537-M, “Standard for the Verification of Fire Alarm Systems”.

The fire alarm control panel as well as emergency function controls for certain other building systems, including those of the smoke management system (required under NFPA 101 as an aspect of smoke-protected assembly seating), will be located in a control centre readily accessible to firefighters entering the building. In addition to being provided with the conventional means of system activation (pull stations and fire detectors), the fire alarm system will be capable of monitoring the sprinkler system water supply valves and other system features critical to water supply for the sprinkler system. The control centre will also contain emergency function controls for supervision, actuation and control of mechanical smoke management system components.

Emergency Voice Communication

An emergency voice communication system will be installed and integrated with the fire alarm and detection system. Controls and microphones for this system will be installed in the control centre.

LIGHTING AND POWER

Lighting

Lighting will be provided in means of egress and other facilities as required by the relevant provisions of the NBC or provincial regulations. Emergency lighting will be provided at levels required in exits and other components of means of egress as required by the NBC.

Power

An emergency electrical power supply system will be installed in accordance with CAN/CSA-C282, “Emergency Electrical Supply for Buildings”.

Emergency power will be provided for the fire alarm and the smoke management systems, and for equipment necessary for water supply for firefighting if such equipment is dependent on electrical power.

SMOKE MANAGEMENT MEASURES

Smoke-protected assembly seating will be used as an alternative to NBC provisions respecting configuration and capacity of means of egress and travel distance. Provisions for smoke-protected assembly seating are described in NFPA 101, and smoke management design will be based on NFPA 92B, “Guide for Smoke Management Systems in Malls, Atria and Large Areas”.

The smoke-protected seating concept will be used so that exits and access to exit will remain clear of smoke during an evacuation situation, under the protocols described in NFPA 101. The smoke management system will provide additional time needed for occupants to evacuate the building, which may be in excess of the evacuation time implicit in conventional egress design where smoke protection is not mandated.

The allowances for egress from fixed seating as described in NFPA 101 for smoke-protected assembly seating will be implemented, as smoke-protected assembly seating will be incorporated into the design.

The smoke management system will be supervised and monitored by the building’s fire alarm system.

Testing and commissioning of the smoke management system will be conducted in accordance with NFPA 92B.

EGRESS AND EXITING

Smoke-Protected Assembly Seating

The seating and egress requirements in the open bowl of the arena will be based on NFPA 101, as indicated above. On this basis, travel distance from seats in the assembly areas to an exit may be greater than the limits otherwise imposed under the NBC.

Exit design will accommodate possible future additional seating.

Areas Outside of Smoke-Protected Assembly Seating

Configuration and capacity of means of egress in portions of the building not designed for smoke-protected seating will be based on the NBC. This will entail a maximum travel distance to an exit of 45 m.

WASHROOMS

Based on an occupant load of 33,000 persons under Phase 1 of the project, approximately 87 water closets (or a combination of water closets and urinals) will be required for males and 172 water closets for females. The addition of another 12,000 seats under a possible Phase 2 expansion would entail approximately 30 more water closets/urinals for males, and 60 water closets for females. The project will conform with these requirements, in addition to any applicable provincial regulation.

BARRIER-FREE ACCESSIBILITY

The project will comply with the requirements pertaining to barrier-free design in Section 3.8 of Division B of the NBC, as well as any other applicable provincial or municipal requirements pertaining to accessibility.

At least 50% of building entrances will be barrier-free, and doors at these locations will be provided with power door operators. Barrier-free entrances will be provided to maximize convenience for persons with disabilities in gaining access to the building.

A barrier-free path of travel will be provided from barrier-free entrance doors throughout the entrance storey and within all normally occupied floor areas served by a passenger elevator or other elevating device. Elevating devices will conform to Appendix E of CAN/CSA B44, “Safety Code for Elevator”.

Barrier-free washrooms will be provided for all floor areas required to be barrier-free accessible as described in NBC 3.8.2.1. and other applicable requirements. Barrier-free facilities will be provided by special washrooms or with barrier-free stalls within washrooms intended for the general building population.

Ramps in a barrier-free path of travel will be designed to meet the requirements of the NBC, as well as other possible applicable provincial or local requirements.

Facilities for athletes and sports teams will be designed to accommodate persons with disabilities.

Signage incorporating the international symbol of accessibility will be provided at barrier-free entrances, means of egress, washrooms, parking areas and all facilities intended to be barrier-free accessible.

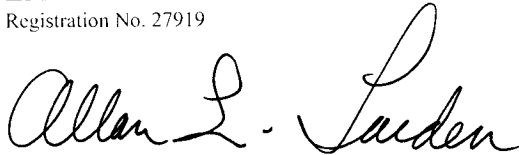
SUMMARY

This report highlights major aspects of building code requirements that will apply and have been considered in the preliminary design of the Saskatchewan Multi-Use facility. More detailed analysis and evaluation will occur as the design progresses.

It is possible that certain nominal requirements could be modified where alternative solutions are accepted by Authorities Having Jurisdiction, as is envisaged under the 2005 NBC.



Prepared by:
LARDEN MUNIAK CONSULTING INC.
Registration No. 27919



Allan E. Larden, MRAIC
BCIN 25053

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STRUCTURAL WIND LOADING REPORT

**Saskatchewan Multi-Use Facility
Regina, Saskatchewan**

**Project # 1010704
December 17, 2009**

Prepared By:
Rowan Williams Davies & Irwin Inc.
650 Woodlawn Road West, Guelph, Ontario, Canada N1K 1B8

Xiangdong Du, Ph.D., P.Eng., Senior Engineer
Jonathan B. Lankin, P.Eng., Project Manager

Please find attached the preliminary estimates of structural wind loading cases for the Saskatchewan Multi-Use Facility, in Regina, Saskatchewan for the roof. This report provides the maximum vertical and unbalanced wind loads on the fully retractable roof option.

These structural wind loads represent RWDI's estimates only and should not be used for any final design. The structural wind loading should be replaced by wind tunnel measured loading for final design considerations. All wind pressures act normal to the surface, positive pressures in towards the exterior surface of the roof, negative pressure acting outwards away from the exterior surface of the stadium. The wind loading for the roof closed case is provided as net wind pressures. The net wind pressures consider the pressure difference across the surface of the roof (includes estimates of the internal pressure in the stadium as described below).

All loading is based on a 50 year return period including an important factor of 1.15 on wind pressure to account for the stadium occupancy. This effectively makes the wind loading a 100 year return period load. The reference wind pressure matches the NBC 2005 for Regina of 0.42 kPa mean hourly at 33 feet in open terrain.

Roof Positioning and Internal Pressure Considerations

Due to the sensitivity of wind loads to roof geometry, the stadium was analyzed for the following three configurations:

- Closed Position - Movable roof panels covering the playing field;
- Open Position - Movable roof panels stacked at the north and south ends of the stadium;
- Half Open Position - Both movable roof panels situated half way between fully open and closed positions within their range of movement.

The wind loading determined in this study is also very reliant on the roof's proposed operation scenario. Figures 1 to 3 apply to the roof closed position, Figures 4 to 6 to the roof in the open

position and Figure 7 to the roof in the half open position. The roof pressures in Figures 4 to 7 are shown on the roof in the closed position for presentation purposes only.

The structural wind loads presented for the Closed Position include an allowance for internal pressures. If the stadium is tightly sealed, then the internal pressure becomes sensitive to any breaching of the envelope by bladder or seal failure. A breach at one point facing into the wind can produce internal pressures on the order of 0.2 kPa. A breach point at one point in the leeward of winds can produce a relative high negative internal pressure of the -0.4 kPa. This is likely to occur in some bladder locations but not in all locations at the same time. Based on mean pressure measurements alone the internal pressure will increase to 0.2 kPa for the downforce case due to this situation. Figure 2 shows the downforce wind loading on the roof in the closed position. If a bladder or seal failure is considered that results in a non-uniform distribution of openings then all the wind pressures in the non overhang areas of the roof should be increased by 0.2 kPa.

When the roof is not closed, net pressure differences across each surface have been analyzed and used.

Structural Wind Loads on Roof Panels

The wind load cases in Figures 1 to 7 are selected for the overall structural design of the roof panels. The wind loading is shown on half of the roof. The same wind loads may be applied to the unmarked half of the roof by mirroring the wind loading about the north-south (N-S) axis shown.

Figures 1 and 2 provide the maximum uplift and downforce on the upper roof at closed position. These cases may be mirrored about the north-south axis.

Figure 3 provides the maximum north-south unbalanced vertical loading on the roof at closed position. This case may be mirrored about the north-south axis. An additional wind loading case of mirroring these wind loads about the east-west axis should be considered.

Figures 4 and 5 provide the maximum uplift and downforce on the roof at fully open position. These cases may be mirrored about the north-south axis.

Figure 6 provides the maximum north-south unbalanced vertical loading on the roof at fully open position. This case may be mirrored about the north-south axis and the east-west axis.

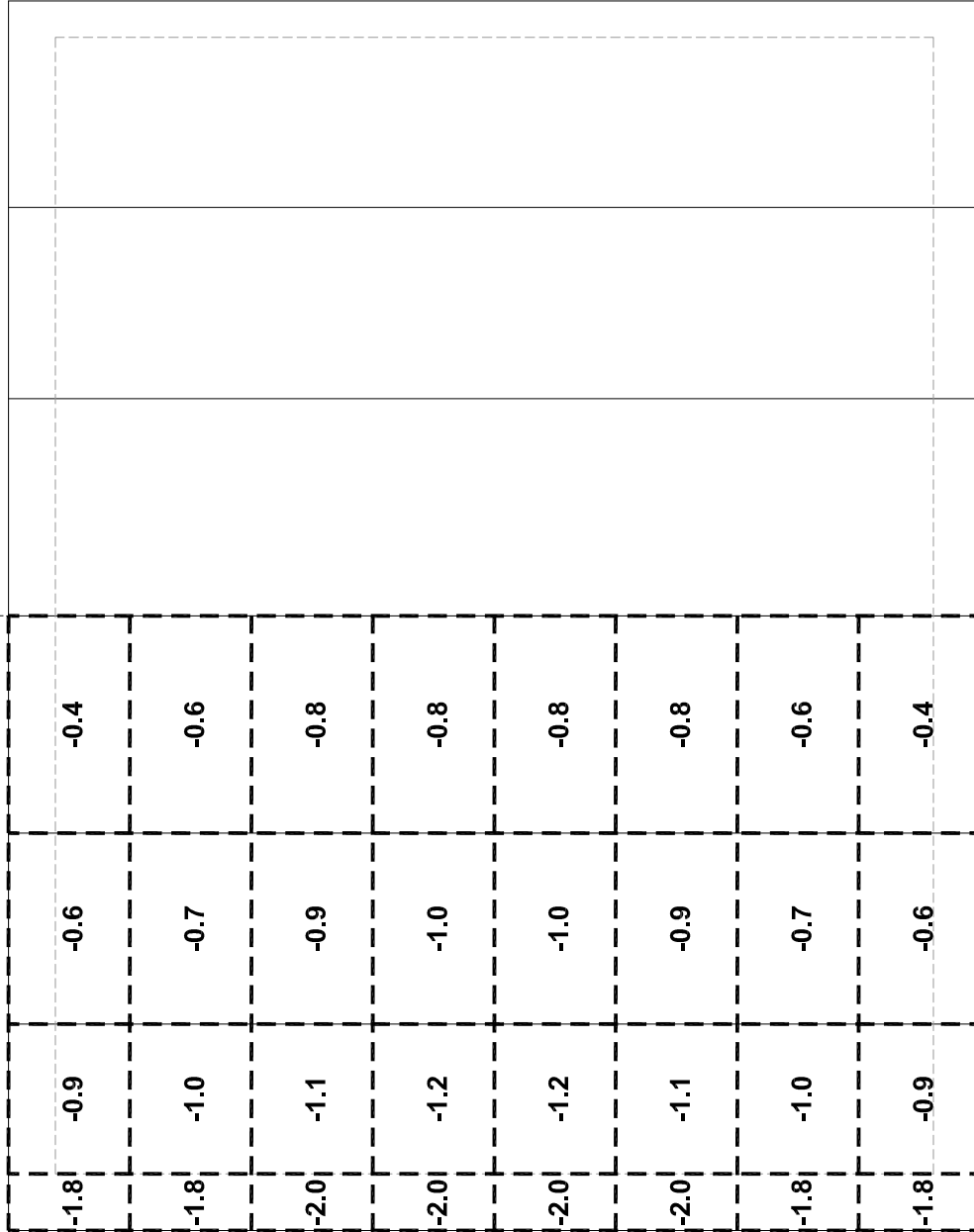
Figure 7 provides the maximum north-south unbalanced vertical loading on the roof at half open position. This case may be mirrored about the north-south axis and the east-west axis.

The structural wind loading provided does not include any load or safety factors

Please contact me if you have any questions.

FIGURES

N-S



E-W

E-W

N-S

CLOSED ROOF PLAN



Estimated Structural Wind Loads (kPa)
 Load Case 1a - Uplift - Roof Closed
 50-Year Reference Wind Pressure = 0.42 kPa, Importance Factor = 1.15

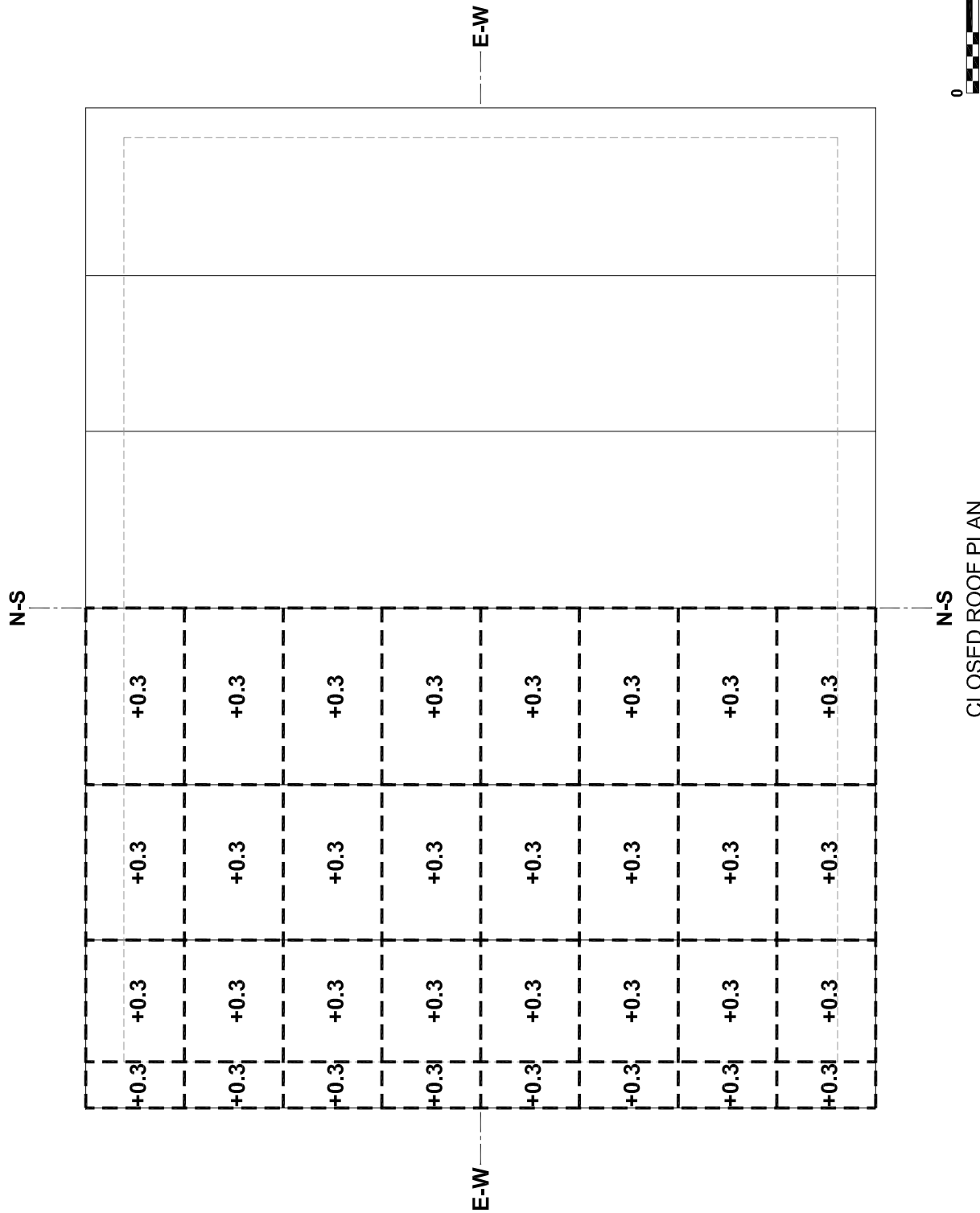


Drawn by: DJM Figure: **1**
 Approx. Scale: 1:1500
 Date Revised: Dec. 14, 2009



Saskatchewan Multi-Use Facility - Regina, Saskatchewan

Project #1010704



Estimated Structural Wind Loads (kPa)
 Load Case 1b - Downforce - Roof Closed
 50-Year Reference Wind Pressure = 0.42 kPa, Importance Factor = 1.15

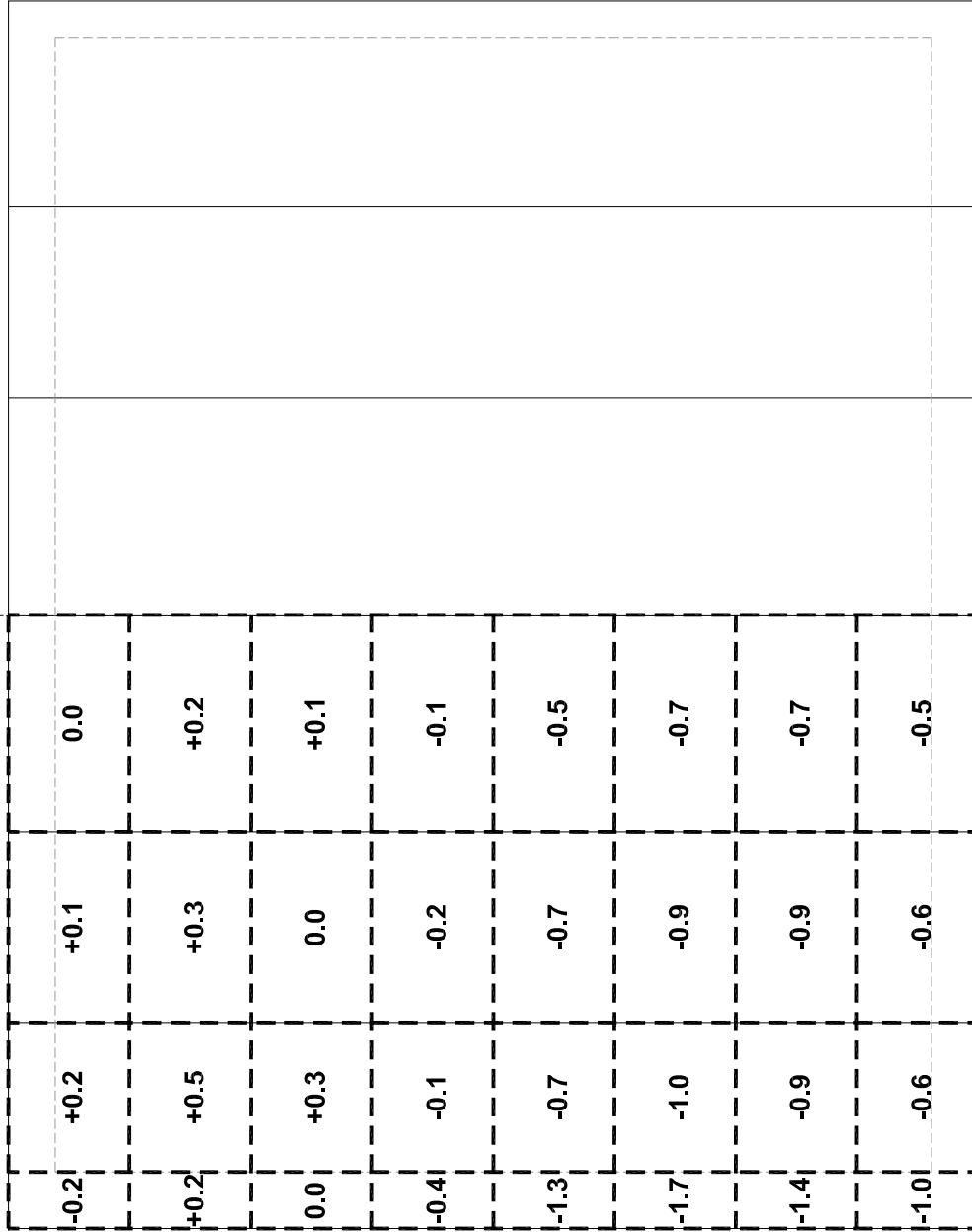
Saskatchewan Multi-Use Facility - Regina, Saskatchewan

Project #1010704

Drawn by: DJM Approx. Scale: 1:1500 Date Revised: Dec. 14, 2009	True North Figure: 2
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RWDI

N-S



E-W

E-W

CLOSED ROOF PLAN

N-S



Estimated Structural Wind Loads (kPa)

Load Case 1c - Unbalanced - Roof Closed
50-Year Reference Wind Pressure = 0.42 kPa, Importance Factor = 1.15

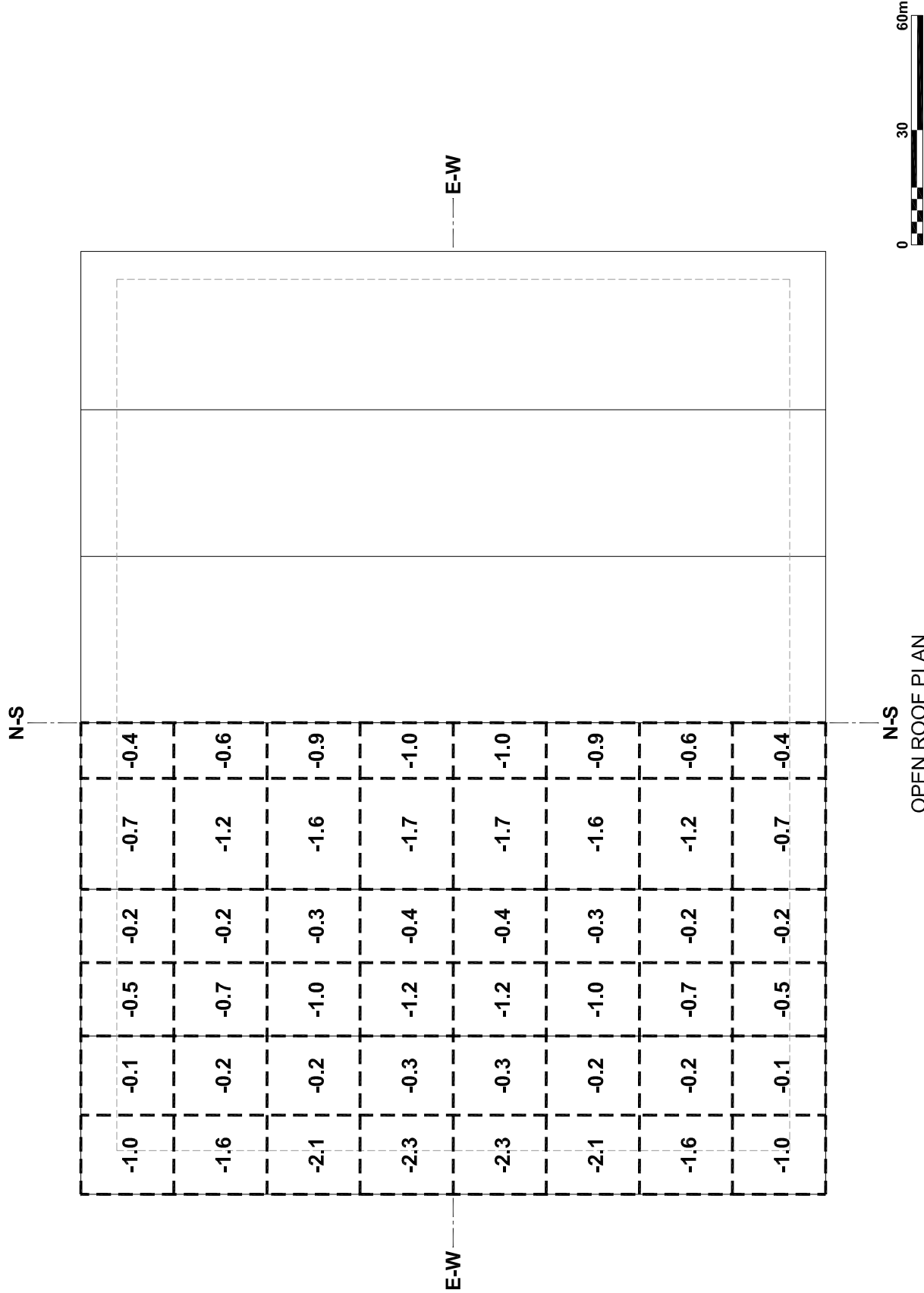


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 Approx. Scale: 1:1500
 Date Revised: Dec. 14, 2009



Saskatchewan Multi-Use Facility - Regina, Saskatchewan

Project #1010704



Estimated Structural Wind Loads (kPa)
 Load Case 2a - Uplift - Roof Open
 50-Year Reference Wind Pressure = 0.42 kPa, Importance Factor = 1.15

True North

Saskatchewan Multi-Use Facility - Regina, Saskatchewan

Project #1010704

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Approx. Scale: 1:1500		
Date Revised: Dec. 14, 2009		

N-S



E-W


E-W

N-S

OPEN ROOF PLAN




Estimated Structural Wind Loads (kPa)
 Load Case 2b - Downforce - Roof Open
 50-Year Reference Wind Pressure = 0.42 kPa, Importance Factor = 1.15

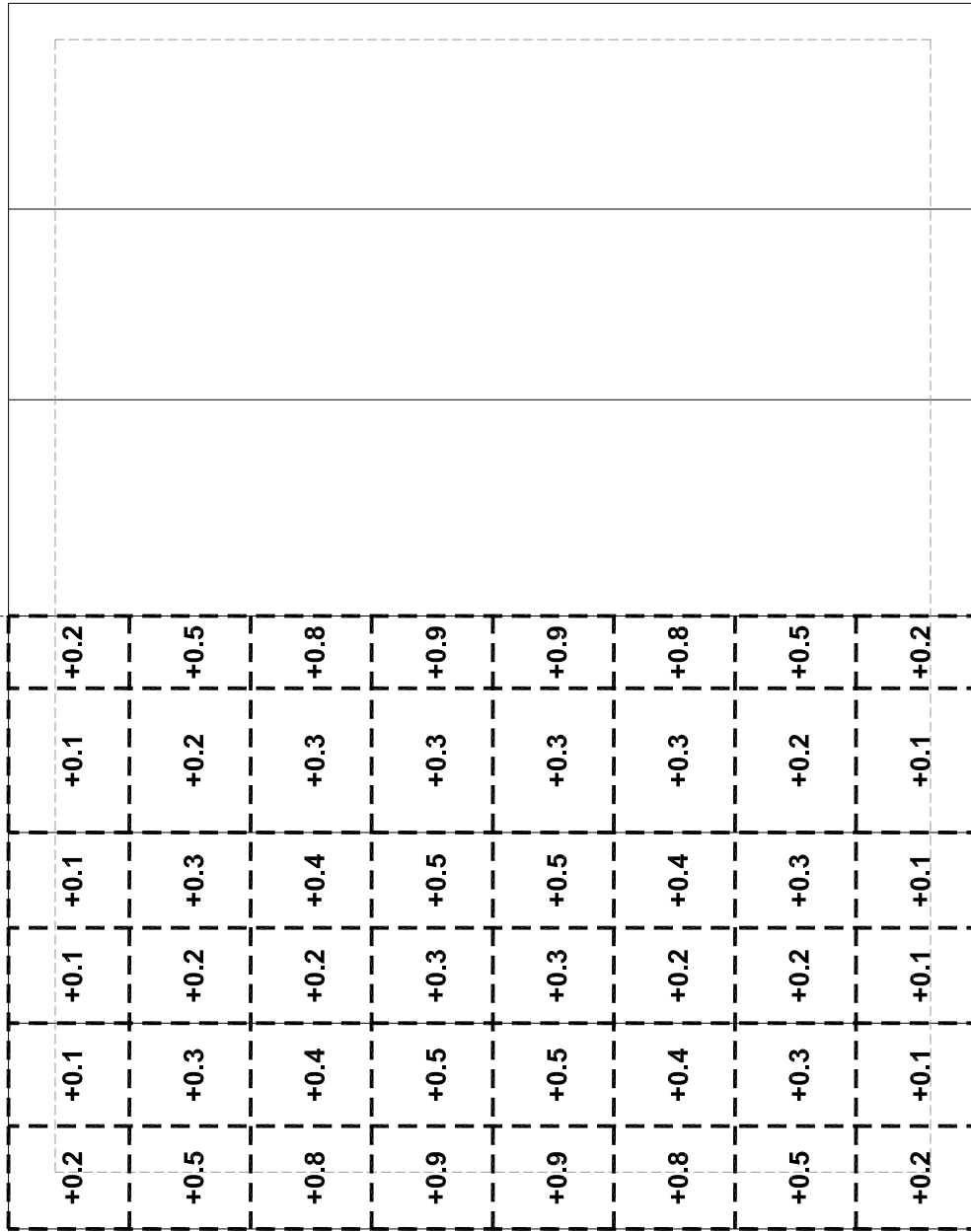
True North 

Saskatchewan Multi-Use Facility - Regina, Saskatchewan Project #1010704

Drawn by: DJM	Figure: 5
Approx. Scale: 1:1500	
Date Revised: Dec. 14, 2009	



N-S



E-W

E-W

N-S

OPEN ROOF PLAN



Estimated Structural Wind Loads (kPa)
 Load Case 3b - Uplift - Roof Half-Open
 50-Year Reference Wind Pressure = 0.42 kPa, Importance Factor = 1.15

Saskatchewan Multi-Use Facility - Regina, Saskatchewan

Project #1010704

True North

Drawn by: DJM	Figure: 7
Approx. Scale: 1:1500	
Date Revised: Dec. 14, 2009	

RWDI

STRUCTURAL SNOW LOADING REPORT

Saskatchewan Multi-Use Facility Regina, Saskatchewan

Project # 1010704
December 22, 2009

Prepared By:
Rowan Williams Davies & Irwin Inc.
650 Woodlawn Road West, Guelph, Ontario, Canada N1K 1B8

Tahrana Lovlin, P.Eng. Senior Project Engineer
Jonathan B. Lankin, P.Eng., Project Manager

Please find attached the preliminary estimates of structural snow loading cases for the Saskatchewan Multi-Use Facility, in Regina, Saskatchewan for the main roof. Our comments on the roof snow loads are for the 50-year design snow loads. The recommended loads are based on:

- Information received from Brisbin Brook Beynon Architects on December 4th, 2009;
- Analytical calculations, using the National Building Code of Canada (NBCC) 2005;
- A review of the regional long-term meteorological data;
- Our engineering judgement and knowledge of wind flows around buildings; and,
- Our experience with snow loading measurements and simulations on similar structures.

This letter summarizes our methodology, as well as presenting the 50-year design snow loads for the proposed facility as per Figure 1.

Site & Building Information

The proposed site is located in downtown Regina, in the middle of the block encompassed by Dewdney Avenue to the north, Broad Street to the east, the CN Line to the south, and Albert Street to the west (see Image 1).

The proposed building is approximately 235 m by 209 m, with the long axis aligned in the west-southwest/east-northeast direction. The building is approximately 42 m high at the peak of the main roof, and is therefore taller than the surroundings. The roof has a slight arch to it, perpendicular to the long axis.

The immediate surroundings include numerous low-rise commercial or industrial buildings. Beyond the immediate surroundings, there are low-rise residential and commercial areas to the west through north to east. To the southeast through southwest is the downtown core of Regina, which includes mid and high-rise buildings. Also considered in the analysis was that the proposed roof has



*Image 1 – Aerial View of Existing Site
(Courtesy of GoogleEarth™)*

an insulation value of R-30 (approximately RSI 4.22). RWDI assumed an interior temperature, near the ceiling, of approximately 15°C.

Meteorological Information

Meteorological data was available from the Regina International Airport for the period 1991 to 1995. This data shows the annual wind rose for Regina (Figure 2a), with prevailing winds from southeast, east-southeast, west, northwest and west-northwest. However, as these winds are annual, no conclusions can be made regarding wind conditions during the winter season.

As limited meteorological data was available in-house for Regina, Saskatoon (approximately 240 km to the northwest) was used for a more in-depth analysis. Meteorological data for Saskatoon Airport for the period 1953 to 2006 were used as a reference for wind and snowfall conditions in the region. The following meteorological conditions were assessed for the winter months (November through April):

- winds greater than 15 km/h;
- wind greater than 15 km/h combined with snowfall; and,
- blowing snow events.

The movement of drifting snow at low wind speeds is negligible. A threshold wind speed of 15 km/h was therefore used to determine the predominant winds that could be associated with snow movement on and around the site. The 15 km/h wind speed is measured at the weather station's anemometer, which is typically located on a mast approximately 10 m above the ground. Winter winds with blowing snow represent higher wind speeds often associated with storm events and significant drifting.

It is evident from the upper left wind rose in Figure 2b that the primary wind directions associated with strong winds are from the west-northwest, northwest, south, southeast and north directions. The primary wind directions associated with strong winds and snowfall are from the northeast quadrant (upper right windrose), while blowing snow events are most often associated with northeast, north, south-southeast, southeast and northwest winds.

Recommendations

When reviewing the roof snow loads, the roof insulation value was considered within our analysis. In RWDI's experience, the higher the roof insulation value, the less melting of the accumulated snow on the roof. Therefore, there is a greater potential for increased loads over the course of the winter. In our experience, a roof with an R-30 roof insulation value will have higher loads than the same roof with a (typical) roof insulation value of R-20. The difference in loads between these two roof insulation values, in a climate such as Regina, is approximately 5%. This potential has been included within the loads provided in Figure 1. As the design progresses, the design team should consider a Finite Area Element (FAE) study, in order to provide roof loads which take into account the geometry of the building, the roof insulation value, the interior temperature, as well as the local meteorological climate.

The snow loads presented in Figure 1 are recommended for use in the preliminary design of the proposed roof. The loads provided in this figure are for a 50-year return period and should be used in the same way as loads calculated by Section 4.1.6 of the National Building Code of Canada (NBCC) 2005. **There is an importance factor, I_s , of 1.15 included within the loads provided. Any additional factors, including load and/or safety, should be applied at the discretion of the**

structural engineer. These loads are based on a Ground Snow Load of 1.4 kPa plus 0.1 kPa rain surcharge, as specified by the NBCC 2005.

Loads in hatched areas are to be interpolated linearly between points. Loads in other areas are uniform, as indicated.

The arch of the roof, in both the x and y directions, is shallow; the roof could be considered flat, as per Figure G-2 of Commentary G – Snow Loads of the NBCC 2005. However, we recommend the design team still consider the unbalanced loading, based on the prevailing winds. Based on the wind directionality, there is the potential for more snow to accumulate on the south and east halves of the roof (as per the upper wind roses in Figure 2b).

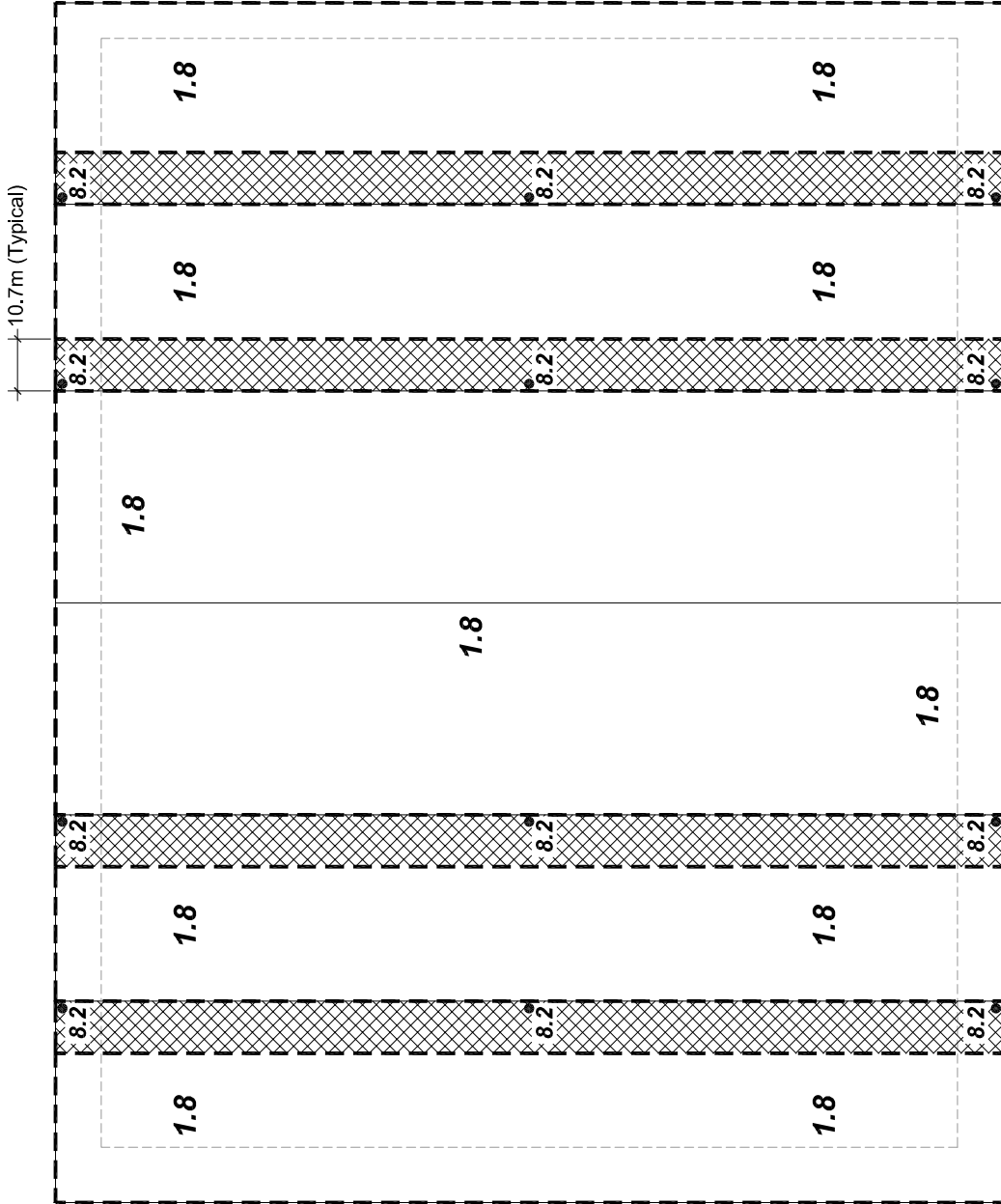
Limitations

The scope of snow services provided by RWDI, upon request of the design team, was limited to providing an estimate of snow loads for the roof surfaces of the proposed Saskatchewan Multi-Use Facility in Regina, Saskatchewan. In our experience, a building with sloped roof constructed of smooth, unobstructed surfaces need to consider the potential for falling ice and snow, ice or icicle formations that could slide, blow or fall from the building. In addition, the sliding or falling of snow could create significant impact loads on any lower roof surfaces.

Conclusions

We trust the above information is adequate for your current needs. If you have any questions or need additional information, please feel free to contact us at your convenience.



FIGURES

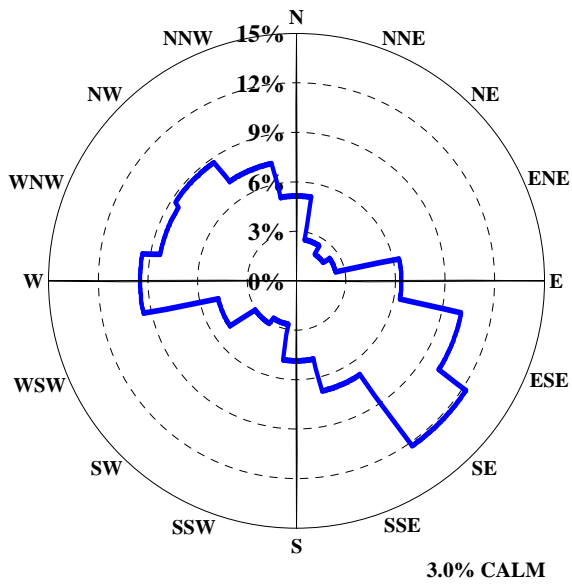


ROOF PLAN

Note:
 Loads in hatched areas indicate variable-depth drifts.
 Loads in these areas are to be interpolated linearly
 between points and adjacent uniformly-distributed zones.



True North 		Drawn by: DJM	Figure: 1
		Approx. Scale: 1:1500	Date Revised: Dec. 22, 2009
Estimated Structural Loads Due To Snow (kPa) 50-year Return Period - $I_s = 1.15$			
Saskatchewan Multi-Use Facility - Regina, Saskatchewan		Project #1010704	
			



ALL ANNUAL WINDS

Directional Distribution (%) of Winds (Blowing From)

Station: Regina International Airport, SK (1991 - 1995)

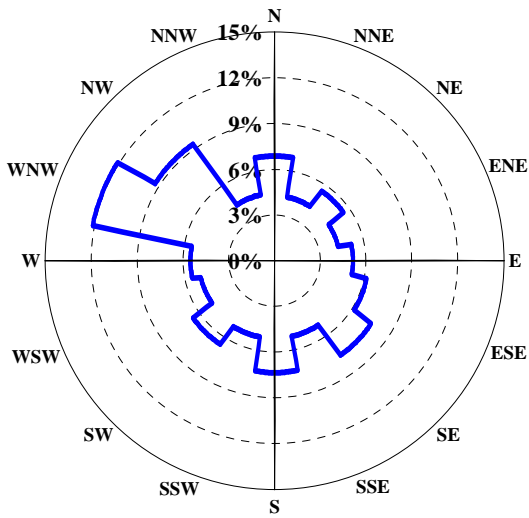
Figure No. **2a**

Date: December 22, 2009

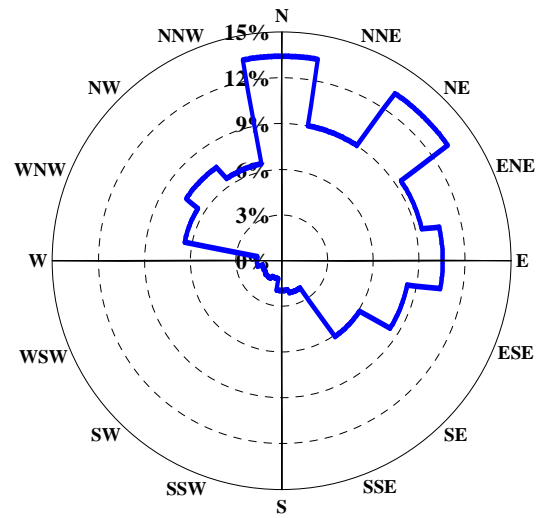
RWDI

Saskatchewan Multi-Use Facility - Regina, Saskatchewan

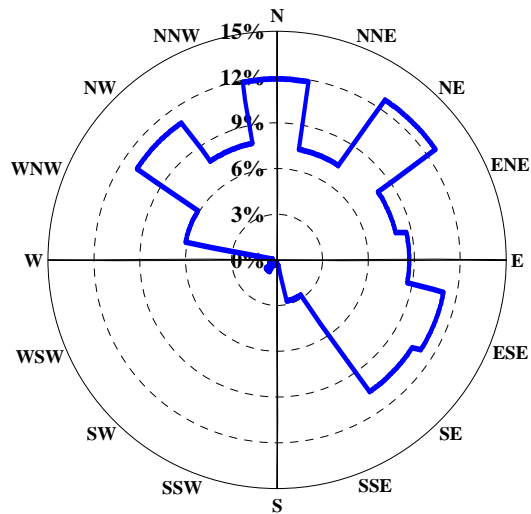
Project #: 1010704




WINTER WINDS > 15 km/h



WINDS DURING SNOWFALL > 15 km/h



BLOWING SNOW EVENTS

Directional Distribution (%) of Winds (Blowing From) Station: Saskatoon Airport, SK (1953 - 2006)	Figure No. 2b	
	Date: December 22, 2009	
Saskatchewan Multi-Use Facility - Regina, Saskatchewan	Project #: 1010704	