

Executive Summary

The Farquhar Park Aquatic Center is a 37,000 square foot natatorium complex that serves the YMCA of York and York County. Located in York, Pennsylvania, the entire facility consists of a 53-foot high natatorium, a 12-foot deep indoor swimming pool, a 3,600 square foot single story masonry bath house, and a large outdoor swimming pool. The original design of the natatorium was never constructed due to cost and budget concerns and a pre-engineered structure was built instead.

The current structural system of the original design for the Farquhar Park Aquatic Center natatorium is composed of curved, triangular shaped steel HSS trusses with tapered columns that span 130'-0" over the indoor pool area. The proposed thesis will include a redesign of the entire roof structural system, which will have strong architectural impacts as well. New truss configurations will be designed using a king post truss system, wood trusses or glulam members, and a modified space frame. After the proposed truss systems are designed, they will be compared in terms of cost, feasibility, and architectural impact and a final design will be chosen. In the event that the new trusses only take gravity loads, a new lateral force resisting system composed of perimeter steel braced frames will be designed. It will be crucial to ensure that lateral loads applied to the roof actually get transferred to these perimeter braced frames. In addition, the existing concourse level floor system, balcony, and grandstand seating area will be redesigned as an entirely precast structure. Nitterhouse Concrete Products, Inc. will be contacted to investigate the feasibility and design of this precast system. Also, the current steel HSS columns that support the east end of the large trusses will be redesigned as concrete columns. Concrete moment frames may also be used to replace the existing steel braced frames at the grandstand seating area in the North/South direction. A final foundation check will be performed to verify that the existing foundation can adequately carry all loads present with the proposed system.

An architectural depth will be studied due to the introduction of a new truss system into the indoor pool area. Changes in building height and in the shape of the roof will be investigated, as well as effects on the lighting of the space. The overall appearance of the building, both internally and externally, will be affected by each new truss design. Plus, room layouts may need to change due to changes in column locations. A second breadth topic will relate to an analysis of the building enclosure. Material covered in AE 542 (Building Enclosures) will be used to investigate how the design of the building accounts for moisture-related and thermal-related problems due to the fact that the building is a natatorium. The MAE course-related topic will be a continuation of the building enclosure analysis by including information addressed in AE 537 concerning moisture-related problems with buildings. Necessary changes to building elements to account for these problems will also be made. Extensive use of AE 597A (Computer Modeling) will also be necessary to model the proposed trusses and proposed lateral force resisting systems in SAP2000. If time permits, an alternative seismic analysis will be performed by moving the natatorium to a high-seismic zone and analyzing the effects of the higher seismic forces on the structure. This will be supplemented by a redesign of the steel connections of the moment frame in the lobby for these loads, time permitting.