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To: Ed Houghton

From: Dave McNalty

WGD Comparison of Various Construction Options for Arena at Central Park

In the course of providing a cost estimate for a pre-engineered steel style arena for Central Park, WGD Architects provided comments on the inherent differences in this type of construction versus fabric membrane structures.

Initially, the basis that WGD was comparing to was an un-insulated membrane system as would be typical for enclosures that would have an ambient indoor environment. These structures are typically constructed using manufactured steel trusses with a single fabric membrane stretched over and may be quite suitable for applications such as dry storage, various agricultural, industrial and manufacturing purposes. We have noted that these structures have also been adapted to cover various types of outdoor sports facilities and even seasonal ice arenas.

WGD correctly identified that the pre-engineered steel structure with insulated sandwich panel wall cladding (R-12) and roof panels (R-19) would clearly provide better energy performance over the un-insulated fabric membrane structure that they were comparing to. Their comments, on this basis, agreed with our own research over the past three to four years which has indicated that an un-insulated steel structure over an ice arena would provide only a marginal improvement over a completely outdoor facility (the existing Central Park outdoor rink).

The basis set out for a new arena in Central Park, however, was a 12 month ice surface that would provide an energy conscious solution and reduced operating costs over the existing year round ice facility (EBMA). The alternative insulated architectural membrane structure, such as supplied by Sprung, was introduced to WGD and many of their comments were retracted. Prior to our suggestion, the architects seemed to be quite unaware of this advanced technology available in the market, and are naturally focused on the delivery of brick and mortar, concrete and steel facilities.

A schematic wall section of the Sprung building system was provided to WGD and they acknowledged that with the enhanced wall cavity and additional insulation (R-30), thermal performance as compared to a typical pre-engineered steel structure may be superior. They suggested that a similar thermal resistance could be achieved in the pre-engineered steel building with the addition of more insulation. This would be a customized option and specific pricing on this option was not requested or provided although our budget worksheet carried a placeholder for this additional cost.

In order to provide a realistic comparison between the proposed Sprung arena and a pre-engineered steel facility, the options that were provided by WGD to improve the energy efficiency and bring the proposed arena to a LEED Silver equivalent were included in the project budget. The Sprung facility would be provided with that level of qualification and also included a second floor mezzanine and lounge area that was also added into the basic budget provided by WGD. The estimated cost reduction of $500,000 for a fabric structure that WGD Architects provided at the end of their report would have been baseless as it was not for an insulated architectural membrane system. It has no relevance to the comparison.

WGD was cautious with regard to the thermal bridging opportunity at each of the aluminum support frames that form the structure for the insulated architectural membrane structure. We had already addressed this question with Sprung, and the explanation that was provided was satisfactory. The aluminum frame does extend through the insulated wall without a thermal break, however the spacing of the frames is typically 10 – 15 feet depending on the snow loading requirement and the span of the structure. There are thermal caps affixed on the inside and outside of the aluminum frames to help reduce the effect of the potential bridge. In consideration of the spacing and the large thermal barrier between the frames, thermal bridging does not present an issue and there have not been issues associated with this in Sprung's experience in various climactic locations.

It was suggested in the WGD report that accurate energy modelling that compared the insulated architectural membrane structure to other construction methods could be performed. A published third party comparison (copy attached) has already been performed on actual operating facilities, which is arguably more reliable than a theoretical model. The comparison was based on similar sized worship facilities that are constructed using a traditional method and a Sprung structure. The investigation focused on Energy Star performance rating criteria, energy consumption and cost data, and annual carbon emission relationships. Both facilities are located in Central Ontario.

The third party audit and report presents a clear advantage in favour of the insulated architectural membrane structure. The investigation included thermal imaging of the facilities which illustrates the inherent problems associated with air infiltration in traditional construction. The air-tightness of the continuous architectural membrane panels on both the interior and exterior improves thermal performance of the facility (air tightness test report from another Sprung facility attached). The potential for thermal bridging discussed above is also illustrated by the thermal images and in comparison to component built structures would seem to be superior.

Additional comments were provided by WGD regarding future maintenance considerations. Steel roof and wall panels on a pre-engineered steel building are provided with a variety of coatings to provide longevity. Depending on the coating, various warranties and anticipated life spans may be available. Experience shows that re-painting of the steel panels is likely to be required at some point in the life of the pre-engineered steel structure. Flat sections of the roof, as were proposed for the entrance and lobby areas of the arena, would include a membrane roofing system with a life expectancy of approximately 25 to 30 years.

In comparison, the exterior membrane panels of the Sprung structure are fully warrantied for 20 years, and would be expected to require full replacement after approximately 30 years. Renewal of the exterior membrane is performed completely from the outside without any disruption to ongoing

activities within the facility. Either the steel structure or the aluminum substructure would be expected have a life span in excess of 60 years.

WGD provided a typical schedule for the design and construction of a pre-engineered steel arena which illustrates an inherent issue with traditional construction techniques. The project would include a 7 to 8 month design period followed by 10 to 12 months for procurement and physical construction. A design-build option to construct an insulated architectural membrane arena may be completed from beginning to end with a 8 to 9 month time frame.

Please let me know if you would like further information regarding this process.

Dave