Executive Summary

Swedish American Hospital recently completed construction of the new Heart and Vascular Center, also known as the Heart Hospital. This structure is designed as a 7 story patient facility located in Rockford, Illinois. Although the building was designed as a 100’ tall building, it currently only stands 4 stories tall with mechanical units on the roof enclosed by a mechanical screen wall. The final phase of construction would be to enclose the current roof into a 5th floor mechanical space and complete the remaining two stories.

The existing gravity system uses composite action between rolled wide flange beams and 3” metal deck with 3.25” of lightweight concrete. Shear studs connect the beams to the concrete and metal deck. Typical interior spans are 32’-0” with shorter spans found towards the perimeter of the building, typically 18’-0” or 22’-7”. Typical beam sizes range from W12x14’s to W27x146. The smaller W12’s and W16’s are found at the shorter 18’-0” and 22’-7” spans. Larger W18’s and W21’s are designed for the 32’-0” spans, or the shorter spans with heavier concentrated loads.

The largest beams, W27x146, are part of the existing moment frames acting as the lateral framing system. These members span 32’-0” and are connected using Bolted Flange Plate moment connections to W14x176 columns. Each moment frame typically spans the length of two bays (64’-0”).

The purpose of this report is to determine the performance of an alternative lateral force resisting system as a part of the AE Senior Thesis. A braced frame is chosen as the new lateral system and a computer model was created in RAM Structural System to thoroughly analyze the structure’s response to lateral loads from wind and seismic forces. Framing elements modeled in the program were connected together at each story level with a rigid diaphragm. In the model, columns were assumed to be pinned at the base. This is a conservative assumption and was also assumed by the structural engineer of record.

The proposed braced frame design is intended to reduce the story drift and overall displacement. A total of 10 chevron braces are situated on every floor with each frame spanning one bay. Hollow HSS members are used as the bracing members so they can be concealed in wall cavities instead of being exposed. W14x120 columns will replace the larger W14x176 columns from the moment frames. Beams in the braced frames are shear connected and are designed for only gravity loads, with one exception. Beams at the 2nd floor level will be moment connected to provide extra stiffness in case braces cannot be added on the first floor (lobby area).

Detailed analysis of the braced frame system reveals an improvement in stiffness by reducing drift from 3.41” (E-W) and 3.66” (N-S), with moment frames, to 1.45” (E-W) and 2.16” (N-S) with braced frames (values are from wind pressures). A displacement of 2.16” corresponds to an H/555 value compared to the accepted value of H/400 for wind. The switch to

braced frames also decreases the total tonnage of steel needed for construction. This decrease in tonnage will save money on material costs and time of construction.

Additionally, this report also investigates a moisture condensation problem observed at the window sills in the patient rooms. Construction drawings and window manufacturer details were analyzed to determine the possible causes of condensation. Possible repairs were then developed and presented as solutions to the existing problem. It was concluded that a relatively new product, called "Heat Trace" would be the most cost effective solution. Heat Trace works by running current through a wire to produce heat. The wire is attached to the interior sill surfaces and is covered with a prefabricated aluminum sill piece to create a heat sink. The applied heat will raise the temperature of the frame above the dew point for the interior air conditions.