Opportunity and Significance
A building’s structure serves the most important role in the design of any new building. It allows an architect’s beautiful design to come to life as well as safely house the building’s occupants and protect them from wind and seismic forces. Using modern software the Structural Engineer can create a hi-performance, lightweight structure that will provide a long lifespan. This project serves as a great example of optimization. By utilizing RAM Structural Software we were able to optimize our structure and create a cost effective, hi-performance building to serve its occupants.

Technical Approach, Accomplishments and Results

Frame
The goal for frame design is to find the lightest steel elements to carry any potential load safely. This design utilizes steel elements that are capable of resisting dead load from the building self-weight and live load from its occupants. In addition, snow, wind, and seismic loads were taken into consideration. The frame consists of columns to carry the gravity axial loads, beams that carry tensile and bending loads in addition to frame members to resist lateral forces.

Foundation:
Foundation design consists of designing footings to carry the total weight of each column and transfer it to the soil. Soil capacity is a crucial factor to determine foundation type, dimension, and reinforcement. Retaining walls were also designed for the basement and detention ponds to prevent any potential landslides.

Next Steps for Development and Test
The software, although very powerful, is not very user friendly. The steps in creating a full structure is complex and without proper training can be quite tedious. The software is also limited in its ability to design certain aspects such as trusses. Further development would expand the software’s ability to design trusses and other structures such as bridges. A better cooperation between AutoCAD and RAM software would be more advantageous. The ability to import a CAD drawing without any conflicting parameters would greatly increase overall efficiency as well.

Related Work and State of Practice
Classes such as steel design, structural analysis and reinforced concrete have prepared us to put our ideas into a practical model that could be built in the real world. Our courses have prepared us to use design standards such as ASCE 7-10 and the AISC and International Building Code standards. Our coursework has prepared us to apply principles of beam and column design as well as retaining wall and foundation design.

Commercialization Plan & Partners
Much of the structural aspect of an overall development project relied mostly on established software such as AutoCAD and RAM by Bentley to design and test the capacity and efficiency of the overall design. Field Engineers were consulted throughout the process to ensure that the software was utilized properly and to evaluate the results. Commercializing the software is difficult due to the cost of the product and the applicability to which the software covers. (Buildings)

References
Michigan Building Code 2015
ASCE/SEI 7-16 Minimum Design Loads and Associated Criteria for Buildings and Other Structures
ACI 318-14 Building Code Requirements for Structural Concrete
AISC 360-10 - Specification for Structural Steel Buildings