Proposal Letter

Thesis Research Weight Matrix

Description	Research	Value Eng.	Constr. Review	Schedule Red.	Total
Analysis #1: Role of Construction Manager in Design	25%		10%		**35%**
Analysis #2: 4D CAD Modeling for Structural Steel Erection			15%	10%	**25%**
Analysis #3: Redesign of Earth Retention System	10%	10%	10%	10%	**40%**
Total					**100 %**

Analysis #1: Role of the Construction Manager in Design

In typical project delivery approaches, the contractor is not brought on board until the design is nearly complete. Contractors have been trying to make the design process a more integrated approach and include the contractor in design in order to address constructability concerns with designs. Currently, contractors do not know how, and have limited opportunity, to express the value they provide to the owner with early involvement in design. Therefore, they have difficulty converting owners to an integrated design approach.

The two main goals of the Analysis #1 research is to determine the value contractors can add to the design process for owners (e.g. cost and constructability) that would be beneficial to the owner and to develop a way in which contractors and owners can measure the value of a contractor in design.

The National Museum of the Marine Corps project was developed from a nation-wide design competition; therefore, construction manager involvement in the design was not an option. The diagram below provides a schematic illustration of the project development process.

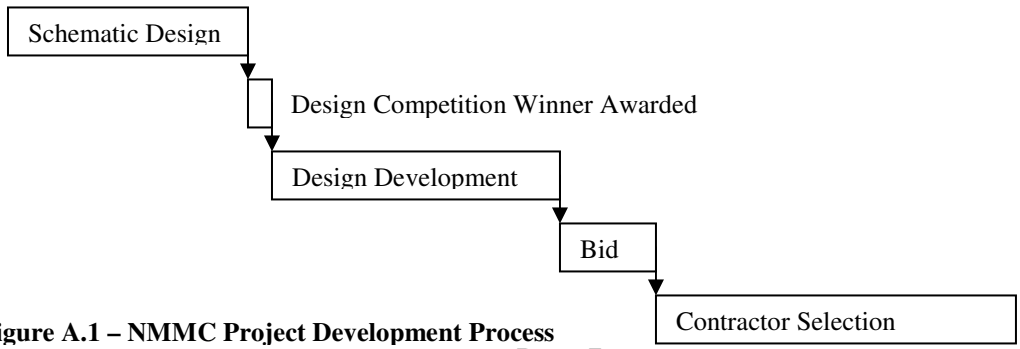

Figure A.1 – NMMC Project Development Process

Based on the results of the research, a recommendation may develop that would lead to earlier contractor involvement. An analysis of any construction issues on the project (to date) will help create a portrayal of areas in which the involvement of a construction manager during design could have prevented and/or improved any of the construction issues. The figure below represents a schematic design process alternative that could result from this analysis.

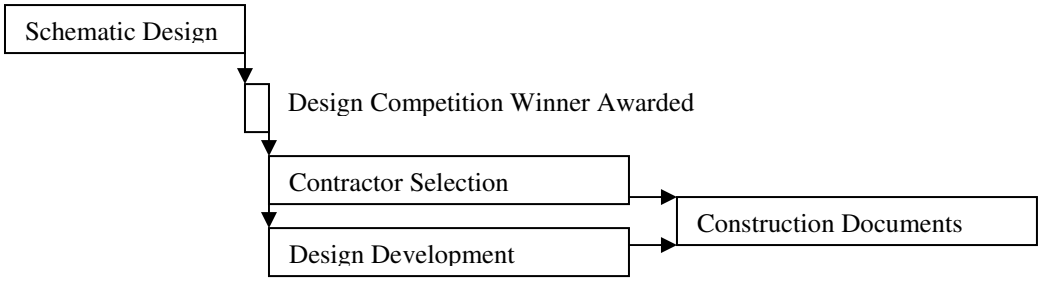

Figure A.2 – Proposed NMMC Project Development Process

Analysis #2: Redesign of Earth Retention System

One of the sustainable features of the National Museum of the Marine Corps is the earth-covered exterior walls (Figures 4a and 4b). Specifically, in the area around the Central Gallery there exists a 45 feet high, 2 feet thick concrete wall with earth backfilled 30 feet up on the exterior of the wall. Another unique feature to this situation is the exterior buried ductwork that feeds the Central Gallery space and penetrates the wall at various locations around the room.

Constructability concerns have risen regarding the methods of backfilling around the exterior ductwork and how the exterior ductwork will be waterproofed adequately. Furthermore, the overall plan for the museum will include an IMAX Theater and gallery space expansion in the area where the earth backfill exists (Figure 5a vs. Figure 5b). Since the concrete walls must retain the loads imposed by the earth backfill, they are required to be extremely thick and with heavy reinforcing. As a result, future expansion in this area will be challenging.

Therefore, an investigation into alternative earth retention methods could potentially improve the constructability of the system, reduce the size and cost of the

concrete wall, and decrease the overall project schedule. Alternative retention methods have been proposed and are described further in this document. A structural and cost analysis will be conducted to determine the impact of the alternate systems on the project. The results of the alternate systems investigation will be compared and contrasted to the current situation. The ultimate determinant will be how well the current and alternate systems score on a list of criteria. The criteria will consist of things such as: design intent, cost, schedule, quality, future expansion, and constructability. The results will be clearly presented in a tabular format and the system that scores the best on the criteria scale will be the best system for this situation.

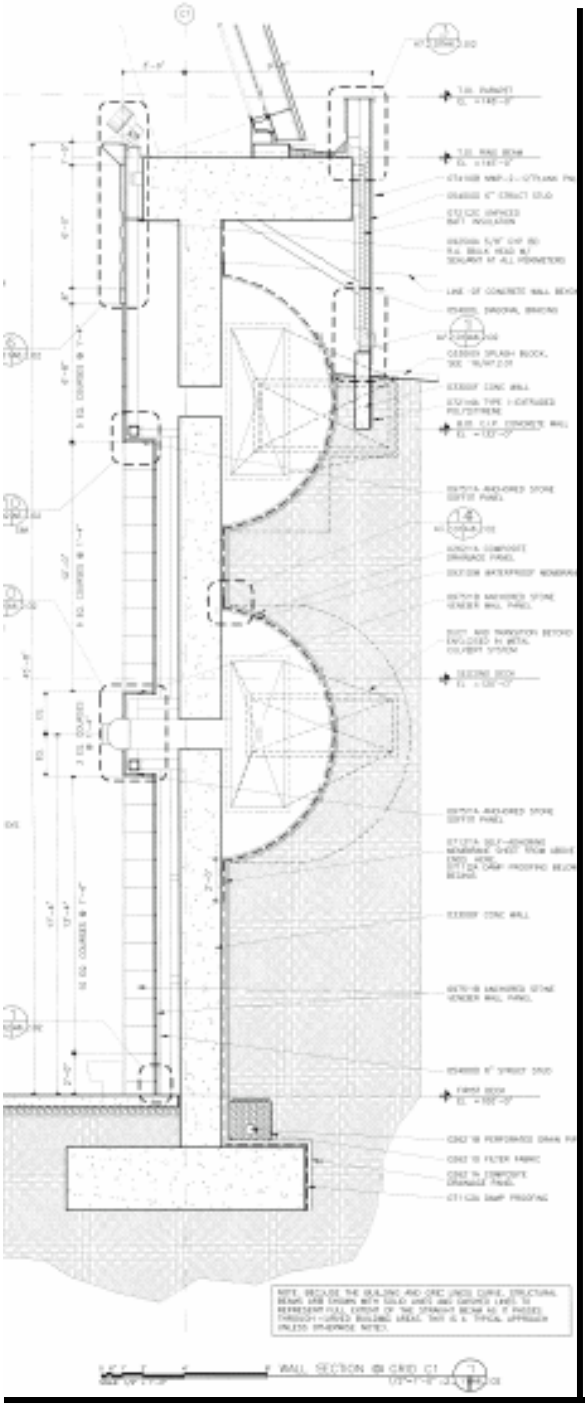

Figure A.3a – Architectural Wall Section

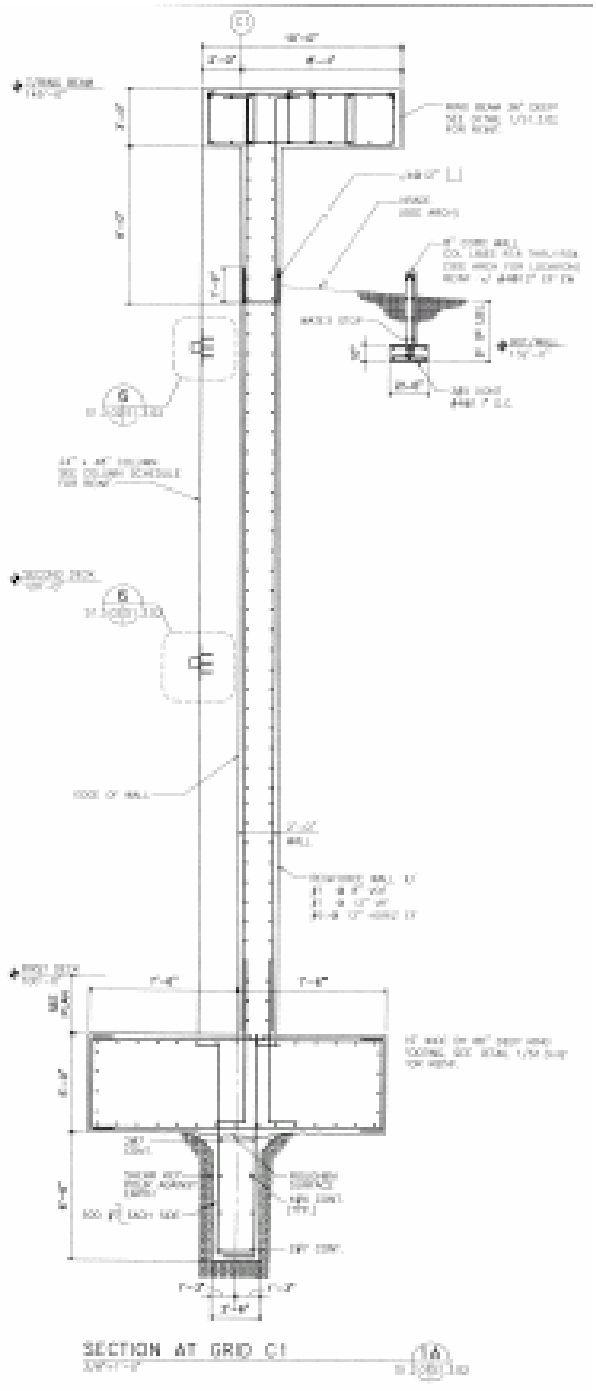

Figure A.3b – Structural Wall Section

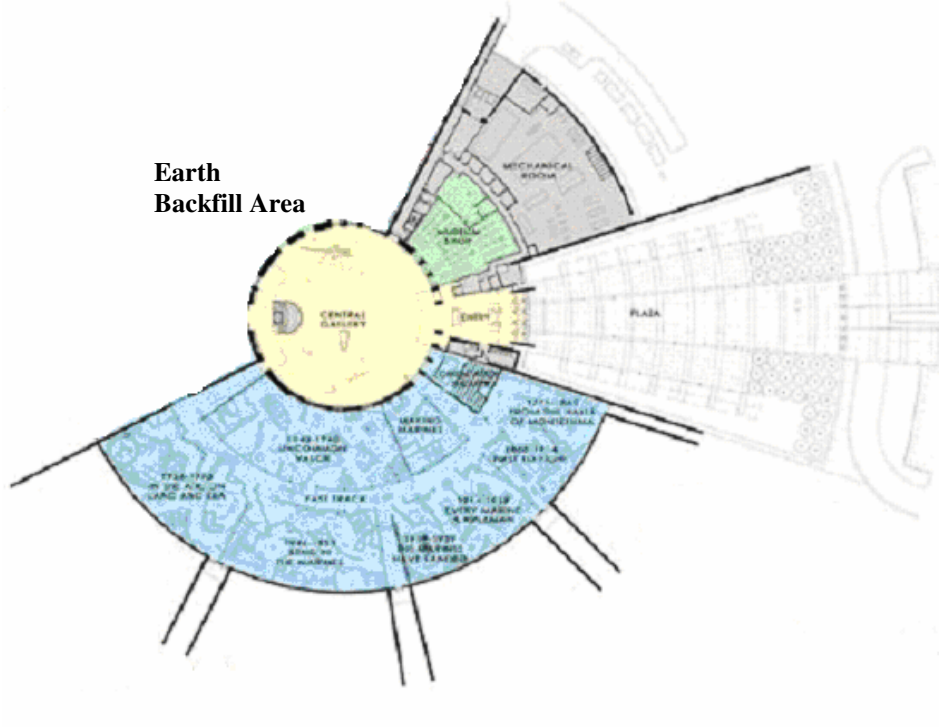

Figure A.4a – Plan view of National Museum of the Marine Corps – Initial Phase

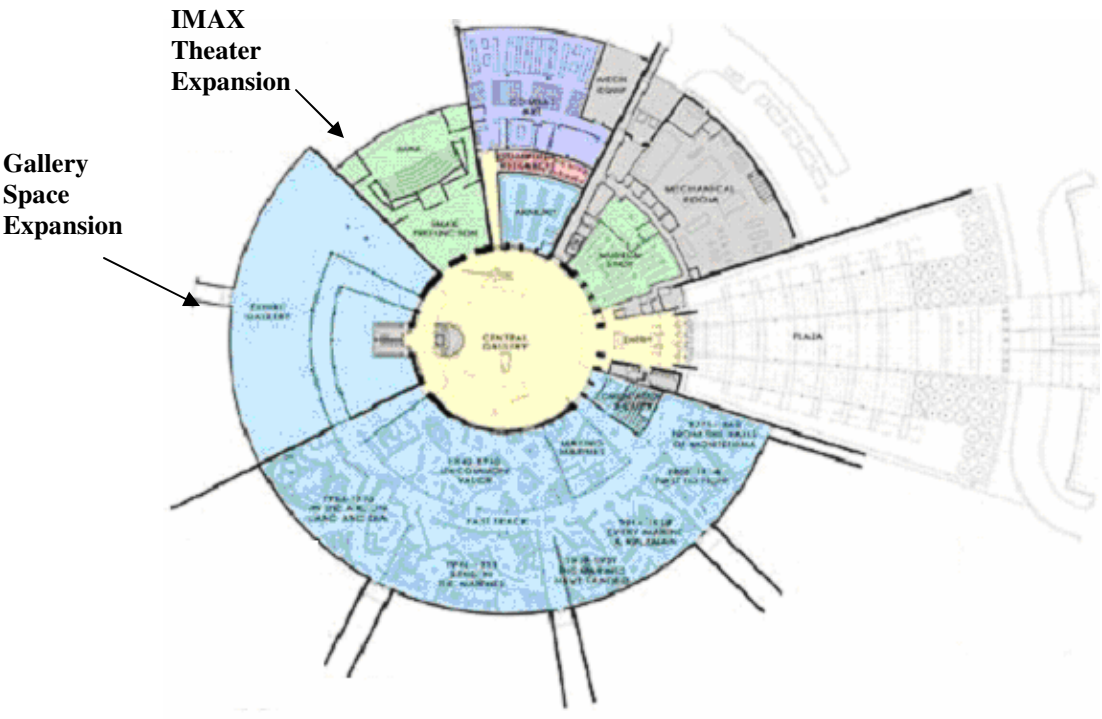

Figure A.4b – Plan View of National Museum of the Marine Corps – Overall Plan

Design Alternatives

The preliminary alternatives for the redesign of the concrete wall and backfill area will be with the use of a geo-grid soil retention system, a slurry wall, or a sheet pile retention wall system. The geo-grid system is a series of cages that are embedded into the soil in layers during the backfill process. Once completely backfilled, the cages will retain the majority of the load of the soil. The slurry wall system is essentially a concrete wall that retains the soil behind it. And the sheet pile retention system is a series of interlocking steel sheet piles with tiebacks embedded into the soil to anchor the system and retain the soil. All three of these components will be able to reduce the load on the exterior wall but only one will be the optimal solution for this scenario.

Analysis #3: 4D CAD Modeling for Structural Steel Erection

The National Museum of the Marine Corps has a very unique structural steel skylight system (Figure 3). The structure of the skylight requires a critical erection sequence for the major steel members in order to support the temporary loads imposed before the remaining structural steel members can be erected. Therefore, the use of a steel erection sequencing plan is vital for this to occur.

The steel erection sequence can simply be developed using 2D drawings and even 3D CAD drawings. This form of erection sequence planning is typical for most steel erectors and it is fairly straightforward for them to visualize and erect the steel according this type of plan. However, during the steel erection phase of any construction project, the steel erectors are not the only individuals working on the site. Therefore, an enhanced visualization and representation of the structural erection sequence could be very advantageous.

The use of 4D CAD technologies for erection sequence planning could portray the exact erection sequence piece-by-piece. A 4D CAD model could display location of the crane(s) and the swing path of the crane(s) during erection. The model could also display the steel staging areas and delivery paths around the construction site. This type of detail could be advantageous for trade coordination and could also be utilized as a tool for site safety planning during the structural erection phase. Displaying the erection sequence

plan visually and detailed would allow for other trades to adjust their flow of work accordingly and work in a safe manner.

One of the main reasons for unsafe work practices in the industry is workers being uneducated as to the hazards that exist around them. The development of a 4D CAD representation of the structural steel erection could outline hazardous areas around the site which could potentially reduce the risk of an accident occurring.

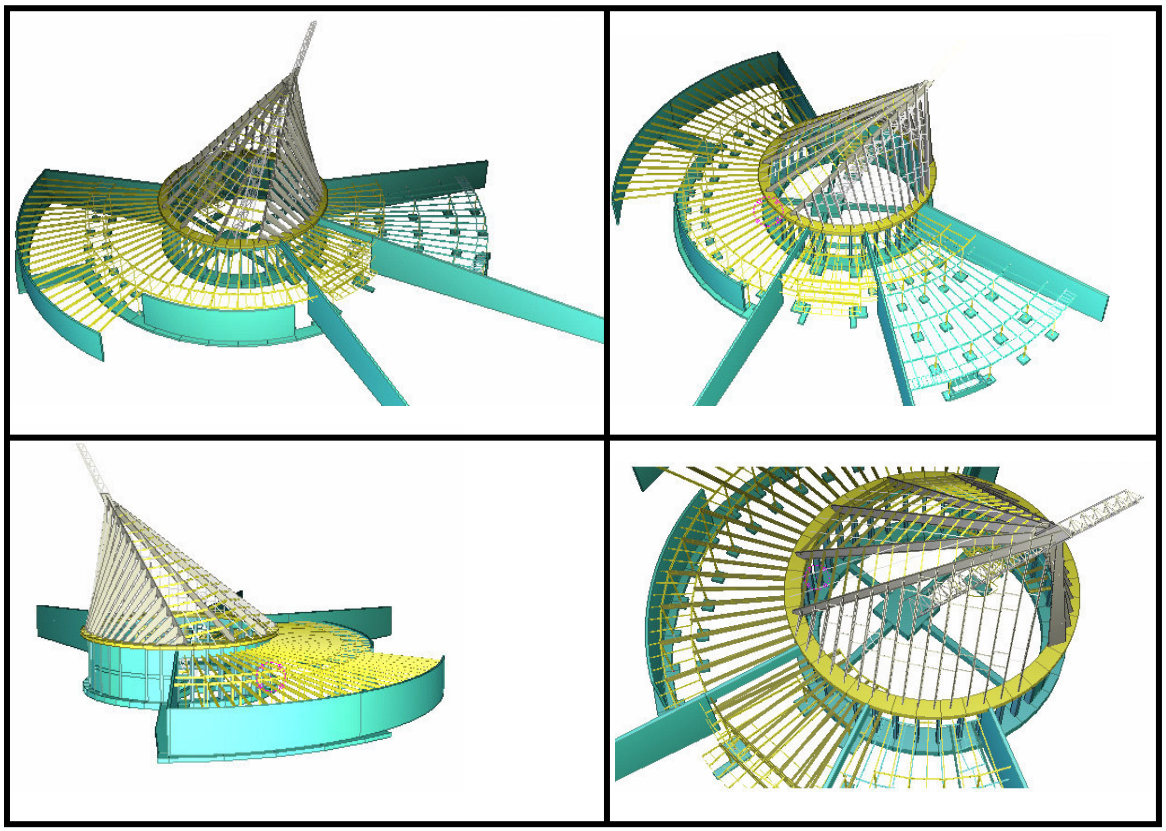

Figure A.5 – NMMC Structural Steel 3D Images