

**Bennington Battle Monument
Restoration Project Phasing Feasibility Study****10.01.2024
Pre-Design Phase**

The Bennington Battle Monument is an important cultural heritage resource that memorializes a crucial victory in the battle for the creation of our nation. Cultural heritage sites are more than physical landmarks and structures, it's what they represent that is intrinsic in its value to the site, an historic timeline, and its enduring legacy as a marker of time. As a steward to this monument, while the State is responsible for the maintenance of the monument, it also has the benefit of owning the history, the story, and the telling of this story.

The analyses from our Phase 2 Assessment have provided our team with a tremendous amount of relevant information, and we believe we have succeeded in narrowing our focus to not only what we see are the mechanisms of deterioration at work, but most importantly, a critical path of how to approach the restoration and the crucial next steps in the development of a Preservation Work Plan. The major factors that need to be addressed include:

- Saturated stone
- Water infiltration
- Vertical cracking, spalling and stone damage
- High humidity
- Inverse stack effect for ventilation
- Outdated electrical and lightning protection systems
- General deterioration due to moisture and moisture vapor on stairs and elevator mechanisms
- Exacerbated deterioration due to ineffective and inappropriate previous repair campaigns
- Generalized material deterioration due to petrographic make up of stone

It is important to note that proceeding with the immediate next phases as part of the overall preservation efforts of the Monument are most effective if completed in the next two years to capitalize on the investment the State has made over the last three (3) years investigating, testing, analyzing and understanding the behavior of the Monument. Establishing a phasing plan is a critical step and we have utilized the cost estimate data available from the Phase 1 investigation work as a preliminary guide. However, the project should move into the design phase next in order to further develop the scope of work and provide the basis for an accurate cost estimate.

Our approach to the phasing study summarized below has focused on what is involved from a scope, cost and schedule perspective, addressing risks and uncertainties, and defining the variables that will help the State comprehend the necessary components, professional services and related budgeting items in order to continue moving forward on this project. We have

categorized this into Phases 1A and 1B, this is in reference to what we now would consider the schematic design and construction phase. The initial assessment conclusion, further defended with supporting evidence in the second phase of studies performed, is that a critical component in the successful restoration of the monument is making the monument watertight. This effort has multiple components and unknowns to it and is what comprises Phases 1A and 1B. In establishing a process, timeline, and budget for these phases, there are two crucial variables to understand are key factors in determining the cost, and potential duration, of the work:

1. Establishing an accurate cost of the building enclosure system (and a 2nd component of that, establishing an accurate timeline for its use)
2. Establishing an accurate duration, the power/energy requirements and the related costs to dry out the monument

This phasing/feasibility study presents three considerations:

1. Scope of Work
2. Opinion of Probable Cost
3. Project Schedule

These three considerations are being studied to understand the relevant components and sequence and scope of the work; the associated costs of each sequence; the risks and uncertainties; and the duration. By providing this analysis, we can drive our sequencing to solve the two key variables identified, pinpoint the uncertainties, and determine where in the sequencing certain work is inserted to reduce the associated risk and eliminate, or minimize these uncertainties. These components comprise the sequencing as follows:

Phase 1A: Monument Enclosure System Design & Erection

Phase 1B: Infrastructure and Schematic Design

COMPONENTS OF THE PROJECT

In considering the uniqueness of this project, the breadth of technical data collected, while providing a clearer vision on what is required to restore the monument, has determined there is a more advanced nature and complexity of how this work will be accomplished. This involves the scaffolding, which we feel is more accurately referred to as a building enclosure system. The scope of this system (interior and exterior) has further developed in its performance requirements over the past few months.

And while an initial budget for the project (and “scaffolding”) was provided, this, along with a revised scope, cost, and schedule expectations has been adjusted based on the information that we’ve garnered in the past year and half of investigation (the Phase 2 analysis). In recent

discussions with both Contractors and Engineers who specialize in the design/ fabrication/ and erection of complex enclosure systems, several different options have been identified as crucial to the design performance and necessitate consideration in the final design of the enclosure system.

Alongside the development of the enclosure system and its performance requirements, is defining and understanding the parameters of the engineering scope of work to complete the first critical step of the restoration work- drying out the monument. The cost of the enclosure system and the duration of time for drying out the monument are the two variables that each require a more calculated solution. To arrive at these solutions, the first step is to outline the needs of the enclosure system.

Construction Management

It is important for the state to consider engaging a construction management company. The coordination of scheduling, budgets and cost estimates, consultants, site preparation and mobilization, and coordinating the erection of the enclosure system is a large undertaking that is most efficiently and effectively managed by a CM.

PHASE 1A: MONUMENT ENCLOSURE SYSTEM DESIGN AND ERECTION

It has been determined that the exterior restoration of the Monument necessitates a more advanced level of enclosure system and access than originally considered. From our work, it's been determined a custom designed enclosure system is required to provide a stable environment for drying out the structure, as well as providing access for the A/E team, and for the performance of the restoration work. This requires the engineering design and erection of a specific enclosure system, similar to what was utilized at the Washington Monument. The key factors of performance for the enclosure system are:

- Designing and erecting a 100% watertight enclosure to allow for engineering of interior conditions to be implemented
- Understanding the timeframe for this engineering to occur
- Providing access/means to visually assess the exterior of the monument to design appropriate repairs, and provide the appropriate engineered platforms to perform the work now known to be necessary

Next, there are four key components to this design process, and the solution of the first component (schematic design and performance drawings) will enable our team to solicit an accurate cost estimate for the procurement of the enclosure system. The components are identified as follows and discussed in more detail below:

1. Design of Monument Enclosure System and Associated Cost Estimate
2. Geotechnical Engineering, Site Preparation Design, & Site Improvements
3. Preparation of Monument Enclosure Bidding Documents & Procurement Period
4. Erection of Monument Enclosure

Additionally, there are several factors to consider for each of these components and will require schematic design services to inform the design of the enclosure. Items for consideration are:

- Extent of weatherproofing/type of enclosure
- Mechanical/electrical needs for enclosure including OSHA safety, architectural lighting, and egress lighting.
- Accessibility/access needs for A&E team and construction team (lift/hoist/crane) based on A&E Team restoration design approach
- Geotechnical engineering (soil bearing capacity/tests)
- A&E Coordination services with enclosure system engineers
- Site access/mobilization and staging

1. Design of Monument Enclosure System and Associated Cost Estimate

It is recommended as an initial step that a building scaffolding engineering consultant be retained to develop preliminary design for the enclosure system, and present 2-3 options for consideration in collaboration with the A/E team. From this preliminary design set, the A&E team will coordinate with the State to select the most appropriate design direction and coordinate the development of the performance set. The geotechnical study will inform the parameters of the site to be considered, as will studying the nature of erecting a 300'+ enclosure that is essentially a self-supporting structure. It may be necessary to design and erect an insulated enclosure system in order for it to be heated to allow for cold weather work. This would be determined during the initial SD phase design and costing.

The preliminary engineering design of the enclosure system will include an outline scope of work for the performance of the enclosure, and a study of multiple options, and the necessary components of the enclosure system that would benefit the restoration. The Schematic Design and cost estimate will consider phased construction of the Enclosure system (i.e. a controlled environment and access are needed prior to construction)

Schedule: 3 months for design, 1 month for cost estimate

Cost: \$150,000 estimate

Risks & Uncertainties

A/E team has discussed this project with a specialty engineering firm about proceeding with a proposal for services. Delaying this process prevents the immediate steps of enclosure

design and cost estimating to commence and could potentially lead to extensive delays that will have a negative impact on the schedule and the health of the monument.

2. Geotechnical Engineering, Site Preparation Design, & Site Improvements

As part of the design process for the enclosure system, a Geotech engineering consultant will perform soil bearing tests to assist in the engineering design, and develop and design footings/below grade support, etc. for the enclosure system. This work will be performed in conjunction with the enclosure system engineering and will be included as part of the bid set that is completed in the next step.

Additionally, the site will need to be prepared for the extensive amount of preparation work for this project.

Site protection will include staging, storage, and establishment of a work surface will need to be constructed. Protection will need to be put in place for many historic statues and artifacts in the vicinity of the monument. The erection of the enclosure around the monument is a huge project, analogous to constructing a 30-story building, and it is anticipated that most of the lawn around the monument will be needed for various elements of the project.

Costs for protective measures, staging, mobilization and establishment of a work surface are all assumed to be part of the General Contractor's bid number for the enclosure system.

Schedule: 2 to 4 months –preliminary estimate.

Costs: \$150,000 - Preliminary order of magnitude cost placeholder.

Risks & Uncertainties – Site preparations were beyond the scope of the assessment work on the monument, hence the cost and schedule for this improvement are unknown and could vary widely. The scope and cost for this work need to be informed by additional investigation, discussions with the CM, schematic design, and a professional cost estimate. The extent of ground disturbance needed is unknown – the scaffolding enclosure will require structural foundation below grade, and the need for any archeological work at the monument would add significant costs beyond the current budget.

3. Preparation of Monument Enclosure Bidding Documents & Procurement

The completion of pre-design and design with A/E consulting and coordination would lead to a performance set that can be used for a cost estimate and issued for procurement. This is a key step in designing and assembling the physical components for the project to move into the initial phase of restoration work. Performance design set of drawings prepared for bidding estimate is \$450-\$500,000 of soft costs for design. *This is a critical first step.* (See the A/E Section below for additional discussion)

Schedule: 3 months for completion of documents and 3 months for procurement period

Costs: \$200,000

Risks & Uncertainties

There is little risk at this stage in proceeding with securing a cost estimate for the enclosure and proceeding with the procurement process. Any uncertainties associated with the process of the enclosure system and the design and development of it are likely to have been addressed in the preliminary design stage. This component is focused on moving directly into the erection of the system.

4. Erection of Monument Enclosure

Schedule: 8-12 months to erect, 3 to 6 years in place – preliminary estimates. Additional elements added to the enclosure could extend the timeline for erection. The duration for the enclosure to be in place will depend on funding and phasing for the project.

Costs: \$5MM to \$10MM - Preliminary order of magnitude estimate for enclosure system. Additional recent investigation into options for the enclosure system, along with discussions with engineering specialists for scaffolding systems have further informed us of the potential cost. The need for a weather tight enclosure is expected to increase the cost.

Risks & Uncertainties – It is recommended that as a next step in the project, the cost for the enclosure around the monument be better understood by procuring final performance document level design by a scaffold design specialist. This improvement is the largest cost associated with the overall project budget that currently has many unknowns and a highly variable cost. Geotechnical engineering (for scaffold foundation design) and structural engineering of the monument (for assessment of the lateral load impacts of the proposed scaffold) should also be completed to inform the design of the enclosure and the primary structural frame of the scaffold itself.

The design of the enclosure will also inform the initial and annual costs for maintaining the enclosure at the site, along with if it is appropriate for the State to purchase the scaffolding rather than leasing. We should note that the enclosure may also be required to provide dust control during the various masonry restoration activities (including cutting, drilling, cleaning, raking, repointing, placement of anchors, and grouting). This protection may be required to ameliorate conditions experienced by residential neighbors near the monument.

PHASE 1B: INFRASTRUCTURE AND SCHEMATIC DESIGN

Parallel, and supplemental to, the design of the monument enclosure system, is the engineering design as it relates to the drying out of the monument, the work necessary to develop and erect the enclosure, work that will occur following the erection of the enclosure, and the design work necessary to establish a detailed scope of work for the exterior restoration. The three general components of Phase 1B are:

- Mechanical Improvements for Moisture Reduction and Dehumidification
- Architectural Preservation & Restoration and Structural Engineering Schematic Design
- Exterior Preservation and Restoration Scope of Work Cost Estimate

1. **Mechanical/Electrical Engineering Improvements Design & Installation**

Mechanical Engineers will perform analysis and calculations and prepare the design of the system for moisture reduction from stone and dehumidification of the interior of the Monument. This includes design of mechanical units (number, locations, capacity) power requirements, including design of additional electrical infrastructure as required, and expected power consumption, expected probable duration of process, contingencies and targeted results.

Schedule: 4-6 months for design – a very preliminary estimate of the timeframe to dry the monument with mechanical equipment is six (6) to twelve (12) months. The mechanical engineering calculations & design is expected to better inform the timeframe.

Costs: \$600,000 - Preliminary order of magnitude estimates for engineering design, and 10 to 12 dehumidification units and associated electrical improvements to support the dehumidification and drying process.

Risks & Uncertainties – This improvement should be independent from the exterior scaffolding work and both improvements should be able to proceed in parallel. Mechanical engineering design is necessary to inform the necessary improvements and timeframe. The schedule and cost to dry the monument could double. Depending on the timeframe it takes to reduce the moisture and humidity in the stone would have an impact on the schedule of the A/E team to complete schematic design, which includes mock-ups following the drying process.

2. **Architectural (Design+Preservation) and Structural Engineering Schematic Design**

In addition to the Architectural/Engineering Consulting Team providing coordination of engineering consultants and collaborating on enclosure design with scaffolding engineer consultant, the A&E team can begin Schematic Design and the development of the

Preservation Master Plan. This will include use of the enclosure system to access the exterior of the monument up close, assessment of the behavior of the stone following the moisture reduction and dehumidification process, and the development of repairs that will require onsite mock-ups. The completion of the Schematic Design phase will enable us to solicit an accurate cost estimate of the exterior restoration.

The architecture and engineering design for the exterior restoration of the monument is needed for the next phases of the project and should progress at several key levels outlined below. Final design for full restoration is not included currently:

- Site Preparation & Permitting – civil engineering should be completed to confirm site preparations and secure any permits necessary for the work.
- A/E Schematic Design – schematic design for the restoration of the monument is recommended to be completed once the enclosure is erected. This step will inform a professional cost estimate that can be used to inform future phasing of the improvements.
- Professional Cost Estimate – A professional cost estimate for the enclosure should be completed as soon as possible to confirm the budget for the next step. A separate professional cost estimate for the restoration of the monument should be completed following schematic design.

Schedule: 18 to 24 months through Schematic Design – the architecture and engineering associated with the enclosure and drying the monument should begin as soon as possible.

Costs: \$1.25-1.5 M - preliminary opinion of cost as a percentage of construction (some costs are placeholders)

Risks & Uncertainties –The timeline for completing schematic design will depend on drying out the monument and the mock-up work.

3. Exterior Preservation Mock-Ups for Restoration Scope of Work & Cost Estimate

Propose mockups of techniques and methods, review material samples so prepared for onsite work once Monument is dry This work will be conducted by the CM collaborating with the design team to confirm appropriate repair methods for restoration. Mock-ups should be completed during the Schematic Design to inform final design and a professional cost estimate. The assessment work informed the type of repairs that will be needed, mock-ups are necessary to inform the means and methods of the repairs, allowing contractors to accurately bid the work. This work should be completed after the monument is dry to be consistent with the condition of the monument during the actual restoration.

Schedule: 2-3 months –preliminary estimate.

Costs: \$150-250,000 - Preliminary order of magnitude cost as placeholder.

Risks & Uncertainties – The cost and schedule for this work needs to be bid to confirm architectural preservation and restoration design and structural engineering design needs to be completed to bid the work. The exterior enclosure is required for effective mock-ups of the repairs needed, and therefore the architectural and structural engineering should be progressed in parallel with the design of the exterior enclosure for efficient scheduling. This work should be sequenced after the monument is dry, and there is uncertainty in the timeframe required to dry the monument.