ENGINEERING ASSESSMENT OF STRUCTURES AT THE OLD BURYING GROUND STONEHAM, MASSACHUSETTS

STRUCTURES AT THE OLD BURYING GROUND

This purpose of this report is to review the existing conditions of the significant structures located within the burying ground, and to make recommendations for preservation and restoration. These structures include the following:

Private Tomb – Peter Green Tomb
Private Tomb – James Hill's Family Tomb
Town Receiving Tomb
Oriental Court Retaining Wall
Pleasant Street Retaining Wall and Gate

EXISTING CONDITIONS OF THE THREE TOMBS

The Old Burying Ground contains three tombs. Two Private tombs, and the Town Receiving tomb. All three tombs are built in a similar manner and are in approximately the same condition. The Hill and Green Tombs are dated 1855 and 1836 respectively. The Town tomb is from approximately the same era based on the historical data. A vote was held in a Town meeting in 1845 to construct the tomb. No record was found giving the actual completion. The following are photos of the Tomb Exteriors.

Peter Green Tomb
Dated 1855

James Hill's Family Tomb
Dated 1836

Town Receiving Tomb
Dated ca. 1845

The following is a general description of the condition of the three tombs. More photos and specific condition descriptions can be found in the attached inspection notes.

Exterior conditions:

All three tombs are built in line with each other. Historical data indicates that these tombs predate the adjacent retaining walls. At one time, the tombs may have been built into a sloping hillside, which is quite common in Massachusetts. The walls may have been added when Pleasant Street was widened, or when the sidewalk was installed.

All three tombs are built with granite facades. The Hill Tomb is more finely cut stone. Many of the joints are pointed at this time; however upon closer inspection, it was determined that the original façades were built without mortar. The inspection from the interior of the tombs confirmed this conclusion.

The jagged stones on top of the tombs may not be original to the tombs and adjacent wall. The mortar used to adhere the stones is cement based, which is not consistent with the construction of the adjacent walls. Also, given the fact that the walls were built after the tombs, one could infer that the jagged stones were added after the construction of the tombs. It is assumed that the jagged stones were added when the fencing was installed in 1937.

The top stones on all three tombs have shifted toward the street. The Green Tomb has the least movement, and the Hill Tomb has the most movement. This has caused the joints to open up, which led to the re-pointing on the front façade. There are several sinkholes in the soil above the tombs. These sinkholes are located near the front wall façade.

All three tombs have minor staining and lichen growth.

The Hill tomb has a wooden door that is not hinged. It is not original. A wooden door matching the size of the opening was found inside the tomb. It is not known if this is the original door. Based on the longevity of a typical wood door, this door may also not be the original door. It at least predates the current door. The other tombs have iron doors with iron hinges. The Green Tomb has an ornate casting within the door panel. We suspect that this is the original door, since it is dated. The Town Tomb has a historically accurate recessed panel design. It is most likely the original door.

Interior conditions:

Permission was given to enter the tombs in order to determine the composition and integrity of the structure. All three tombs were opened for inspection. A locksmith was hired to open the doors. Care was taken not to disturb the granite jambs and lintels on the doorways, and any of the contents of the tomb. Upon completion of the inspection, the doors were reset by town maintenance staff.

The interior dimensions of the Town Tomb and Green Tomb are 8 feet wide, 10 feet deep, and 6 feet tall. The Hill Tomb is slightly larger, with dimensions of 8 feet wide, 13 feet deep, and 6 feet tall. The floor of the Town and Green Tombs is mortared or concrete, which may not be original (dirt floors are common in tombs of this age). The floors of the tombs are approximately 2 feet below the outside grade at the doorway. The floor of the Hill Tomb is quite unusual. It is constructed with dry laid clay tiles that are 8" x 8" and laid in a running bond pattern. Another unusual feature of the Hill Tomb is a brick well that is constructed in the middle of the tomb. It is approximately 19" x 32" and is 24" deep. There is a recess in the top edges, which implies that a hatch door was once used to cover the well. The bottom of the well could not be inspected without disturbing remains; therefore we can only hypothesize about its purpose. It could have been built as a dry well that was used to drain infiltrating water.

Composite Photo of the Interior of the Hill Tomb

Floor of the Hill Tomb showing Clay Tile (to left) and Brick Well (center)

All three tombs have walls constructed with mortared stone masonry. The interior joints are pointed with lime mortar. It is believed that this mortar is original to the tombs. The Town Tomb has been white washed; however it is not known if this original.

The interior stonework is in very good condition. The rear walls, side walls and ceiling do not appear to have shifted at all, however the front wall on all three tombs has moved forward (½" for the Green Tomb, 1" for the Town Tomb and 2" for the Hill Tomb. The tomb roof and walls are constructed with rough-cut granite. The door hinges are bolted through the front stone wall on the Town Tomb, but not on the other tombs. The joints in the stones on the front façade of all three tombs are not mortared.

The shifting of the façade walls has created gaps in the roof stones, cracks in the side walls, and sinkholes in the soil above the joints. This has allowed soil to enter the tombs for many years. The lean is noticeable, however the walls appears stable at this time. If the lean increases more than 2" over the next few years, there may be a safety problem

The remains of the interred are strewn about the floor of the Hill and Green Tomb and the remains of many wood caskets still exist. The caskets have rotted and collapsed; therefore it is hard to determine exactly how many bodies are present. It is estimated that there are approximately 6 bodies in each of the family tombs. The Town receiving Tomb was empty except for a severely rotted wooden structure that appears to be a work bench.

EXISTING CONDITIONS OF RETAINING WALLS

The purpose of retaining walls is to provide relatively level ground where slopes exist. This is typically done in cemeteries to provide additional space for burials on uneven ground. The Old Burying Ground has two long retaining walls, one along the entire length of Oriental Court, and one along the entire length of Pleasant Street. Based on historical records, both walls were built around 1916, which post-dates many of the burials in the burying ground. It is assumed that the walls were built in conjunction with the widening of the roadways and construction of the sidewalk. Slopes most likely existed prior to 1916.

Pleasant Street Wall

Oriental Court Wall

Town records indicate that these walls are not th e original walls at the site. There are notes regarding walls dating to back 1835. Before th at time, the boundary was delineated by several generations of wood fencing.

Both walls have relatively modern chain link fencing installed on top. Town records indicate that this fence was installed in 1937. The fence posts ar e attached to stones that are different than the adjacent stones. The post base stones are square d off and larger than the random rubble stones that make up the rem ainder of the walls. This can be seen on the photograph of the Oriental Court wall on the preceding page. These stones are not ed in the Town records and were part of the original 1917 wall. They were used to support another fence that was installed in 1917. The make-up of the original fence is unknown.

Both walls have flush pointed joints. The m ortar in the joints is cem ent based mortar, which is not consistent with the age of the walls. Walls constructed in the early 1900's typically are either dry laid, or m ortared with lime based mortar. An inspection of a few failed joints indicated that the cement mortar is just near th e surface. The interior of each joint is made with lime mortar. This means that the cement mortar is not original and a result of a past re-pointing project. The Town records indicate that the 1917 wall construction has smooth cement joints that were used to prevent children from climbing on the walls.

The Pleasant Street wall has a jagged stone topping running from the tombs west to the end of the wall. It appears that this topping m ay also not be original to the walls based on the following observations. There is an obvious flat plane on the top course of stonework that separates the main wall from the jagged topping stones. Another clue is the fact that the mortar used to seat the jagged stones is cement based m ortar. This ty pe of mortar is not consistent with the age of the wall or the m ake-up of the interior wall joints . These stones m ay have been added when the fencing was installed in 1937.

There is little sign of movement in both of the walls, which means that the walls were constructed well. The only signs of cracking are near the corners, which indicated m inor wall m ovement. This cracking is not a concern and ty pical at wall corners. There is no sign of weepholes or drainage structures behind the walls. Both walls can retain runoff water behind them ; however this does not appear to have caused any problems over the life of the structures.

Concerns were raised about the condition of the return wall at the end of the Oriental Court Wall (adjacent to building). This portion of the wall h as joints that are m issing most of the m ortar. The concerns were with regard to the structural in tegrity of this section of wall. There is crack in the adjacent wall section, which indicated som e movement; however is it not severe and does not indicate a significant lack of structural integrity. This section of wall should be m onitored over time for more pronounced m ovement. Based on past experience, this m ovement will most likely be very slow. It has taken alm ost 100 years for the crack to develop. It should take m any more years for the movement to increase.

CAUSE OF MOVEMENT IN THE TOMB FACADES

The front façades of the tombs can be classified as retaining structures. They support a certain amount of soil behind them. The most common causes of retaining wall failures are inadequate design, poor backfill soils, and excess ground water. The failures and leaning of the facades in the tombs can be attributed to a combination of all of these causes.

Control of water is extremely important in order to provide a durable long lasting retaining wall. Water infiltration in the backfill soil of a wall can cause several problems:

1. The water will increase the unit weight of the soil, thereby increasing the pressures acting on the wall face.
2. If water is present in the backfill soil during freezing weather and if the backfill soil is not free draining, the soil will freeze and expand causing enormous pressures to build up. This action is further exacerbated by the cold temperatures inside the tombs.
3. Water will decrease the strength of the soil under the base of the wall and limit its ability to support loads.

There is very little control of surface and ground water on these walls. There are no signs of wall drains (weepholes) and the surface runoff is allowed to collect on top of walls where the water can soak into the ground. These walls were probably not engineered. They were probably constructed by masons using a rule-of-thumb approach. Often, walls were construction with a thickness that is a percentage of the wall height. For instance, many walls are built with a thickness that is approximately 60 percent of the height. While this is not based on engineering principles and soil mechanics, it normally results in a stable and durable wall. The tomb façade movement is most likely caused by freezing of the soil directly behind the capstones. The expansion of the freezing soil has slowly pushed the wall forward.

AREAS FOR PRESERVATION

Tombs:

The tomb structures are in very good condition, with the exception of the front façade. In the short term, the tombs can be preserved by means of careful cleaning. The cleaning should not involve high pressure water blasting, or sand blasting. There are modern masonry cleaners that can remove dirt and grime without damaging the base stone. More significant rehabilitation of this structure could easily be justified (see below).

Retaining Walls:

In the short term, the fencing can remain unless funding is available to remove the fencing. The fence posts and rails can be cleaned and painted and the chain link fabric can be replaced. The damaged gate can be removed, repaired, painted and reset. Damaged areas of pointing can be repaired. Once this is done, the entire wall surface can be cleaned. As with the tomb facades, the cleaning should not involve high pressure water blasting, or sand blasting. The plant growth on top of the fencing should be removed.

AREAS FOR REHABILITATION AND RESTORATION

Tomb Rehabilitation:

The tombs are structures that will eventually need to be rehabilitated. The investigation of the tombs brought out several key issues:

1. The soil behind the wall is most likely frost susceptible.
2. There is no existing drainage system for the removal of groundwater behind the walls.

Recommendations:

Reconstruction of the Front Façade

The materials on the front façade are essentially intact. The stones can be carefully removed and numbered. The base stones can rem ain, as they have not m oved a measurable amount. The stones can then be r eset to their original line and grade. Stainless steel pins may be used in inc onspicuous locations to join the stones together. The stones were never m ortared together; therefore we recom mend that the wall be reconstructed without mortar.

The doors of the Town Tomb and Green Tom b can be rem oved and restored. Period locksets can be installed and the da maged areas repaired. The door can then be painted. It is possible to determ ine the original color of the doors as long as the original paint was not sand blasted off during a re-painting.

The hinges and latches of the doors need repairs and possibly replacement. The replacement hinges can be replicated by a historic m etal working shop. It is very important to retain as much of the original fabric of the structure.

The original door on the Hill Tom b may have been wood. A replacem ent door could be m ade of wood, or an iron door can be fabricated that is consistent with period doors.

Special care m ust be taken so as not to disturb the rem ains within the tom bs. Normally the remains should not be touched out of respect for the fam ilies. The Massachusetts Historical Commission may allow the tem porary removal of the remains by an archeologist. This would facilitate the restoration of the front wall. Upon completion of the restoration, the remains could be carefully replaced.

This work need not all be done at one tim e. Individual tombs can be restored as monies become available. The work should start with the Hill Tomb, then the Town Tomb and finally the Green Tom b. This is based on the relative amount of movement of the front façade.

Installation of Ground Water Drainage

The best way to control ground water is to install a foundation underdrain along the entire length of the head wall. The underdra in should be covered with filter fabric in order to prevent clogging from backfill soils. The outlets at the ends of the drain pipes can be conspicuously located at the end embankments.

Replacement of Backfill Material

This is a very useful m ethod of stabilizing walls that are being subjected to frost action. The backfill material directly behind the face of the wall can be rem oved and replaced with high quality gravel or crushed stone. The backfill can be topped with 4 to 6 inches of topsoil that can support new plantings.

If it is desired to provide a perm anent seal to the roof of the tom b, the entire tom b can be excavated and sealed with a m odern waterproofing system. This will not be visible once the backfill is replaced, therefore it would not detract from the historic character of the tomb.

Wall Restoration:

The restoration of the cemetery can be difficult on a site that has undergone several significant changes during its history. If the site is to be restored to its "original" condition, the walls would be removed and replaced with slopes and a wood fence. This is not practical due to the close proximity of Oriental Court and the Pleasant Street sidewalk. Another option would be to remove the walls and replace them with an 1835 vintage wall, which would most likely be a dry laid rough stone wall. The third option would be to restore the current wall back to a 1916 vintage wall. This is the most cost effective option, therefore it is recommended. If funds permit, the Town could consider restoring the original 1835 version of the wall.

The structural integrity of the walls is not in question. There are opportunities to restore these walls to their original condition.

The pointing does not appear to be original. The cement based mortar can be carefully removed and replaced with a lime/cement based mortar. The lime/cement mortar should be removed to a depth of between 3 and 6 inches, so that the new mortar will have sufficient room to adhere to the stones. The mortar joints could be recessed more, which would be more consistent with walls of this era. Once complete, the entire wall surface can be cleaned.

The fencing should be removed and replaced with a fence that is consistent with a 1917 era wall. The gate can be removed, repaired and reset.

The jagged stone topping on the Pleasant Street Walls does not appear to be original. This stone should be carefully removed and the top stones cleaned of any mortar.

Cemetery	**Stoneham Old Burying Ground**		
Inspection Date	**April 11, 2012**	**Inspector**	**Pete Culmo**

Structure

Peter Green Tomb (Exterior) - 1855

Inspection Items	Comments
Movement	The top stone is leaning slightly. The entire front facade has a very minor lean toward the street. See Photo 3.
Door	The hinges are rusted shut. One was broken while attempting to open the door. The door is in good condition. It has been repainted. The original rivets on the hinges are corroded and broken. There is impacted rust behind the hinges.
Joints	The bottom joint of the top course of stone is open. See Photo 1. The original joints were not mortared. The existing mortar is only partial depth. This was verified from the inside as well. See Photo 4.
Staining	Minor staining. Graffiti on door See Photo 2.
Plant Growth	Minor Lichen growth See Photo 1.
Overall Condition	Good
Short Term Repairs	Clean Front Exposed Surfaces
Long Term Repairs	Remove and reset front façade Install drainage behind façade stones Restore door and reset Remove jagged stoned on top of headstone

Photos

Photo 1

Photo 2

Photo 3

Photo 4

Cemetery	**Stoneham Old Burying Ground**		
Inspection Date	**April 11, 2012**	**Inspector**	**Pete Culmo**

Structure

Peter Green Tomb (Interior)

Inspection Items	Comments
Movement	Side and rear walls are stable Roof stones are stable Front façade has moved forward approximately 1", which has led to minor cracks in the side walls near the front
Dimensions	The interior dimensions of the tomb are as follows: Front to back: 10 feet Side to side: 8 feet Floor to ceiling: 6 feet Front wall thickness: 12" (granite)
Joints	The interior joints are all mortared. This may be an original condition. The front façade wall is not mortared.
Staining	Most of the joints have efflorescence staining (white stains) caused by water infiltration.
Floor	Cementitious mortar floor
Overall Condition	Good
Short Term Repairs	None
Long Term Repairs	See exterior notes

Photos

Photo 1

Photo 2

Photo 4

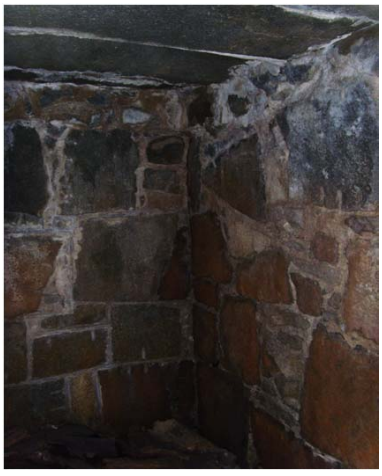

Photo 5

Cemetery	**Stoneham Old Burying Ground**		
Inspection Date	**April 11, 2012**	**Inspector**	**Pete Culmo**

Structure

James Hill's Family Tomb (Exterior)

Inspection Items	Comments
Movement	All façade stones are leaning and shifting. There is a significant lean of 3" toward the street.
Door	The original door has been replaced. A wood door was found inside the tomb. It may not be the original door, but it could be a replica of the original door. It is a flat wood door with no significant ornamentation or detail. The original hinges and lockset bolt recess can be seen. See Photo 4.
Joints	Many of the joints are open See Photo 1. The original joints were not mortared. This was verified from the inside as well.
Staining	Minor staining. See Photo 1.
Plant Growth	Minor Lichen growth See Photo 1.
Overall Condition	Fair to Poor
Short Term Repairs	Clean Front Exposed Surfaces
Long Term Repairs	Remove and reset front façade Install drainage behind façade stones Replicate and install new door. Remove jagged stoned on top of headstone

Photos

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Cemetery	**Stoneham Old Burying Ground**		
Inspection Date	**April 11, 2012**	**Inspector**	**Pete Culmo**

Structure

James Hill's Family Tomb (Interior)

Inspection Items	Comments
Movement	Side and rear walls are stable Roof stones are stable Front façade has moved forward approximately 3", which has led to large opening in the corners and between the roof stones. Large amounts of soil have fallen into the front of the tomb. See Photo 1.
Dimensions	The interior dimensions of the tomb are as follows: Front to back: 13 feet Side to side: 8 feet Floor to ceiling: 6 feet Front wall thickness: 12" (granite)
Joints	The interior joints are all mortared. This may be an original condition. The front façade wall is not mortared.
Staining	Minor staining and moisture.
Floor	Unusual tile floor (8"x8" clay) Appears to be dry laid. There is an unusual sump pit in the middle of the tomb. It is 19"x32" and 24" deep. It is constructed with brick and may have been added as a dry well? See Photos 4 and 5.
Overall Condition	Fair
Short Term Repairs	None
Long Term Repairs	See exterior notes

Photos

Photo 1

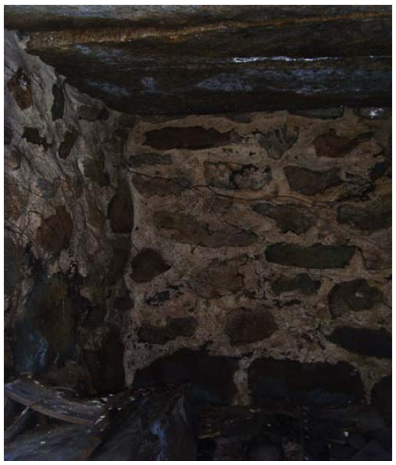

Photo 2

Photo 3

Photo 4

Photo 5

Cemetery	**Stoneham Old Burying Ground**		
Inspection Date	**April 11, 2012**	**Inspector**	**Pete Culmo**

Structure

Town Receiving Tomb (Exterior)

Inspection Items	Comments
Movement	The front façade is leaning slightly forward. toward the street. See Photo 3.
Door	The hinges are heavily rusted. The door is in fair condition. It has been repainted. The lockset was corroded beyond repair.
Joints	Most of the joints are open to some degree. See Photo 1. The original joints were not mortared. The existing mortar is only partial depth. This was verified from the inside as well. See Photo 3.
Staining	Minor staining and graffiti. See Photo 1.
Plant Growth	Minor Lichen growth See Photo 1.
Overall Condition	Good
Short Term Repairs	Clean Front Exposed Surfaces
Long Term Repairs	Remove and reset front façade Install drainage behind façade stones Restore door and reset Remove jagged stoned on top of headstone

Photos

Photo 1

Photo 2

Photo 3

Photo 4

Cemetery Structures Inspection Report

May 25, 2012

Cemetery	**Stoneham Old Burying Ground**		
Inspection Date	**April 11, 2012**	**Inspector**	**Pete Culmo**

Structure

Town Receiving Tomb (Interior)

Inspection Items	Comments
Movement	Side and rear walls are stable Roof stones are stable Front façade has moved forward approximately 1", which has led to minor cracks in the side walls near the front There is minor amounts of soil that has fallen through the open roof joint.
Dimensions	The interior dimensions of the tomb are as follows: Front to back: 10 feet Side to side: 8 feet Floor to ceiling: 6 feet Front wall thickness: 8" (granite)
Joints	The interior joints are all mortared. This may be an original condition. The front façade wall is not mortared.
Staining	Most of the joints have efflorescence staining (white stains) caused by water infiltration. The walls are white washed.
Floor	Cementitious mortar floor
Overall Condition	Good
Short Term Repairs	None
Long Term Repairs	See exterior notes

Photos

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Cemetery Structures Inspection Report

May 25, 2012

Cemetery	**Stoneham Old Burying Ground**		
Inspection Date	**April 11, 2012**	**Inspector**	**Pete Culmo**

Structure

Oriental Court Retaining Wall

Inspection Items	Comments
Movement	Minor if any Most of the wall is very plumb and stable There is a crack near the corner caused by minor movement of the return wall. (just to the right of the "do not enter sign" in photo 1). Photo 3 also shows the crack.
Joints	The return wall near the adjacent building has rough joints with missing mortar. The joints in the main wall are smooth and made with cement based mortar. There is lime based mortar below the cement mortar, which most likely the original mortar. Photo 2 shows the two layers of mortar since the cement mortar has fallen away. Most of the joints are in fair to good condition. Many joints at the base of the wall are missing mortar. This is most likely due to snow plows or water.
Staining	There is staining from the corrosion of the chain link fencing. See Photo 4.
Plant Growth	There is significant plant growth on the fence near the far end. See Photo 1.
Fencing	The fencing is not original (added in 1937). The stones at the base of the posts do not the other stones in size and shape. They are larger and squared off. They were part of the original wall; however they supported an older fence (Town records).
Drainage	There are no signs of weep holes of foundation drains. There are areas behind the wall that can collect water; however there are no signs that this has caused distress to the wall.
Overall Condition	The wall is in very good condition considering the age. The wall is true and plumb with little sign of movement or settlement. The fencing is corroded and damaged.
Short Term Repairs	Repair and paint fence posts and rails. Replace chain link fabric. Repair damaged and missing pointing. Remove rust staining.
Long Term Repairs	Repoint entire wall with historic mortar Clean all surfaces Remove fence and install a new hisotrically accurate fence.

Photos

Photo 1

Photo 2

Photo 3

Photo 4

Cemetery	**Stoneham Old Burying Ground**		
Inspection Date	**April 11, 2012**	**Inspector**	**Pete Culmo**

Structure

Pleasant Street Retaining Wall

Inspection Items	Comments
Movement	None Most of the wall is very plumb and stable There is a crack near the Oriental Court corner caused by minor movement of the wall.
Joints	The joints are smooth and made with cement based mortar. There is lime based mortar below the cement mortar, which is most likely the original mortar. See Photo 2 shows the two layers of mortar since the cement mortar has fallen away. Most of the joints are in fair to good condition.
Staining	There is staining from the corrosion of the chain link fencing.
Plant Growth	There is significant plant growth on the fence near the far end. See Photo 1. There is minor lichen and moss growth.
Fencing	The jagged stones on top of the wall do not appear to be original. They do not match the details on the Oriental Court wall and the mortar used to adhere the stones is cement based. The fencing is not original (see notes on. the Oriental Court Wall). The gate is corroded and damaged, but still functional.
Drainage	There are no signs of weep holes of foundation drains. There are areas behind the wall that can collect water; however there are no signs that this has caused distress to the wall.
Overall Condition	The wall is in very good condition considering the age. The wall is true and plumb with little sign of movement or settlement. The fencing and gate are corroded and damaged.
Short Term Repairs	Repair and paint fence posts, gate and rails. Replace chain link fabric. Repair damaged pointing. Remove rust staining.
Long Term Repairs	Repoint entire wall with historic mortar Clean all surfaces Remove fence and install a new historically accurate fence. Remove jagged stone.

Photos

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5