NABIH YOUSSEF ASSOCIATES
STRUCTURAL ENGINEERS

December 15, 2017

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88 First Street, 5th Floor
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Project: FDIC Building at 25 Jessie Street (NYA # 17164.00)
Subject: Evaluation for Excavation Induced Ground Movements –***Report***

Dear Linlin,

We have completed our analysis of the Federal Deposit Insurance Corporation (FDIC) Building at 25 Jessie Street in San Francisco. Our analysis focused on impacts to the existing 25 Jessie Street structure based on the estimated ground movements resulting from the construction of the neighboring Oceanwide Center development.

Please refer to the attached report, which summarizes our findings.

Kind Regards,

Michael Gemmill, S.E.
Principal

Sudharshan Navalpakkam, S.E.
Project Manager

EXECUTIVE SUMMARY

Nabih Youssef Associates (NYA) was engaged to evaluate the structural impacts to the FDIC Building at 25 Jessie Street based on estimated ground movements caused by the shoring, mass excavation and construction of the adjacent Oceanwide Center project. The FDIC Building is an 18-story steel-framed office building originally constructed in 1981. The building is founded on precast concrete piles. The lateral force resisting system consists of a welded steel moment frame utilizing pre-Northridge type moment connections.

NYA's analysis is based on the estimated ground movements provided by Brierley Associates. The 2016 California Existing Building Code (CEBC) and ASCE 41-13 were utilized as a basis for our evaluation and the estimated ground movements were treated as an "alteration" to the building, per the CEBC. Per the CEBC, any alteration that increases the gravity demand to any component by more than 5% and/or increases the seismic demand-to-capacity ratio (DCR) by more than 10% requires those elements to be flagged and evaluated based on the new demands. Any flagged elements which have a DCR greater than 1.0 would then require strengthening. Any flagged elements which have a DCR less than or equal to 1.0 would not require strengthening.

Prior to evaluating the building for the estimated ground movements, NYA performed an evaluation of the FDIC Building, primarily to serve as a baseline to compare the impact of the estimated ground movements. The existing building appears to meet all of the serviceability requirements of the CEBC for dead, live and wind loading. The results of our ASCE 41-13 seismic evaluation indicate that the structure generally meets Life Safety performance under a BSE-1n seismic hazard, except for overstress of a few pile foundations and a majority of the pre-Northridge moment frame connections.

With the incorporation of the estimated ground movements, the building still meets all of the code serviceability requirements for dead, live and wind loading. However, a number of elements exceed the gravity and/or seismic DCR triggers, and were flagged for further evaluation. Upon further evaluation, all of the flagged elements that exceeded the gravity trigger, have DCRs less than 1.0 and do not require retrofitting. The majority of the elements that exceeded the seismic trigger have DCRs less than 1.0, however there are three pre-Northridge moment frame connections (two at Mezzanine and one at Level 3) that exceed the 10% trigger by 1-3% and also have DCRs greater than 1.0. These three connections would require retrofitting, should the estimated ground movements become a reality. Likewise, should the actual ground movements exceed the Brierley estimates, additional connections may require retrofitting. Additionally, any changes to the assumed distribution of ground movement across the site will affect the results. For comparison purposes, the three moment connections would not exceed the 10% seismic trigger at a ground movement of approximately 85% of the Brierley estimates. Correspondingly, the maximum building roof displacement, including these ground movements and service level wind loads (10 year return period) will not exceed the H/400 (i.e., 0.25%) serviceability limit for typical steel framed buildings.

Since the ground movements used in our analysis are estimated, we recommend updating our analysis at discrete intervals during construction. We recommend that the base of each column be surveyed and the elevation reported to NYA prior to excavation and at agreed-upon intervals during construction. If any of the surveyed differential elevations between any adjacent columns changes by 3/8" or more, we would recommend initiating the updating of the analysis model with the most current ground movement values and reporting back our updated findings. Subsequent to the initial update, we recommend continuing to update the analysis model if differential elevations between any adjacent columns changes by more than 1/8".

Pre-Northridge connections are not considered a hazard to life safety, since gravity support is typically maintained even if the connection is damaged during an earthquake. Therefore, we would not recommend halting construction should any connections exceed the 10% trigger with a DCR greater than 1.0. At the end of construction, any elements that exceed the Code triggers, and exceed a DCR of 1.0, would require strengthening. Though we don't anticipate dead, live or wind loading (serviceability) being an issue based on our preliminary analysis, if, at any point during construction, the serviceability DCR on any element exceeds 1.0, construction should be halted and all parties should convene to determine the next steps, which could include temporary shoring and/or retrofitting depending on the extent of the overage.

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Reference Documents:

The following existing documents were provided by FDIC for review:

- Original structural drawings for Ecker Square (Sheets S1 to S16), by Raj Desai Associates Inc., dated 04/16/1981
- Building Evaluation Report, dated December 10, 2002, by Ratcliff Architects
- Engineering Services Report, dated December 2003, by DASSE Design Inc.
- Draft Building Evaluation Report, dated January 30, 2017, by Perkins + Will and Consultants

1. Introduction and Background:

This report evaluates the impact of ongoing foundation construction and site excavation for the Oceanwide Center project, adjacent to the FDIC Building at 25 Jessie Street.

Oceanwide Center Project:

The Oceanwide Center Project is situated on First Street between Mission Street and Stevenson Street. It is on the same city block as the FDIC Building and will involve the construction of two high-rise buildings adjacent to the subject building. Tower 1 of the new development will be built to the east of the subject building and it will be a 61-story steel-framed building with four basement levels. To the south of the subject building, Tower 2, a 53-story concrete residential building with three basement levels, will be constructed. The construction of the planned basement levels and foundations for proposed towers will require site excavations as deep as 72 and 65 feet below the existing exterior ground surface at Tower 1 and 2, respectively.

FDIC Building:

The FDIC Building is an 18-story office building with a partial basement. Constructed in 1981, the subject building is steel-framed and founded on precast concrete piles. The typical pile tip elevation is 67 feet below grade.

Scope of Report:

Oceanwide Center has contracted with a shoring contractor, Malcolm Drilling, to provide a design-build package for the Oceanwide Center site excavation and shoring. The shoring contractor's engineering consultants, Brierley Associates, have estimated the excavation induced ground movements at the FDIC Building site based on an engineered soil-structure analysis.

In this evaluation report, NYA has used the estimated ground movements from Brierley Associates and geotechnical recommendations provided by Langan, the Oceanwide Center's Geotechnical Engineer of Record, to evaluate the impact of the excavation induced ground movements on the FDIC Building structure.

NYA's structural evaluation is based primarily on the original 1981 structural permit drawings for the FDIC Building (formerly Ecker Square), prepared by Raj Desai Associates Inc. NYA has requested access to the FDIC building to verify information shown on the drawings, but has not been granted access to date. For the purposes of this report, we assume that the original permit drawings accurately represent the as-built condition of the building elements.

2. FDIC Building Description

A. Building Description

The FDIC Building is located in San Francisco's Financial District between Mission Street, Market Street, 1st Street and Jessie Street. It is currently utilized as an office building occupied by several departments of the FDIC. It is an 18-story rectangular steel framed structure with an overall footprint measuring approximately 70 feet x 90 feet at the base, and a roof penthouse height of approximately 284 feet above the street level. The building was designed in 1981 and construction was completed in 1984.

Exterior cladding consists of glazing and glass fiber reinforced concrete (GFRC) panels. Interior partitions consist of gypsum board on metals studs. Based on previous reports, it appears the gypsum board typically terminates at the suspended ceiling level. The elevators, stairs, toilets, HVAC duct risers, and utility shafts are all concentrated within a core on the east side of the building.

B. Building History

The building was originally designed as office condominiums. Initially, the FDIC occupied the top four floors of the building. In 1999, the FDIC purchased the last of the condominium units from other owners and began several major interior renovation projects. In 2000, the building received a new roof. In 2001, a major interior renovation of the office floors along with the installation of a new HVAC system was completed. A major waterproofing project in 2001 sealed the windows and exterior GFRC panels.

In 2000-2001, the building was structurally retrofitted to support interior architectural renovations. NYA is not in receipt of drawings detailing the building modifications made at this time, but based on the 2003 DASSE report, it is our understanding that these modifications were relatively minor and localized, and did not alter the main building configuration and structural behavior. To our knowledge, these are the only structural modifications to the original building structure to date.

C. Building Structural System Description

Building Geometry:

Plan layout: The FDIC Building is nearly square (approximately 73 feet by 70 feet at the upper floors) in plan, with a smaller rectangular building core (approximately 17 feet by 44 feet) at the east side of the building. The building has a partial basement measuring approximately 40 feet by 16 feet in plan and houses the fire pump room. The basement occurs on the east side of the building, west of the elevators.

Vertical Layout: The second floor is located 50 feet above the ground level and there are 17 additional floor levels above it. The main roof elevation is about 262.5

feet above the ground floor. The highest point at the top of roof penthouse is at 284 feet above ground level. The typical story height is 12'-6".

The building is largely open below the second floor, except a partial mezzanine on the east side at the core. The area below this second floor is an outdoor plaza on the ground floor. There is an intermediate level of beams between the second floor and ground floor.

Structural Systems:

Floors: The typical floor consists of 2 ½" thick normal weight concrete over 3" metal decking (total 5 ½" thickness). The decks are supported by steel beams located at a spacing of approximately 8 feet on center. The typical steel beams span up to 24 feet between steel girders and columns. The decks serve as diaphragms to transfer lateral loads to the vertical elements.

Steel Framing: The gravity system consists of steel wide flange beams and columns. Steel moment frames are located around the perimeter of the building on four sides and serve as the primary lateral force resisting system for the building. The moment frames utilize pre-Northridge style welded connections. The corner columns, where perpendicular moment frame lines intersect, are designed as built-up box columns. All perimeter moment frame columns consist of built-up box columns below the 2nd floor.

Steel Moment Frame System Detailing:

"Pre-Northridge" steel moment frame connections with limited ductility:
The FDIC building original permit drawings show welded flange moment connections at the perimeter moment resisting frames. As noted in previous Building Evaluation Reports, it is widely acknowledged that this type of connection detailing is prone to damage during significant seismic events. In California, moment-frame buildings with welded flange steel connections were damaged during both the 1989 Loma Prieta earthquake (San Francisco Bay Area) and the 1994 Northridge earthquake (Los Angeles Area).
Welded connections in steel moment-resisting frames built before the Northridge earthquake performed poorly because of the brittleness of the as-built welds - these older types of connections are commonly referred to as pre-Northridge connections and possess limited rotation capacity and ductility.

Partial Penetration Moment Frame Column Splices:
The FDIC building original permit drawings also show partial penetration welding of the moment frame columns at the column splices and at the WF column to box column splices above the second floor. This type of detailing points to potential localized weakness and brittle welds, i.e., limited rotation capacity and ductility at these column splices.

Foundations: The columns are supported by reinforced concrete pile caps with precast concrete piles. Reinforced concrete grade beams interconnect adjacent pile caps. The typical pile tip elevation is 67 feet below grade which locates the pile tips on a stratum of dense sand that is underlain by a layer of thick clay.

The majority of the ground floor is a 5” thick reinforced concrete slab on grade. The basement walls are typically 10” thick reinforced concrete and the basement slabs are a 6” to 8” thick reinforced concrete slab on grade.

D. Original Building Design Criteria:

Design Code: San Francisco Building Code, 1975 edition.

Floor Loading Criteria: Live loads of 20 pounds per square foot (psf) at the roof and a total of 100 psf at typical floors (80 psf for occupancy, 20 psf for partitions)

3. Building Evaluation Approach

NYA has performed a structural evaluation of the FDIC Building, per 2016 California Existing Building Code (CEBC) and ASCE 41-13 requirements for existing buildings. This evaluation was performed as a two-step process treating the site excavation induced settlements as a building "alteration" to the existing building, consistent with CEBC Sections 301.1 and 403.

A. **Step 1 – Existing Building Evaluation:** NYA analyzed the FDIC building in its current configuration, without ground movements, using ASCE 41-13 linear elastic methodologies to evaluate adequacy of the existing buildings elements and determine existing demand-to-capacity ratios (DCRs) for the critical structural elements under gravity and lateral loads. This evaluation served as a baseline for evaluating the effects of ground movements on the FDIC building.
ASCE41-13 Seismic Hazard & Performance Objective description: Per CEBC Section 403.4 and Table 301.1.4.1, the FDIC Building (Risk Category 1 office building structure) has been evaluated under a BSE-1N earthquake hazard level for a Life Safety performance objective - this is referred to as the "Basic Performance Objective for Existing Building" (BPOE) in this report.

B. **Step 2 - Existing Building Evaluation Incorporating Estimated Ground Movements:** NYA analyzed the FDIC building including the estimated ground movements due to the adjacent site excavation and shoring. Estimated ground movements for this building analysis were obtained from a soil-structure analysis performed by the design-build shoring engineer for the Oceanwide Center project (Refer to Appendix A for Brierley Associates Report). NYA evaluated the existing building structural elements with demands due to ground movement combined with existing dead load, live load and lateral (seismic and wind) loads and determined updated DCRs for the structural elements.

C. **Step 3 – CEBC DCR Comparison:** NYA evaluated structural elements that were part of the building primary gravity and lateral system consistent with CEBC Sections 403.3 and 403.4:
   i. CEBC Section 403.3: "*Any existing gravity load-carrying structural element for which an alteration causes an increase in design gravity load of more than 5 percent … shall be shown to have the capacity to resist the applicable design gravity loads.*"
      a. Therefore, any gravity element whose demand does not increase by more than 5% will be deemed acceptable as-is by the CEBC and any gravity element whose demand increases by more than 5% will be flagged and evaluated to determine the associated DCR. Any flagged elements with DCRs greater than 1.0 would require retrofitting.
   ii. CEBC Section 403.4: "*Any existing lateral load-carrying structural element whose demand-capacity ratio with the alteration considered is no more than 10 percent greater than its demand-capacity ratio with the alteration ignored shall be permitted to remain unaltered.*"

a. Therefore, any lateral load-carrying element whose DCR does not increase by more than 10% will be deemed acceptable as-is by the CEBC and any lateral load-carrying element whose DCR increases by more than 10% will be flagged and evaluated to determine the associated DCR. Any flagged elements with DCRs greater than 1.0 would require retrofitting.

Description of Building Model & Analysis:

Analysis Model: NYA created a 3-D finite element analysis model of the FDIC building in ETABS (Version 16.2.0) using the existing building permit drawings dated January 21, 1982. The ETABS 3-D model represents the structural configuration of both gravity and lateral systems of the building and accounts for P-delta effects. Grade beams were modeled to accurately capture the rotational fixity at the base of the frame columns.

Material and Element Properties: All structural element sizes and material properties are based on the existing building drawings. Appropriate modifications have been made in accordance with ASCE 41-13 to obtain expected material strengths, where applicable, for structural element evaluation.

Applied Loading: Lateral seismic loads were applied corresponding to the seismic hazard outlined in Section 3.A. Linear dynamic response spectral analysis was performed using the ASCE 41-13 guidelines. Gravity loads were input in the model as slab loads.

Load Combinations for Evaluation: Design load combinations per ASCE 41-13 were used for lateral load checks per CEBC-2016 Section 403.4. Design load combinations per ASCE 7-10 were used for gravity load checks per CEBC-2016 Section 403.3.

4. Brierley Estimated Ground Movements - Incorporation into Building Evaluation

A. **Vertical ground movements** were applied in the ETABS model as vertical settlement values at the base of each of the columns. The structure was then analyzed to determine the demands on the various structural elements due to this ground movement.

B. **Lateral ground movements** at ground surface result primarily in rigid body sliding, i.e, translation of the building. Therefore, this was not input in the ETABS model for analysis as it does not impact the building superstructure. The sub-surface lateral ground movements caused by movement of the shoring walls and adjacent soils do impact the building piles, however. The impact of this "sympathetic" pile movement on the pile structure has been captured through an L-Pile analysis performed by Langan on the building piles closest to the proposed shoring walls. The pile flexural and shear demands, due to this lateral ground movement, has been included in the pile element evaluation. Please refer to the letter provided by Langan in Appendix C for further information on their analysis.

5. Summary of Findings

A. FDIC Building Performance Under Service Loads (As-is Condition)

Based on review of Building Evaluation Reports made available to NYA, it is our understanding that the FDIC building has performed well under typical service loading – namely, dead, live and wind loading.

NYA performed a limited review of the main gravity and lateral force resisting system, and concurs that the FDIC building (in its current configuration) appears to be adequate to support service level dead, live and wind loads. Please note that a detailed evaluation of the slabs, beams, girders and other local elements is beyond the scope of this report.

B. FDIC Building Performance Under Service Loads Combined with Excavation-induced Ground Movements (per Section 3.C.i)

Impact of Ground Movement on FDIC Building Serviceability: Based on the building analysis results obtained by imposing the estimated ground movements predicted by the Brierley report, the building structural elements were evaluated per Section 3.C.i. Our main findings are summarized below:

i. The main elements of the lateral force resisting system – the moment frame (MF) beams, columns, connections, and grade beams– typically do not see much load demand under normal service gravity load conditions. However, these elements do participate in resisting the overturning imposed by the differential ground movements, i.e., settlement. Therefore, the load demands (including settlement effects) on these elements increased by more than 5% compared to normal service gravity load demands. A detailed demand-capacity evaluation of these elements was performed and it was confirmed that the maximum load demands were less than the available design strength of these elements (DCRs << 1.0).

ii. A summary of the maximum DCRs at the various elements, under service loads combined with settlement, is as follows:
   a. MF beams: 0.27 << 1.0
   b. MF columns: 0.30 (axial-flexure) << 1.0
   c. Grade beams: 0.38 (flexure) & 0.26 (shear) << 1.0
   d. Piles: 0.50 << 1.0
   e. Interior Gravity columns: Demands increased by 3% only. Adequate, by inspection.

   In general, it was determined that the building elements will remain well below the elastic limit under the imposed ground movements. See Appendix B for details.

iii. The maximum building tilt is 0.11% and the maximum roof displacement is 3.5 inches in the North-South direction due to the excavation-induced ground movements. The average building tilt at the occupied floors above the 2nd floor is 0.11%. These numbers are well under the H/400 (i.e., 0.25%) serviceability limit for typical steel framed buildings (ref. ASCE 7-10 Appendix C Commentary).

    Further, combining excavation-induced ground movements with service level wind loading (10 year mean recurrence interval), the total maximum roof displacement is expected to be approximately 8.7 inches in the North-South direction – this is slightly (10%) over the H/400 limit. However, at a ground movement of approximately 85% of the Brierley estimates, the combined average building tilt at the occupied floors above the 2nd floor is 0.25%, which satisfies the H/400 (i.e., 0.25%) serviceability limit.

    From a building serviceability perspective, we expect this to have minimal impact to the building occupants and non-structural components.

iv. Therefore, at a ground movement of approximately 85% of the Brierley ground movement estimates, we don't anticipate building serviceability to be an issue. Additionally, any changes to the assumed distribution of ground movement across the site will affect the results.

C. FDIC Building Performance - ASCE41-13 Seismic BPOE Evaluation (Step 1)

Existing building performance: Based on NYA's evaluation per Section 3.A, the FDIC Building in its current configuration will likely experience localized damage during moderate to large seismic events. Some of building elements that do not meet ASCE 41-13 requirements are identified below (See Appendix B for details):

i. **Moment Frame Connections:** The existing building has pre-Northridge moment frame connections – these connections have been known to be relatively brittle in nature and prone to damage during a seismic event. Therefore, pre-Northridge connections are permitted only limited ductility (i.e., deformation capacity) per ASCE 41-13 guidelines. The structural evaluation of the current building indicates that approximately 90% of the existing MF connections do not meet ASCE 41-13 requirements (i.e., DCR exceeds 1.0, and varies from 1.1 at the 17^{th} floor to 2.8 at the 3^{rd} floor). This means the building will likely see local damage to the moment frame connections during moderate to large seismic events. Based on damage to similar pre-Northridge moment frame connections in past earthquakes, we do not expect this to be a significant life safety hazard, as gravity support of the beams are typically maintained, however, post-earthquake repairs can be relatively expensive.

ii. **Moment Frame Column Splices:** The existing building MF column splices are detailed with partial penetration welds – the effective weld thickness of these welds is only half the thickness of the column flanges. This creates a significantly weaker local section with limited ductility. Where column splices occur near the mid-story height (at the typical 12'-6" story heights between Levels 3 and the Roof), the column splices are deemed adequate by inspection as they occur close to the theoretical bending moment inflection point, and are not evaluated separately. However, the box column splice welds at 29'-6" elevation (above the Mezzanine level) were evaluated specifically for combined axial-flexural-shear action as force controlled elements per ASCE 41-13. The splices were found to be near or slightly exceeding capacity (max. DCR of 1.01).

iii. **Foundation piles:** The piles under the corner columns have limited uplift capacity and compression capacity (as provided by Langan – See Appendix C for details). The corner moment frame column piles were found to be overstressed in pile capacity and in axial-flexural capacity under uplift demands for the BPOE. It is expected that this will result in localized damage, foundation rocking and increased building drifts.

iv. The remainder of the lateral force resisting system, including all moment frame beams and columns, appear to be adequate based on NYA's ASCE 41-13 evaluation.

D. <u>FDIC Building Performance Under ASCE41-13 Seismic Evaluation Combined with Excavation-induced Ground Movements (Steps 2 & 3)</u>

As described in Section 3.C.ii, the increase in the DCRs for all lateral force resisting elements were calculated based on the estimated ground movements provided by Brierley Associates. The elements that experience an increase in DCR by 10% or more were flagged for further review. All of the flagged elements were evaluated to determine if their DCR was greater than 1.0. If their DCR was greater than 1.0, these elements would require retrofitting. Here's a brief summary of our findings:

i. **Moment frame connections:** The DCRs for six moment frame connections increase by 10-13%, which is slightly over the threshold of

10% and have been flagged for further review. Of these six connections, three have DCRs less than 1.0 and are therefore acceptable. The remaining three connections (two at the Mezzanine Level and one at Level 3) have DCRs greater than 1.0 and would theoretically require retrofitting, should the full Brierley Associates estimated ground movements come to fruition.

ii. **Moment Frame Corner Columns:** The DCRs for a few corner columns are between 110-132% of existing DCRs, therefore these elements have been flagged for further review. Upon further review, the column DCRs, including settlement, are typically below 1.0.

iii. **Moment Frame Column Splices:** As outlined in Section 5.C.iii, the corner box column splice above the Mezzanine level was checked. DCR increases including estimated ground movements are less than 10%. Therefore, no elements were flagged for further review.

iv. **Moment Frame Beams:** DCRs including estimated ground movements for five of the moment frame beams are between 110-113% of existing DCRs, therefore these elements have been flagged for further review. Upon further review, the MF beam DCRs, including estimated ground movements, are typically below 1.0 (maximum of 0.84).

v. **Grade Beams:** DCRs including estimated ground movements for three of the moment frame grade beams are between 110-116% of existing DCRs, therefore these elements have been flagged for further review. Upon further review, the grade beam DCRs, including estimated ground movements, are typically below 1.0 (maximum of 0.51).

vi. **Foundation Piles:** The impact due to excavation induced vertical ground movements (per Section 4.A) on the pile foundations was mainly in the form of increased compression loads at the corner columns – this was included as additional compression demand in the pile evaluation. It was found that this additional compression load induced at the corner columns due to settlement helped alleviate the slight seismic tension uplift overstresses observed in the existing building configuration.

The impact due to excavation induced “sympathetic” lateral pile movement (per Section 4.B) was found to be minimal (flexural DCR < 0.35; shear DCR < 0.25) and concentrated at significantly lower elevations (approx.. 20’ to 30’ below the pile cap) based on Langan’s analysis for pile element evaluation - See Appendix C for details. In comparison, the impact due to seismic forces was concentrated near the top of the pile (approx.. 3’ to 5’ below the bottom of the pile cap, based on Langan’s analysis – See Appendix C for details). Therefore, for pile element evaluation, the critical sections for the pile evaluation under seismic action were independent of and not impacted by the "sympathetic" pile movements due to excavation induced ground movements.

DCRs including estimated ground movements for piles under the four corner MF columns are between 110-121% of existing DCRs, therefore these elements were flagged for further review. Upon further review, the pile DCRs, including estimated ground movements, are less than or equal to 1.06. Typically, structural engineering industry standard is to deem DCRs less than 1.05 as acceptable. We deem this to be acceptable.

E. <u>Non-Structural Components:</u>

The maximum building tilt is 0.11% and the maximum roof displacement is 3.5 inches in the North-South direction due to the excavation-induced ground movements. The average building tilt at the occupied floors above the 2nd floor is 0.11%. These numbers are well under the H/400 (i.e., 0.25%) serviceability limit for typical steel framed buildings (ref. ASCE 7-10 Appendix C Commentary).

Further, combining excavation-induced ground movements with service level wind loading (10 year mean recurrence interval), the total maximum roof displacement is expected to be approximately 8.7 inches in the North-South direction – this is slightly (10%) over the H/400 limit. However, at a ground movement of approximately 85% of the Brierley estimates, the combined average building tilt at the occupied floors above the 2nd floor is 0.25%, which satisfies the H/400 (i.e., 0.25%) serviceability limit.

From a building serviceability perspective, we expect this to have minimal impact to the building occupants and non-structural components such as building cladding, interior partition walls, ceilings, architectural elements, floor finishes, equipment, utilities, piping, etc.

6. Conclusion and Recommendations

NYA has completed our analysis for the impacts of estimated ground movements on the FDIC building at 25 Jessie Street. Our analysis is based on the estimated ground movements provided by Brierley Associates. The 2016 CEBC and ASCE 41-13 were utilized as a basis for our evaluation and the estimated ground movements were treated as an "alteration" to the building, per the CEBC. Per the CEBC, any alteration that increases the gravity demand to any component by more than 5% and/or increases the seismic DCR by more than 10% requires those elements to be flagged and evaluated based on the new demands. Any flagged elements which have a DCR greater than 1.0 would then require strengthening. Any flagged elements which have a DCR less than or equal to 1.0 would not require strengthening.

Prior to evaluating the building for the estimated ground movements, NYA performed an evaluation of the FDIC Building, primarily to serve as a baseline to compare the impact of the estimated ground movements. The existing building appears to meet all of the serviceability requirements of the CEBC for dead, live and wind loading. The results of our ASCE 41-13 seismic evaluation indicate that the structure generally meets Life Safety performance under a BSE-1n seismic hazard, except for overstress of a few pile foundations and a majority of the pre-Northridge moment frame connections.

With the incorporation of the estimated ground movements, the building still meets all of the code serviceability requirements for dead, live and wind loading. However, a number of elements exceed the gravity and/or seismic DCR triggers, and were flagged for further evaluation. Upon further evaluation, all of the flagged elements that exceeded the gravity trigger, have DCRs less than 1.0 and do not require retrofitting. The majority of the elements that exceeded the seismic trigger have DCRs less than 1.0, however there are three pre-Northridge moment frame connections (two at Mezzanine and one at Level 3) that exceed the 10% trigger by 1-3% and also have DCRs greater than 1.0. These three connections would require retrofitting, should the estimated ground movements become a reality. Likewise, should the actual ground movements exceed the Brierley estimates, additional connections may require retrofitting. Additionally, any changes to the assumed distribution of ground movement across the site will affect the results. For comparison purposes, the three moment connections would not exceed the 10% seismic trigger at a ground movement of approximately 85% of the Brierley estimates. Correspondingly, the maximum building roof displacement, including these ground movements and service level wind loads (10 year return period) will not exceed the H/400 (i.e., 0.25%) serviceability limit for typical steel framed buildings.

There are a number of options available for retrofitting pre-Northridge connections and the retrofit would be localized to the connection. The preferred retrofit concept should one be required, should be developed by the building owner's structural engineer.

Since the ground movements used in our analysis are estimated, we recommend updating our analysis at discrete intervals during construction. We recommend that the base of each column be surveyed and the elevation reported to NYA prior to excavation and at agreed-upon intervals during construction. If any of the surveyed differential elevations between any adjacent columns changes by 3/8" or more, we would recommend initiating the updating of the analysis model with the updated ground movement values and reporting back our updated findings. Subsequent to the initial update, we recommend continuing to update the analysis model if differential elevations between any adjacent columns changes by more than 1/8".

Pre-Northridge connections are not considered a hazard to life safety, since gravity support is typically maintained even if the connection is damaged during an earthquake. Therefore, we would not recommend halting construction should any connections exceed the 10% trigger with a DCR greater than 1.0. At the end of construction, any elements that exceed the Code trigger, and exceed a DCR of 1.0, would require strengthening. Though we don't anticipate serviceability being an issue based on our preliminary analysis, if at any point during construction, the serviceability DCR on any element exceeds 1.0, construction should be halted and all parties should convene to determine the next steps, which could include temporary shoring and/or retrofitting depending on the extent of the overage.

NABIH YOUSSEF ASSOCIATES
STRUCTURAL ENGINEERS

FDIC Building at 25 Jessie Street,

San Francisco, CA

Appendix A

Report by Brierley Associates–

Oceanwide Center, 526 Mission Street, San Francisco, 3D Finite Element Analysis Stage 2: Tower 1 Excavation (Rev. 2), dated July 7, 2017

December 15, 2017

Prepared by:

Nabih Youssef Associates

NYA Project: 17164.01

Prepared for:

Oceanwide Center LLP,

88 First Street, 6th Floor, San Francisco, CA 94105

BRIERLEY ASSOCIATES
Creating Space Underground

MEMORANDUM

DATE: July 7, 2017

TO: Rob Jameson, Malcolm Drilling Company, Inc.

CC: John Morgan and Adam Hinton, Malcolm Drilling Company, Inc.

FROM: AJ McGinn, PhD, PE and Eric Lindquist, PhD, PE

SUBJECT: Oceanwide Center, 526 Mission Street, San Francisco
3D Finite Element Analysis Stage 1: Tower 2 Excavation (Rev. 2)

INTRODUCTION

Brierley Associates performed a three-dimensional (3D) numerical analysis to evaluate the behavior of the shored excavation required for the construction of the Oceanwide Center Tower 2 (T2) basement and elevator pit and to evaluate the potential range of short-term, excavation-induced lateral wall and ground deformations. The two proposed excavations are adjacent to the existing pile-supported high-rise building located at 25 Jessie Street. That building is 18 stories tall, with a footprint that is approximately 90 feet in the east-west direction, 75 feet in the north-south direction, with the east face of the building directly behind the Tower 1 (T1) excavation west wall and the south face of the building located across Elim Alley (about 13 feet away) from the planned T2 excavation north wall. Isometric and plan views of the model and excavation are provided in Figure 1 along with a typical cross-section.

The T2 excavation will be shored with a perimeter cutter soil mix (CSM) wall restrained by three levels of preloaded internal bracing. The elevator pit will be shored with a perimeter CSM wall restrained by two levels of preloaded internal bracing. The current design of the braced CSM wall was developed based on the soil, groundwater and surcharge pressures recommended by Langan, the project geotechnical engineer.

Brierley's modeling efforts utilize soil properties and behavioral assumptions that are generally consistent with the geotechnical data and the interpretation of that data that was presented by Langan in their geotechnical reports and appurtenant appendices.

This 3D model utilizes interface elements, as opposed to the contact elements that were employed in our previous 2D model for the T2 excavation. The CSM walls, drilled shafts and CSM buttress each have interface elements; and, the drilled shafts are modeled as square shapes, not circular in order to reduce the complexity of the mesh and decrease computational time. The 3D model allowed for the incorporation of the elevator pit excavation. This was not modelled in the 2D analysis, as that model replicates plane-strain conditions.

In addition to the above, the piles that support 25 Jessie have been modelled as pile elements with interface elements along their full depth. The load for each pile is applied to the top of the pile and it is distributed with depth based on the strength characteristics of the surrounding soil. Based on parametric studies of the 25 Jessie foundation load application we have performed it appears that the piles are distributing the surcharge load to the soil layers in a reasonable manner. Note that ground deformations are reset to zero in the model after the 25 Jessie piles load is applied but before the next steps in the model are processed. Note that we are running a couple of additional analyses to confirm the modeling software is resetting the ground deformations in the manner we expect

It should be noted that changes to the assumed sequence of construction and phasing of the two excavations will affect the results of the analysis.

NUMERICAL MODELING FOR BASE HEAVE EVALUATION

Software

The analyses that are summarized in this memorandum were performed using Midas GTS NX, a comprehensive finite element analysis software package that is equipped to handle the entire range of geotechnical applications including deep foundations, excavation, complex tunnel systems, seepage analysis, consolidation analysis, embankment design, dynamic and slope stability analysis.

Although GTS NX is capable of conducting fully-coupled analyses, this modeling effort utilizes a sequential stress – seepage analysis type and a Mohr-Coulomb soil strength criterion. Therefore, it does not capture soil consolidation and strength or deformation property changes over time. The Mohr-Coulomb soil model exhibits linearly elastic behavior until the soil shear strength is exceeded, and then perfectly-plastic deformation at a constant shear stress for failed elements. Therefore, this analysis is considered to provide only a rough approximation of deformation behavior that attempts to simulate steady-state conditions at each major construction stage.

Assumed Soil Profile

An isometric view and representative cross-section that has been analyzed for this study are illustrated in Figure 1. Working from ground surface down the layers that have been modeled are Fill, Dune Sand, Marine Deposits, Colma Sand, Old Bay Clay Crust, Old Bay Clay and Alluvium Colluvium. Layer geometries are based on the boring information and typical soil profiles provided in Langan geotechnical investigation report and appurtenant appendices for this project. The profile that has been analyzed in this study utilizes horizontal layer contacts to reduce computational time.

Excavation and Bracing Geometry and Sequence

Existing grade is assumed at elevation +7 ft. The general subgrade elevation within the excavation at T2 is assumed to be elevation -58 ft. Internal bracing will be installed at elevations -3 ft -24.5 ft and -41 ft. The additional shored excavation for the elevator pit located near the center of the T2 footprint is assumed to be elevation -72 ft. The elevator pit is assumed to have two levels of internal bracing at elevations -60.5 ft and -65.5 ft. Prior to the installation of each bracing level, the excavation will be advanced to 3 feet below the specified bracing elevation. The groundwater level inside the excavation will be drawn down progressively.

Per the submitted T2 CSM Wall design calculations, the groundwater level inside the excavation is specified to be lowered to 5 feet below bottom of excavation at all intermediate excavation stages and a minimum of 3 feet below general subgrade during the final stage of mass excavation.

Assumed Soil Properties

Table 1: Soil Properties

Unit	Unit Weight (pcf)	Ko	c (psf)	ϕ' (deg)	E (ksf)	ν
Fill	120	0.47	0	32	278	0.20
Dune Sand	125	0.60	0	36	605	0.35
Marine Deposits	100	0.60	$0.60\sigma'_z$	0	563	0.49
Colma Sand	133	0.60	150	36	2089	0.35
Old Bay Clay Crust	116	0.70	3500	0	1066	0.49
OBC (Case D)	112	0.70	$0.31\sigma'_z$	0	1336	0.49
Alluvium/Colluvium	125	0.50	0	32	2768	0.45
Bedrock	NA	NA	NA	NA	NA	NA

The Marine Deposits and Old Bay Clay were assumed to behave as undrained materials beginning with stress changes that are applicable to the first dewatering stage. The Old Bay Crust was assumed to be six feet thick and behave as an undrained material inside and outside of the excavations. The crust is modelled with an undrained strength of 3,500 psf based on Stress History and Normalized Soil Engineering Properties (SHANSEP) correlations with over-consolidation ratios. However, additional geotechnical testing data received on 6/4/17 report undrained strengths between 1,500 and 4,000 psf in the depth range from 75 to 90 FT below grade. As such the 3,500 psf used in this analysis may be non-conservative.

A Poisson's ratio of 0.49 was applied to the materials that are assumed to behave in an undrained manner. Therefore, this analysis is considered to provide only a rough approximation of deformation behavior prior to the dissipation of excess positive, or negative, soil pore pressures over time.

It should be noted that for the 3D analysis we added some effective cohesion (150 psf) to the Colma Sand to prevent passive failure within the ground at the elevator pit during pre-loading of the upper level. The effective friction angle was lowered from 38 degrees to 36 degrees to approximate the failure envelope for the 38 degree value.

Properties of CSM Wall, Internal Bracing, Drilled Shafts and Soil-Cement Buttresses

The CSM walls have been modeled using 3-foot thick elastic elements. For each case, the depth of CSM wall is 116 ft. Note that the wall depth in the current CSM plan is 115 ft. The flexural wall stiffness utilized in the model is based on the section properties of 30-in deep wide flange soldier piles alone without any contribution from the soil-cement. We understand that Malcolm plans to use W33 sections at the T2 excavation, which are stiffer than a W30 section, but this difference does not warrant reanalysis at this time. The flexural and lateral bracing stiffness values are provided in Table 2.

6.5-foot diameter drilled shafts to rock are included within the modeled cross-section. An equivalent square cross-section was used in lieu of circular shapes as discussed previously. We have used solid state elements with interface elements to model these structural elements, see Figure 1 for approximate locations, with an area of 33 ft^2 and a cracked moment of inertia of 44 ft^4, which is half the calculated value. We assumed a Young's modulus value of 1,450 ksi, which is consistent with earlier studies. The drilled shafts were assumed to have a fixed support at the bedrock surface. Interface elements have been employed to model the soil-structure interaction between the drilled shafts and the soil below subgrade.

Table 2: T2-25 Jessie CSM Wall Properties

Wall	Top Elevation	Bottom Elevation	Total Depth (feet)	Top 35' EI (k-in^2/ft)	35'-94' EI (k-in^2/ft)	>94' EI (k-in^2/ft)
25 Jessie	+7	-109	116	66,700,000	94,975,000	66,700,000
Other perimeter	+7	-82	89	66,700,000	94,975,000	NA
Elevator Pit (E-W)	-53.5 (top of pile) -58 (shored grade)	-82	28.5	5,267,450 (W14x90 throughout whole depth)		
Elevator Pit (N-S)	-55 (top of pile) -58 (shored grade)	-87	32	7,276,360 (W14x120 throughout whole depth)		

Unreinforced 3-foot thick CSM buttresses extend 24 feet perpendicular to the CSM shoring wall from ground surface to a depth of 116 feet below ground surface were employed in the model. However, nominal reinforcement, W14s at 12 ft centers along the panel length will be installed in the field. The soil-cement has been modeled with elastic properties correlated to an average unconfined compressive strength of 150-200 psi. Assumed deformation parameters are presented in Table 3. Elastic interface elements have been employed to model the soil-structure interaction between the soil-cement and in situ ground conditions.

Table 3 – Soil-Cement Properties

E (psi)	ν
40,000	0.2

Interfaces

Interface elements were used for the 3D model with k_n (normal stiffness) and and k_t (tangential stiffness) determined automatically for the interface elements by the "Interface Wizard", which is a feature of the Midas software. This program function automatically assigns interface parameters at the T2 wall interfaces. Those assigned parameters are listed in Table 4.

Table 4 – Elastic Interface Element Properties

Interface	E_{OED}(psi)	G(psi)	k_n	k_t	k_t/G
Fill to CSM Wall	2144	804	1800	165	0.205
Dune Sand to CSM Wall	6742	1556	3500	315	0.202
Marine Deposits to CSM Wall	7323	1417	3170	290	0.205
Colma Sand to CSM Wall	19528	5580	12500	1300	0.233
Old Bay Clay Crust to CSM Wall	9966	2847	5500	490	0.172
Old Bay Clay to CSM Wall	9966	2847	5500	490	0.172
Buttresses to CSM Walls	53846	15385	80000	4000	0.269
Shafts to Colma Sand	19528	5580	12500	1300	0.233
Shafts to Old Bay Clay Crust	9966	2847	5500	490	0.172
Shafts to Old Bay Clay	9966	2847	5500	490	0. 172
Shafts to Alluvium/Colluvium	25873	7392	15000	1500	0.203

Internal Bracing

The internal bracing has been modeled using solid state structural elements that have the same structural properties as those shown on the temporary support of excavation design documents prepared by Brierley, which is a departure from the 1-D truss elements at 3-foot spacing that were used in the 2D models. For this study, each main excavation strut is pre-loaded to 50% of its maximum ASD compression demand. The ASD compression demand for each strut can be found in Brierley's bracing design calculations for the T1 and T2 bracing. The struts at the elevator pit excavations are specified to be preloaded to 100% of their ASD design load; however, these values need to be reduced slightly for modeling purposes to avoid local passive failures behind the elevator pit shoring walls.

In the analysis, each bracing level is installed and preloaded prior to the next stage of excavation.

We understand that the project team agreed to reduce main basement excavation bracing level one pre-load values to 35 to 40% of the design load and that the other levels will be pre-loaded to 75% of the design value. Those updated preloads have not been incorporated into this analysis.

<u>SUMMARY OF RESULTS</u>

Previous Analysis

Tables 5 and 6 present a summary of the numerical analyses performed to date for the T2 excavation by Brierley (baseline) memorandum dated December 6th, 2016 and February 3rd, 2017.

The values present in Table 5 for our three baseline analyses do not include interface elements and were taken at ground surface. Because interface elements were not used in our initial 2D models (Table 5), heave associated with the excavation masks the settlement behind the wall, especially in close proximity to the wall.

Table 5: Comparison of Numerical Results to Date

Date	Case	Notes	Strength Correlation	Undrained Shear Strength (psf)	FS on OBC Strength	Basal Heave (in.)	Wall Δh (in.)	Building Δv s (in.)	Building Δv n (in.)
12/6/2016	Baseline	No reinforcemnt	0.31*s'v	2300	1.3	15.2	2.0	1.3	0.5
12/6/2016	Baseline	Drilled shafts	0.31*s'v	2300	1.3	16.1	1.5	1.0	0.5
12/6/2016	Baseline	Buttresses	0.31*s'v	2300	1.3	8.3	1.4	1.0	-0.2

The reader is referred to our memorandum dated February 3rd for a discussion on the results for Cases A through D presented in Table 6. The 3D model is based on Case D, lower tangential stiffness input parameters.

Table 6: Tower 2 2D Analysis Deformations

2/3/2017		Wall Displacement						Ground Surface		Near Pile Tip	
	Tangential	Top	B1	B2	B3	Max	Heave	Δv 13 ft	Δv 88 ft	Δv 13 ft	Δv 88 ft
Case	Stiffness	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)
A	Lower	0.7	1.1	1.7	2.0	2.2	9.7	1.9	1.2	1.0	0.6
A	Upper	0.4	0.8	1.5	1.8	2.0	9.2	1.4	1.1	0.6	0.5
B	Lower	1.1	1.4	1.8	2.2	2.6	7.5	2.1	1.4	1.4	0.8
B	Upper	0.5	0.8	1.4	1.6	1.9	6.6	1.1	1.2	0.5	0.7
C	Lower	1.0	1.3	1.8	2.0	2.4	9.1	2.1	1.3	1.4	0.7
C	Upper	0.4	0.8	1.3	1.6	1.8	4.0	1.2	1.1	0.8	0.8
D	Lower	1.0	1.0	2.0	2.5	2.6	9.7	2.3	1.5	1.6	0.8
D	Upper	0.4	0.8	1.4	1.7	1.9	7.9	1.4	1.2	0.8	0.7

Current Analysis

The surface plan, profile and isometric view of the model are presented in Figure 1. Due to the large lateral extent of the model and the fact that both the T2 and pit excavations were modeled, a simplified soil profile with horizontal contacts was used and slight elevation adjustments were made to accommodate the model grid.

Figure 2 presents contours of total deformation at ground surface. The deep-seated nature of ground deformation can be seen in the pattern of deformation around the perimeter of the excavation with total deformation ranging from 1.0 to 1.3 in. at distance from the excavation. The influence of the piles that support 25 Jessie and the CSM walls around T1 can be seen in the lesser values of predicted total deformation in those areas than elsewhere around the perimeter of the T2 excavation.

Contours of total deformation at the top of the Colma Sand are presented in Figure 3. In this figure, the deep-seated nature of ground deformation is evident around the perimeter of the excavation. Deformations associated with the vertical loads transmitted by the piles to the Colma Sand are noticeable below the limits of 25 Jessie.

Contours of total CSM perimeter wall deformation are presented in Figure 4 for the final excavation stage at T2 25 Jessie. At the north wall, the wall adjacent to 25 Jessie, the maximum total deformation, which is mostly in the lateral direction, is on the order of 1.2 in. and ranges from 0.7 to 0.8 in. with depth. The range of deformations above the bottom of excavation is similar, 0.9 to 1.0 in., at the south wall. The largest total deformation, 1.7 in. occurs along the west wall. At the east wall, the total deformation ranges from 0.6 to 1.0 in.

Figure 5 presents contours of lateral deformation at ground surface in the north-south direction. Ground deformations to the north beneath 25 Jessie are on the order of 0.5 in. and they are approximately 0.3 in. to the south of the excavation.

Figure 6 presents contours of lateral deformation at top of the Colma Sand in the north-south direction. Ground deformations to the north beneath 25 Jessie are on the order of 0.4 to 0.7 in. with a maximum value of 0.8 in. directly behind the wall. They are approximately 0.3 to 0.6 in. to the south of the excavation with a maximum value of 0.7 in. directly behind the wall.

Contours of lateral CSM perimeter wall deformation in the north-south direction are presented in Figure 7. The maximum lateral deformation is on the order of 1.1 to 1.2 in. at both walls near the same elevation. Lateral deformations below the bottom of the excavation range from 0.6 to 0.8 in.

Figure 8 presents contours of lateral deformation at ground surface in the east-west direction. Ground deformations to the west are on the order of 0.1 to 0.5 in. and they are approximately 0.1 to 0.6 in. the east of the excavation.

Figure 9 presents contours of lateral deformation at top of the Colma Sand in the east-west direction. Ground deformations to the west are on the order of 0.4 to 0.7 in. with a maximum value of 1.2 in. directly behind the wall. They are approximately 0.4 to 0.8 in. to the east of the excavation with a maximum value of 0.9 in. directly behind the wall.

Contours of lateral CSM perimeter wall deformation in the east-west direction are presented in Figure 10. The maximum lateral deformation is on the order of 1.7 in the west wall and 1.0 in. at east wall. Lateral deformations below the bottom of the excavation range from 0.6 to 0.8 in.

Figure 11 presents contours vertical deformation at ground surface. Ground deformations range from 0.6 to 1.3-in. around the perimeter of the excavation. They are predicted to be less under the 25 Jessie structure, on the order of 0.3 to 0.8 in., due to the presence of the piles.

Contours of vertical deformation at the top of the Colma Sand are shown in Figure 12. Around the perimeter of the excavation the vertical deformation ranges from 0.6 to 0.8 in. Under 25 Jessie the deformation ranges from 0.2 to 0.6 in., with the larger deformations occurring along the northern edge of the building.

Contours of major principal stress in the drilled shafts are shown in Figure 13. The maximum tensile stress predicted in the drilled shafts ranges from 235 to 278 psi and is primarily located on the edge of the shaft that faces away from the perimeter CSM walls.

Contours of minor principal stress in the drilled shafts are shown in Figure 14. The maximum compressive stress predicted in the drilled shafts ranges from 107 to 124 psi.

Figures 15 and 16 present contours of major principal stress and minor principal stress, respectively. The maximum tensile stress is 27 to 37 psi near the top of the CSM buttresses at the edge farthest from the CSM wall. The maximum compressive stress is 196 psi located at the top of the buttresses where they contact the CSM perimeter wall adjacent to 25 Jessie.

Figure 17 presents an isometric view of the elevator pit excavation and shows the lateral support system within the excavation. There are two levels of support in the excavation.

Contours of total deformation for the elevator pit CSM walls are provided in Figure 18. Total deformations in the wall range from 0.8 to 0.85-in.

Contours of lateral displacement for the elevator pit CSM in north-south direction are presented in Figure 19. Maximum lateral deformation in the north-south direction on the north and south walls are on the order of 0.4 to 0.5 and 0.2 to 0.3 in., respectively, while negligible deformation is predicted in the east and west walls.

Contours of lateral displacement for the elevator pit CSM in east-west direction are presented in Figure 20. Maximum lateral deformation in the east-west direction on the east and west walls are on the order of 0.1 to 0.3 and 0.4 to 0.5 in., respectively, while negligible deformation is predicted in the north and south walls.

Time Dependent Soil Behavior

The current modeling utilizes undrained strength parameters for the fine-grained soils (Marine Deposits, Old Bay Clay Crust and Old Bay Clay). As a result, the modeling does not capture the dissipation of pore water pressure and the transition from undrained to drained strength and stiffness over time. As a result, the behavior that is reported herein is different from long-term behavior during and after building construction. This analysis would require a fully-coupled soil-groundwater model that captures the time dependence of the soil properties and changes in stress state. While the models addressed herein may not evaluate stability or geometric deformation in absolute terms, certain behavioral trends can be surmised and the models are considered useful for that purpose.

Concluding Remarks

The purpose of the finite element analysis presented herein was to provide the team with insight about the behavior of the CSM walls, drilled shafts, CSM buttresses and ground inside and outside the excavations for T2 and the elevator pit therein. These should not be taken as absolute values as strength and deformation parameters of the soil might be different than assumed herein. Moreover, the boundary conditions for the 3D model are different from the 2D models performed to date, which replicate plane-strain conditions. Due to the limited dimensions of the elevator pit, it was not modelled in the 2D parametric studies performed to date.

Previous studies have applied pre-load values for Level B1 in the main excavation based on 50% of the loads derived for the full excavation depth. This level of pre-loading in B1 appears to result in outward wall displacement and ground heave effects around the excavation. In reality, it is unlikely that these pre-loads could be generated, or if applied could result in heave impacts to adjacent structures and facilities. As such, models run with those values should be considered as non-conservative with respect to near field and surficial estimated deformation. We understand that the project team has agreed to reduce the main basement excavation bracing level one pre-load values to 35 to 40% of the design load and that other levels will be pre-loaded to 75% of the design value. Those updated preloads have not been incorporated in this analysis, which has applied a preload value of 50% of design load.

It should be noted that we had to add some effective cohesion (150 psf) to the Colma Sand to prevent passive failure within the ground at the elevator pit during pre-loading of the upper level bracing. The effective friction angle was lowered from 38 degrees to 36 degrees to approximate the failure envelope for the 38 degree value.

The predicted deformations levels below the footprint of the 25 Jessie structure are ground deformations, not structural deformation. Estimate deformation of the 25 Jessie structure and the underlying foundation system is outside the scope of this work.

We note that the predicted deformations in this model, particularly near-field effects, are sensitive to interface properties. As such, large scale, deep-seated deformations can be estimated with more confidence compared to deformations immediately adjacent to walls or structural elements.

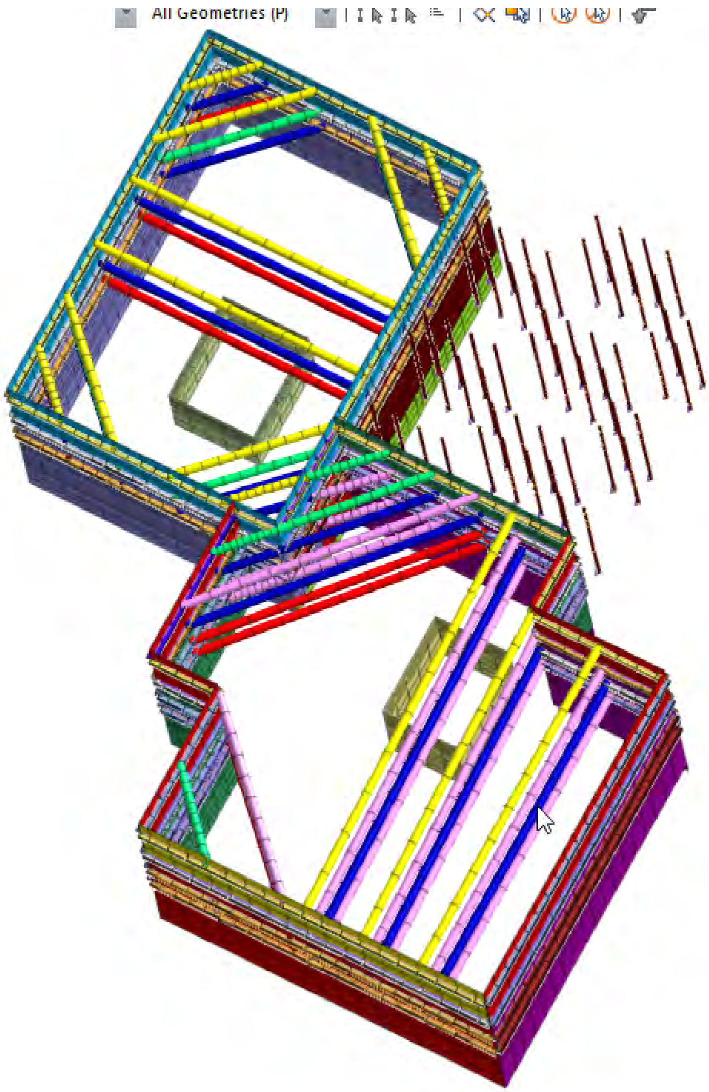

Figure 1a: Isometric View of Stage 1 Excavation

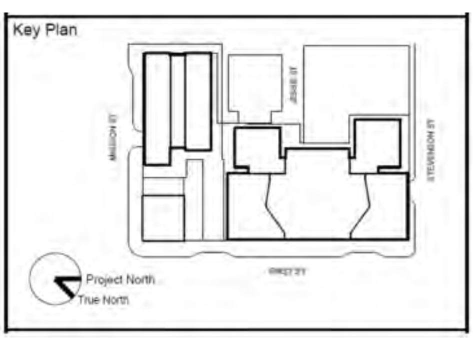

Figure 1b: Key Plan

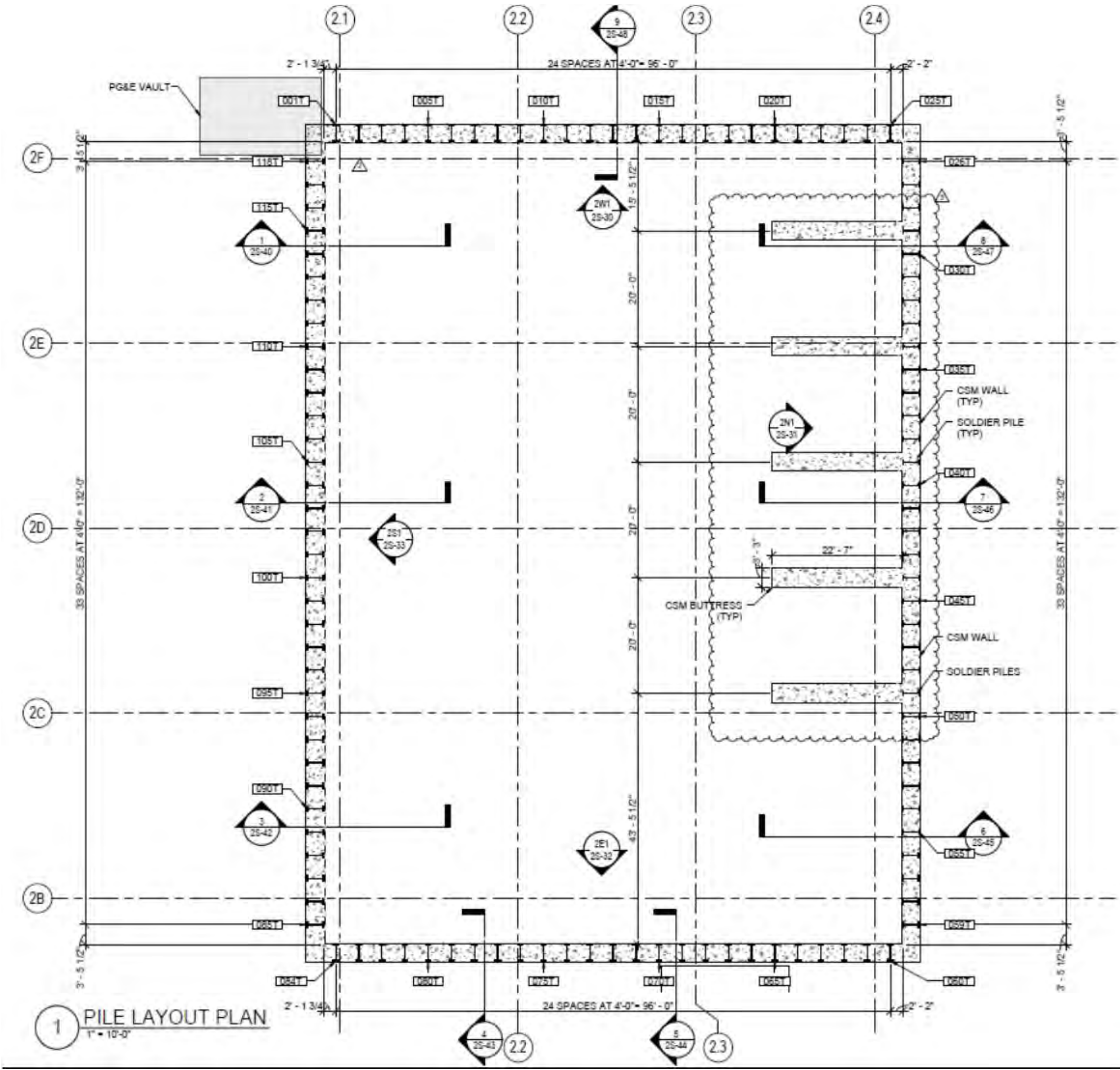

Figure 1c: Tower 2 Excavation Plan

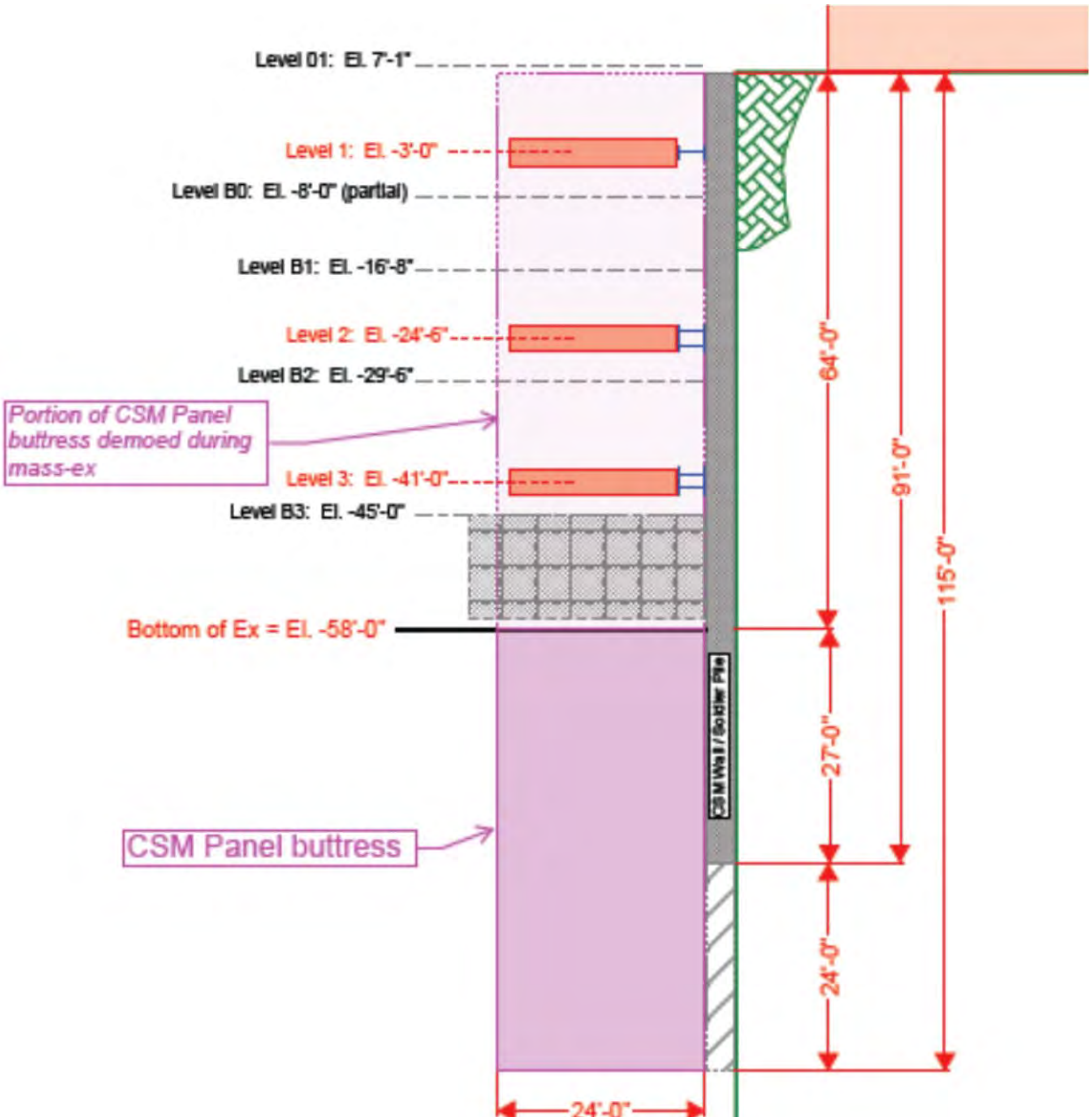

Figure 1d: Tower 2 SOE Cross-Section

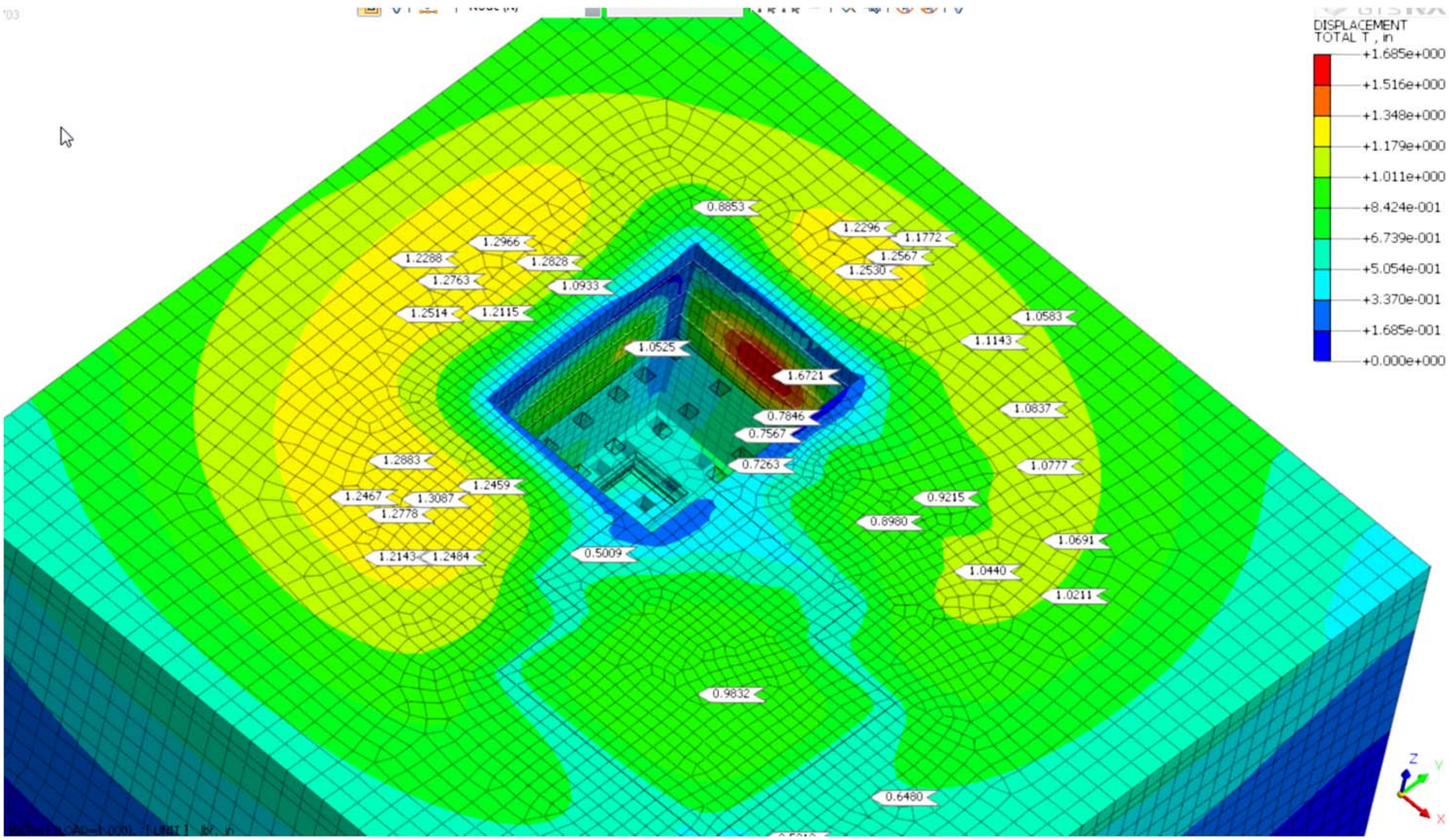

Figure 2: Contours of Total Deformation at Ground Surface, Final Excavation Stage I.

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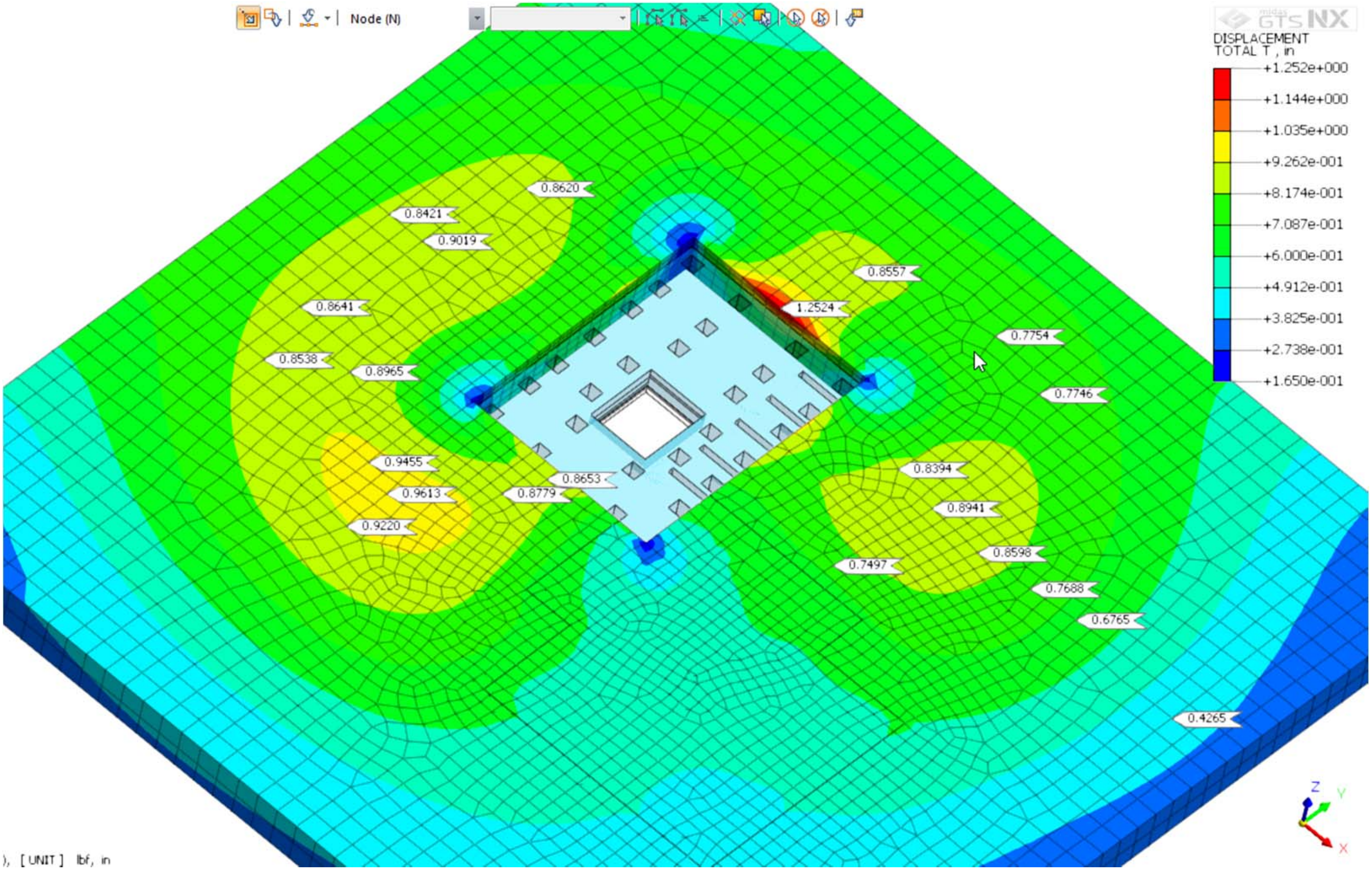

Figure 3: Contours of Total Deformation at Top of Colma Sand, Final Excavation Stage I.

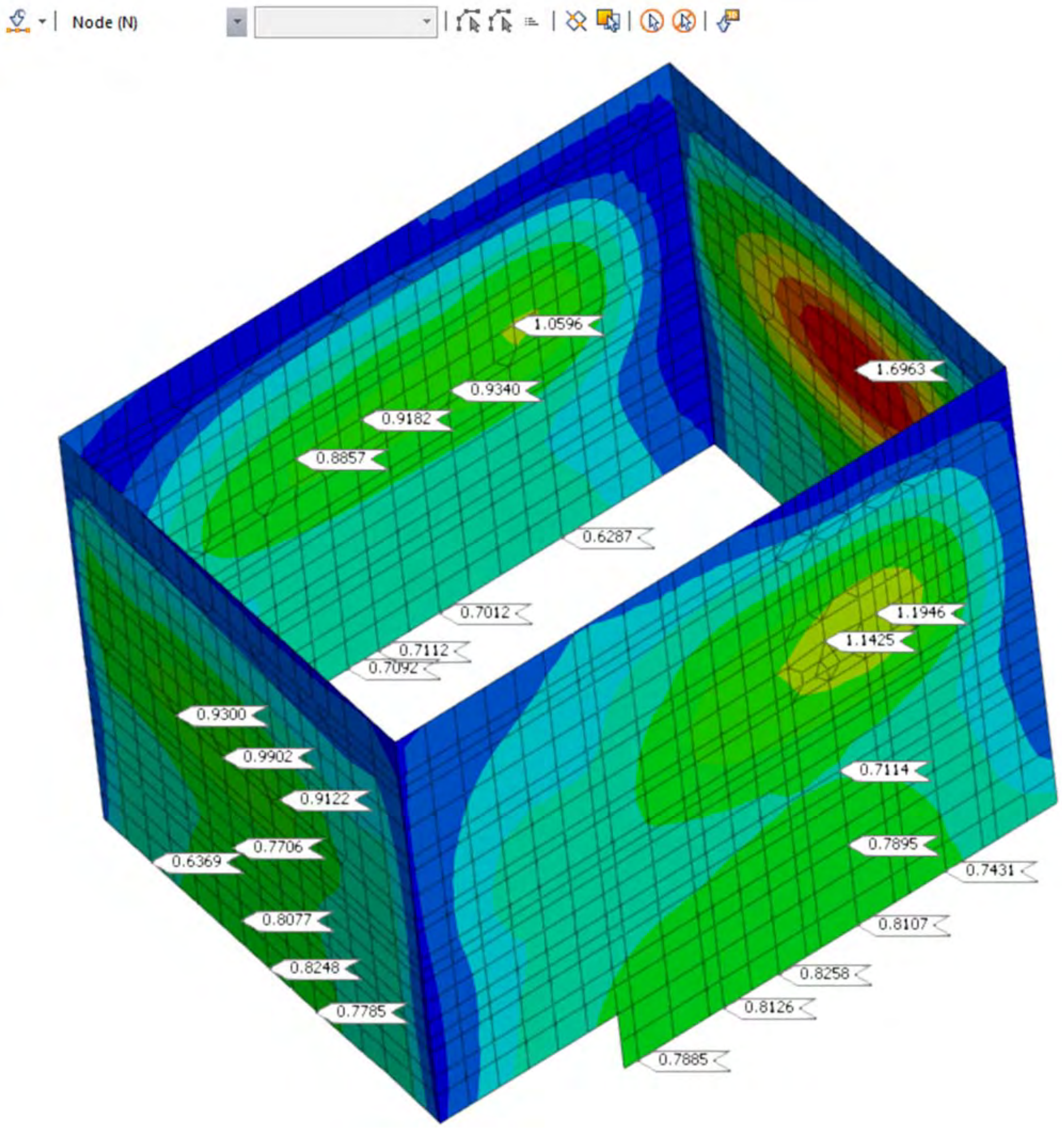

Figure 4: Contours of Total CSM Perimeter Wall Deformation, Final Excavation Stage I.

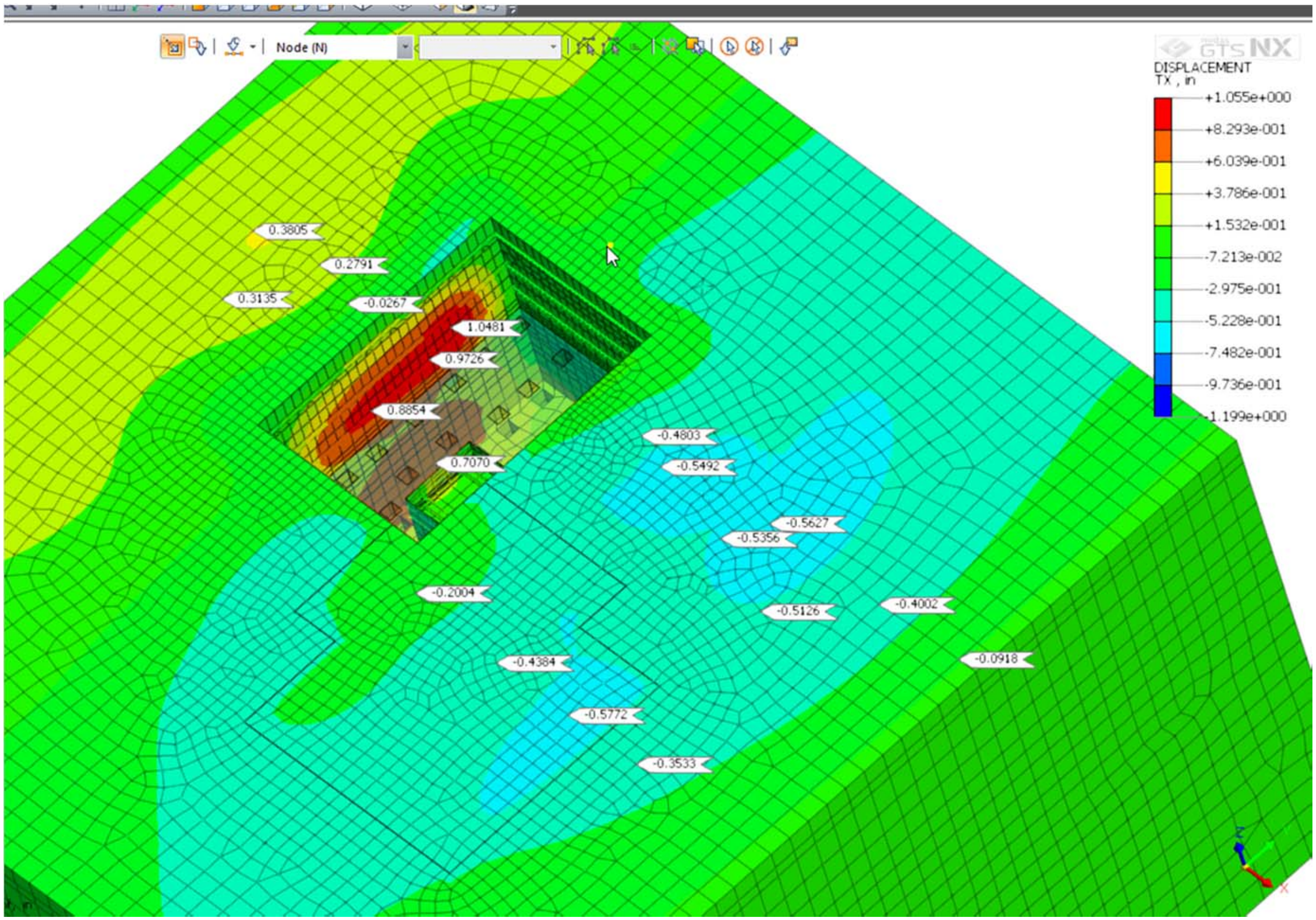

Figure 5: Contours of Lateral Deformation (N-S) at Ground Surface, Final Excavation Stage I.

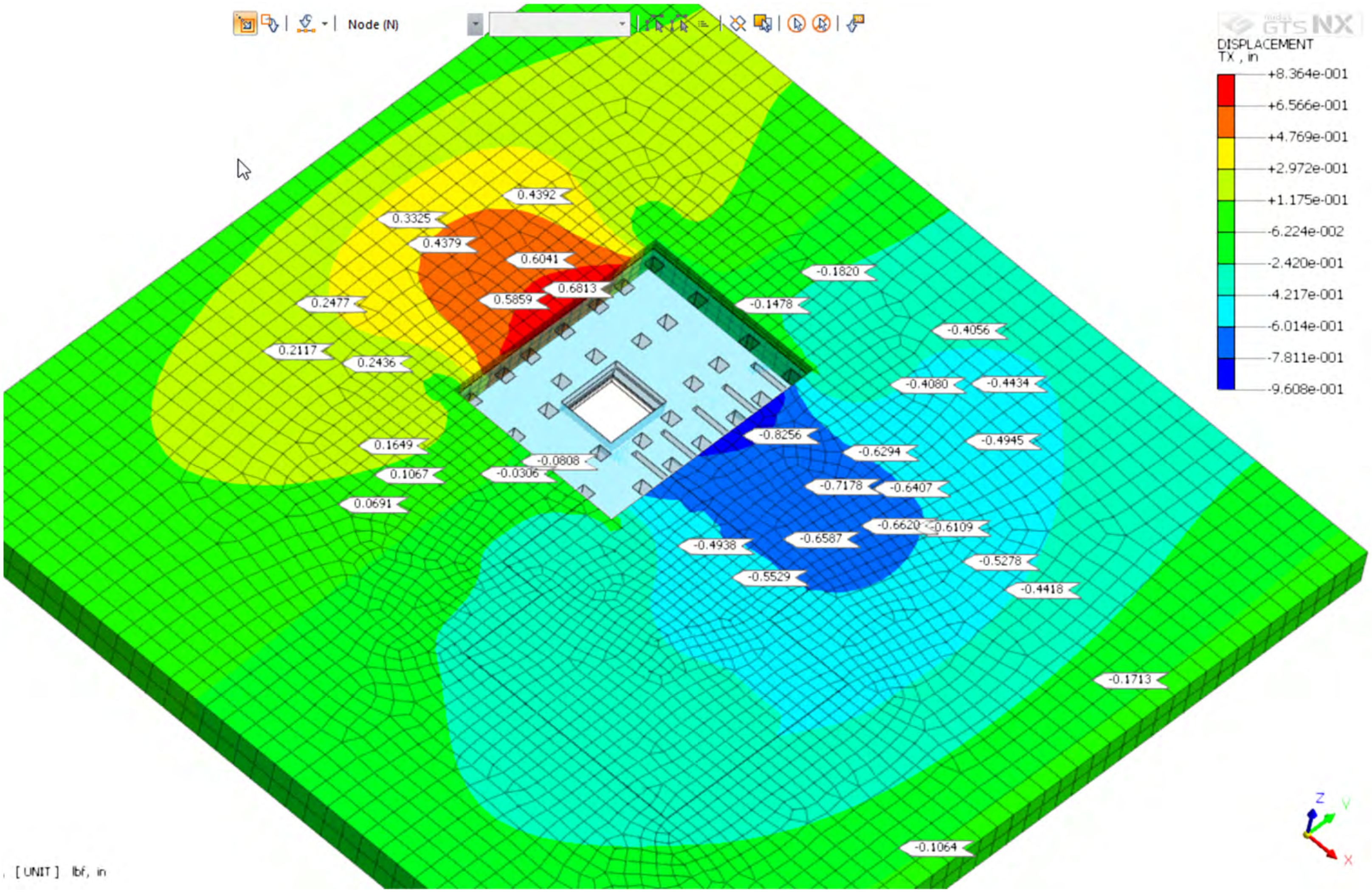

Figure 6: Contours of Lateral Deformation (N-S) at Top of Colma Sand, Final Excavation Stage I.

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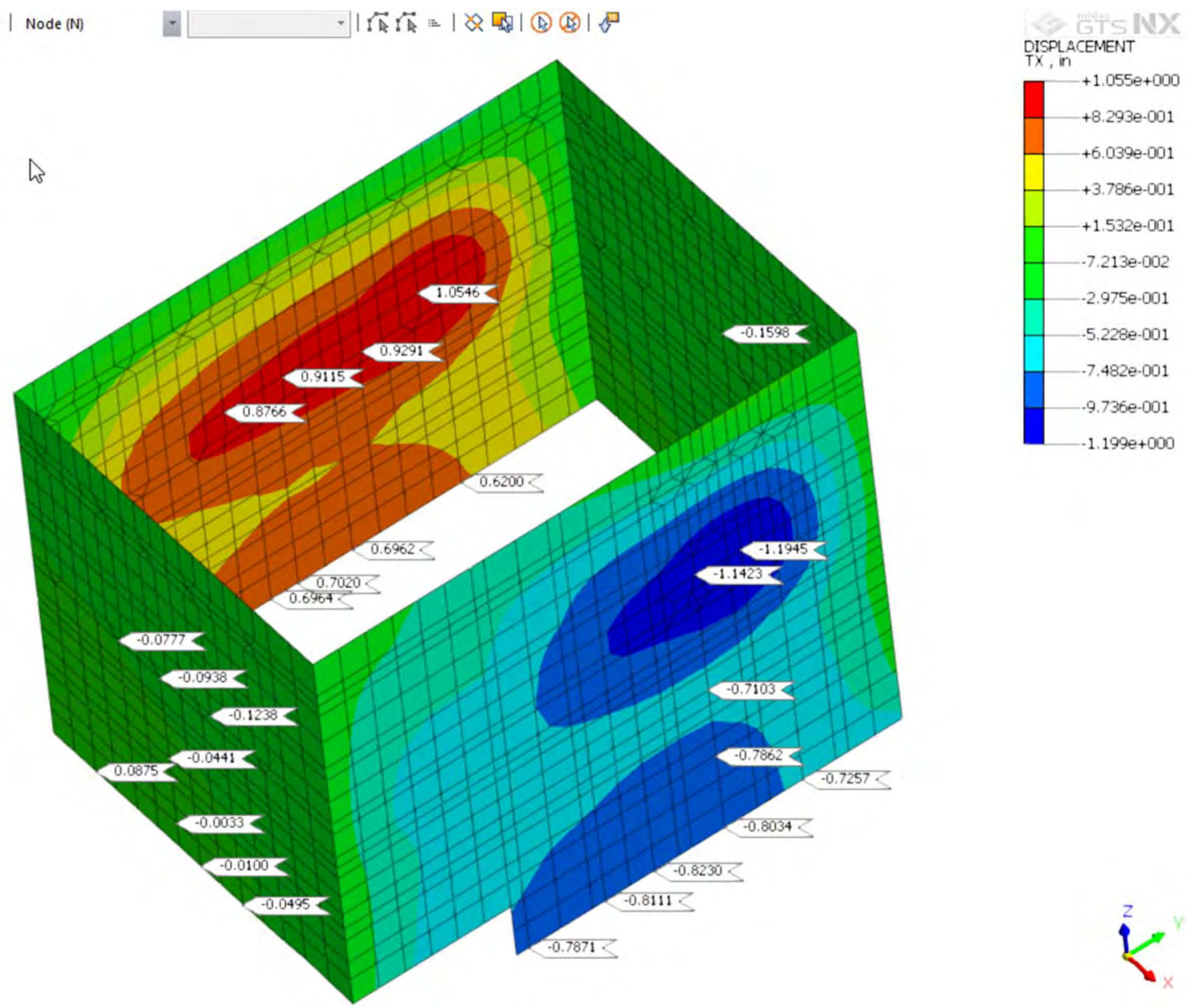

Figure 7: Contours of Lateral CSM Perimeter Wall Deformation, Final Excavation Stage I.

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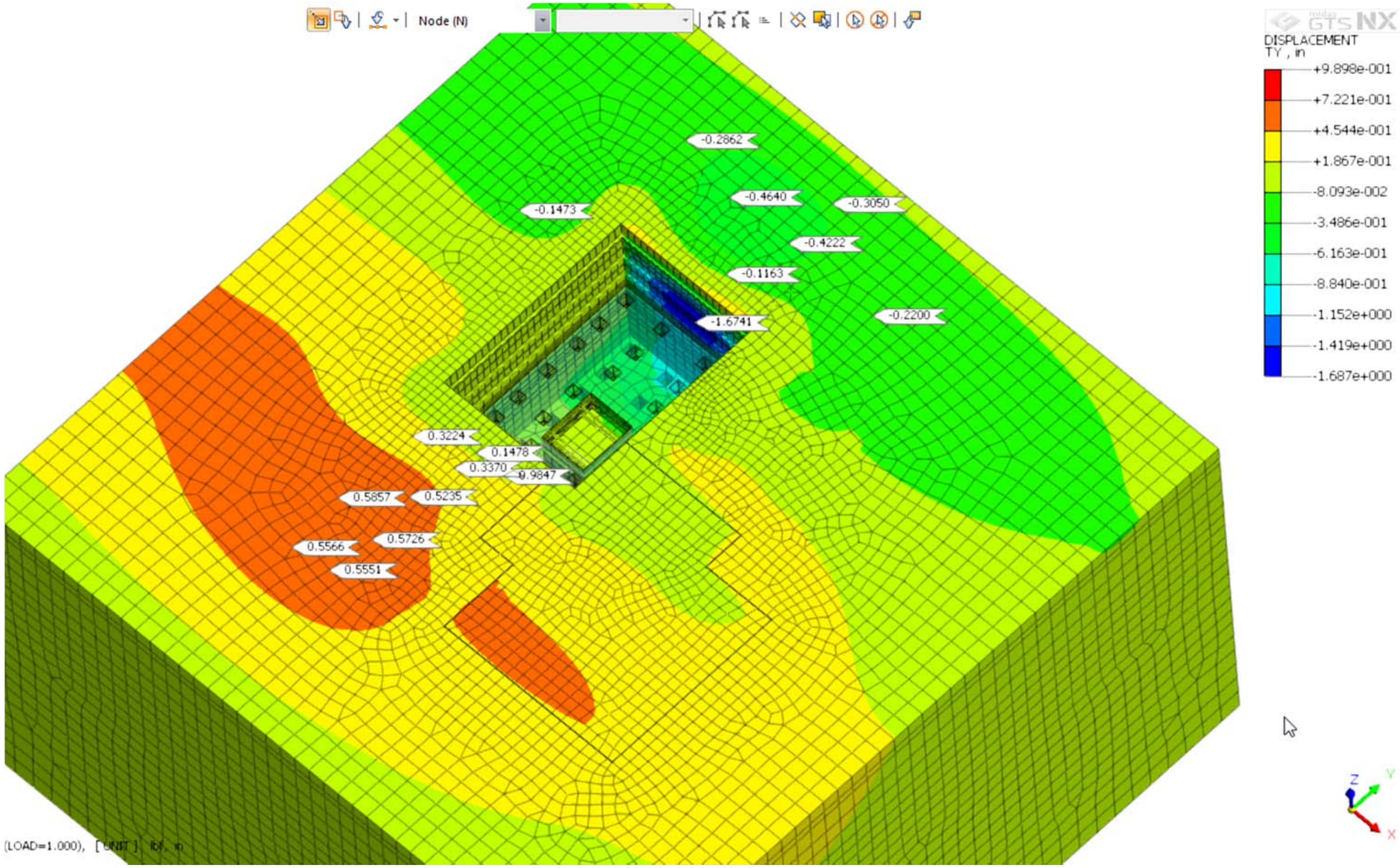

Figure 8: Contours of Lateral Deformation (E-W) at Ground Surface, Final Excavation Stage I.

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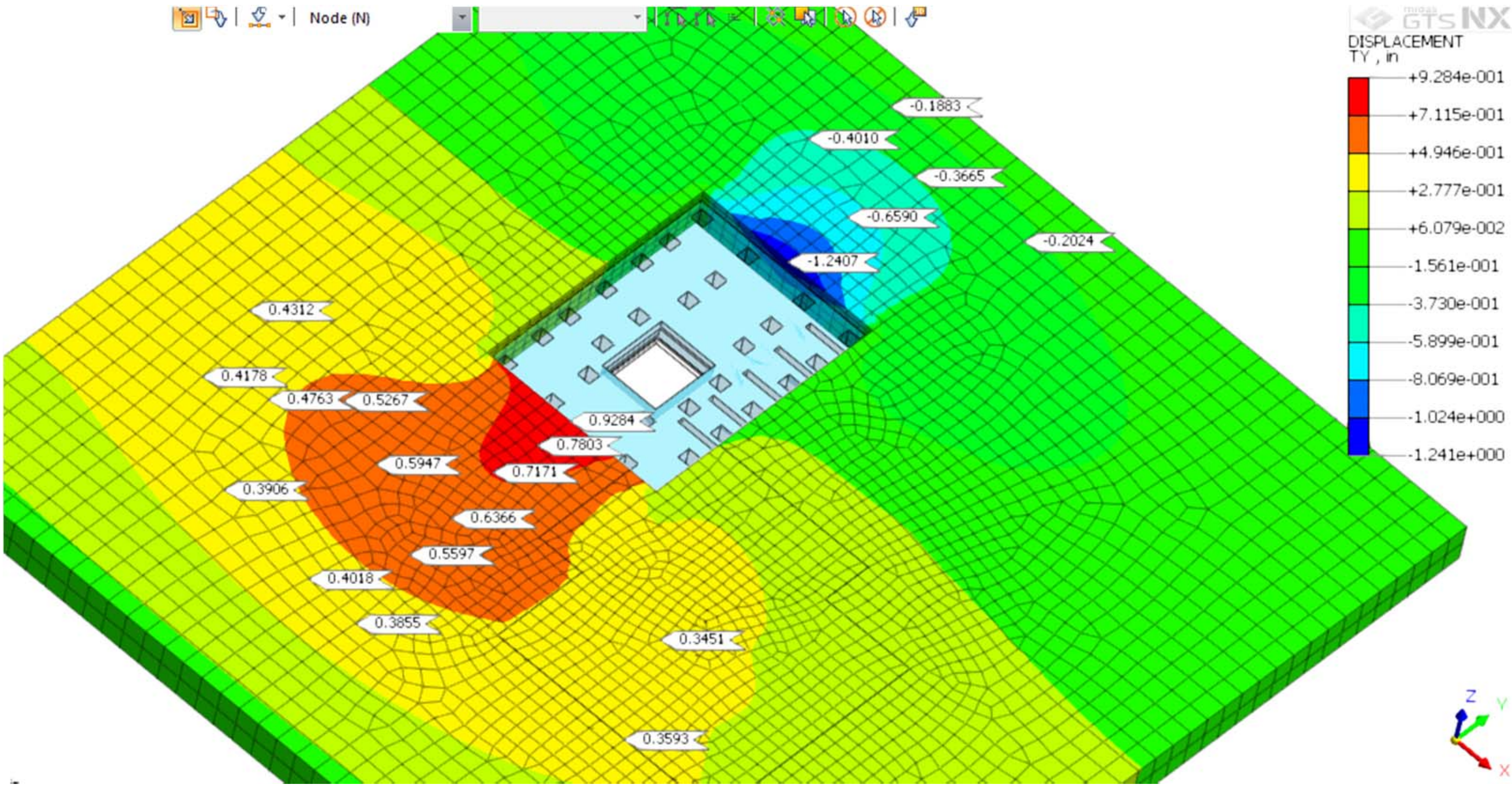

Figure 9: Contours of Lateral Deformation (E-W) at Top of Colma Sand, Final Excavation Stage I.

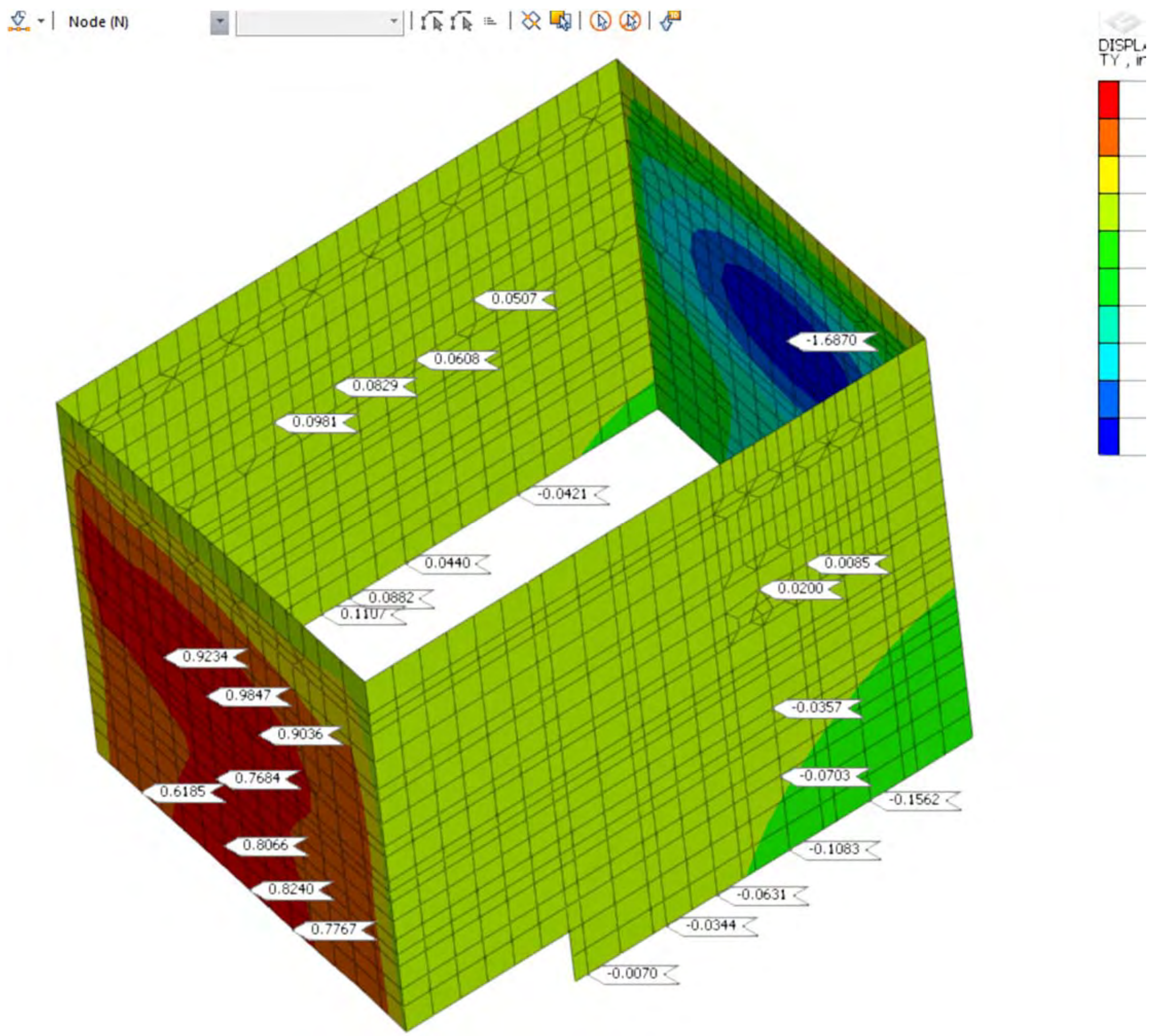

Figure 10: Contours of Lateral CSM Perimeter Wall Deformation (E-W), Final Excavation Stage I.

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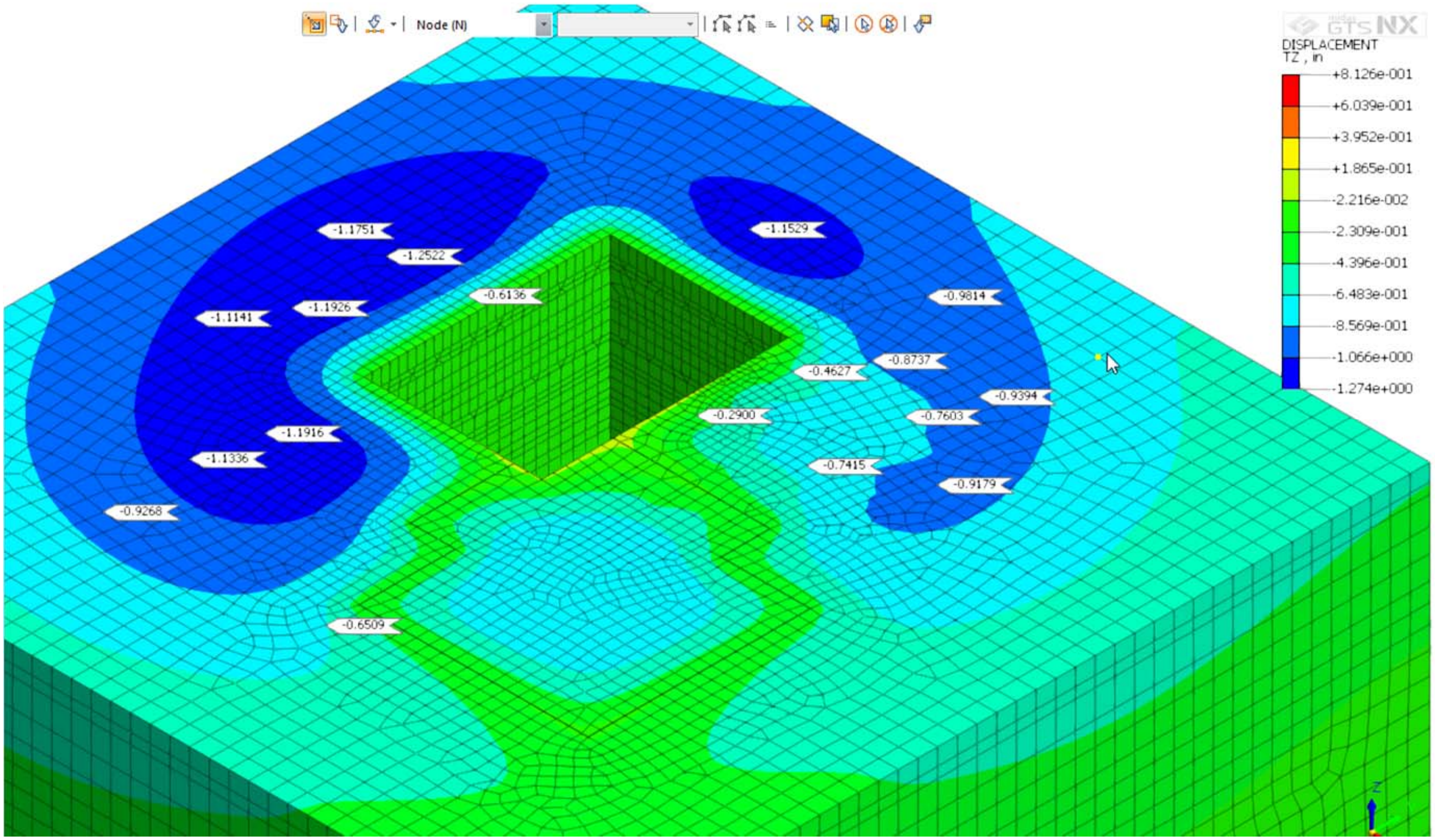

Figure 11: Contours of Vertical Deformation at Ground Surface, Final Excavation Stage I.

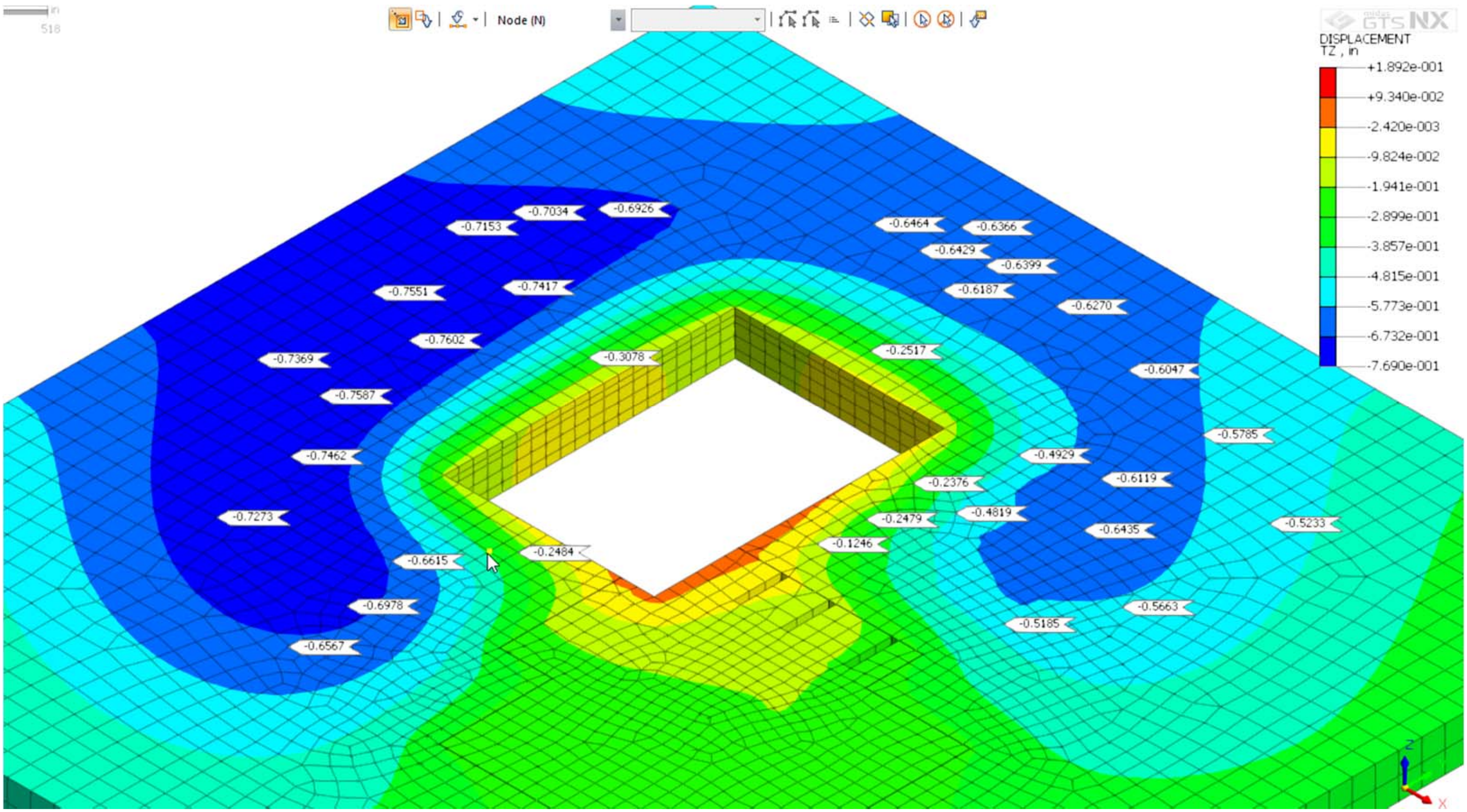

Figure 12: Contours of Vertical Deformation at Top of Colma Sand, Final Excavation Stage I.

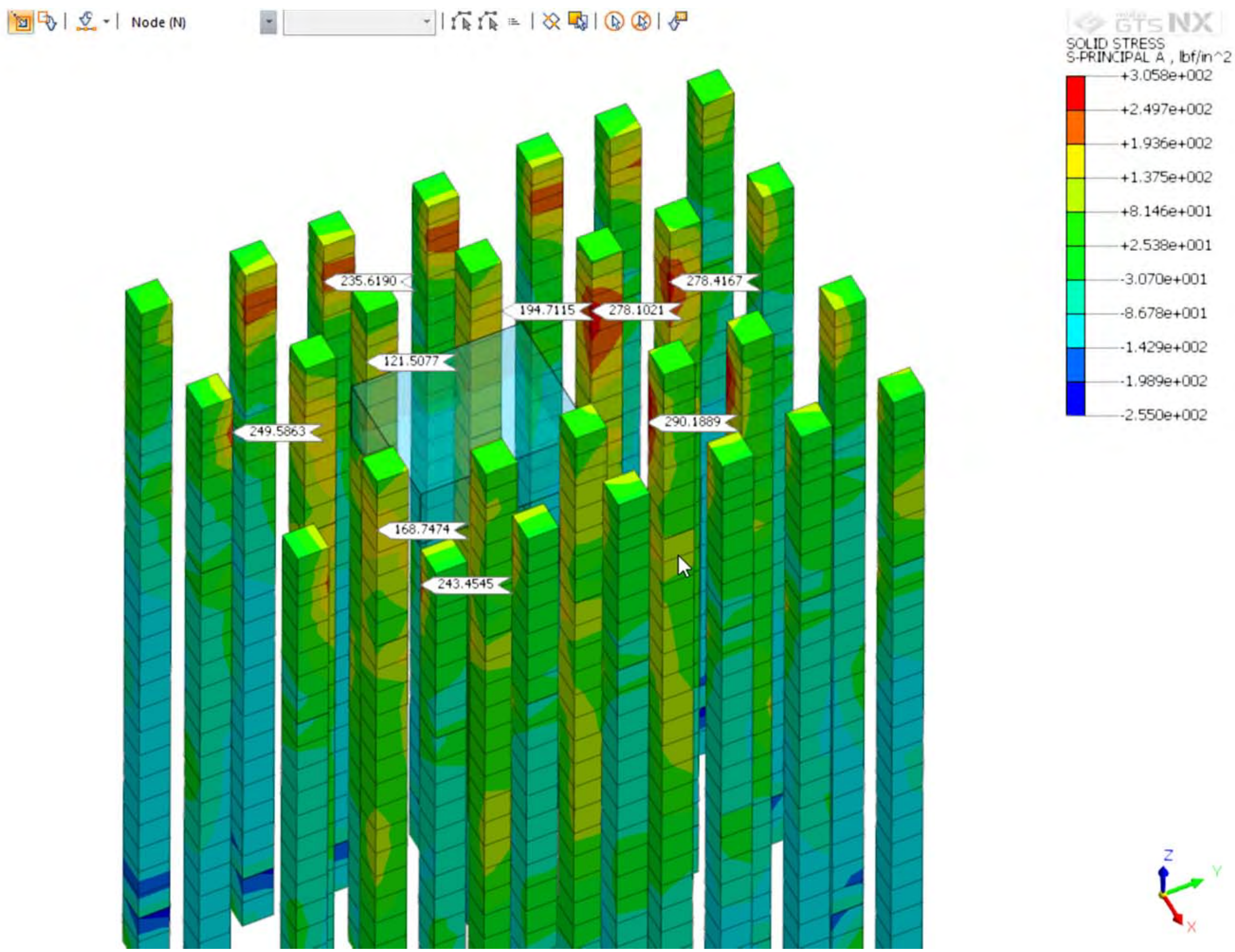

Figure 13: Contours of Major Principal Stresses (Tension) in Drilled Shafts, Final Excavation Stage I.

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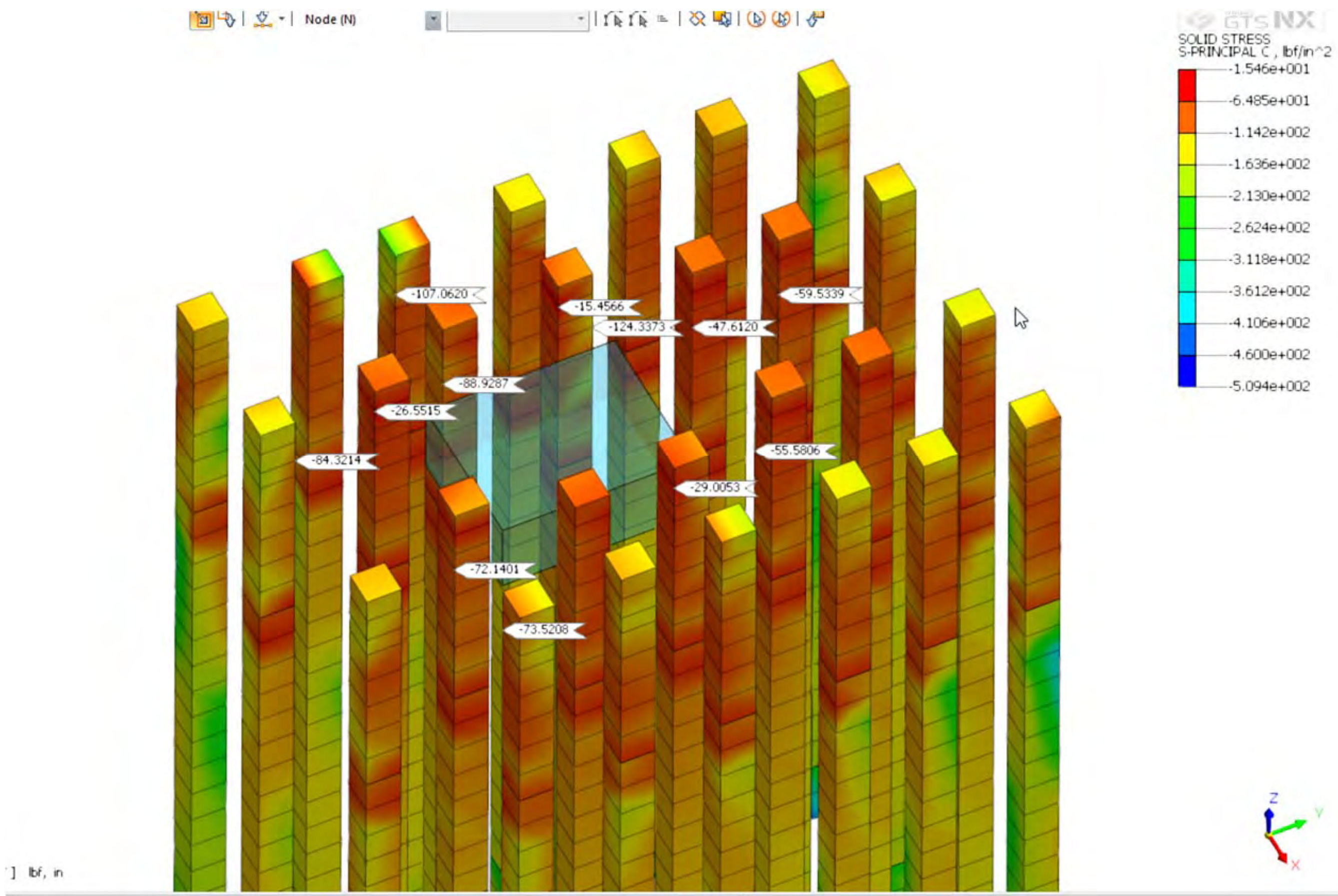

Figure 14: Contours of Minor Principal Stresses in Drilled Shafts, Final Excavation Stage I.

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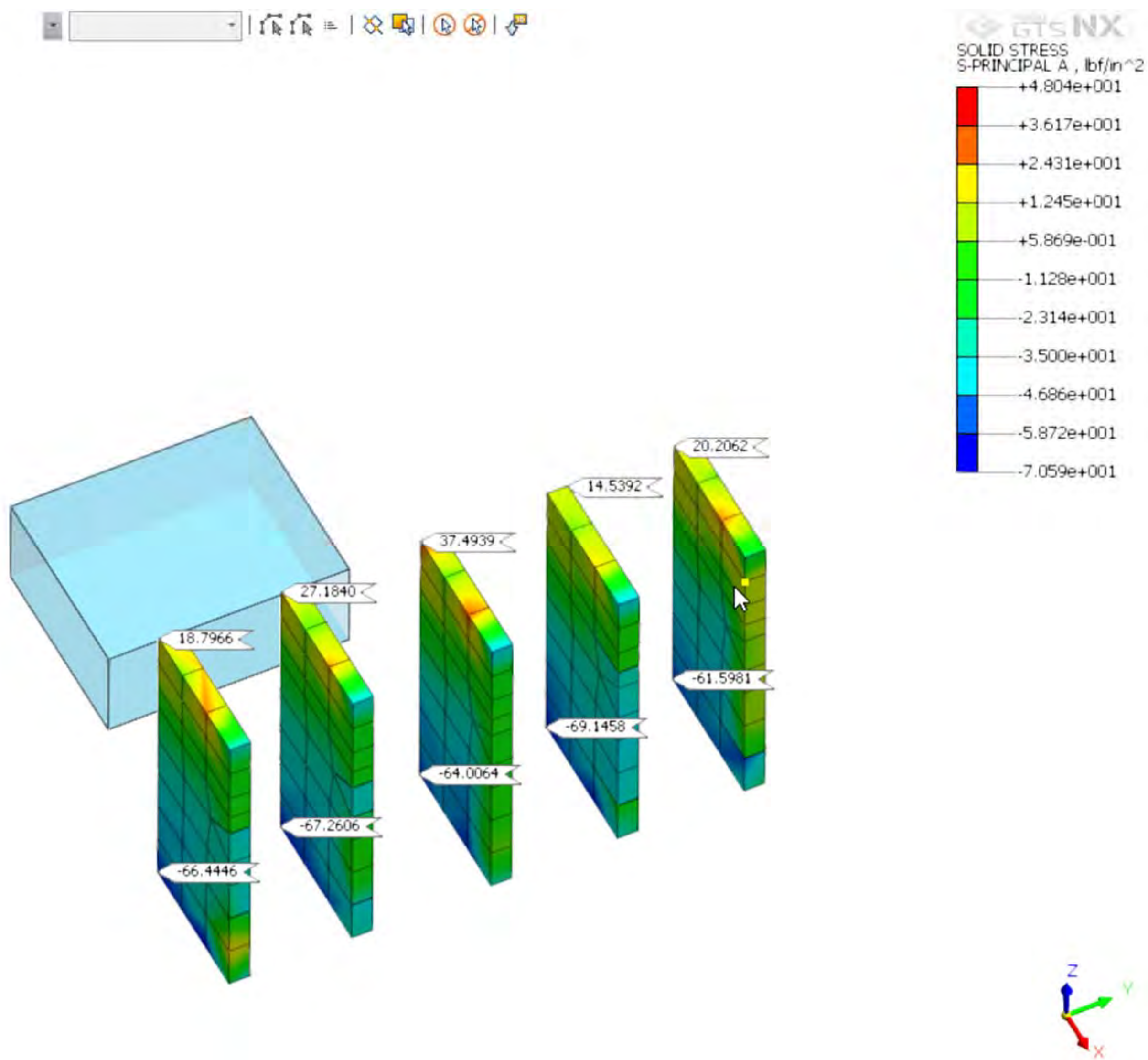

Figure 15: Contours of Major Principal Stress (Tension) in CSM Buttresses, Final Excavation Stage I.

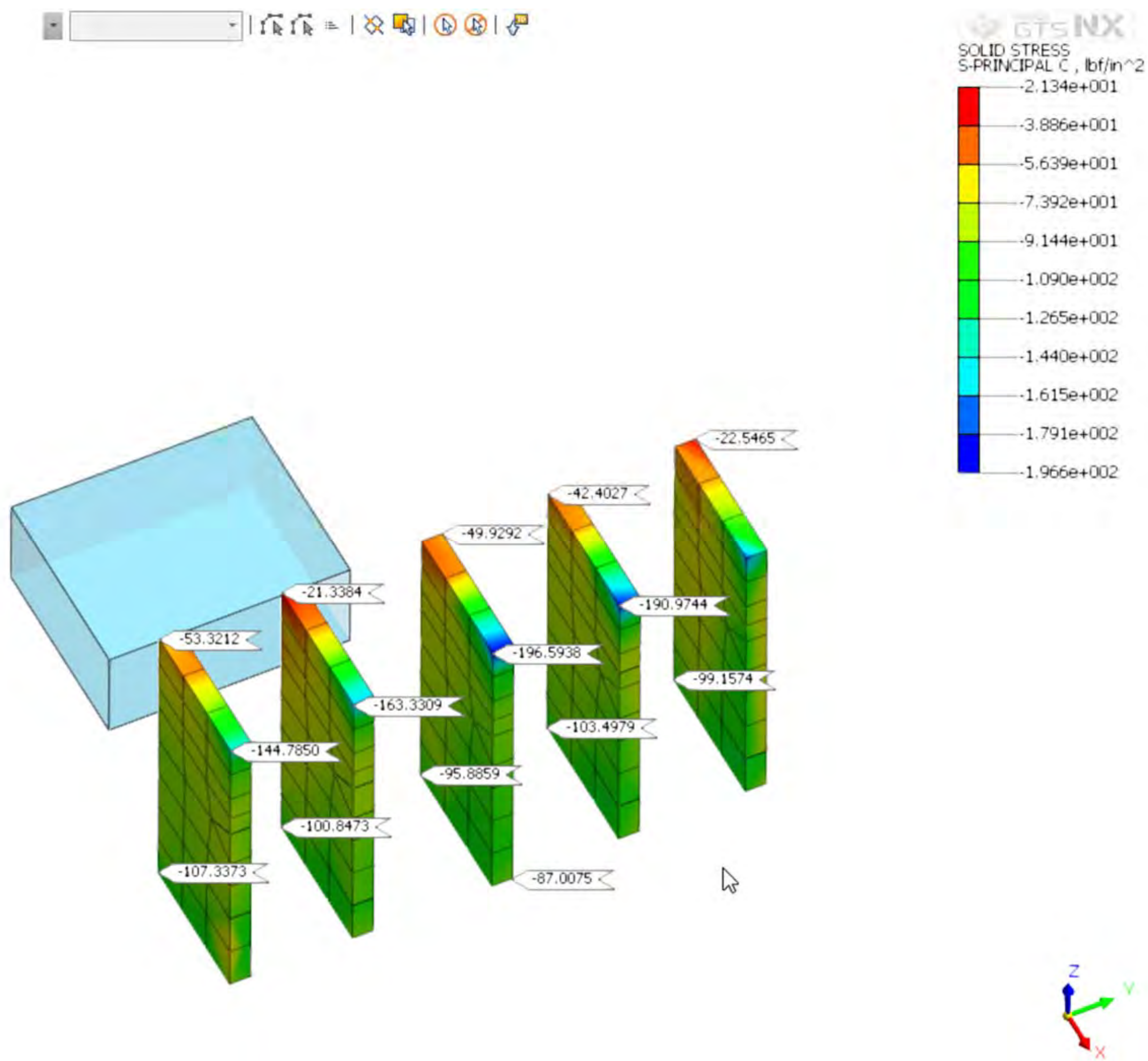

Figure 16: Contours of Minor Principal Stress in CSM Buttresses, Final Excavation Stage I.

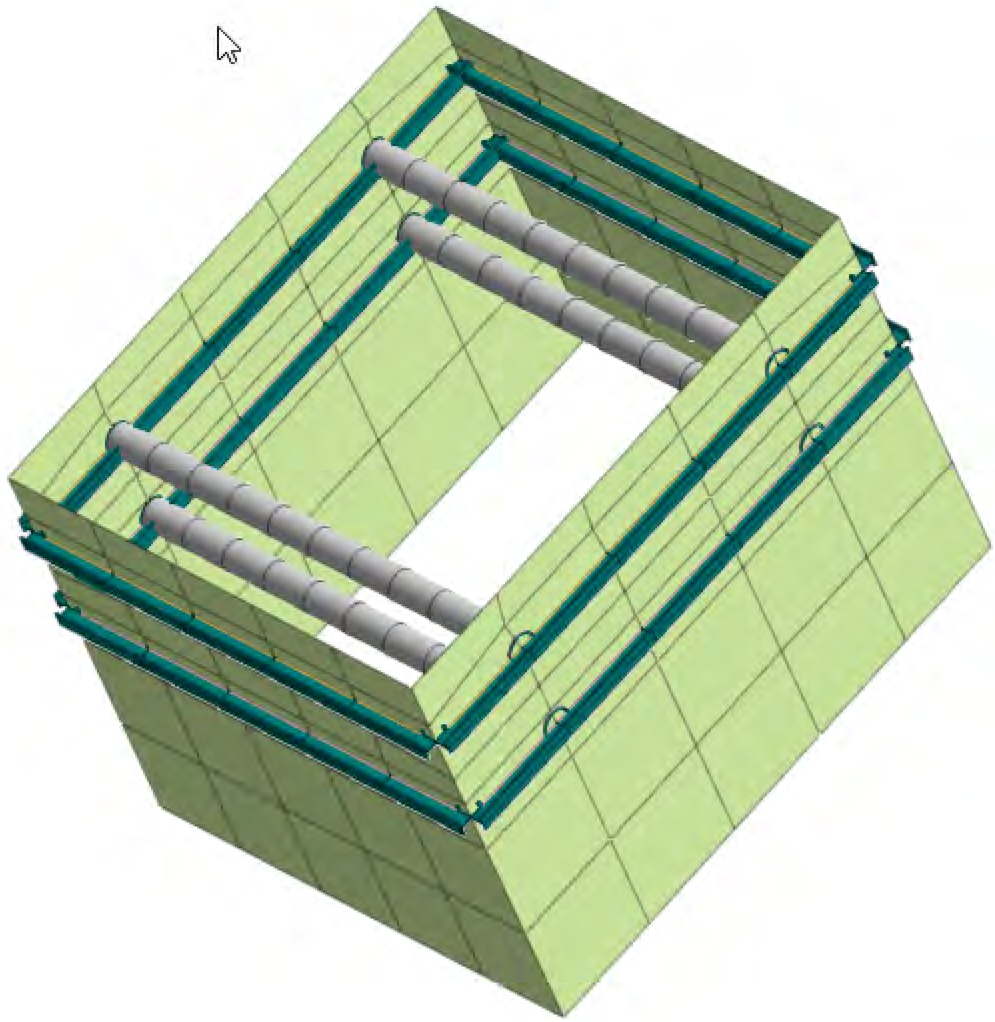

Figure 17: Isometric View of Elevator Pit Excavation.

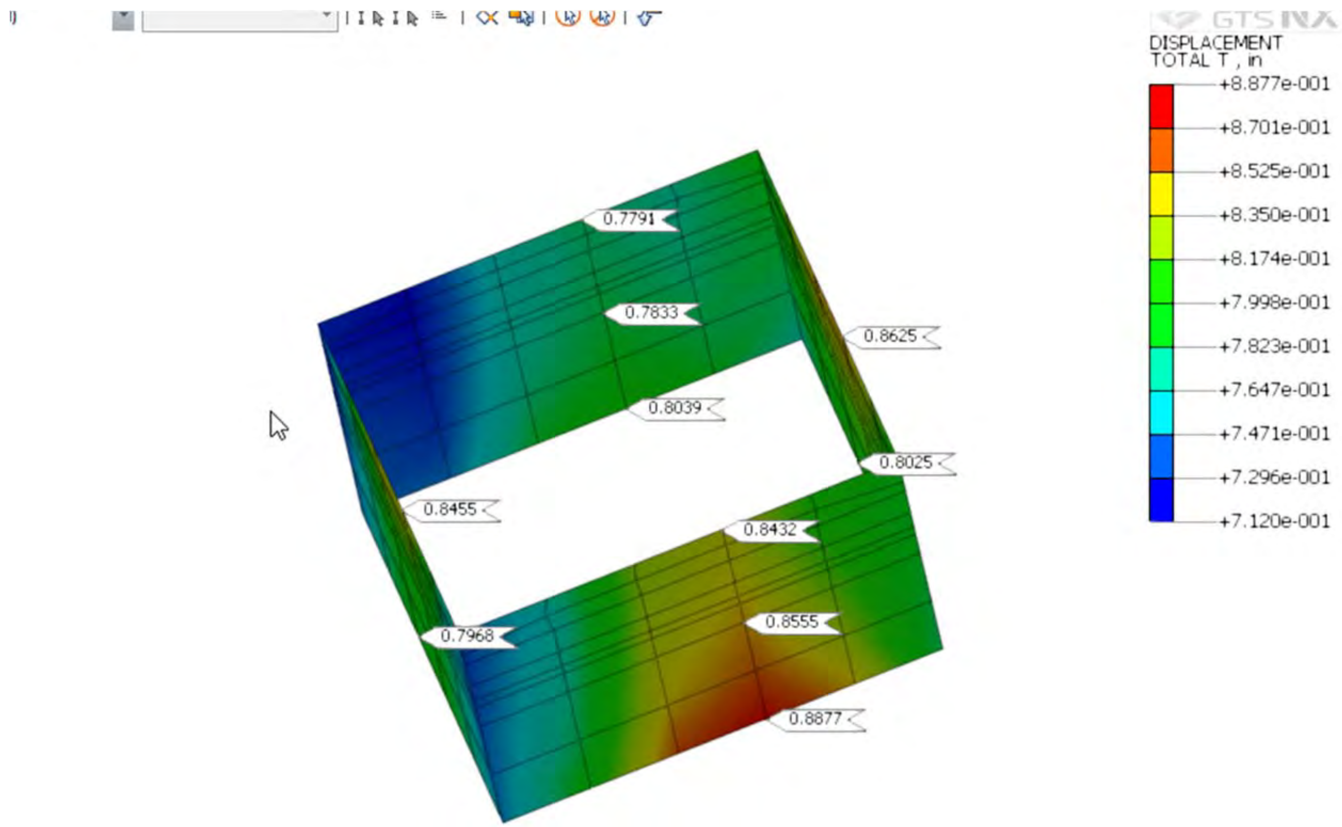

Figure 18: Contours of Total CSM Pit Wall Deformation, Final Stage I.

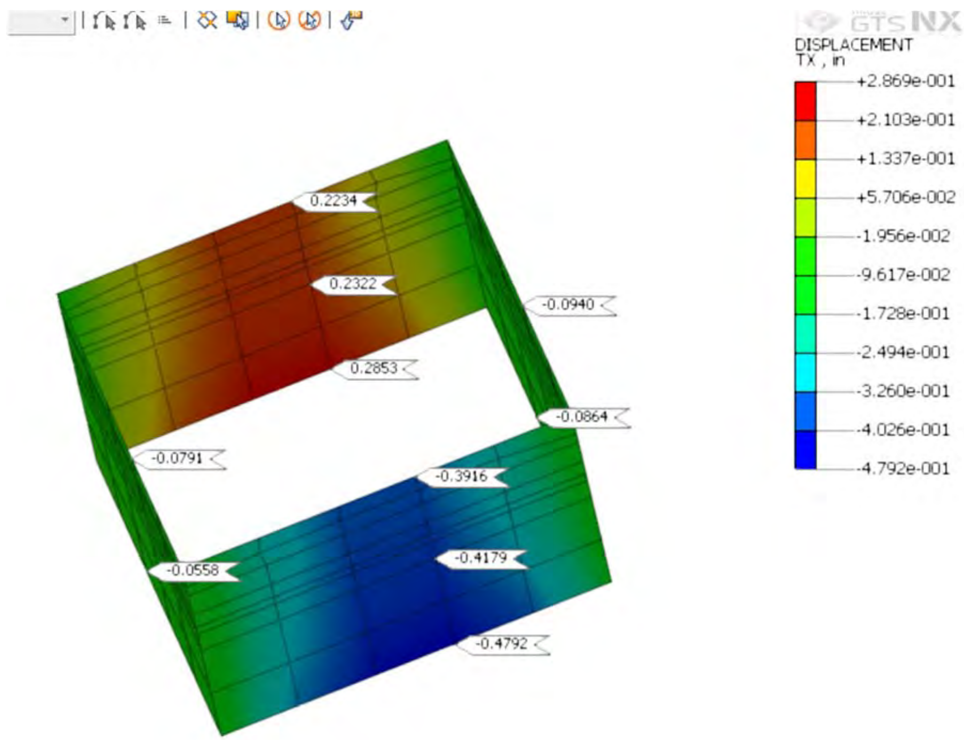

Figure 19: Contours of CSM Pit Wall Deformation (N-S), Final Stage I.

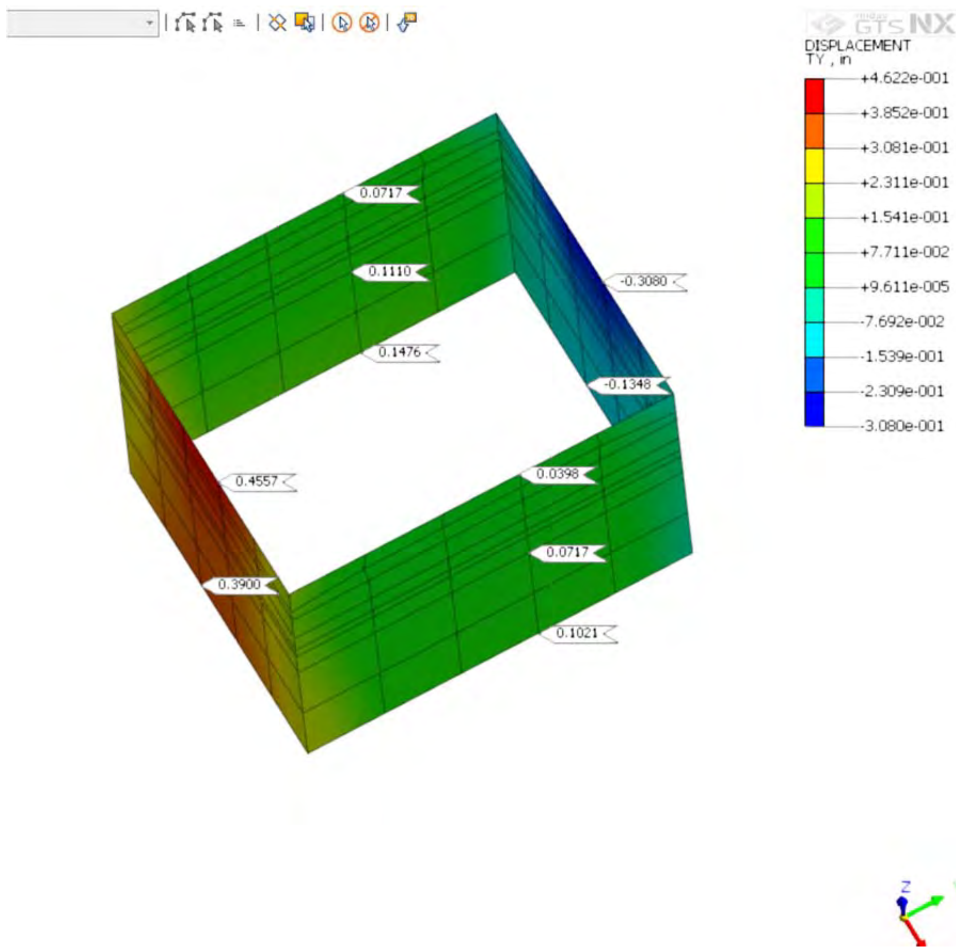

Figure 20: Contours of CSM Pit Wall Deformation (E-W), Final Stage I.

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MEMORANDUM

DATE: July 7, 2017

TO: Rob Jameson, Malcolm Drilling Company, Inc.

CC: John Morgan and Adam Hinton, Malcolm Drilling Company, Inc.

FROM: AJ McGinn, PhD, PE, Eric Lindquist, PhD, PE and Mohamed Gamal, PhD, PE

SUBJECT: Oceanwide Center, 526 Mission Street, San Francisco
3D Finite Element Analysis Stage 2: Tower 1 Excavation (Rev. 1)

INTRODUCTION

Brierley Associates performed a three-dimensional (3D) numerical analysis to evaluate the behavior of the ground deformations induced by excavations for Tower 2 (T2) and the southern segment of Tower 1 (T1). These shored excavations are required for the construction of the Oceanwide Center and its appurtenant basements and elevator pits. The 3D analysis predicts ranges of short-term, excavation-induced ground deformation and lateral wall movements. It allows the reader to develop independent evaluations of the potential impacts of ground and lateral wall deformations on abutting third parties, such as the structure at 25 Jessie. The two proposed excavations are adjacent to the existing pile-supported high-rise building located at 25 Jessie Street. That building is 18 stories tall, with a footprint that is approximately 90 feet in the east-west direction, 75 feet in the north-south direction, with the east face of the building directly behind the west wall of the T1 and the south face of the building is approximately 13 ft behind the north wall of the T2 excavation. Isometric and plan views of the model and excavation are provided in Figure 1 along with a typical cross-section.

The results of the analysis presented herein are for after both the T2 and T1 excavations have been completed. It is our understanding that the T2 excavation will take place first. After that T1 will be excavated and the soil cement within common wall that separates the two excavations will be removed as the adjacent T1 excavation is advanced.

Both the T1 and T2 excavations will be shored with a perimeter cutter soil mix (CSM). The T1 excavation will be restrained by four levels of preloaded internal bracing. The elevator pit will be shored with a perimeter CSM wall restrained by three levels of preloaded internal bracing. The current design of the braced CSM wall was developed based on the soil, groundwater and surcharge pressures recommended by Langan, the project geotechnical engineer.

Brierley's modeling efforts utilize soil properties and behavioral assumptions that are generally consistent with the geotechnical data and the interpretation of that data that was presented by Langan in their geotechnical reports and appurtenant appendices.

This 3D model utilizes interface elements, as opposed to the contact elements that were employed in our previous 2D model for the T1 excavation. The CSM walls, drilled shafts and CSM buttress each have interface elements; and, the drilled shafts are modeled as square shapes, not circular in order to reduce the complexity of the mesh and decrease computational time. The 3D model allowed for the incorporation of the elevator pit excavation. This was not modelled in the 2D analysis, as that model replicates plane-strain conditions.

In addition to the above, the piles that support 25 Jessie have been modelled as pile elements with interface elements along their full depth. The load for each pile is applied to the top of the pile and it is distributed with depth based on the strength characteristics of the surrounding soil. Based on parametric studies of the 25 Jessie foundation load application we have performed it appears that the piles are distributing the surcharge load to the soil layers in a reasonable manner. Note that ground deformations are reset to zero in the model after the 25 Jessie piles load is applied but before the next steps in the model are processed. Note that we are running a couple of additional analyses to confirm the modeling software is resetting the ground deformations in the manner we expect

It should be noted that changes to the assumed sequence of construction and phasing of the two excavations will affect the results of the analysis.

NUMERICAL MODELING FOR BASE HEAVE EVALUATION

Software

The analyses that are summarized in this memorandum were performed using Midas GTS NX, a comprehensive finite element analysis software package that is equipped to handle the entire range of geotechnical applications including deep foundations, excavation, complex tunnel systems, seepage analysis, consolidation analysis, embankment design, dynamic and slope stability analysis.

Although GTS NX is capable of conducting fully-coupled analyses, this modeling effort utilizes a sequential stress – seepage analysis type and a Mohr-Coulomb soil strength criterion. Therefore, it does not capture soil consolidation and strength or deformation property changes over time. The Mohr-Coulomb soil model exhibits linearly elastic behavior until the soil shear strength is exceeded, and then perfectly-plastic deformation at a constant shear stress for failed elements. Therefore, this analysis is considered to provide only a rough approximation of deformation behavior that attempts to simulate steady-state conditions at each major construction stage.

Assumed Soil Profile

An isometric view and representative cross-section that has been analyzed for this study are illustrated in Figure 1. Working from ground surface down the layers that have been modeled are Fill, Dune Sand, Marine Deposits, Colma Sand, Old Bay Clay Crust, Old Bay Clay and Alluvium Colluvium. Layer geometries are based on the boring information and typical soil profiles provided in Langan geotechnical investigation report and appurtenant appendices for this project. The profile that has been analyzed in this study utilizes horizontal layer contacts to reduce computational time.

Excavation and Bracing Geometry and Sequence

Existing grade is assumed at elevation +7 ft. The general subgrade elevation within the excavation at T1 is assumed to be elevation -67.5 ft. Internal bracing will be installed at elevations -3 ft, -24.5 ft, -41 ft and -54 ft. The additional shored excavation for the elevator pit located near the center of the T1 footprint is assumed to begin at elevation -67.5 ft. The elevator pit is assumed to have three levels of internal bracing at elevations -65 ft, -72 and -79 ft. Prior to the installation of each bracing level, the excavation will be advanced to 3 feet below the specified bracing elevation. The groundwater level inside the excavation will be drawn down progressively.

Per the submitted T1 CSM Wall design calculations, the groundwater level inside the excavation is specified to be lowered to 5 feet below bottom of excavation at all intermediate excavation stages and a minimum of 3 feet below general subgrade during the final stage of mass excavation.

The transition between the T1 and T2 excavations was modelled as a vertical wall for simplicity. In reality it will be a ramp with a fourth corner brace in the northeast corner of T2. The model is a reasonable representation based on current schedules which assume start of concrete placement in T2 mat before completion of T1 excavation. In the event T1 excavation is completed before the start of T2 concrete, induced deformation would increase.

Assumed Soil Properties

Table 1: Soil Properties

Unit	Unit Weight (pcf)	Ko	c (psf)	ϕ' (deg)	E (ksf)	ν
Fill	120	0.47	0	32	278	0.20
Dune Sand	125	0.60	0	36	605	0.35
Marine Deposits	100	0.60	$0.60\sigma'_z$	0	563	0.49
Colma Sand	133	0.60	150	36	2089	0.35
Old Bay Clay Crust	116	0.70	3500	0	1066	0.49
OBC (Case D)	112	0.70	$0.31\sigma'_z$	0	1336	0.49
Alluvium/Colluvium	125	0.50	0	32	2768	0.45
Bedrock	NA	NA	NA	NA	NA	NA

The Marine Deposits and Old Bay Clay were assumed to behave as undrained materials beginning with stress changes that are applicable to the first dewatering stage. The Old Bay Crust was assumed to be six feet thick and behave as an undrained material inside and outside of the excavations. The crust is modelled with an undrained strength of 3,500 psf based on Stress History and Normalized Soil Engineering Properties (SHANSEP) correlations with over-consolidation ratios. However, additional geotechnical testing data received on 6/4/17 report undrained strengths between 1,500 and 4,000 psf in the depth range from 75 to 90 FT below grade. As such the 3,500 psf used in this analysis may be non-conservative.

A Poisson's ratio of 0.49 was applied to the materials that are assumed to behave in an undrained manner. Therefore, this analysis is considered to provide only a rough approximation of deformation behavior prior to the dissipation of excess positive, or negative, soil pore pressures over time.

It should be noted that for the 3D analysis we added some effective cohesion (150 psf) to the Colma Sand to prevent passive failure within the ground at the elevator pit during pre-loading of the upper level. The effective friction angle was lowered from 38 degrees to 36 degrees to approximate the failure envelope for the 38 degree value.

Properties of CSM Wall, Internal Bracing, Drilled Shafts and Soil-Cement Buttresses

The CSM walls have been modeled using shell elements with bi-directional stiffness. For each case, the depth of CSM wall is 116 ft. Note that the wall depth in the current CSM plan is 115 ft. The flexural wall stiffness utilized in the model is based on the section properties of 30-in deep wide flange soldier piles alone without any contribution from the soil-cement. We understand that Malcolm plans to use W30 sections at the T1 excavation and W33 sections at the T2 excavation, which are stiffer than a W30 section, but this difference does not warrant reanalysis at this time. The flexural stiffness values for the CSM walls are provided in Table 2 and 3 for the T1 and T2 excavations, respectively. The bolted splice at 95 FT depth in perimeter soldier piles will limit moment capacity below that point, however since parametric studies indicated limited effect of stiffness in this pile segment, the T1 model employs a uniform parameter below 35 Ft depth.

Table 2: T1-25 Jessie CSM Wall Properties

Wall	Top Elevation	Bottom Elevation	Total Depth (feet)	Top 35’ EI (k-in^2/ft)	>35’ EI (k-in^2/ft)
25 Jessie	+7	-109	116	66,700,000	94,975,000
Other Perimeter	+7	-89	96	48,430,000	59,667,500
Elevator Pit (E-W)	-66.5 (shored grade) -64 (top of pile)	-110	46	15,870,900 (W14x233 throughout the whole depth)	
Elevator Pit (N-S)	-66.5 (top of pile and grade are same)	-96.5	30	5,267,450 (W14x90 throughout the whole depth)	

Table 3: T2-25 Jessie CSM Wall Properties

Wall	Top Elevation	Bottom Elevation	Total Depth (feet)	Top 35’ EI (k-in^2/ft)	35’-94’ EI (k-in^2/ft)	>94’ EI (k-in^2/ft)
25 Jessie	+7	-109	116	66,700,000	94,975,000	66,700,000
Other perimeter	+7	-82	89	66,700,000	94,975,000	NA
Elevator Pit (E-W)	-53.5 (top of pile) -58 (shored grade)	-82	28.5	5,267,450 (W14x90 throughout whole depth)		
Elevator Pit (N-S)	-55 (top of pile) -58 (shored grade)	-87	32	7,276,360 (W14x120 throughout whole depth)		

6.5-foot diameter drilled shafts to rock are included within the modeled cross-section. An equivalent square cross-section was used in lieu of circular shapes as discussed previously.

We have used solid state elements with interface elements to model these structural elements, see Figure 1 for approximate locations, with an area of 33 ft^2 and a cracked moment of inertia of 44 ft^4, which is half the calculated value. We assumed a Young's modulus value of 1,450 ksi, which is consistent with earlier studies. The drilled shafts were assumed to have a fixed support at the bedrock surface. Interface elements have been employed to model the soil-structure interaction between the drilled shafts and the soil below subgrade.
Unreinforced 3-foot thick CSM buttresses extend 24 feet perpendicular to the CSM shoring wall from ground surface to a depth of 116 feet below ground surface were employed in the model. However, nominal reinforcement, W14s at 12 ft centers along the panel length will be installed in the field. The soil-cement has been modeled with elastic properties correlated to an average unconfined compressive strength of 150-200 psi. Assumed deformation parameters are presented in Table 4. Elastic interface elements have been employed to model the soil-structure interaction between the soil-cement and in situ ground conditions.

Table 4: Soil-Cement Properties

E (psi)	ν
40,000	0.2

Interfaces

Interface elements were used for the 3D model with k_n (normal stiffness) and and k_t (tangential stiffness) determined automatically for the interface elements by the "Interface Wizard", which is a feature of the Midas software. This program function automatically assigns interface parameters at the T2 wall interfaces. Those assigned parameters are listed in Table 5.

Table 5: Elastic Interface Element Properties

Interface	E_{OED}(psi)	G(psi)	k_n	k_t	k_t/G
Fill to CSM Wall	2144	804	1800	165	0.205
Dune Sand to CSM Wall	6742	1556	3500	315	0.202
Marine Deposits to CSM Wall	7323	1417	3170	290	0.205
Colma Sand to CSM Wall	19528	5580	12500	1300	0.233
Old Bay Clay Crust to CSM Wall	9966	2847	5500	490	0.172
Old Bay Clay to CSM Wall	9966	2847	5500	490	0.172
Buttresses to CSM Walls	53846	15385	80000	4000	0.269
Shafts to Colma Sand	19528	5580	12500	1300	0.233
Shafts to Old Bay Clay Crust	9966	2847	5500	490	0.172
Shafts to Old Bay Clay	9966	2847	5500	490	0. 172
Shafts to Alluvium/Colluvium	25873	7392	15000	1500	0.203

Internal Bracing

The internal bracing has been modeled using solid state structural elements that have the same structural properties as those shown on the temporary support of excavation design documents prepared by Brierley, which is a departure from the 1-D truss elements at 3-foot spacing that were used in the 2D models. For this study, each main excavation strut is pre-loaded to 50% of its maximum ASD compression demand. The ASD compression demand for each strut can be found in Brierley's bracing design calculations for the T1 and T2 bracing. The struts at the elevator pit excavations are specified to be preloaded to 100% of their ASD design load;

however, these values need to be reduced slightly for modeling purposes to avoid local passive failures behind the elevator pit shoring walls.

In the analysis, each bracing level is installed and preloaded prior to the next stage of excavation.

We understand that the project team agreed to reduce main basement excavation bracing level one pre-load values to 35 to 40% of the design load and that the other levels will be pre-loaded to 75% of the design value. Those updated preloads have not been incorporated into this analysis.

SUMMARY OF RESULTS

Previous Analysis

Tables 6 presents a summary of the numerical analyses performed for the T1 excavation by Brierley to date. The results of the four cases, Cases A through D, that were run with a pre-load value of 50% of design load were are presented in Table 6 and the results are discussed in our memorandum dated February 22nd, 2017. This memorandum was re-issued with a corrected Figure 3 on June 6th, 2017. Case D was updated for pre-load values of 75% of design load the results of that analysis are presented in our memorandum dated May 16th, 2017

- Case A: Drilled Shafts Only
- Case B: CSM Buttresses Only
- Case C: Drilled Shafts and CSM Buttresses with Upper Bound Soil Strength
- Case D: Drilled Shafts and CSM Buttresses with Lower Bound Soil Strength (50% and 75% Pre-load values)

Table 6: Summary of Predicted Deformations

	Wall Displacement							Ground Surface		Near Pile Tip	
	Top	B1	B2	B3	B4	Max	Heave	Δv 2 ft	Δv 92 ft	Δv 2 ft	Δv 92 ft
Case	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)	(in.)
A	0.5	0.8	1.5	1.9	2.2	2.5	10.0	0.5	1.7	0.5	1.5
B	1.6	1.8	2.0	2.2	2.5	3.2	7.0	2.5	2.1	2.0	1.5
C	1.5	1.7	2.0	2.2	2.5	3.1	9.5	2.6	2.0	2.0	1.5
D 50%	1.6	1.8	2.1	2.4	2.7	3.6	10.6	3.0	2.4	3.0	1.5
D 75%	1.1	1.3	1.7	1.9	2.3	3.4	6.0	3.0	2.0	2.3	1.2

Current Analysis

The surface plan, profile and isometric view of the model are presented in Figure 1. Due to the large lateral extent of the model and the fact that both the T1 and T2 and pit excavations were modeled, a simplified soil profile with horizontal contacts was used and slight elevation adjustments were made to accommodate the model grid.

Figure 2 presents contours of total deformation at ground surface. The deep-seated nature of ground deformation can be seen in the pattern of deformation around the perimeter of the excavation with total deformation ranging from 1.4 to 2.0 in. at distance from the excavation.

The influence of the piles that support 25 Jessie can be seen in the lesser values of predicted total deformation at ground surface in that area compared to elsewhere around the perimeter of the T1 and T2 excavations.

Contours of total deformation at the top of the Colma Sand are presented in Figure 3. In this figure, the deep-seated nature of ground deformation is evident around the perimeter of both excavations. Deformations associated with the vertical loads transmitted by the piles to the Colma Sand and excavation-induced deformations are noticeable below the limits of 25 Jessie where the total displacement is approximately 1.7 in.

Contours of total T2 CSM wall total deformation are presented in Figure 4 for the final excavation stage at T1 25 Jessie (Stage II). At the north wall, the wall adjacent to 25 Jessie, the maximum total deformation, which is mostly in the lateral direction, is on the order of 1.0 in. and ranges from 0.8 to 0.9 in. at depth. The range of deformations above the bottom of excavation is similar, 1.0 to 1.1 in., at the south wall. The largest total deformation, 1.8 in. occurs along the west wall. At the east wall, the total deformation ranges from 0.9 to 1.0 in.

We note that we have tried several options to model the connections at CSM wall corners including; 1.) wall-to-wall interface and, 2) end release at the ends of the wall. These options had almost no impact on the value of maximum displacement and the influence in behavioral change was limited to a small zone near the corners of the wall.

Contours of total T1 CSM wall total deformation are presented in Figure 5 for Stage II. At the west wall, the wall adjacent to 25 Jessie, the maximum total deformation, which is mostly in the lateral direction, is on the order of 0.8 to 1.0 in. near the bottom of the excavation and ranges from 0.8 to 1.1 in. at depth near the bottom of the wall. The range of deformations at the south wall is 0.8 to 0.9 in. The largest total deformation, 2.4 in. occurs along the east wall near the bottom of the T1 excavation.

Figure 6 presents contours of lateral deformation at ground surface in the north-south direction. Ground deformations to the north beneath 25 Jessie are on the order of 0.1 to 0.5 in. and they are approximately 0.4 to 0.6 in. to the south of the two excavations.

Figure 7 presents contours of lateral deformation at top of the Colma Sand in the north-south direction. Ground deformations to the north beneath 25 Jessie are on the order of 0.4 to 0.5 in. with a maximum value of 0.5 in. directly behind the wall. They are approximately 0.6 to 1.2 in. to the south of the excavation with a maximum value of 1.2 in. directly behind the T2 south wall.

Contours of lateral T2 CSM wall lateral deformation in the north-south direction are presented in Figure 8. The maximum lateral deformation is on the order of 1.3 in. at the south wall near the bottom of the excavation. The maximum lateral deformation at the north wall, the wall closest to 25 Jessie is approximately 1.0 in.

Contours of lateral T1 CSM wall lateral deformation in the north-south direction are presented in Figure 9. The maximum lateral deformation is on the order of 1.2 in. at the easternmost south wall near the bottom of the excavation. The maximum lateral deformation the other southern wall, the wall closest to T2, are near the bottom of the excavation and are approximately 0.9 in. and is not near the 25 Jessie structure.

Figure 10 presents contours of lateral deformation at ground surface in the east-west direction. Ground deformations to the west are on the order of 0.3 to 0.5 in. and they are approximately 0.2 to 0.5 in. the east of the excavations.

Figure 11 presents contours of lateral deformation at top of the Colma Sand in the east-west direction. Ground deformations to the west or the T2 excavation are on the order of 0.5 to 1.4 in. with a maximum value of 1.4 in. directly behind the west wall. They are approximately 0.5 to 1.9 in. east of the T1 excavation with a maximum value of 1.9 in. directly behind the east wall, which is opposite the 25 Jessie structure.

Contours of T2 CSM wall lateral deformation in the east-west direction are presented in Figure 12. The maximum lateral deformation is on the order of 1.7 in the west wall and 0.7 in. at east wall. Lateral deformations below the bottom of the excavation range from 0.3 to 0.4 in.

Contours of T1 CSM wall lateral deformation in the east-west direction are presented in Figure 13. The maximum lateral deformation is on the order of 2.3 in the east wall and 1.5 in. at west wall. Lateral deformations below the bottom of the excavation range from 1.1 at the east wall to 0.8 in at the west wall.

Figure 14 presents contours vertical deformation at ground surface. Ground deformations range from 1.0 to 1.8-in. around the perimeter of the excavation. They are predicted to be approximately 0.5 to 1.8 in. the 25 Jessie structure.

Contours of vertical deformation at the top of the Colma Sand are shown in Figure 15. Around the perimeter of the excavation the vertical deformation ranges from 0.8 to 0.5 in. Under 25 Jessie the deformation ranges from 0.5 to 1.5 in., with the larger deformations occurring along the northern edge of the building.

Contours of major principal stress in the drilled shafts are shown in Figure 16. The maximum tensile stress predicted in the drilled shafts ranges from 390 to 465 psi within the T1 excavation and is primarily located on the edge of the shaft that faces away from the perimeter CSM walls.

Contours of minor principal stress in the drilled shafts are shown in Figure 17. The maximum compressive stress predicted in the drilled shafts is approximately 143 psi within the T1 excavation.

Figures 18 and 19 present contours of major principal stress and minor principal stress, respectively. The maximum tensile stress is 38 psi in the T2 excavation and 49 psi in the T1 excavation both occur near the top of the CSM buttresses at the edge farthest from the CSM wall. The maximum compressive stress in the T2 and T1 excavations are 197 psi and 220 psi, respectively. The stress concentrations are located at the top of the buttresses where they contact the CSM perimeter wall adjacent to 25 Jessie.

Figure 20 presents an isometric view of the T2 and elevator pit excavations along with contours of total deformation. The maximum total deformation within the limits of the T2 excavation is 1.4 in. and is predicted to occur in the northeast corner of the excavation near the common wall with the T1 excavation. The maximum total deformation within the elevator pit excavation is 1.5 in. and occurs near the center of the excavation.

Contours of lateral displacement in the north-south direction for the T2 elevator pit CSM walls are presented in Figure 21. The maximum lateral deformation in the south wall is 0.5 to 0.6 in. near the middle of the wall. The east wall translates laterally northward toward the T1 excavation approximately 0.4 in while the west wall translate slightly lesser amount, 0.2 in. to the north. The lateral displacement in the north wall that was induced by the excavation of the elevator pit (refer to the T2 3D memo) has been reduced to negligible amounts due to the lateral translation to the north towards the T1 excavation.

Contours of lateral displacement in the east-west direction for the T2 elevator pit CSM walls are presented in Figure 22. The maximum lateral deformation in the east-west direction is 0.3 to 0.4 in. and occurs in the west wall. The north and south wall translate laterally eastward approximately 0.2 in. to 0.3 in., respectively. The east wall translates eastward approximately 0.1 in. to 0.2 in. with the highest concentration of displacement in the northeast corner closest to the T1 excavation.

Figure 23 presents an isometric view of the T1 and elevator pit excavations along with contours of total deformation. The maximum total deformation within the limits of the T1 excavation is 1.7 in. and is predicted to occur near the middle of the excavation. The maximum total deformation within the elevator pit excavation is 1.3 in. and occurs near the center of the excavation. Note that the localized, larger total deformations along the northern edge of the mesh are on the nominal limit of the model and are not considered to be representative of actual behavior. Due to size of the T1 excavation and its impact on run time, the length of the excavation was truncated in the Stage 2 3D model. The northern boundary of the model was established to allow for an assessment of the 25 Jessie structure and the configuration of the bracing system needed to be adjusted at the northern end to capture the behavior along the western and eastern walls. The deformations along the northern boundary of the model do not reflect actual ground behavior given that the bracing system that will be constructed at the northern end of the T1 excavation, i.e., at 525 Market, is not accurately modeled in Stage 2, e.g., there are no corner struts at the northern end of the model.

Contours of lateral displacement in the north-south direction for the T1 elevator pit CSM walls are presented in Figure 24. The maximum lateral deformation in the east wall is 0.2 to 0.3 in southward near the top and bottom of the wall, respectively. The east west wall translates laterally southward approximately 0.5 in. The lateral displacement in the north ranges from 0.5 to 0.6 in. southward.

Contours of lateral displacement in the east-west direction for the T1 elevator pit CSM walls are presented in Figure 25. The maximum lateral deformation in the east-west direction is 0.5 in. eastward in east wall. Similar magnitudes of lateral translation are predicted in the northern wall near the bottom of the wall. The east and south walls are shown to translate laterally eastward approximately 0.2 to 0.3 in.

Time Dependent Soil Behavior

The current modeling utilizes undrained strength parameters for the fine-grained soils (Marine Deposits, Old Bay Clay Crust and Old Bay Clay). As a result, the modeling does not capture the dissipation of pore water pressure and the transition from undrained to drained strength and stiffness over time. As a result, the behavior that is reported herein is different from long-term behavior during and after building construction. This analysis would require a fully-coupled soil-groundwater model that captures the time dependence of the soil properties and changes in stress state. While the models addressed herein may not evaluate stability or geometric deformation in absolute terms, certain behavioral trends can be surmised and the models are considered useful for that purpose.

Concluding Remarks

The purpose of the finite element analysis presented herein was to provide the team with insight about the behavior of the CSM walls, drilled shafts, CSM buttresses and ground inside and outside the excavations for T1 and T2 and the elevator pits therein. These should not be taken as absolute values as strength and deformation parameters of the soil might be different than assumed herein. Moreover, the boundary conditions for the 3D model are different from the 2D models performed to date, which replicate plane-strain conditions. Due to the limited dimensions of the elevator pit, it was not modelled in the 2D parametric studies performed to date.

Previous studies have applied preload values for Level B1 in the main excavation based on 50% and 75% of the loads derived for the full excavation depth. This level of pre-loading in B1 appears to result in outward wall displacement and ground heave effects around the excavation. In reality, it is unlikely that these pre-loads could be generated, or if applied could result in heave impacts to adjacent structures and facilities. As such, models run with those values should be considered as non-conservative with respect to near field and surficial estimated deformation. We understand that the project team has agreed to reduce the main basement excavation bracing level one pre-load values to 35 to 40% of the design load and that other levels will be pre-loaded to 75% of the design value. Those updated preloads have not been incorporated in this analysis, which has applied a preload value of 50% of design load.

It should be noted that we had to add some effective cohesion (150 psf) to the Colma Sand to prevent passive failure within the ground at the elevator pit during pre-loading of the upper level bracing. The effective friction angle was lowered from 38 degrees to 36 degrees to approximate the failure envelope for the 38 degree value.

The predicted deformations levels below the footprint of the 25 Jessie structure are ground deformations, not structural deformation. Estimate deformation of the 25 Jessie structure and the underlying foundation system is outside the scope of this work.

We note that the predicted deformations in this model, particularly near-field effects, are sensitive to interface properties. As such, large scale, deep-seated deformations can be estimated with more confidence compared to deformations immediately adjacent to walls or structural elements.

We have tried several options to model the connections at CSM wall corners including; 1.) wall-to-wall interface and, 2) end release at the ends of the wall. These options had almost no impact on the value of maximum displacement and the influence in behavioral change was limited to a small zone near the corners of the wall.

Finally, the localized, larger total deformations along the northern edge of the mesh are not considered to be representative of actual behavior. The northern boundary of the excavation modeled does not correspond to northern limit of actual Tower 1 excavation. This northern boundary was established to allow for assessment of the 25 Jessie structure, while aiming to limit overall size and run time of the model.

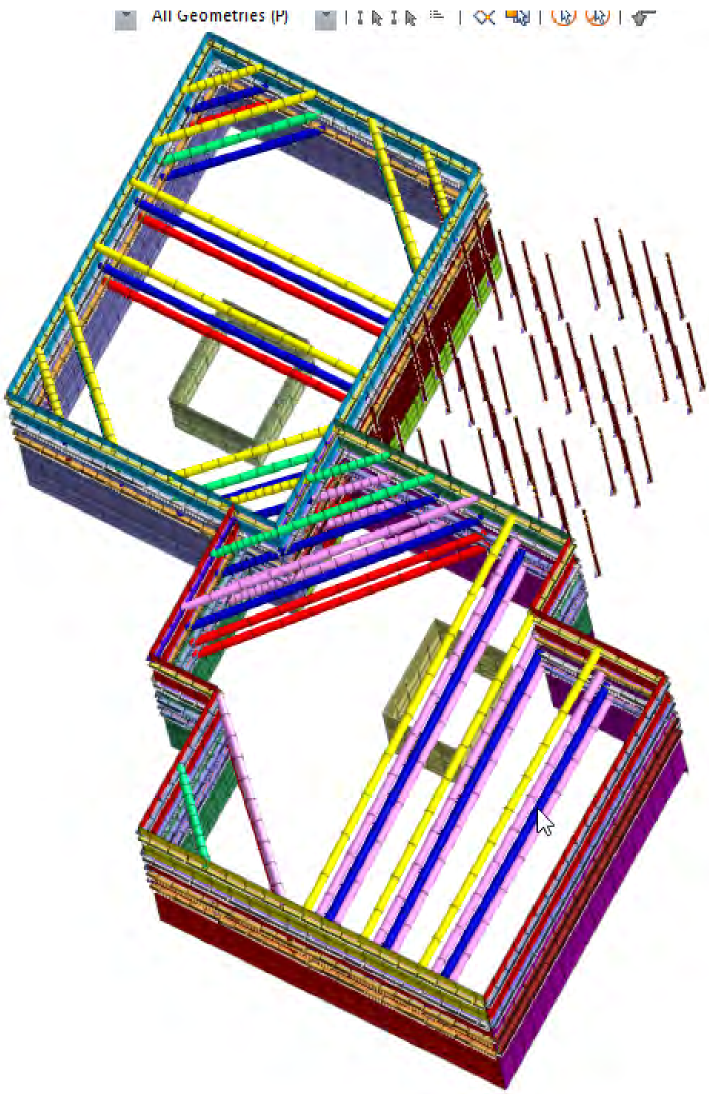

Figure 1a: Isometric View of Stage II Excavation

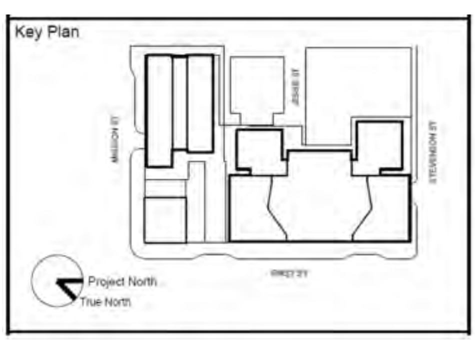

Figure 1b: Key Plan

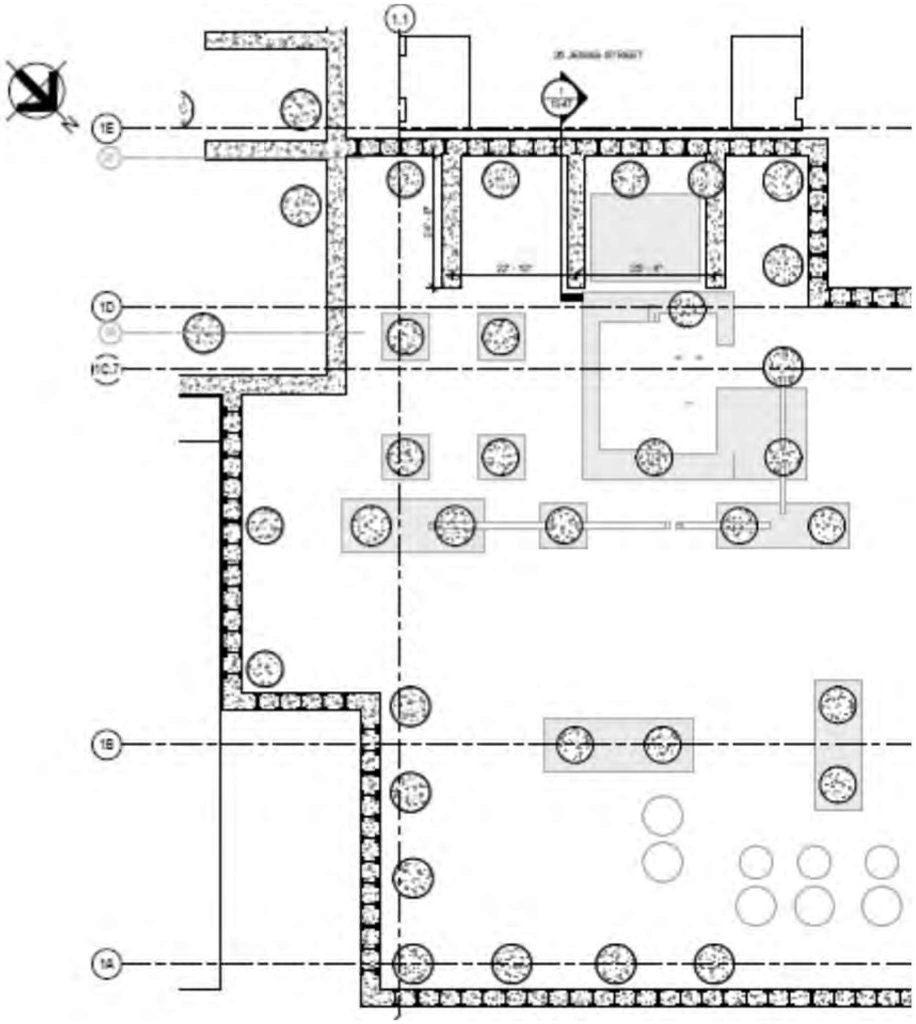

Figure 1c: Tower 1 Excavation Plan

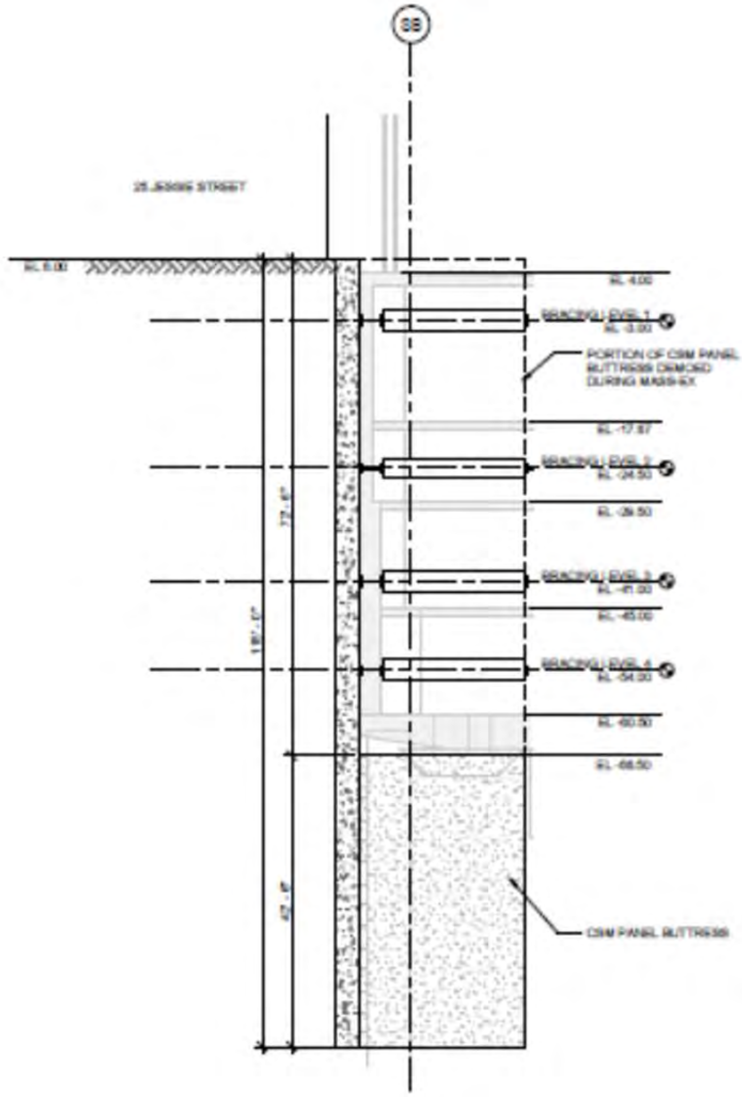

Figure 1d: Tower 1 SOE Cross-Section

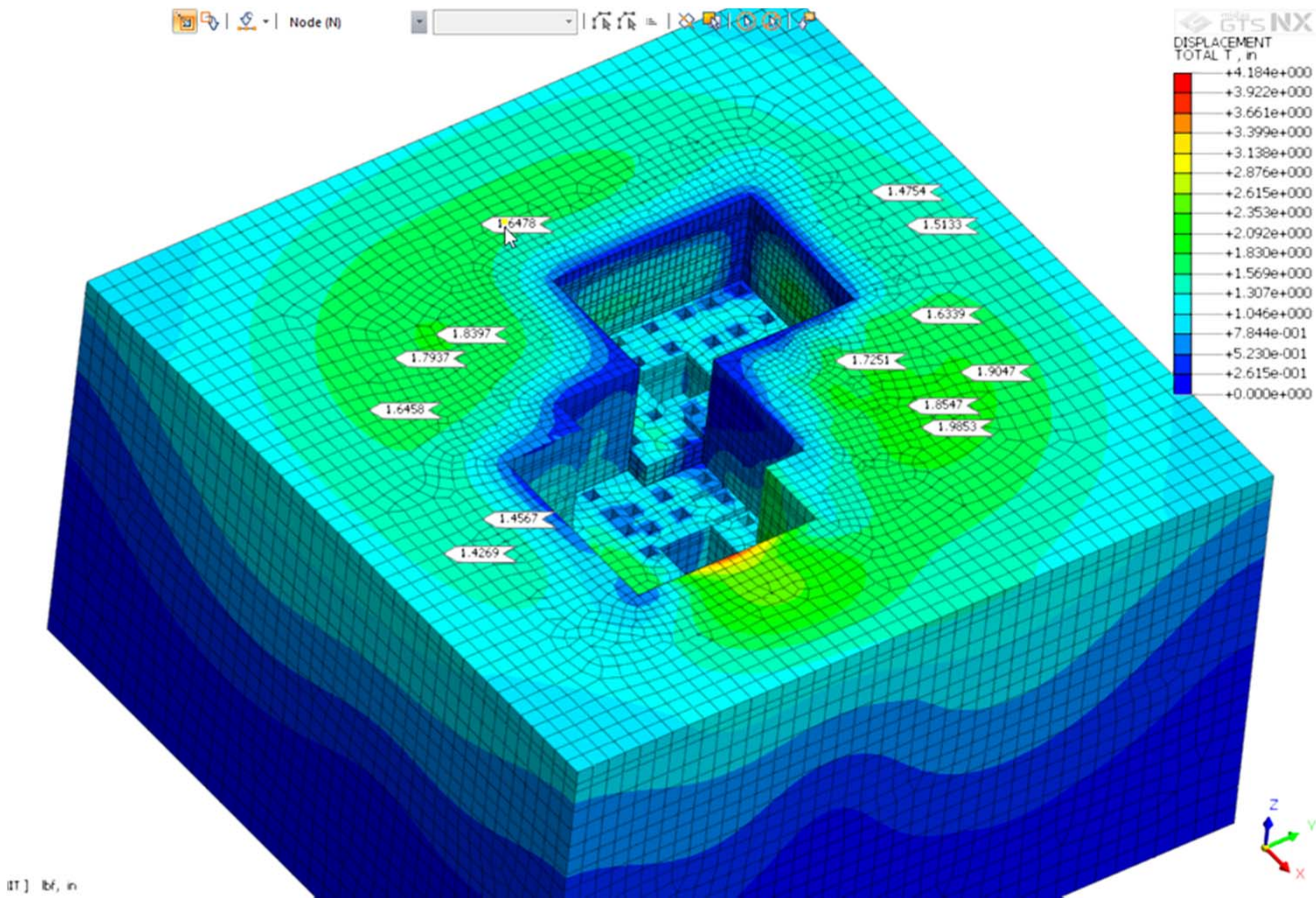

Figure 2: Contours of Total Displacement at Ground Surface, Final Excavation Stage II.

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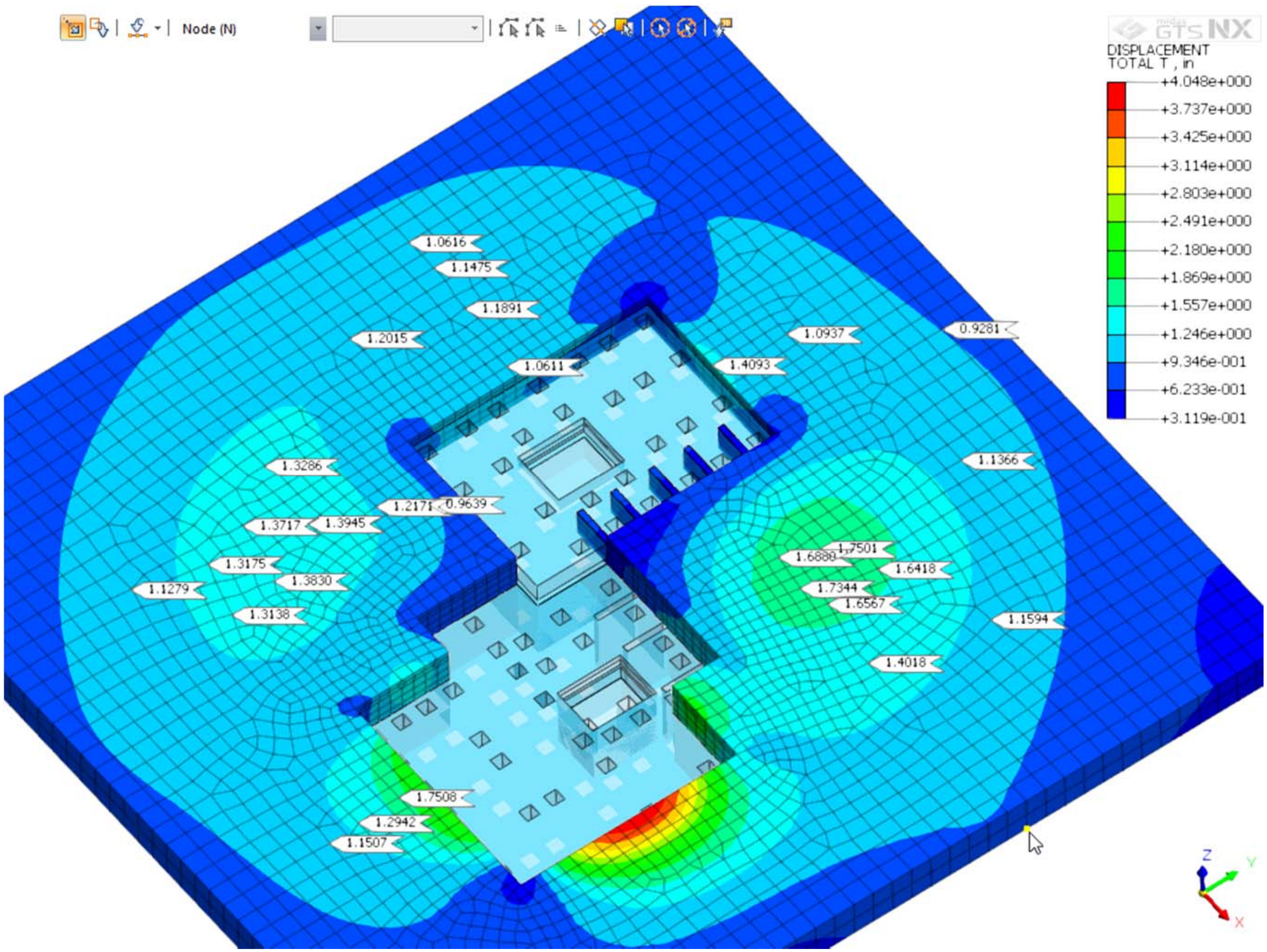

Figure 3: Contours of Total Displacement at Top of Colma Sand, Final Excavation Stage II.

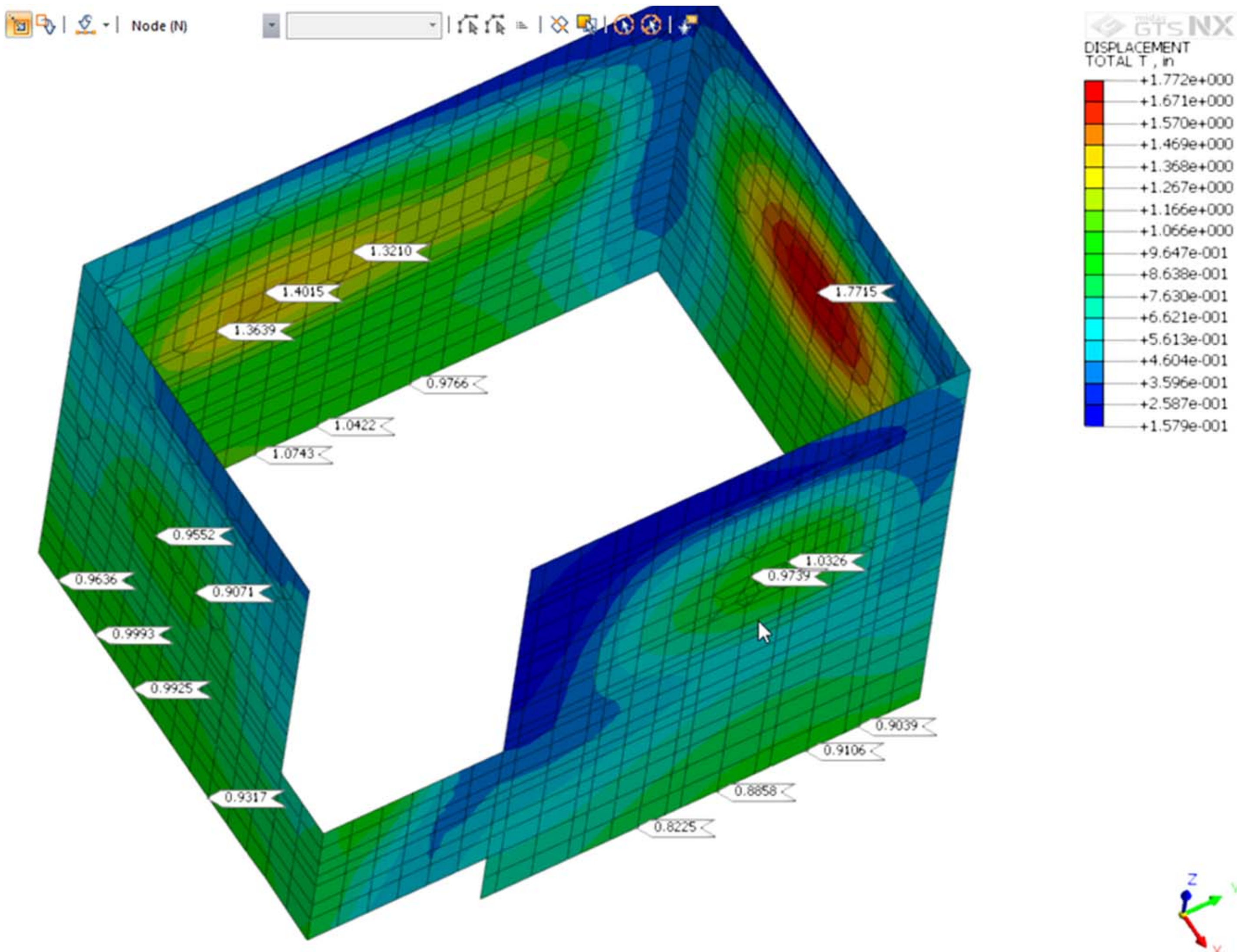

Figure 4: Contours of T2 CSM Wall Total Deformation at Ground Surface, Final Excavation Stage II.

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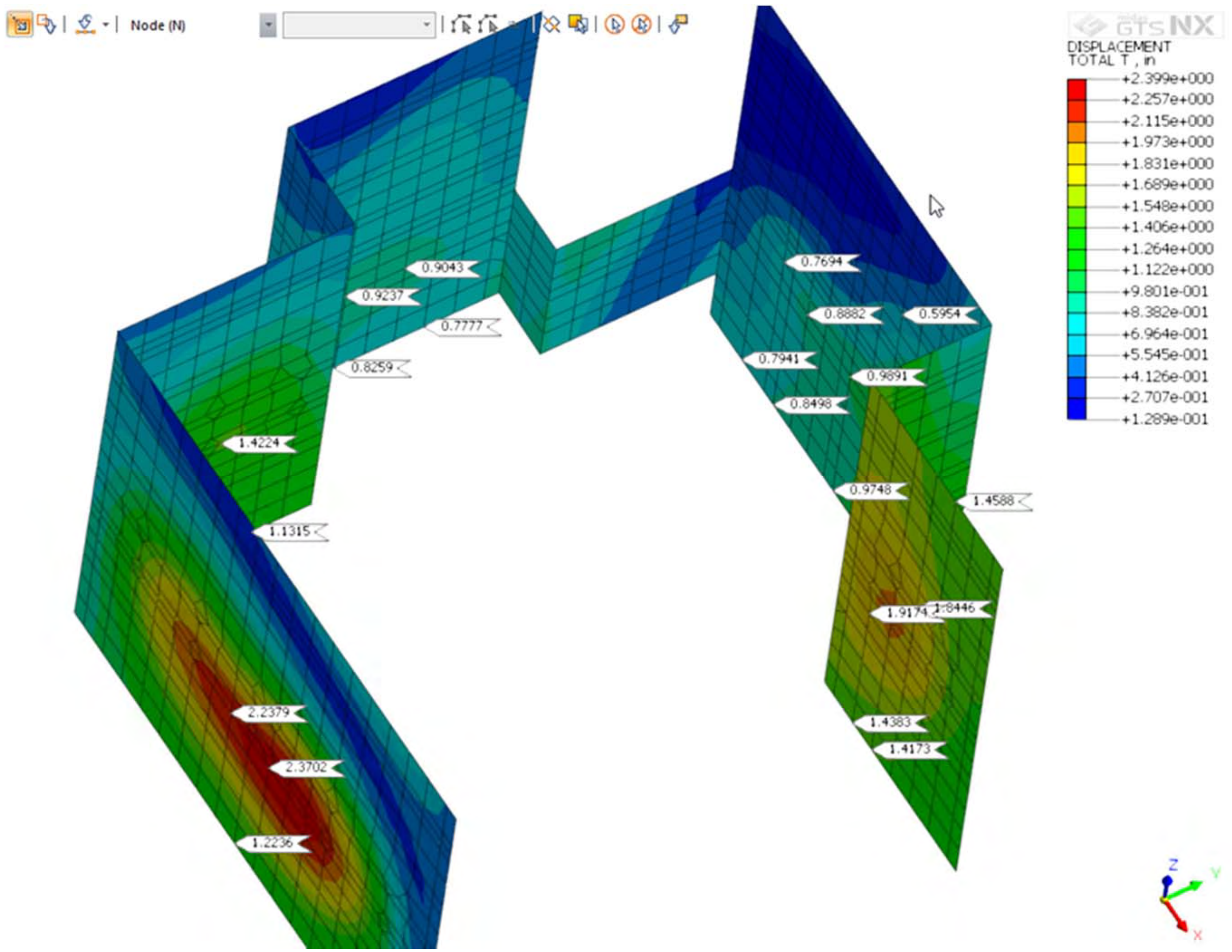

Figure 5: Contours of T1 CSM Wall Total Deformation, Final Excavation Stage II.

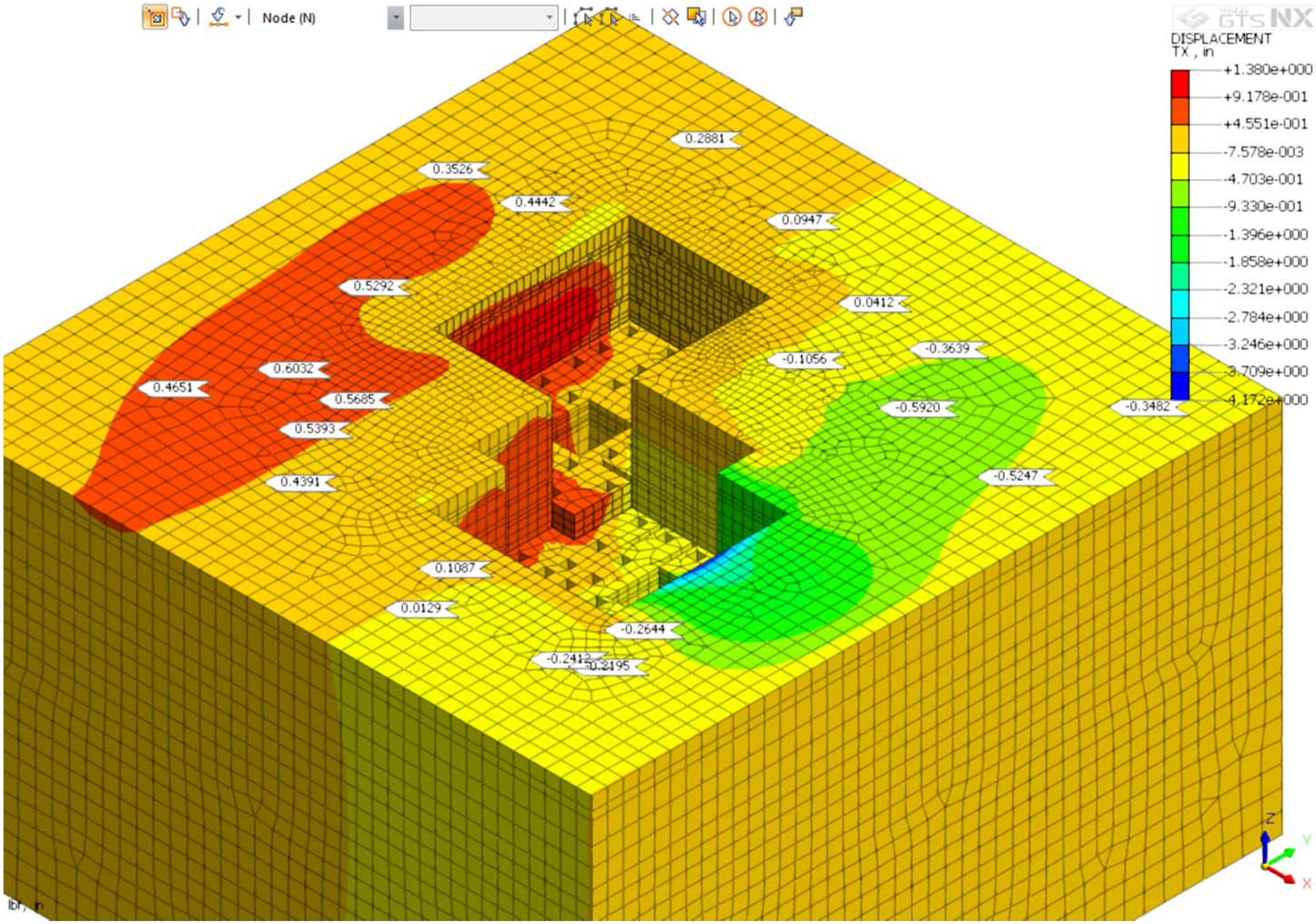

Figure 6: Contours of Lateral Deformation (N-S) at Ground Surface, Final Excavation Stage II.

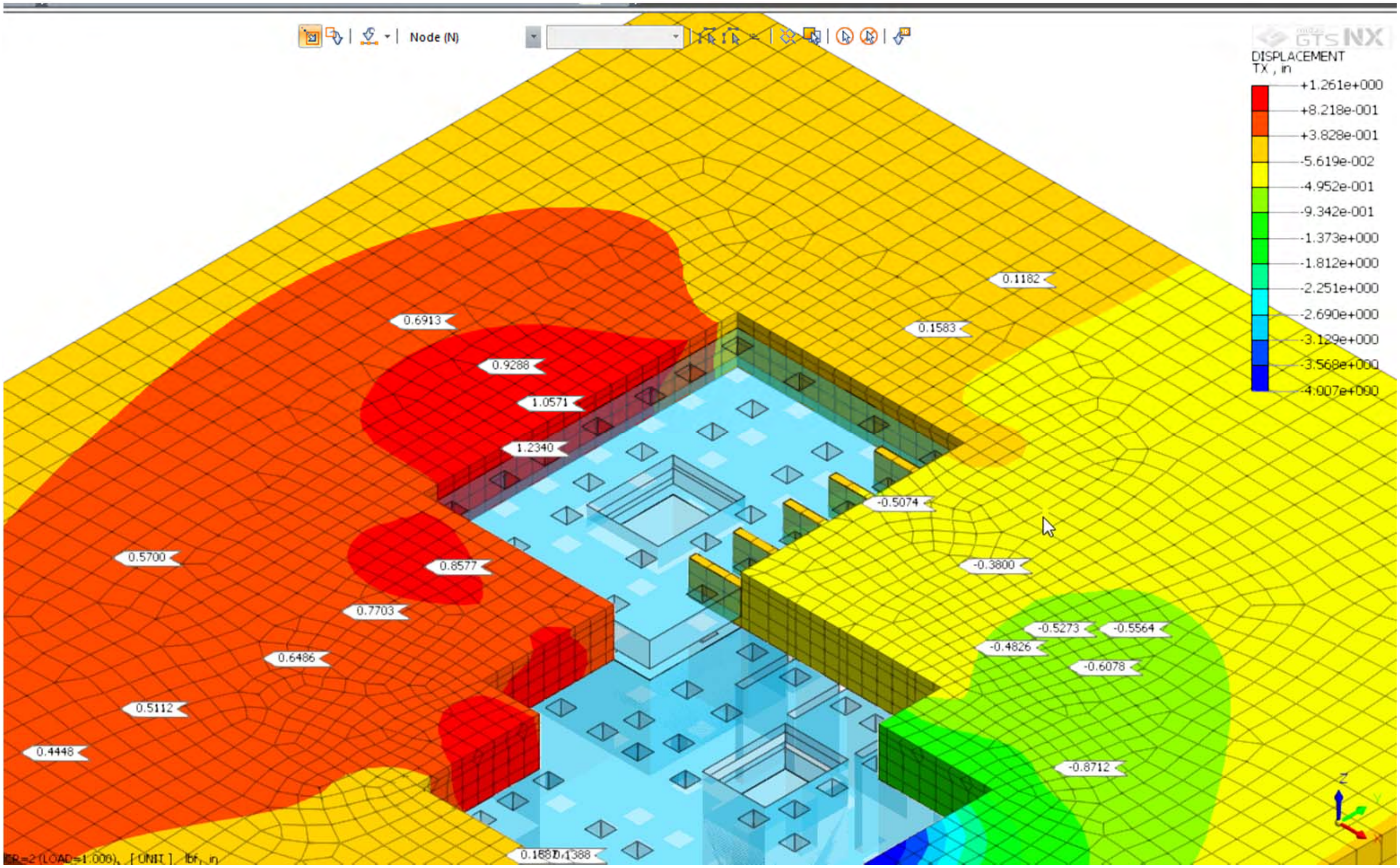

Figure 7: Contours of Lateral Deformation (N-S) at Top of Colma Sand, Final Excavation Stage II.

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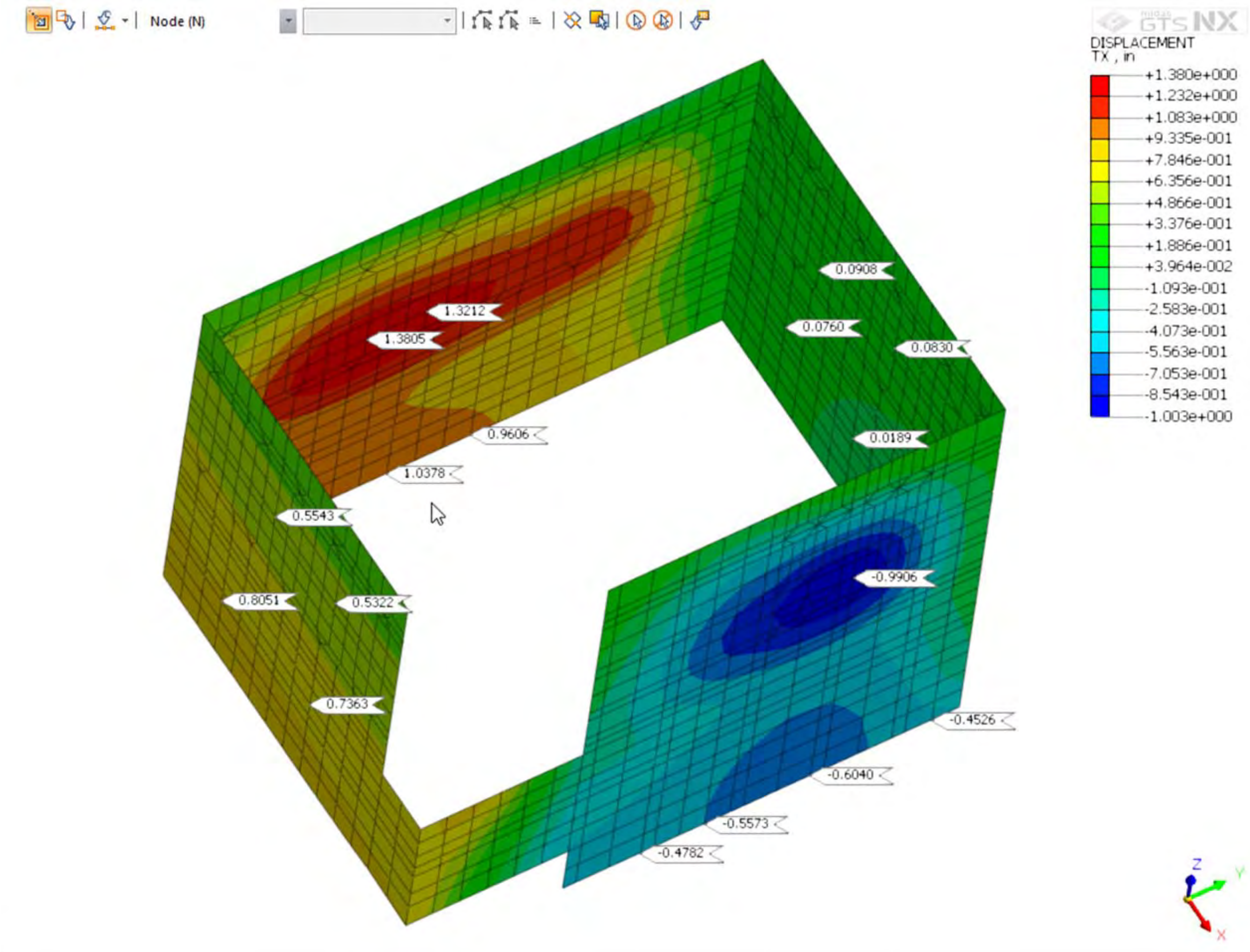

Figure 8: Contours of T2 CSM Wall Lateral Deformation (N-S), Final Excavation Stage II.

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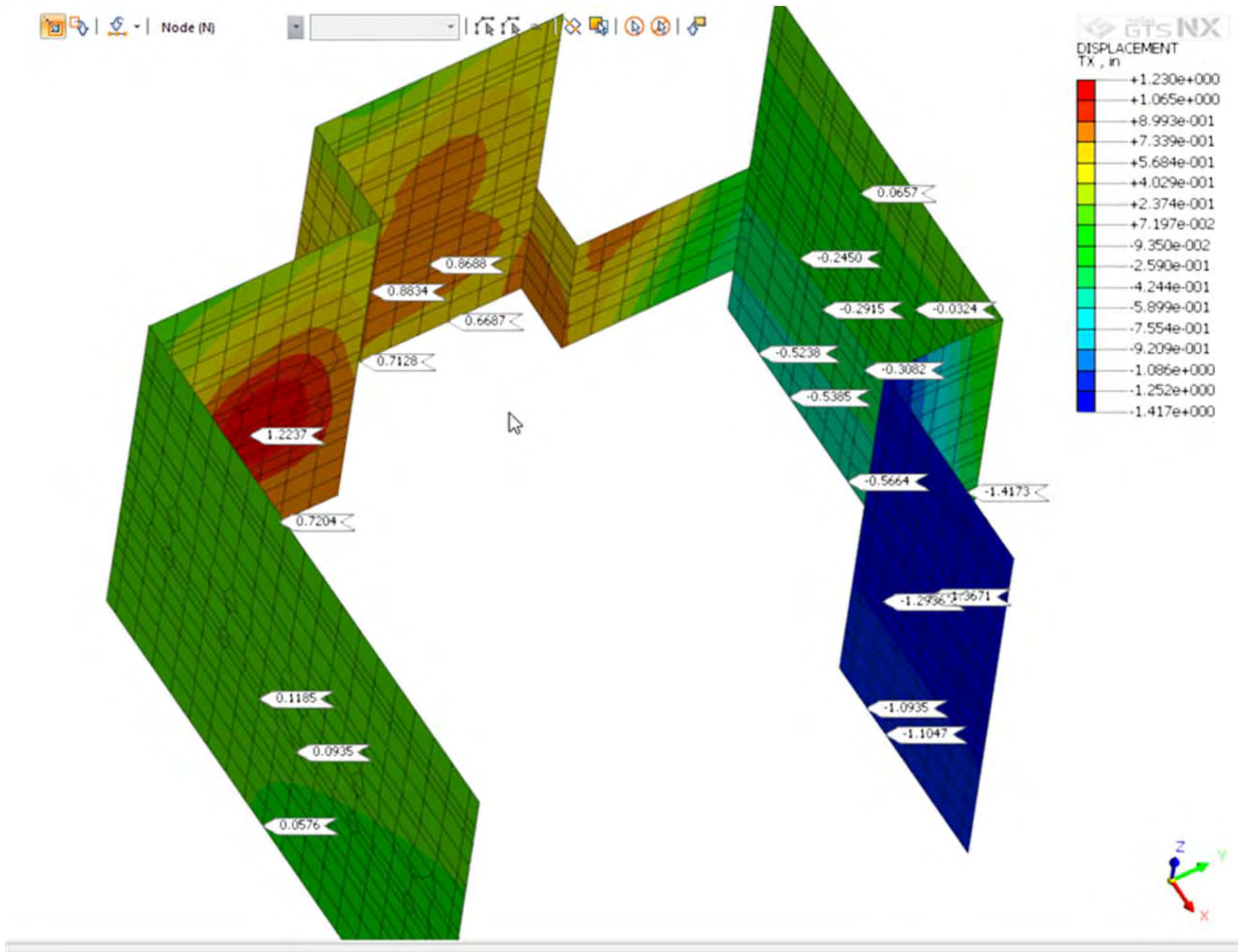


Figure 9: Contours of T1 CSM Wall Lateral Deformation (N-S), Final Excavation Stage II.

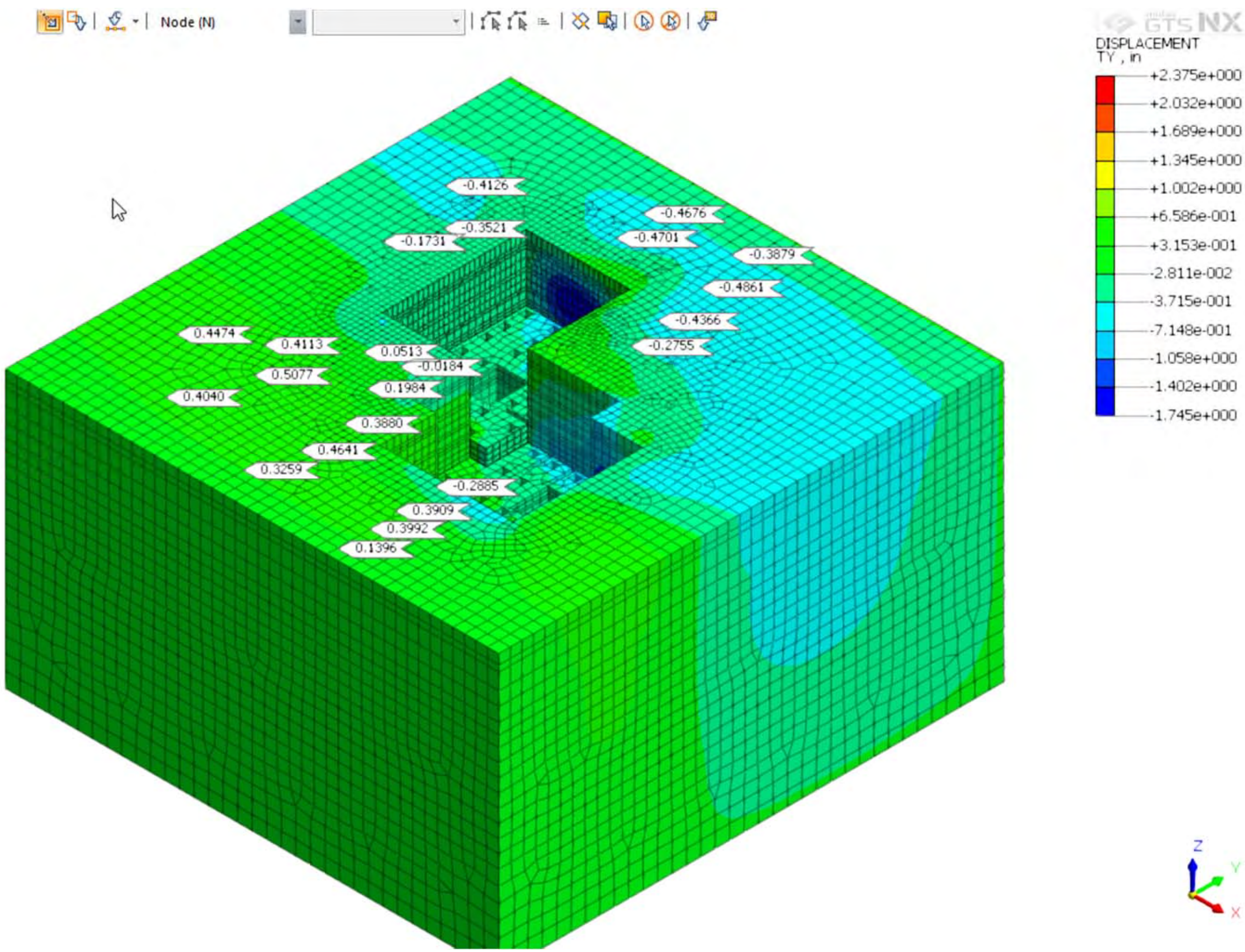
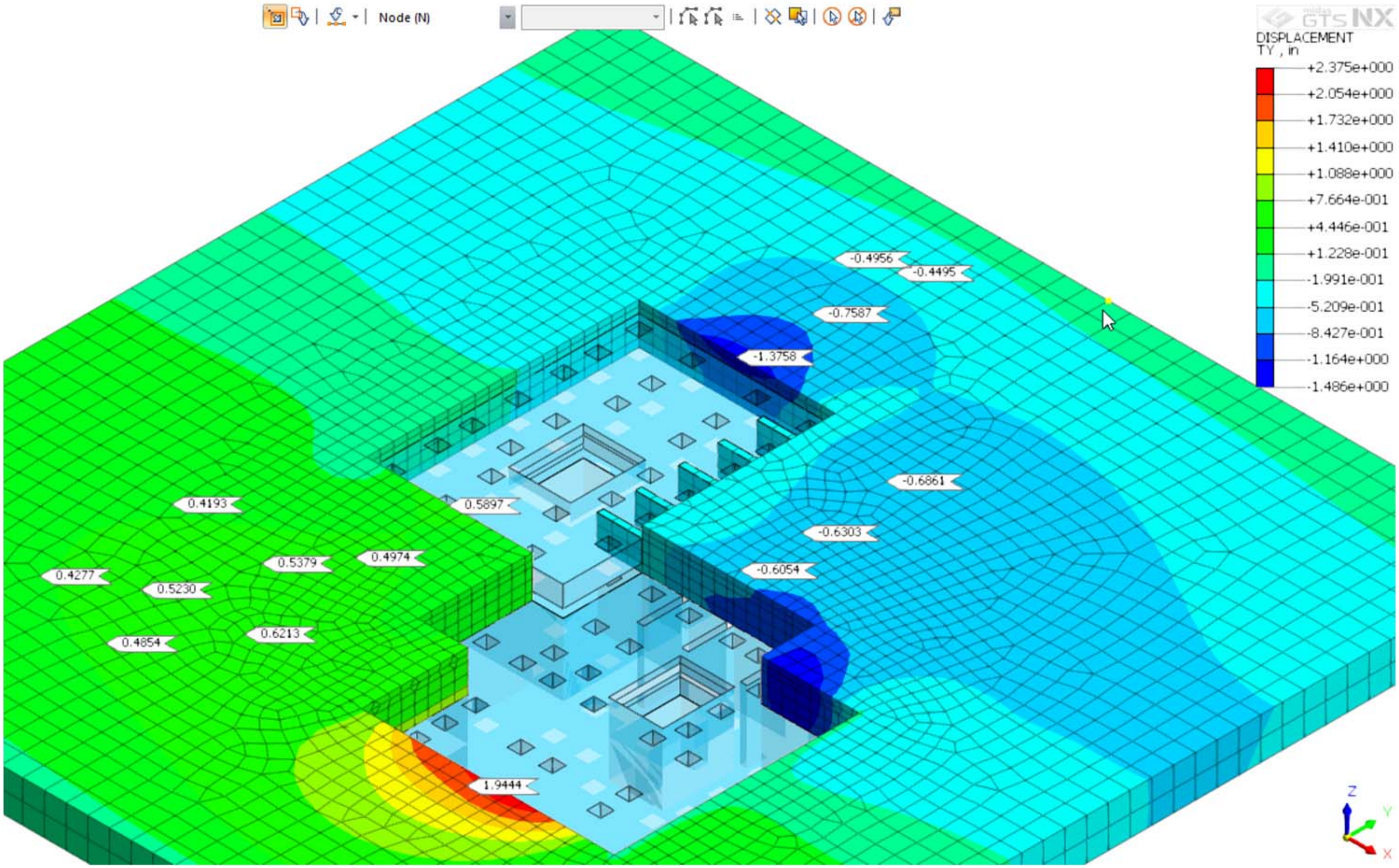


Figure 10: Contours of Lateral Deformation (E-W) at Ground Surface, Final Excavation Stage II



. Figure 11: Contours of Lateral Deformation (E-W) at Top of Colma Sand, Final Excavation Stage II

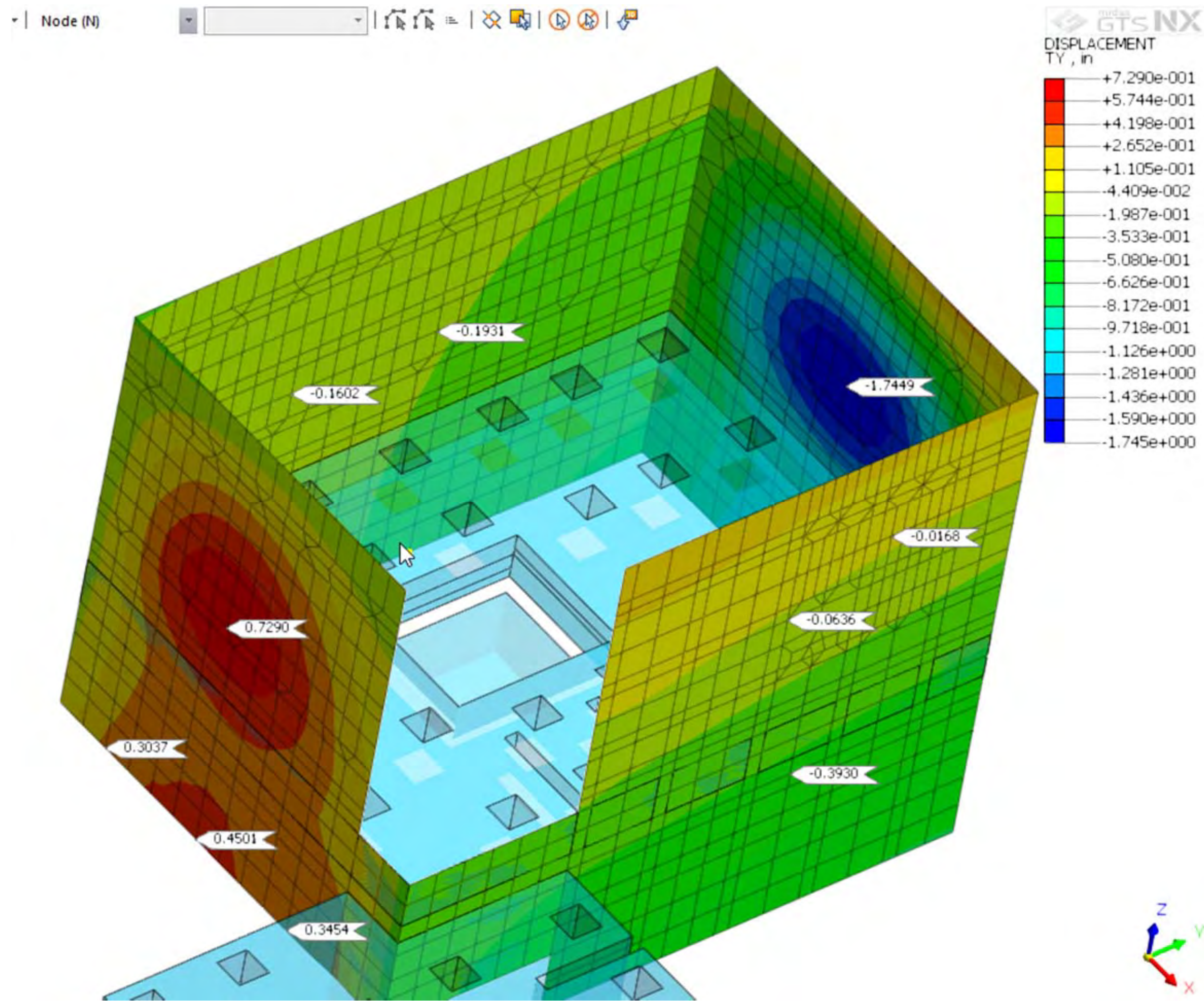


Figure 12: Contours of T2 CSM Wall Lateral Deformation (E-W), Final Excavation Stage II.

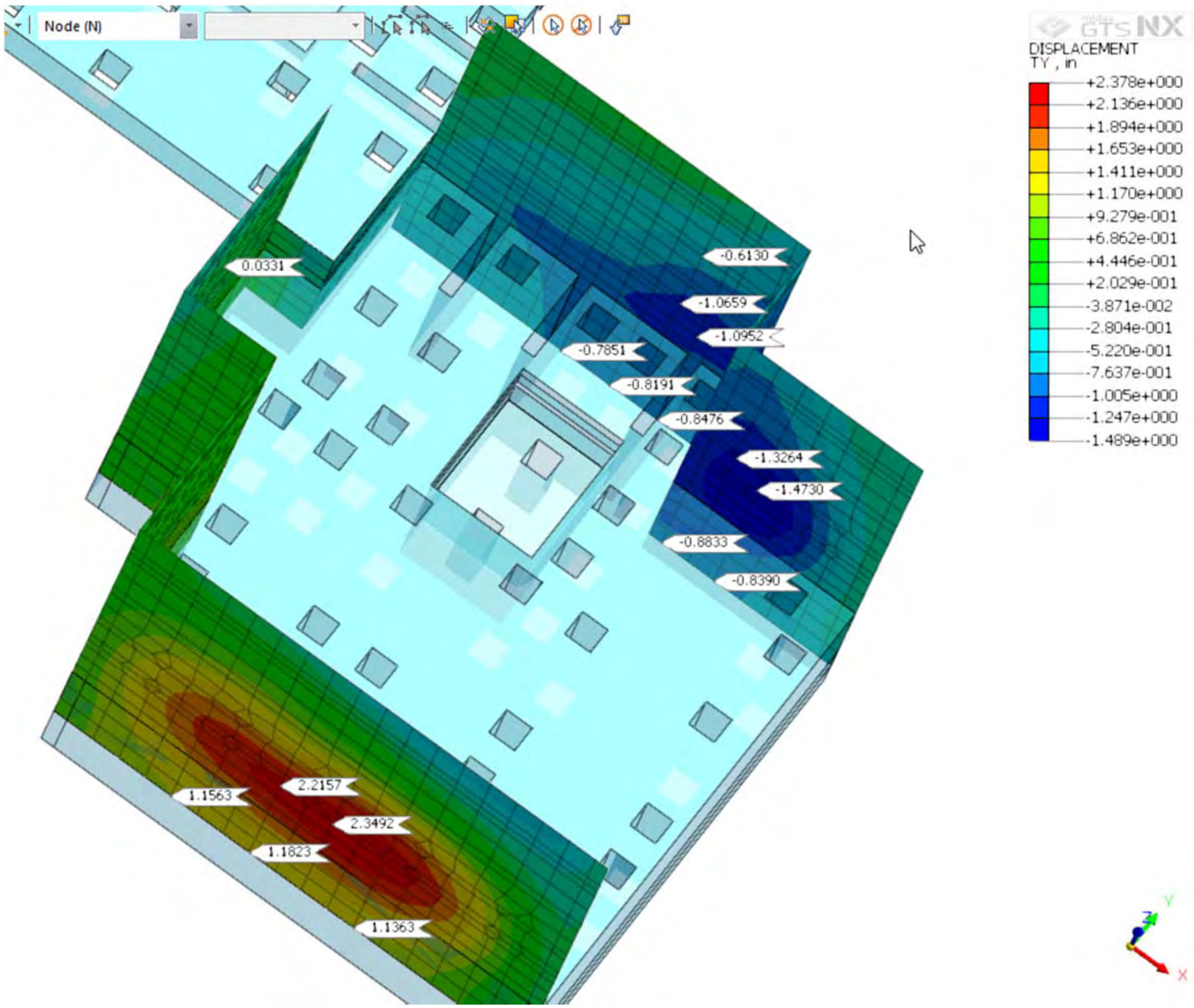


Figure 13: Contours of T1 CSM Wall Lateral Deformation (E-W), Final Excavation Stage II.

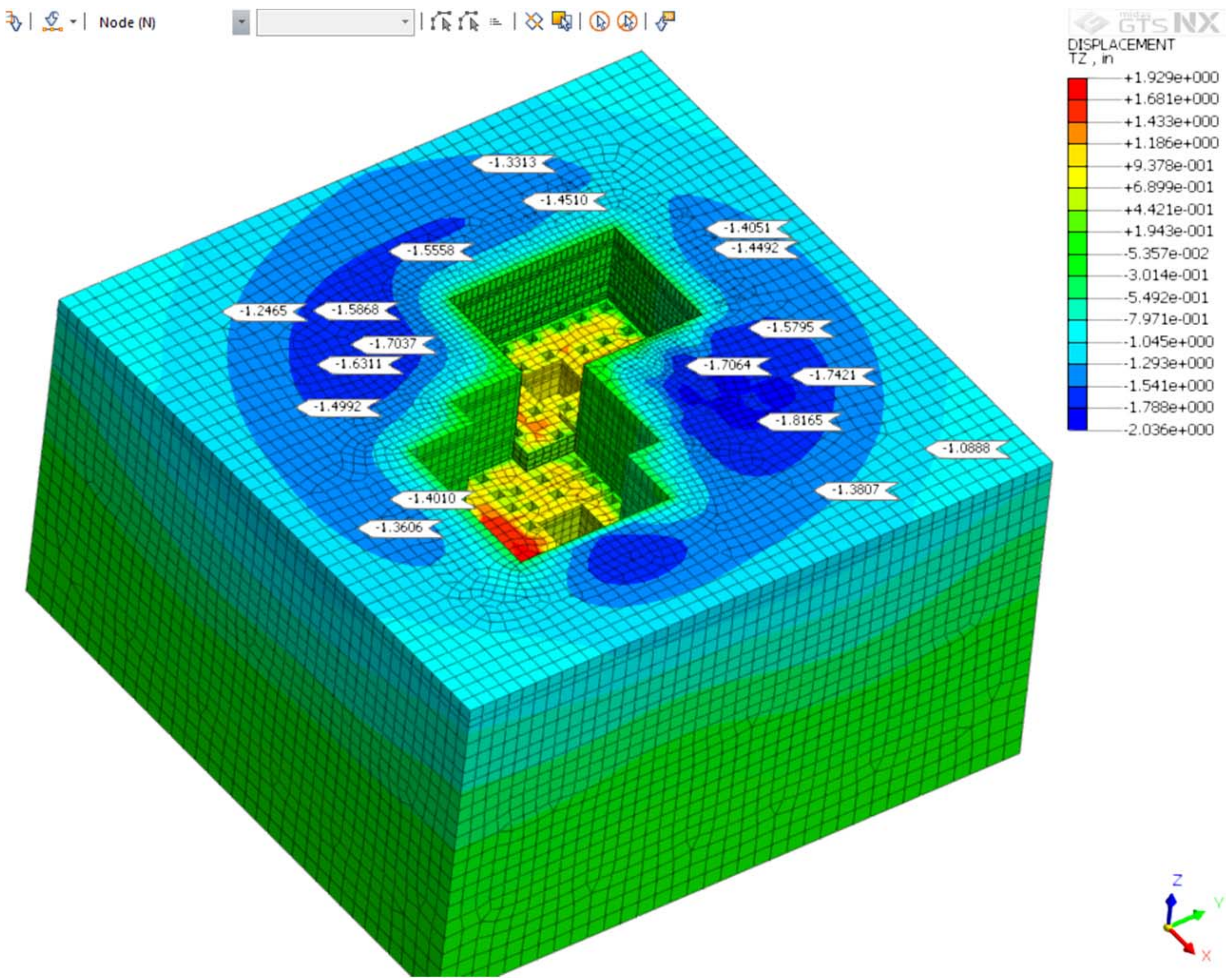


Figure 14: Contours of Vertical Deformation at Ground Surface, Final Excavation Stage II.

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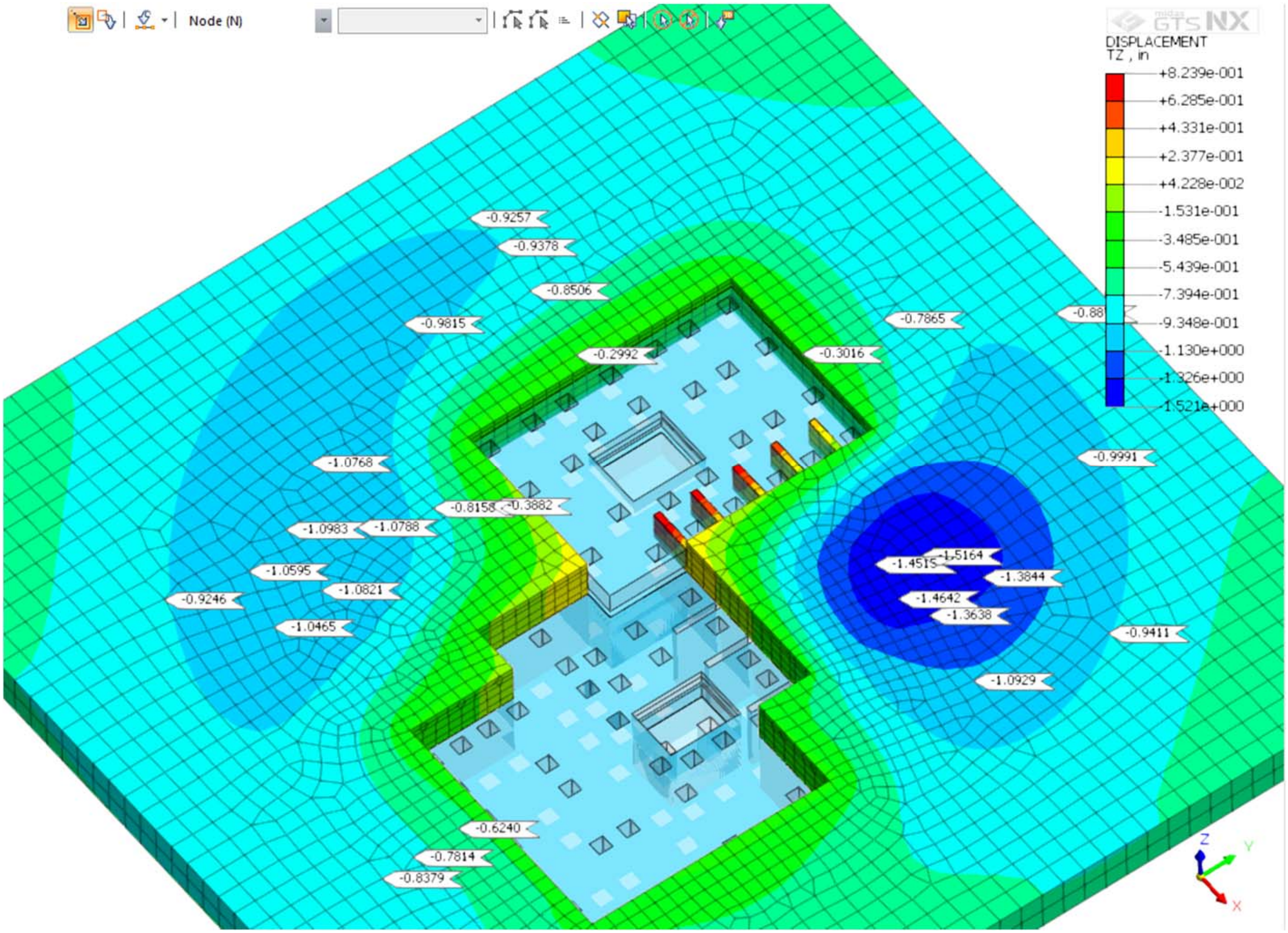

Figure 15: Contours of Vertical Deformation at Top of Colma Sand, Final Excavation Stage II.

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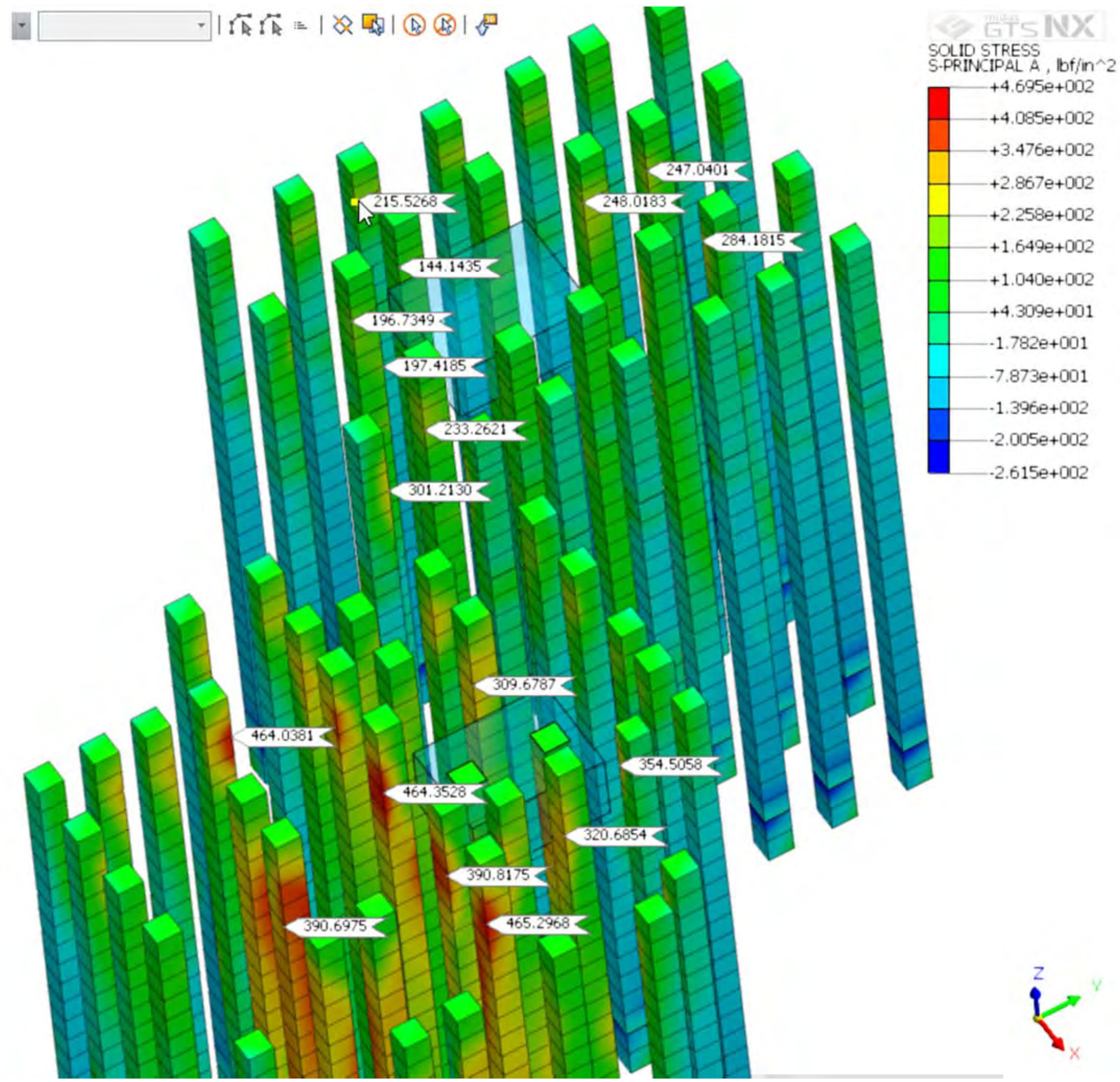

Figure 16: Contours of Major Principal Stresses (Tension) in Drilled Shafts, Final Excavation Stage II.

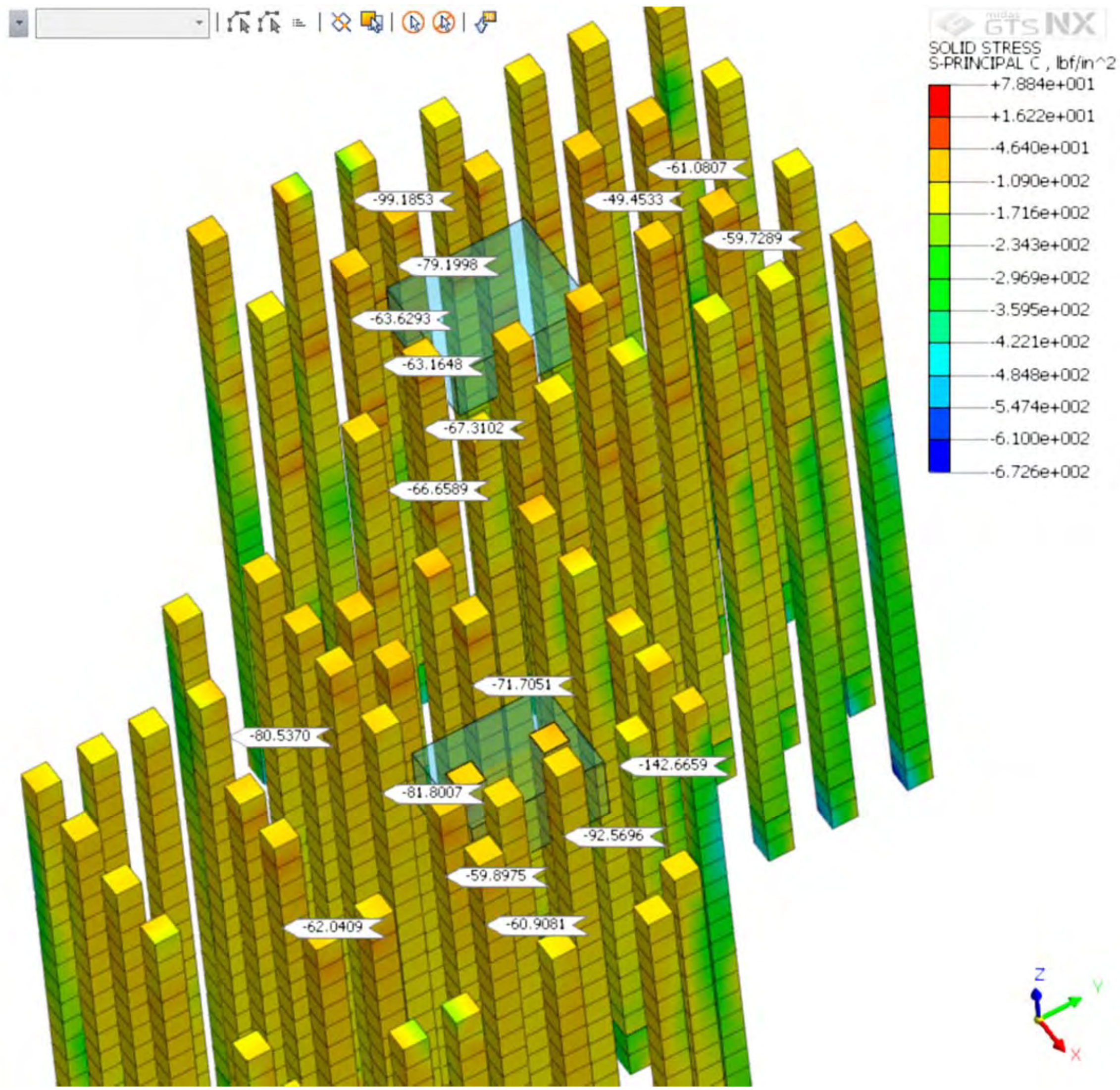

Figure 17: Contours of Minor Principal Stresses in Drilled Shafts, Final Excavation Stage II.

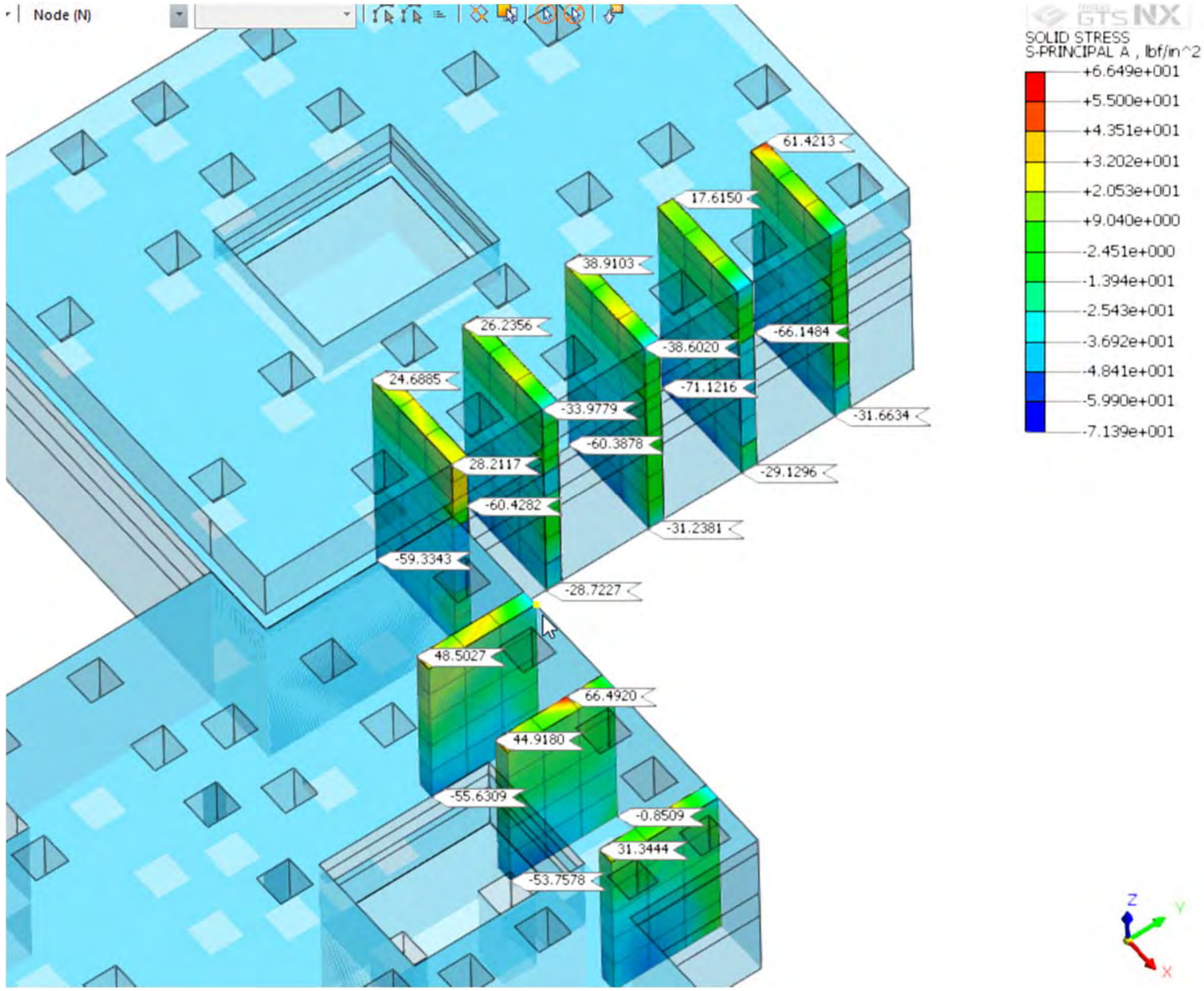

Figure 18: Contours of Major Principal Stress (Tension) in CSM Buttresses, Final Excavation Stage II.

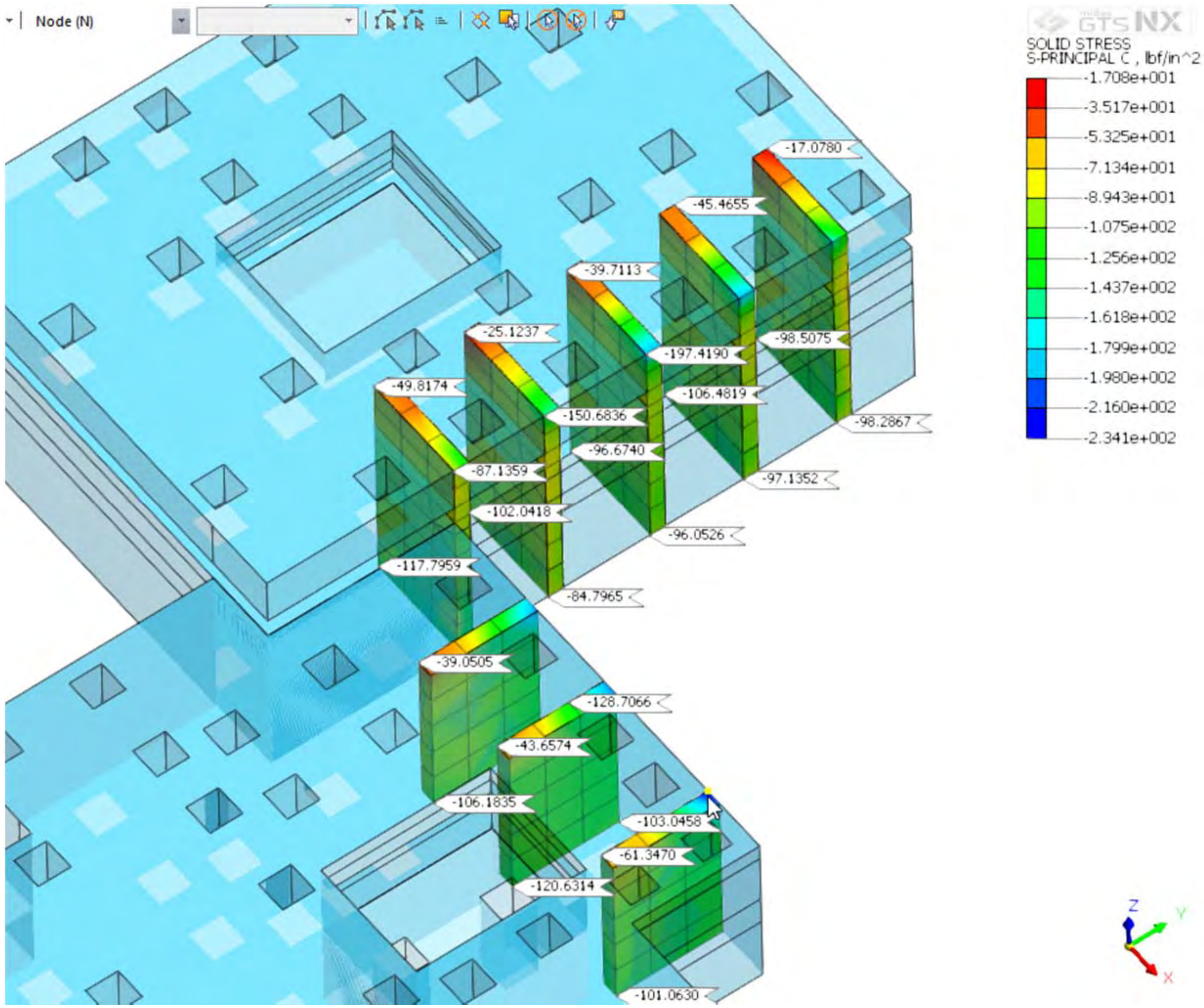

Figure 19: Contours of Minor Principal Stress in CSM Buttresses, Final Excavation Stage II.

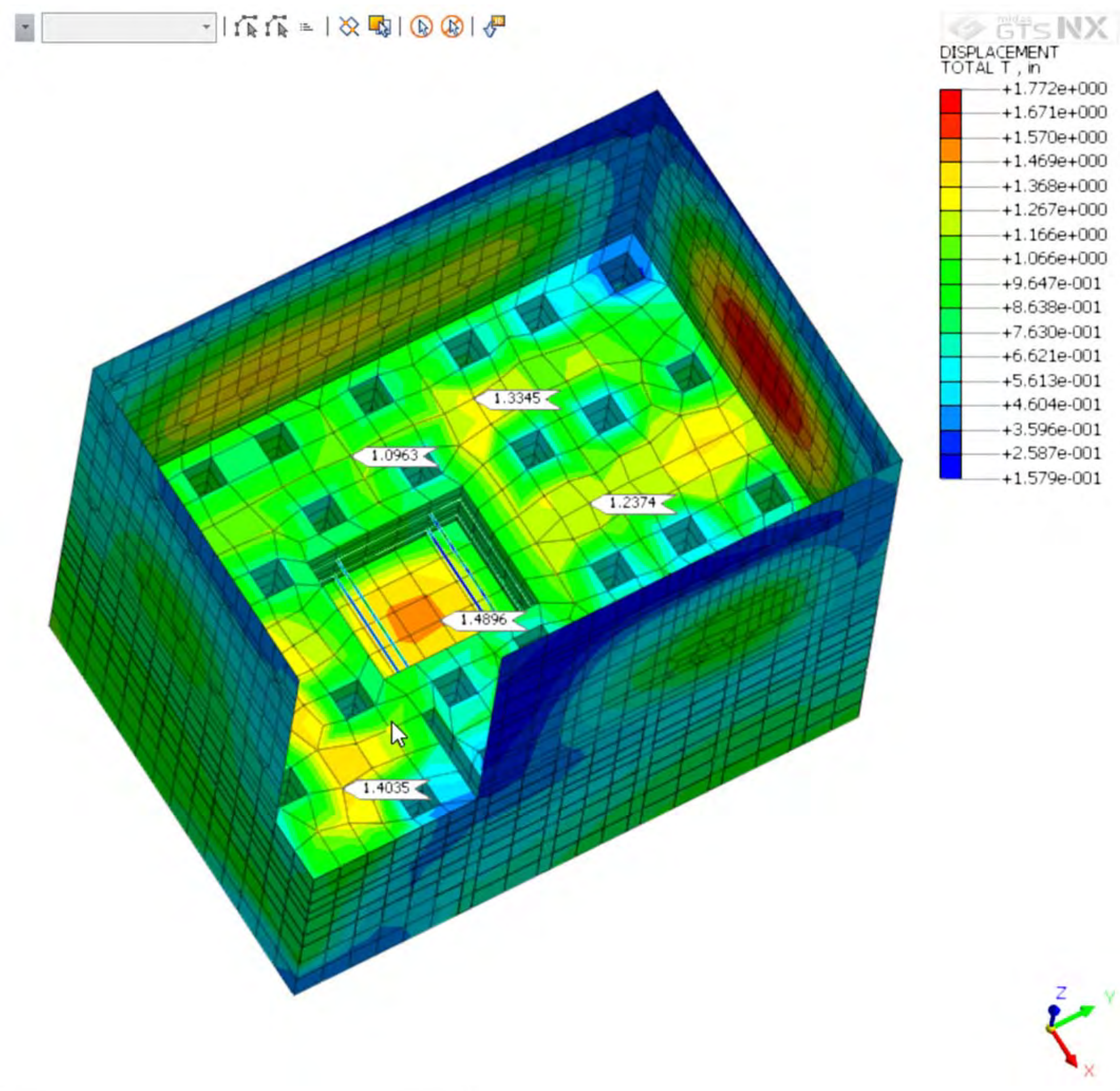

Figure 20: Isometric View of T2 Elevator Pit Excavation with Contours of Total Deformation.

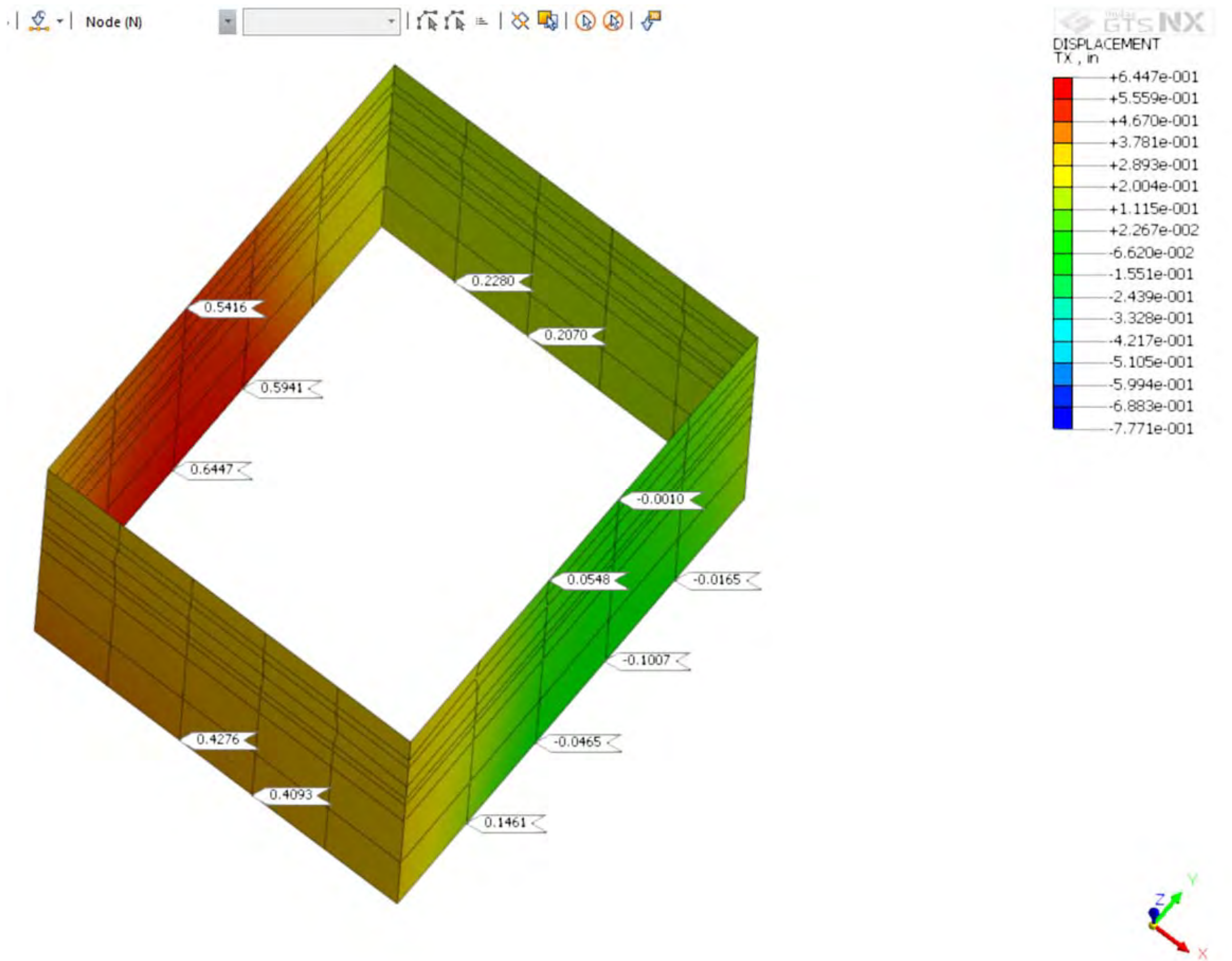

Figure 21: Contours of T2 CSM Pit Wall Lateral Deformation (N-S), Final Stage II.

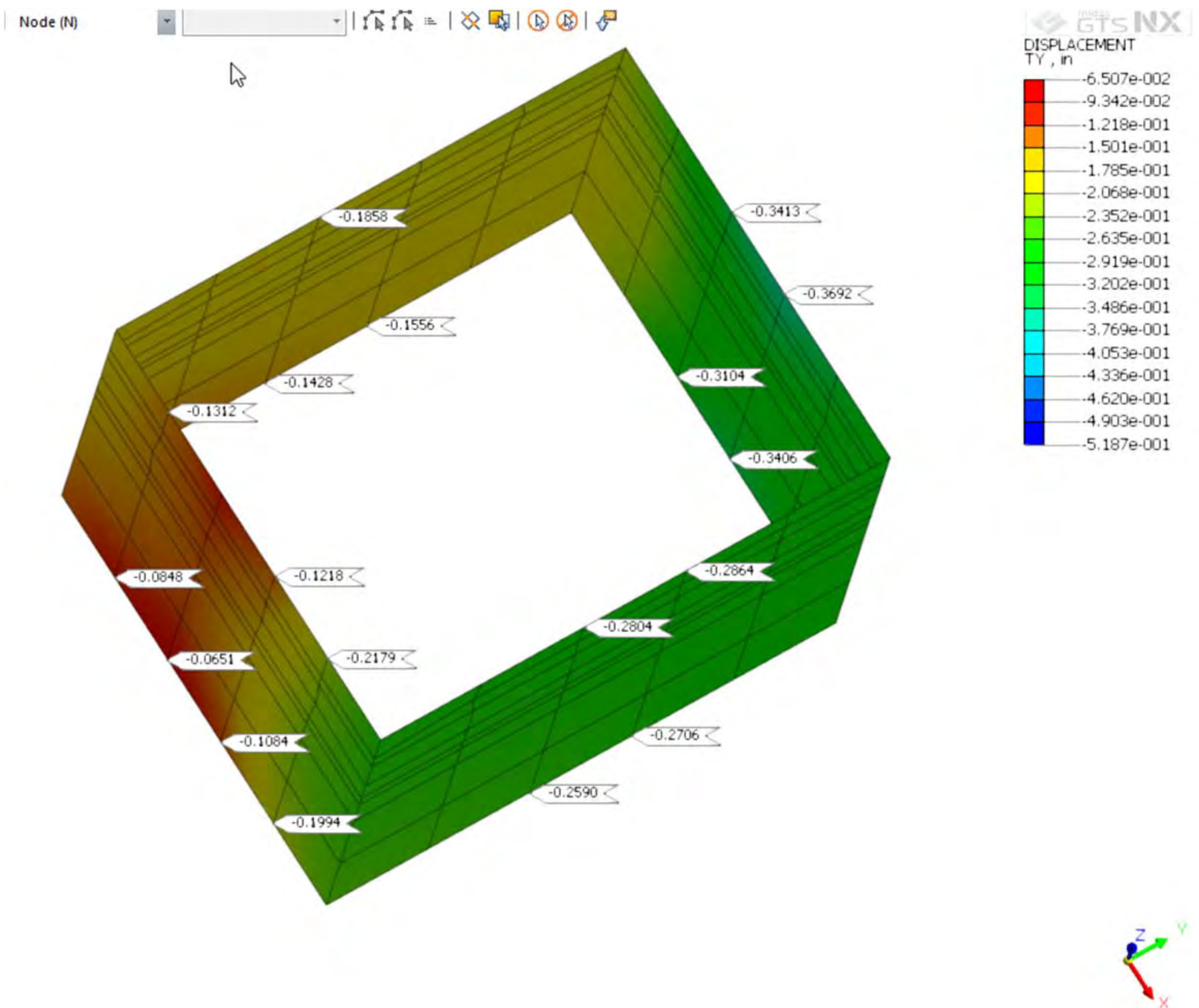

Figure 22: Contours of T2 CSM Pit Wall Lateral Deformation (E-W), Final Stage II.

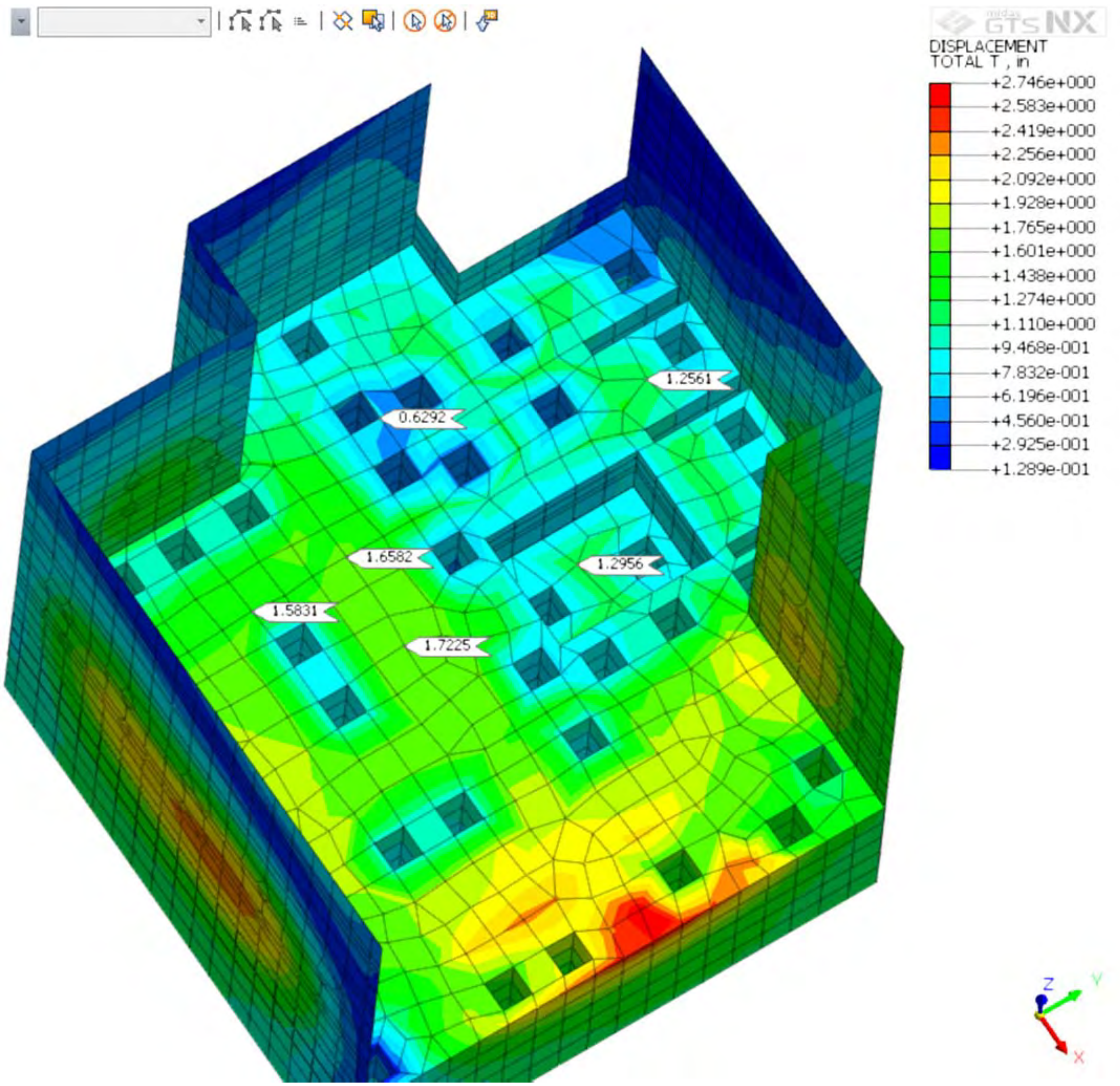

Figure 23: Isometric View of T1 Elevator Pit Excavation.

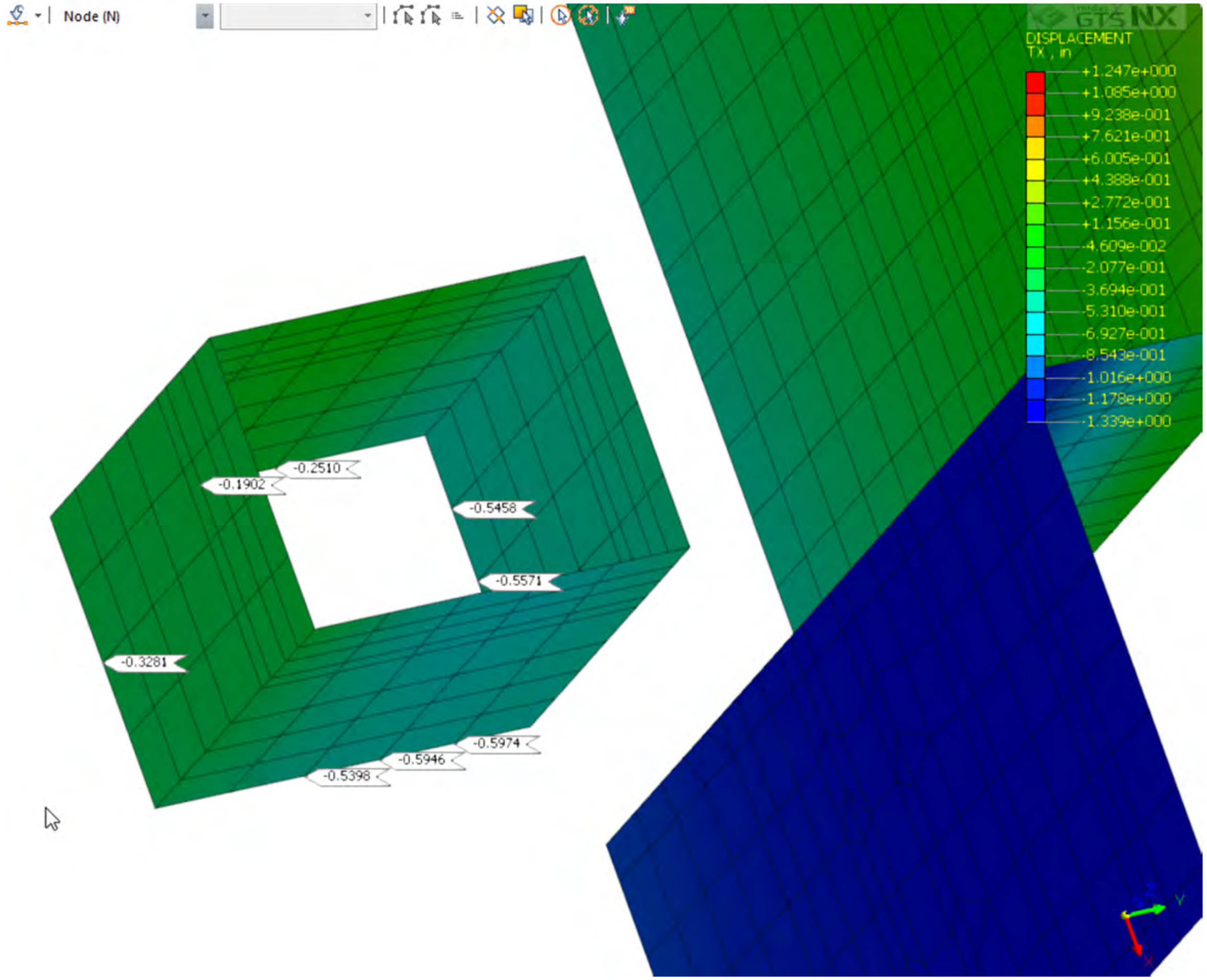

Figure 24: Contours of T1 CSM Pit Wall Lateral Deformation (N-S), Final Stage II.

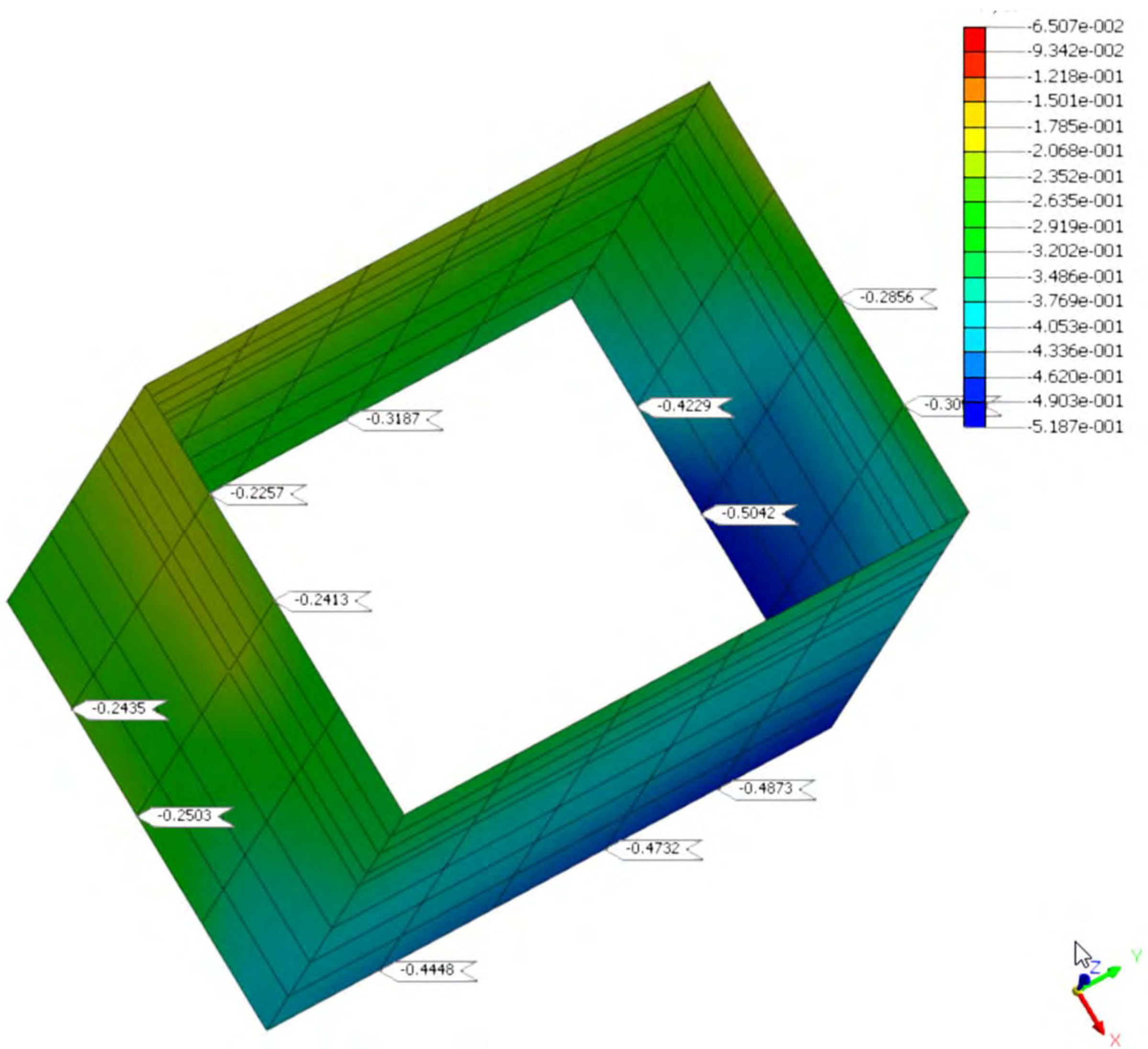

Figure 25: Contours of T2 CSM Pit Wall Lateral Deformation (E-W), Final Stage II.

FDIC Building at 25 Jessie Street,

San Francisco, CA

Appendix B

Structural Calculations
FDIC Building Evaluation for
Excavation Induced Ground Movements

December 15, 2017

Prepared by:

Nabih Youssef Associates

NYA Project: 17164.01

Prepared for:

Oceanwide Center LLP,

88 First Street, 6th Floor, San Francisco, CA 94105

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C.3.1 Moment Frame (MF) Connections – Seismic

D Threshold Limit - Check at 88% of Excavation Induced Ground Settlements

D.1 Moment Frame (MF) Connections – Threshold Settlement Magnitude

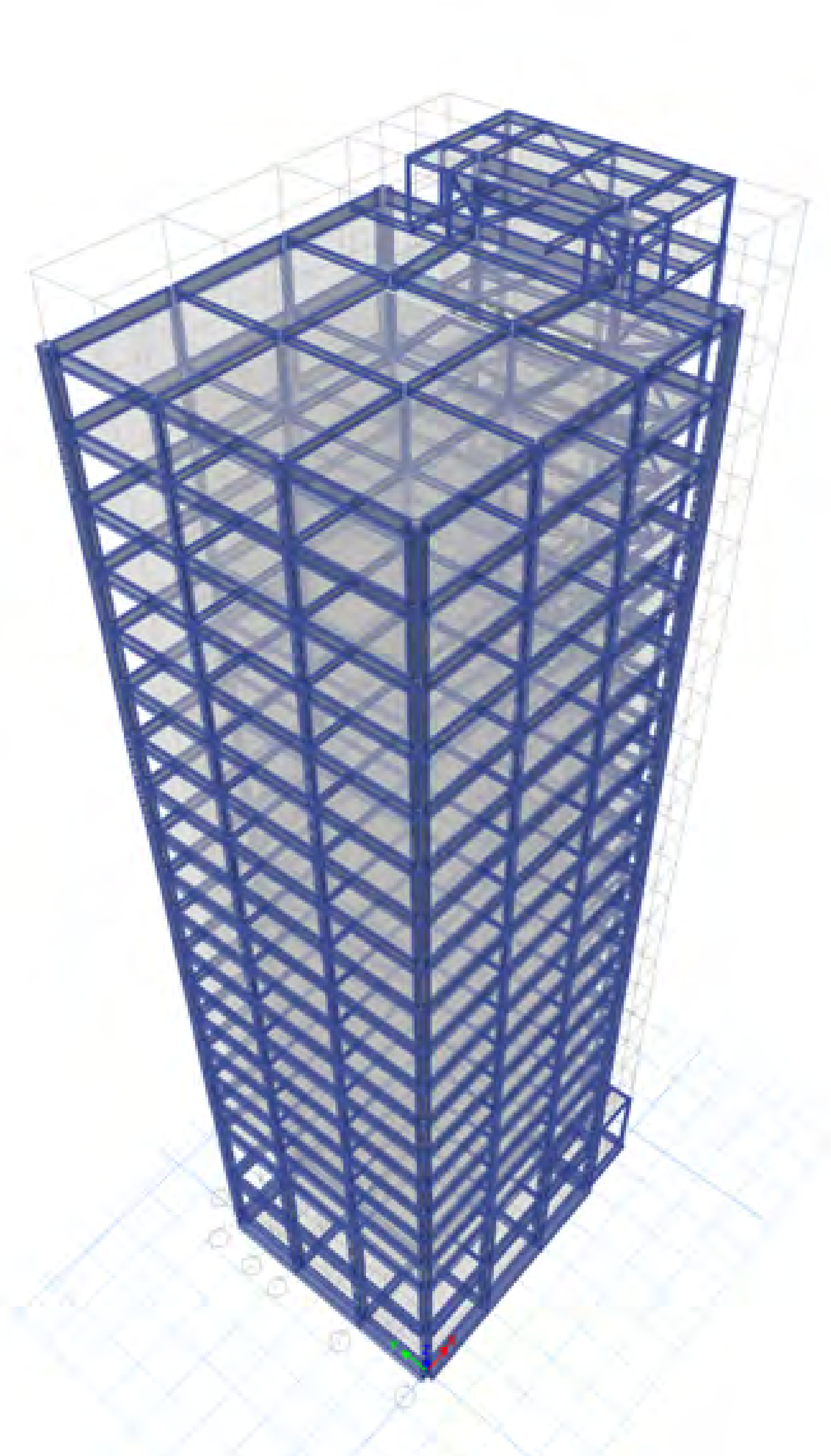


Figure: 3-D view of FDIC Building Analysis Model
(See Report Section 3 for "Description of Building Model & Analysis")

A.1.1 Roof Drift due to Excavation Induced Ground Settlement
(ref. Report Section 5.B & 5.E)

Roof Drift under H case

Origin movement

Story	Label	Unique Name	Load Case/Combo	UX	UY	UZ
				in	in	in
GRD	1	1	H	0.6	-0.47	-0.544
GRD	5	8	H	0.6	-0.47	-0.055
GRD	14	241	H	0.6	-0.47	0.042
GRD	66	281	H	0.6	-0.47	-0.349
GRD	71	81	H	0.6	-0.47	-1.364
GRD	75	88	H	0.6	-0.47	-0.935

Story	Label	Unique Name	Load Case/Combo	UX	UY	UZ	UX~	UY~	Roof Drift	Drift Ratio
				in	in	in	in	in		
RF	1	24	H	-1.1978	2.9529	-0.6864	1.7978	-3.4229	3.423	0.109%
RF	5	26	H	-1.1978	3.0283	-0.1804	1.7978	-3.4983	3.498	0.111%
RF	14	253	H	-1.2113	3.0463	0.0367	1.8113	-3.5163	3.516	0.112%
RF	66	293	H	-1.2567	3.0463	-0.3719	1.8567	-3.5163	3.516	0.112%
RF	71	104	H	-1.2702	2.9529	-1.5378	1.8702	-3.4229	3.423	0.109%
RF	75	106	H	-1.2702	3.0283	-1.0806	1.8702	-3.4983	3.498	0.111%
									max	**0.112%**

tilda(~) is relative displacement from support movement and settlement.
Settlement input is based on contour map by Brierly Associates.
MEMORANDUM dated on July 7, 2017.

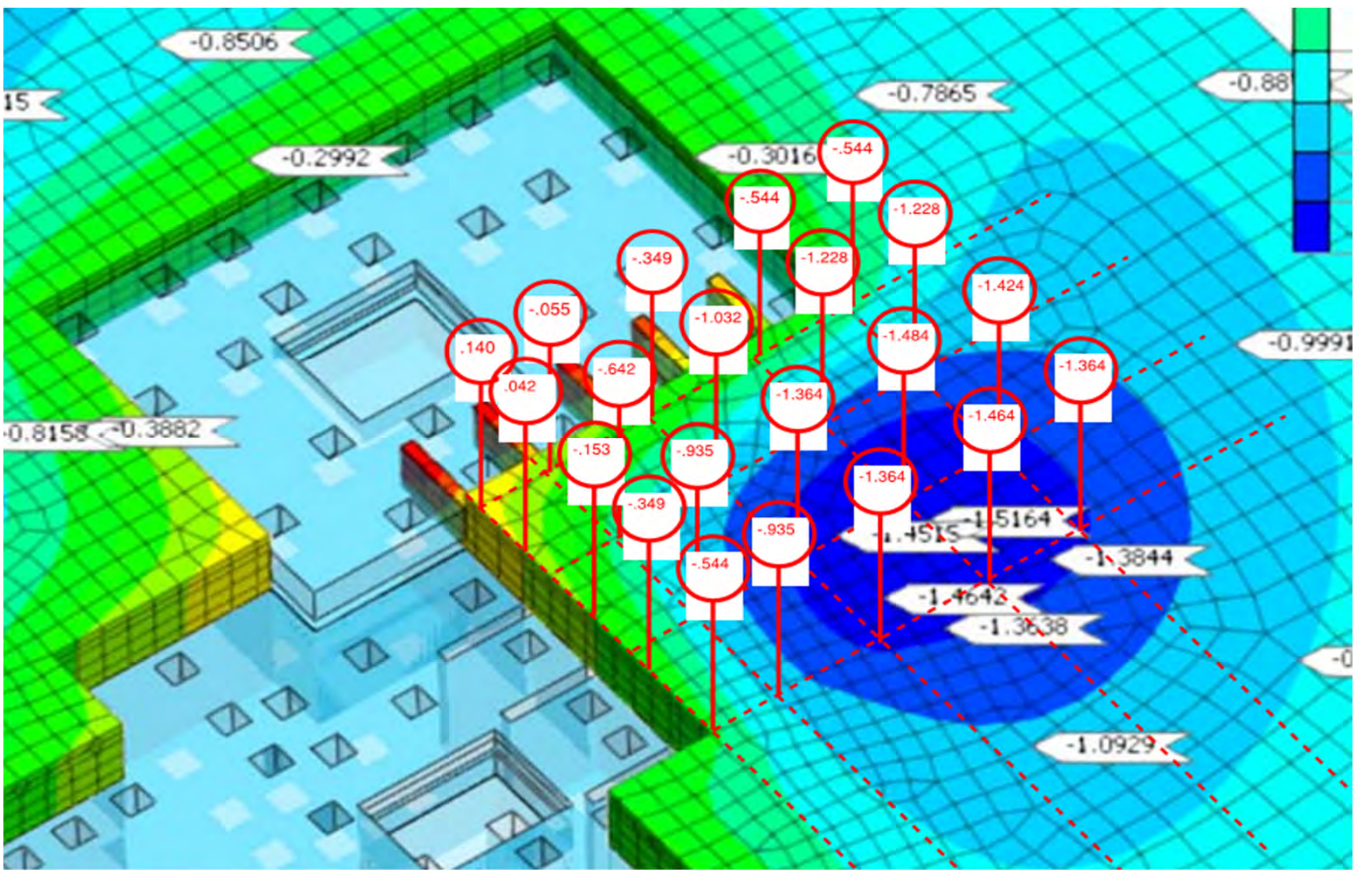


Figure: Excavation Induced Ground Settlement per Brierley Report

A.1.2 Level 2 Drift due to Excavation Induced Ground Settlement (ref. Report Section 5.B & 5.E)

Level 2 Drift under H case

Story	Label	Unique Name	Load Case/Combo	UX in	UY in	UZ in	UX~ in	UY~ in	Roof Drift	Drift Ratio
2	1	3	H	0.2544	0.1871	-0.5965	0.3456	-0.6571	0.657	0.110%
2	5	10	H	0.2544	0.2052	-0.1024	0.3456	-0.6752	0.675	0.113%
2	14	243	H	0.2512	0.2096	0.0407	0.3488	-0.6796	0.680	0.113%
2	66	283	H	0.2403	0.2096	-0.3527	0.3597	-0.6796	0.680	0.113%
2	71	83	H	0.2370	0.1871	-1.4258	0.3630	-0.6571	0.657	0.110%
2	75	90	H	0.2370	0.2052	-0.9898	0.3630	-0.6752	0.675	0.113%
									max	**0.113%**

tilda(~) is relative displacement from support movement and settlement.

A.2.1 Roof Drift - Serviceability Level Wind (ref. Report Section 5.B & 5.E)

Roof Drift under Wind Load

Serviceability level, factor is: **0.42** **from 700 yr RP to 10 yr RP**

per ASCE 7-05 and ASCE 7-10 Commentary and IBC 2015 Table 1604.3 Note

Story	Label	Unique Name	Load Case/Combo	UX	UY	UZ	RX	RY	RZ	Roof Drift	Drift Ratio
				in	in	in	rad	rad	rad		
RF	1	24	W, Service 1	3.369	0.000	0.079	0.000	0.000	0.000	3.369	0.107%
RF	1	24	W, Service 2	0.492	3.879	0.110	0.000	0.000	0.001	3.879	0.123%
RF	1	24	W, Service 3	2.834	-0.314	0.059	0.000	0.000	0.001	2.834	0.090%
RF	1	24	W, Service 4	2.220	0.314	0.060	0.000	0.000	-0.001	2.220	0.070%
RF	1	24	W, Service 5	0.868	2.399	0.081	0.000	0.000	0.002	2.399	0.076%
RF	1	24	W, Service 6	-0.130	3.419	0.083	0.000	0.000	0.000	3.419	0.109%
RF	1	24	W, Service 7	2.158	-2.909	-0.023	0.000	0.000	-0.001	2.909	0.092%
RF	1	24	W, Service 8	2.896	2.910	0.141	0.000	0.000	0.001	2.910	0.092%
RF	1	24	W, Service 9	2.225	-2.802	-0.019	0.000	0.000	0.001	2.802	0.089%
RF	1	24	W, Service 10	1.015	-1.565	-0.016	0.000	0.000	-0.002	1.565	0.050%
RF	1	24	W, Service 11	2.779	1.566	0.105	0.000	0.000	0.002	2.779	0.088%
RF	1	24	W, Service 12	1.569	2.803	0.107	0.000	0.000	-0.001	2.803	0.089%
RF	5	26	W, Service 1	3.369	0.000	-0.075	0.000	0.000	0.000	3.369	0.107%
RF	5	26	W, Service 2	0.492	4.906	0.113	-0.001	0.000	0.001	4.906	0.156%
RF	5	26	W, Service 3	2.834	0.326	-0.055	0.000	0.000	0.001	2.834	0.090%
RF	5	26	W, Service 4	2.220	-0.326	-0.057	0.000	0.000	-0.001	2.220	0.070%
RF	5	26	W, Service 5	0.868	4.210	0.087	-0.001	0.000	0.002	4.210	0.134%
RF	5	26	W, Service 6	-0.130	3.149	0.083	0.000	0.000	0.000	3.149	0.100%
RF	5	26	W, Service 7	2.158	-3.679	-0.141	0.001	0.000	-0.001	3.679	0.117%
RF	5	26	W, Service 8	2.896	3.679	0.029	0.000	0.000	0.001	3.679	0.117%
RF	5	26	W, Service 9	2.225	-2.119	-0.103	0.000	0.000	0.001	2.225	0.071%
RF	5	26	W, Service 10	1.015	-3.405	-0.108	0.000	0.000	-0.002	3.405	0.108%
RF	5	26	W, Service 11	2.779	3.405	0.024	0.000	0.000	0.002	3.405	0.108%
RF	5	26	W, Service 12	1.569	2.119	0.019	0.000	0.000	-0.001	2.119	0.067%
RF	14	253	W, Service 1	3.369	0.000	-0.008	0.000	0.000	0.000	3.369	0.107%
RF	14	253	W, Service 2	0.308	5.150	0.007	-0.001	0.000	0.001	5.150	0.163%
RF	14	253	W, Service 3	2.719	0.478	-0.005	0.000	0.000	0.001	2.719	0.086%
RF	14	253	W, Service 4	2.335	-0.479	-0.006	0.000	0.000	-0.001	2.335	0.074%
RF	14	253	W, Service 5	0.543	4.641	0.005	-0.001	0.000	0.002	4.641	0.147%
RF	14	253	W, Service 6	-0.081	3.084	0.005	0.000	0.000	0.000	3.084	0.098%
RF	14	253	W, Service 7	2.296	-3.863	-0.011	0.000	0.000	-0.001	3.863	0.123%
RF	14	253	W, Service 8	2.758	3.862	-0.001	0.000	0.000	0.001	3.862	0.123%
RF	14	253	W, Service 9	2.102	-1.956	-0.008	0.000	0.000	0.001	2.102	0.067%
RF	14	253	W, Service 10	1.345	-3.843	-0.009	0.000	0.000	-0.002	3.843	0.122%
RF	14	253	W, Service 11	2.449	3.843	0.000	0.000	0.000	0.002	3.843	0.122%
RF	14	253	W, Service 12	1.692	1.956	-0.001	0.000	0.000	-0.001	1.956	0.062%
RF	66	293	W, Service 1	3.370	0.000	-0.008	0.000	0.000	0.000	3.370	0.107%
RF	66	293	W, Service 2	-0.308	5.150	-0.007	-0.001	0.000	0.001	5.150	0.163%
RF	66	293	W, Service 3	2.335	0.478	-0.006	0.000	0.000	0.001	2.335	0.074%
RF	66	293	W, Service 4	2.719	-0.479	-0.005	0.000	0.000	-0.001	2.719	0.086%
RF	66	293	W, Service 5	-0.544	4.641	-0.005	-0.001	0.000	0.002	4.641	0.147%
RF	66	293	W, Service 6	0.081	3.084	-0.005	0.000	0.000	0.000	3.084	0.098%
RF	66	293	W, Service 7	2.758	-3.863	-0.001	0.000	0.000	-0.001	3.863	0.123%
RF	66	293	W, Service 8	2.296	3.862	-0.011	0.000	0.000	0.001	3.862	0.123%
RF	66	293	W, Service 9	1.692	-1.956	-0.001	0.000	0.000	0.001	1.956	0.062%
RF	66	293	W, Service 10	2.449	-3.843	0.000	0.000	0.000	-0.002	3.843	0.122%
RF	66	293	W, Service 11	1.345	3.843	-0.009	0.000	0.000	0.002	3.843	0.122%
RF	66	293	W, Service 12	2.102	1.956	-0.008	0.000	0.000	-0.001	2.102	0.067%
RF	71	104	W, Service 1	3.370	0.000	0.079	0.000	0.000	0.000	3.370	0.107%
RF	71	104	W, Service 2	-0.492	3.879	-0.110	0.000	0.000	0.001	3.879	0.123%
RF	71	104	W, Service 3	2.220	-0.314	0.060	0.000	0.000	0.001	2.220	0.070%
RF	71	104	W, Service 4	2.834	0.314	0.059	0.000	0.000	-0.001	2.834	0.090%
RF	71	104	W, Service 5	-0.868	2.399	-0.081	0.000	0.000	0.002	2.399	0.076%
RF	71	104	W, Service 6	0.130	3.419	-0.083	0.000	0.000	0.000	3.419	0.109%
RF	71	104	W, Service 7	2.896	-2.909	0.141	0.000	0.000	-0.001	2.909	0.092%
RF	71	104	W, Service 8	2.158	2.910	-0.023	0.000	0.000	0.001	2.910	0.092%
RF	71	104	W, Service 9	1.569	-2.802	0.107	0.000	0.000	0.001	2.802	0.089%
RF	71	104	W, Service 10	2.779	-1.565	0.105	0.000	0.000	-0.002	2.779	0.088%
RF	71	104	W, Service 11	1.015	1.566	-0.016	0.000	0.000	0.002	1.566	0.050%
RF	71	104	W, Service 12	2.225	2.803	-0.019	0.000	0.000	-0.001	2.803	0.089%
RF	75	106	W, Service 1	3.370	0.000	-0.075	0.000	0.000	0.000	3.370	0.107%
RF	75	106	W, Service 2	-0.492	4.906	-0.113	-0.001	0.000	0.001	4.906	0.156%
RF	75	106	W, Service 3	2.220	0.326	-0.057	0.000	0.000	0.001	2.220	0.070%
RF	75	106	W, Service 4	2.834	-0.326	-0.055	0.000	0.000	-0.001	2.834	0.090%
RF	75	106	W, Service 5	-0.868	4.210	-0.087	-0.001	0.000	0.002	4.210	0.134%
RF	75	106	W, Service 6	0.130	3.149	-0.083	0.000	0.000	0.000	3.149	0.100%
RF	75	106	W, Service 7	2.896	-3.679	0.029	0.000	0.000	-0.001	3.679	0.117%
RF	75	106	W, Service 8	2.158	3.679	-0.141	-0.001	0.000	0.001	3.679	0.117%
RF	75	106	W, Service 9	1.569	-2.119	0.019	0.000	0.000	0.001	2.119	0.067%
RF	75	106	W, Service 10	2.779	-3.405	0.024	0.000	0.000	-0.002	3.405	0.108%
RF	75	106	W, Service 11	1.015	3.405	-0.108	0.000	0.000	0.002	3.405	0.108%
RF	75	106	W, Service 12	2.225	2.119	-0.103	0.000	0.000	-0.001	2.225	0.071%
										max	**0.163%**

A.2.2 Level 2 Drift - Serviceability Level Wind (ref. Report Section 5.B & 5.E)

Level 2 Drift under Wind Load

Serviceability level, factor is: **0.42** **from 700 yr RP to 10 yr RP**

per ASCE 7-05 and ASCE 7-10 Commentary ar IBC 2015 Table 1604.3 Note

Story	Label	Unique Name	Load Case/Combo	UX in	UY in	UZ in	RX rad	RY rad	RZ rad	Roof Drift	Drift Ratio
2	1	3	W, Service 1	0.798	0.000	0.032	0.000	0.001	0.000	0.798	0.133%
2	1	3	W, Service 2	0.121	0.881	0.044	-0.001	0.000	0.000	0.881	0.147%
2	1	3	W, Service 3	0.680	-0.084	0.024	0.000	0.001	0.000	0.680	0.113%
2	1	3	W, Service 4	0.517	0.085	0.024	0.000	0.001	0.000	0.517	0.086%
2	1	3	W, Service 5	0.220	0.526	0.032	-0.001	0.000	0.001	0.526	0.088%
2	1	3	W, Service 6	-0.039	0.795	0.033	-0.001	0.000	0.000	0.795	0.133%
2	1	3	W, Service 7	0.508	-0.660	-0.009	0.001	0.001	0.000	0.660	0.110%
2	1	3	W, Service 8	0.689	0.661	0.057	-0.001	0.001	0.000	0.689	0.115%
2	1	3	W, Service 9	0.540	-0.660	-0.007	0.001	0.001	0.000	0.660	0.110%
2	1	3	W, Service 10	0.223	-0.331	-0.006	0.000	0.000	-0.001	0.331	0.055%
2	1	3	W, Service 11	0.675	0.331	0.042	0.000	0.001	0.001	0.675	0.113%
2	1	3	W, Service 12	0.359	0.660	0.043	-0.001	0.000	0.000	0.660	0.110%
2	5	10	W, Service 1	0.798	0.000	-0.031	0.000	0.001	0.000	0.798	0.133%
2	5	10	W, Service 2	0.121	1.132	0.048	-0.001	0.000	0.000	1.132	0.189%
2	5	10	W, Service 3	0.680	0.085	-0.022	0.000	0.001	0.000	0.680	0.113%
2	5	10	W, Service 4	0.517	-0.085	-0.024	0.000	0.001	0.000	0.517	0.086%
2	5	10	W, Service 5	0.220	0.985	0.037	-0.001	0.000	0.001	0.985	0.164%
2	5	10	W, Service 6	-0.039	0.713	0.035	-0.001	0.000	0.000	0.713	0.119%
2	5	10	W, Service 7	0.508	-0.849	-0.059	0.001	0.001	0.000	0.849	0.142%
2	5	10	W, Service 8	0.689	0.849	0.013	-0.001	0.001	0.000	0.849	0.141%
2	5	10	W, Service 9	0.540	-0.471	-0.043	0.001	0.001	0.000	0.540	0.090%
2	5	10	W, Service 10	0.223	-0.804	-0.046	0.001	0.000	-0.001	0.804	0.134%
2	5	10	W, Service 11	0.675	0.803	0.011	-0.001	0.001	0.001	0.803	0.134%
2	5	10	W, Service 12	0.359	0.471	0.008	-0.001	0.000	0.000	0.471	0.079%
2	14	243	W, Service 1	0.798	0.000	-0.002	0.000	0.001	0.000	0.798	0.133%
2	14	243	W, Service 2	0.075	1.192	0.001	-0.002	0.000	0.000	1.192	0.199%
2	14	243	W, Service 3	0.649	0.125	-0.001	0.000	0.001	0.000	0.649	0.108%
2	14	243	W, Service 4	0.547	-0.126	-0.001	0.000	0.001	0.000	0.547	0.091%
2	14	243	W, Service 5	0.138	1.094	0.001	-0.002	0.000	0.001	1.094	0.182%
2	14	243	W, Service 6	-0.025	0.694	0.001	-0.001	0.000	0.000	0.694	0.116%
2	14	243	W, Service 7	0.542	-0.894	-0.002	0.001	0.001	0.000	0.894	0.149%
2	14	243	W, Service 8	0.655	0.894	0.000	-0.001	0.001	0.000	0.894	0.149%
2	14	243	W, Service 9	0.506	-0.427	-0.001	0.001	0.001	0.000	0.506	0.084%
2	14	243	W, Service 10	0.308	-0.916	-0.001	0.001	0.001	-0.001	0.916	0.153%
2	14	243	W, Service 11	0.591	0.916	0.000	-0.002	0.001	0.001	0.916	0.153%
2	14	243	W, Service 12	0.392	0.426	0.000	-0.001	0.001	0.000	0.426	0.071%
2	66	283	W, Service 1	0.798	0.000	-0.002	0.000	0.001	0.000	0.798	0.133%
2	66	283	W, Service 2	-0.076	1.192	-0.001	-0.002	0.000	0.000	1.192	0.199%
2	66	283	W, Service 3	0.548	0.125	-0.001	0.000	0.001	0.000	0.548	0.091%
2	66	283	W, Service 4	0.649	-0.126	-0.001	0.000	0.001	0.000	0.649	0.108%
2	66	283	W, Service 5	-0.138	1.094	-0.001	-0.002	0.000	0.001	1.094	0.182%
2	66	283	W, Service 6	0.025	0.694	-0.001	-0.001	0.000	0.000	0.694	0.116%
2	66	283	W, Service 7	0.655	-0.894	0.000	0.001	0.001	0.000	0.894	0.149%
2	66	283	W, Service 8	0.542	0.894	-0.002	-0.001	0.001	0.000	0.894	0.149%
2	66	283	W, Service 9	0.393	-0.427	0.000	0.001	0.001	0.000	0.427	0.071%
2	66	283	W, Service 10	0.591	-0.916	0.000	0.002	0.001	-0.001	0.916	0.153%
2	66	283	W, Service 11	0.307	0.916	-0.001	-0.001	0.001	0.001	0.916	0.153%
2	66	283	W, Service 12	0.506	0.426	-0.001	-0.001	0.001	0.000	0.506	0.084%
2	71	83	W, Service 1	0.798	0.000	0.032	0.000	0.001	0.000	0.798	0.133%
2	71	83	W, Service 2	-0.121	0.881	-0.044	-0.001	0.000	0.000	0.881	0.147%
2	71	83	W, Service 3	0.517	-0.084	0.024	0.000	0.001	0.000	0.517	0.086%
2	71	83	W, Service 4	0.680	0.085	0.024	0.000	0.001	0.000	0.680	0.113%
2	71	83	W, Service 5	-0.220	0.526	-0.032	-0.001	0.000	0.001	0.526	0.088%
2	71	83	W, Service 6	0.039	0.795	-0.033	-0.001	0.000	0.000	0.795	0.133%
2	71	83	W, Service 7	0.689	-0.660	0.057	0.001	0.001	0.000	0.689	0.115%
2	71	83	W, Service 8	0.508	0.661	-0.009	-0.001	0.001	0.000	0.661	0.110%
2	71	83	W, Service 9	0.359	-0.660	0.043	0.001	0.000	0.000	0.660	0.110%
2	71	83	W, Service 10	0.676	-0.331	0.042	0.000	0.001	-0.001	0.676	0.113%
2	71	83	W, Service 11	0.223	0.331	-0.006	0.000	0.000	0.001	0.331	0.055%
2	71	83	W, Service 12	0.540	0.660	-0.007	-0.001	0.001	0.000	0.660	0.110%
2	75	90	W, Service 1	0.798	0.000	-0.031	0.000	0.001	0.000	0.798	0.133%
2	75	90	W, Service 2	-0.121	1.132	-0.048	-0.001	0.000	0.000	1.132	0.189%
2	75	90	W, Service 3	0.517	0.085	-0.024	0.000	0.001	0.000	0.517	0.086%
2	75	90	W, Service 4	0.680	-0.085	-0.022	0.000	0.001	0.000	0.680	0.113%
2	75	90	W, Service 5	-0.220	0.985	-0.037	-0.001	0.000	0.001	0.985	0.164%
2	75	90	W, Service 6	0.039	0.713	-0.035	-0.001	0.000	0.000	0.713	0.119%
2	75	90	W, Service 7	0.689	-0.849	0.013	0.001	0.001	0.000	0.849	0.142%
2	75	90	W, Service 8	0.508	0.849	-0.059	-0.001	0.001	0.000	0.849	0.141%
2	75	90	W, Service 9	0.359	-0.471	0.008	0.001	0.000	0.000	0.471	0.079%
2	75	90	W, Service 10	0.676	-0.804	0.011	0.001	0.001	-0.001	0.804	0.134%
2	75	90	W, Service 11	0.223	0.803	-0.046	-0.001	0.000	0.001	0.803	0.134%
2	75	90	W, Service 12	0.540	0.471	-0.043	-0.001	0.001	0.000	0.540	0.090%
										max	**0.199%**

"Existing" indicates DCR under existing building condition per Report Section 3.A & 5.A

"Settlement" indicates DCR under existing building condition **combined** with excavation induced ground movements per Report Section 3.B & 5.B

"norm DCR" indicates DCR comparison per Report Section 3.C.i

B.1.1 Pile Group Check under Gravity Loads
(ref. Report Section 5.A & 5.B)

Pile group

CEBC 2016, 403.4 5% Threshold

Loc	Level*	Column		Node ID	Existing Pu/Pn	Settlement Pu/Pn	norm_DCR**
X-DIR							
A/2	MEZZ	C2	C2 on MEZZ	2	0.382	0.340	0.892
A/3	MEZZ	C3	C3 on MEZZ	3	0.387	0.379	0.979
D/2	MEZZ	C24	C24 on MEZZ	72	0.382	0.340	0.891
D/3	MEZZ	C25	C25 on MEZZ	73	0.387	0.296	0.765
Y-DIR							
1/B	MEZZ	C11	C11 on MEZZ	21	0.385	0.210	0.544
1/C	MEZZ	C15	C15 on MEZZ	51	0.385	0.312	0.810
4/A.9	MEZZ	C9	C9 on MEZZ	15	0.370	0.258	0.698
4/C.1	MEZZ	C19	C19 on MEZZ	60	0.370	0.308	0.831
Bi-axial							
A/1	MEZZ	C1	C1 on MEZZ	1	0.260	0.429	1.648
A/4	MEZZ	C4	C4 on MEZZ	5	0.266	0.401	1.507
D/1	MEZZ	C23	C23 on MEZZ	71	0.260	0.448	1.723
D/4	MEZZ	C26	C26 on MEZZ	75	0.266	0.418	1.571

Load combinations per ASCE 7
Pu = 1.2D + 0.5L + 1.0 times Settement
Pn is based on recommendation from Geotech Engineer.

Notes:
* Level is for internal call ID for location of pile cap.
**norm_DCR is a normalized value as DCR_Existing/DCR_Settlement.
Node ID is shown on A.2.

"Existing" indicates DCR under existing building condition per Report Section 3.A & 5.C

"Settlement" indicates DCR under existing building condition **combined** with excavation induced ground movements per Report Section 3.B & 5.D

"norm DCR" indicates DCR comparison per Report Section 3.C.ii

B.1.2 Pile Group Check under Seismic Loads (ref. Report Section 5.C.iii & 5.D.vi)

Pile group

C_1C_2 = 1.0 , m_max < 6 when T > 1.0
J = 2.0 , High Seismicity
Existing foundation systems as force-controlled: 10.12.3
CEBC 2016, 403.4 10% Threshold

Loc	Level*	Column		Node ID	Existing Pu1/Pn	Existing Pu2/Pn	Settlement Pu1/Pn	Settlement Pu2/Pn	norm_DCR** case 1	norm_DCR case 2
X-DIR										
A/2	MEZZ	C2	C2 on MEZZ	2	0.349	0.216	0.308	0.175	0.881	0.809
A/3	MEZZ	C3	C3 on MEZZ	3	0.349	0.221	0.341	0.213	0.976	0.963
D/2	MEZZ	C24	C24 on MEZZ	72	0.349	0.216	0.307	0.175	0.881	0.808
D/3	MEZZ	C25	C25 on MEZZ	73	0.349	0.222	0.258	0.131	0.739	0.589
Y-DIR										
1/B	MEZZ	C11	C11 on MEZZ	21	0.357	0.214	0.181	0.038	0.508	0.179
1/C	MEZZ	C15	C15 on MEZZ	51	0.357	0.214	0.283	0.140	0.794	0.657
4/A.9	MEZZ	C9	C9 on MEZZ	15	0.436	0.167	0.324	0.068	0.744	0.410
4/C.1	MEZZ	C19	C19 on MEZZ	60	0.436	0.167	0.374	0.035	0.856	0.208
Bi-axial										
A/1	MEZZ	C1	C1 on MEZZ	1	0.877	1.106	1.038	0.751	1.183	0.679
A/4	MEZZ	C4	C4 on MEZZ	5	0.848	1.048	0.976	0.764	1.151	0.729
D/1	MEZZ	C23	C23 on MEZZ	71	0.877	1.106	1.057	0.710	1.206	0.642
D/4	MEZZ	C26	C26 on MEZZ	75	0.848	1.050	0.993	0.730	1.171	0.696

Load combinations per ASCE 41, Linear Procedure.
Pu1 = $1.1(Q_D + 0.25Q_L) +/- Q_E/(C_1C_2J)$
Pu2 = $0.9Q_D +/- Q_E/(C_1C_2J)$

Notes:
* Level is for internal call ID for location of pile cap.
**norm_DCR is a normalized value as DCR_Existing/DCR_Settlement.

B.1.3 Pile Element Check including Excavation Induced Ground Settlement effects (Downward Cases) (ref. Report Section 5.D.vi)

Per Langan analysis (See Appendix C for details)

DCR under existing building condition **combined** with excavation induced ground movements per Report Section 3.B & 5.D

Pile Capacity Check with Settlement

J = 2.0 Vn = 32.0 , comp
13.5 , tens

Location	Node	# of Piles	direction	Pile	Axial Q_{UF} at Pile Cap P_{UF} kips	P_{UF}/Pile kip	Qe = Demand per Pile (ASCE 41-13) M lb-in	V lb	Location of Max. Moment depth in	ft	Q_{UF} = Demand per Pile M_{UF} k-ft	V_{UF} kip	Q_{CL} = Capacity per Pile phi*Mn at P_{UF} k-ft	Mn k-ft	Vn kip	M_{UF}/M_{CL}	V_{UF}/V_{CL}
A/1	1	7	East	5,6,7	2906	415.1	808,000	35,800	41	3.42	33.7	17.9	65	72	32	0.47	0.56
	1	7	West	5,6,7	2906	415.1	808,000	35,800	41	3.42	33.7	17.9	65	72	32	0.47	0.56
	1	7	North	All	2906	415.1	618,000	27,100	41	3.42	25.8	13.55	65	72	32	0.36	0.42
	1	7	South	All	2906	415.1	621,000	28,400	41	3.42	25.9	14.2	65	72	32	0.36	0.44
A/2	2	7	East	5,6,7	861	123.0	753,000	35,600	41	3.42	31.4	17.8	65	72	32	0.43	0.56
	2	7	West	5,6,7	861	123.0	753,000	35,600	41	3.42	31.4	17.8	65	72	32	0.43	0.56
	2	7	North	All	861	123.0	62,400	2,960	41	3.42	2.6	1.48	65	72	32	0.04	0.05
	2	7	South	All	861	123.0	75,900	3,670	41	3.42	3.2	1.835	65	72	32	0.04	0.06
A/3	3	7	East	5,6,7	955	136.4	753,000	35,600	41	3.42	31.4	17.8	67	74	32	0.42	0.56
	3	7	West	5,6,7	955	136.4	753,000	35,600	41	3.42	31.4	17.8	67	74	32	0.42	0.56
	3	7	North	All	955	136.4	72,600	3,430	41	3.42	3.0	1.715	67	74	32	0.04	0.05
	3	7	South	All	955	136.4	76,100	3,670	41	3.42	3.2	1.835	67	74	32	0.04	0.06
A/4	5	8	East	All	3123	390.3	1,600,000	36,300	59	4.92	66.7	18.15	68	76	32	0.88	0.57
	5	8	West	All	3123	390.3	1,600,000	36,300	59	4.92	66.7	18.15	68	76	32	0.88	0.57
	5	8	North	All	3123	390.3	1,780,000	37,500	65	5.42	74.2	18.75	68	76	32	0.98	0.59
	5	8	South	All	3123	390.3	1,780,000	37,500	65	5.42	74.2	18.75	68	76	32	0.98	0.59
A.9/4	15	10	East	All	1297	129.7	83,600	3,100	48	4.00	3.5	1.55	65	72	32	0.05	0.05
	15	10	West	All	1297	129.7	83,600	3,100	48	4.00	3.5	1.55	65	72	32	0.05	0.05
	15	10	North	All	1297	129.7	1,320,000	32,400	65	5.42	55.0	16.2	65	72	32	0.76	0.51
	15	10	South	All	1297	129.7	1,320,000	32,400	65	5.42	55.0	16.2	65	72	32	0.76	0.51
B/1	21	7	East	All	507	72.4	55,000	2,600	41	3.42	2.3	1.3	50	56	32	0.04	0.04
	21	7	West	All	507	72.4	76,000	3,670	41	3.42	3.2	1.835	50	56	32	0.06	0.06
	21	7	North	5,6,7	507	72.4	634,000	29,900	41	3.42	26.4	14.95	50	56	32	0.48	0.47
	21	7	South	5,6,7	507	72.4	634,000	29,900	41	3.42	26.4	14.95	50	56	32	0.48	0.47
C/1	51	7	East	All	793	113.3	55,000	2,600	41	3.42	2.3	1.3	58	64	32	0.04	0.04
	51	7	West	All	793	113.3	76,000	3,670	41	3.42	3.2	1.835	58	64	32	0.05	0.06
	51	7	North	5,6,7	793	113.3	634,000	29,900	41	3.42	26.4	14.95	58	64	32	0.41	0.47
	51	7	South	5,6,7	793	113.3	634,000	29,900	41	3.42	26.4	14.95	58	64	32	0.41	0.47
C.1/4	60	10	East	All	1495	149.5	83,600	3,100	48	4.00	3.5	1.55	67	74	32	0.05	0.05
	60	10	West	All	1495	149.5	83,600	3,100	48	4.00	3.5	1.55	67	74	32	0.05	0.05
	60	10	North	All	1495	149.5	1,320,000	32,400	65	5.42	55.0	16.2	67	74	32	0.74	0.51
	60	10	South	All	1495	149.5	1,320,000	32,400	65	5.42	55.0	16.2	67	74	32	0.74	0.51
D/1	71	7	East	5,6,7	2961	423.0	808,000	35,800	41	3.42	33.7	17.9	65	72	32	0.47	0.56
	71	7	West	5,6,7	2961	423.0	808,000	35,800	41	3.42	33.7	17.9	65	72	32	0.47	0.56
	71	7	North	All	2961	423.0	621,000	28,400	41	3.42	25.9	14.2	65	72	32	0.36	0.44
	71	7	South	All	2961	423.0	618,000	27,100	41	3.42	25.8	13.55	65	72	32	0.36	0.42
D/2	72	7	East	5,6,7	860	122.8	753,000	35,600	41	3.42	31.4	17.8	65	72	32	0.43	0.56
	72	7	West	5,6,7	860	122.8	753,000	35,600	41	3.42	31.4	17.8	65	72	32	0.43	0.56
	72	7	North	All	860	122.8	75,900	3,670	41	3.42	3.2	1.835	65	72	32	0.04	0.06
	72	7	South	All	860	122.8	74,900	3,550	41	3.42	3.1	1.775	65	72	32	0.04	0.06
D/3	73	7	East	5,6,7	721	103.0	753,000	35,600	41	3.42	31.4	17.8	57	63	32	0.50	0.56
	73	7	West	5,6,7	721	103.0	753,000	35,600	41	3.42	31.4	17.8	57	63	32	0.50	0.56
	73	7	North	All	721	103.0	76,100	3,670	41	3.42	3.2	1.835	57	63	32	0.05	0.06
	73	7	South	All	721	103.0	72,600	3,430	41	3.42	3.0	1.715	57	63	32	0.05	0.05
D/4	75	8	East	All	3178	397.2	695,000	31,600	41	3.42	29.0	15.8	68	76	32	0.38	0.49
	75	8	West	All	3178	397.2	695,000	31,600	41	3.42	29.0	15.8	68	76	32	0.38	0.49
	75	8	North	All	3178	397.2	739,000	33,100	41	3.42	30.8	16.55	68	76	32	0.41	0.52
	75	8	South	All	3178	397.2	739,000	33,100	41	3.42	30.8	16.55	68	76	32	0.41	0.52

* $P = 1.1(D+0.25L)+E/(C_1C_2J)$
M,V is from Pile group analysis from Langan.

B.2.1 Grade Beams-Gravity (ref. Report Section 5.A & 5.B)

"Existing" indicates DCR under existing building condition per Report Section 3.A & 5.A

"Settlement" indicates DCR under existing building condition **combined** with excavation induced ground movements per Report Section 3.B & 5.B

"norm DCR" indicates DCR comparison per Report Section 3.C.i

Grade Beams under Gravity Loads

Ieff= 0.5 for Grade Beams

CEBC 2016, 403.4 5% Threshold

					Existing			Settlement					
Loc	Level	BEAM		Section	M_{U-}/ phi*Mn-	M_U+/ phi*Mn+	V_U/ phi*Vn	M_{U-}/ phi*Mn-	M_U+/ phi*Mn+	V_U/ phi*Vn	norm_DCR M_{U-}	norm_DCR M_U+	norm_DCR V_U
A/1-A/2	GRD	B1	B1 on GRD	GB40X48	0.114	0.129	0.129	0.144	0.162	0.152	1.258	1.258	1.179
A/2-A/3	GRD	B2	B2 on GRD	GB40X48	0.101	0.114	0.110	0.087	0.098	0.124	0.860	0.860	1.124
A/3-A/4	GRD	B3	B3 on GRD	GB40X48	0.105	0.118	0.124	0.114	0.129	0.130	1.094	1.094	1.052
D/1-D/2	GRD	B63	B63 on GRD	GB40X48	0.119	0.135	0.129	0.219	0.249	0.175	1.850	1.850	1.361
D/2-D/3	GRD	B64	B64 on GRD	GB40X48	0.105	0.119	0.110	0.137	0.156	0.144	1.302	1.302	1.303
D/3-D/4	GRD	B65	B65 on GRD	GB40X48	0.110	0.125	0.125	0.223	0.253	0.186	2.020	2.020	1.495
1/A-1/B	GRD	B9	B9 on GRD	GB40X48	0.102	0.115	0.121	0.336	0.380	0.251	3.299	3.299	2.076
1/B-1/C	GRD	B31	B31 on GRD	GB40X48	0.094	0.106	0.108	0.200	0.226	0.167	2.135	2.135	1.546
1/C-1/D	GRD	B56	B56 on GRD	GB40X48	0.102	0.115	0.121	0.285	0.322	0.208	2.795	2.795	1.714
4/A-4/B	GRD	B7	B7 on GRD	GB40X48	0.151	0.172	0.157	0.319	0.363	0.256	2.117	2.117	1.634
4/B-4/C	GRD	B35	B35 on GRD	GB40X48	0.169	0.192	0.172	0.205	0.233	0.192	1.214	1.214	1.114
4/C-4/D	GRD	B60	B60 on GRD	GB40X48	0.151	0.172	0.157	0.266	0.302	0.208	1.758	1.758	1.328
				max	0.169	0.192	0.172	**0.336**	**0.380**	**0.256**	3.299	3.299	2.076

B.2.2 Grade Beams-Seismic (ref. Report Section 5.C & 5.D)

"Existing" indicates DCR under existing building condition per Report Section 3.A & 5.C

"Settlement" indicates DCR under existing building condition **combined** with excavation induced ground movements per Report Section 3.B & 5.D

"norm DCR" indicates DCR comparison per Report Section 3.C.ii

Grade Beams

C_1C_2 = 1.0 , m_max < 6 when T > 1.0
J = 2.0 , High Seismicity
k = 0.9
Existing foundation systems as force-controlled: 10.12.3
Ieff= 0.5 for Grade Beams
CEBC 2016, 403.4 10% Threshold

Loc	Level	BEAM		Section	Existing Mu-/ m*Mn-,e	Existing Mu+/ m*Mn+,e	Existing V_{UF}/ k*V_{CL}	Settlement Mu-/ m*Mn-,e	Settlement Mu+/ m*Mn+,e	Settlement V_{UF}/ k*V_{CL}	norm_DCR-M-	norm_DCR+ M+	norm_DCR V
A/1-A/2	GRD	B1	B1 on GRD	GB40X48	0.277	0.392	0.339	0.292	0.413	0.348	1.054	1.054	1.026
A/2-A/3	GRD	B2	B2 on GRD	GB40X48	0.210	0.297	0.267	0.208	0.295	0.272	0.995	0.995	1.017
A/3-A/4	GRD	B3	B3 on GRD	GB40X48	0.264	0.374	0.326	0.274	0.387	0.329	1.035	1.035	1.010
D/1-D/2	GRD	B63	B63 on GRD	GB40X48	0.289	0.411	0.340	0.313	0.446	0.357	1.083	1.083	1.049
D/2-D/3	GRD	B64	B64 on GRD	GB40X48	0.217	0.309	0.266	0.217	0.308	0.277	0.999	0.999	1.042
D/3-D/4	GRD	B65	B65 on GRD	GB40X48	0.285	0.406	0.334	0.308	0.438	0.356	1.079	1.079	1.066
1/A-1/B	GRD	B9	B9 on GRD	GB40X48	0.248	0.351	0.320	0.285	0.404	0.365	1.151	1.151	1.141
1/B-1/C	GRD	B31	B31 on GRD	GB40X48	0.178	0.251	0.232	0.190	0.269	0.252	1.072	1.072	1.085
1/C-1/D	GRD	B56	B56 on GRD	GB40X48	0.248	0.351	0.320	0.280	0.396	0.351	1.130	1.130	1.094
4/A-4/B	GRD	B7	B7 on GRD	GB40X48	0.329	0.468	0.457	0.366	0.521	0.505	1.114	1.114	1.105
4/B-4/C	GRD	B35	B35 on GRD	GB40X48	0.219	0.312	0.251	0.215	0.306	0.258	0.983	0.983	1.026
4/C-4/D	GRD	B60	B60 on GRD	GB40X48	0.330	0.470	0.458	0.361	0.514	0.490	1.094	1.094	1.070
										mean	1.066	1.066	1.061
										max	1.151	1.151	1.141

C.1.1 MF Beams-Gravity (ref. Report Section 5.A & 5.B)

"Settlement" indicates DCR under existing building condition **combined** with excavation induced ground movements per Report Section 3.B & 5.B

MF Beams under Gravity Loads

"Existing" indicates DCR under existing building condition per Report Section 3.A & 5.A

"norm DCR" indicates DCR comparison per Report Section 3.C.i

CEBC 2016, 403.4: 5% Threshold

Loc	Level	BEAM	Section	Existing M_U+/ phi*Mn+	Settlement M_U+/ phi*Mn+	norm_DCR
X-DIR						
A/1-A/2	RF	B1	W30X99	0.089	0.094	1.059
	18	B1	W30X99	0.103	0.108	1.050
	17	B1	W30X99	0.090	0.094	1.047
	16	B1	W30X99	0.086	0.091	1.060
	15	B1	W30X99	0.082	0.088	1.074
	14	B1	W33X118	0.060	0.067	1.115
	13	B1	W33X118	0.058	0.066	1.144
	12	B1	W33X118	0.055	0.065	1.189
	11	B1	W33X118	0.051	0.064	1.251
	10	B1	W33X118	0.052	0.063	1.199
	9	B1	W33X118	0.053	0.065	1.218
	8	B1	W36X135	0.044	0.058	1.311
	7	B1	W36X135	0.044	0.064	1.454
	6	B1	W36X135	0.043	0.071	1.666
	5	B1	W36X135	0.042	0.078	1.875
	4	B1	W36X135	0.041	0.086	2.119
	3	B1	W36X135	0.043	0.099	2.294
	2	B1	W36X230	0.021	0.071	3.418
	MEZZ	B1	BOX24X36	0.009	0.071	7.859
A/2-A/3	RF	B2	W30X99	0.060	0.062	1.040
	18	B2	W30X99	0.066	0.069	1.044
	17	B2	W30X99	0.071	0.074	1.051
	16	B2	W30X99	0.072	0.076	1.051
	15	B2	W30X99	0.073	0.077	1.054
	14	B2	W33X118	0.058	0.062	1.076
	13	B2	W33X118	0.059	0.064	1.085
	12	B2	W33X118	0.059	0.064	1.086
	11	B2	W33X118	0.059	0.064	1.086
	10	B2	W33X118	0.059	0.064	1.098
	9	B2	W33X118	0.058	0.065	1.114
	8	B2	W36X135	0.049	0.056	1.143
	7	B2	W36X135	0.048	0.056	1.162
	6	B2	W36X135	0.047	0.055	1.181
	5	B2	W36X135	0.046	0.055	1.199
	4	B2	W36X135	0.045	0.055	1.230
	3	B2	W36X135	0.044	0.055	1.269
	2	B2	W36X230	0.025	0.034	1.343
	MEZZ	B2	BOX24X36	0.005	0.025	5.421
A/3-A/4	RF	B3	W30X99	0.058	0.060	1.036
	18	B3	W30X99	0.078	0.078	0.997
	17	B3	W30X99	0.082	0.083	1.015
	16	B3	W30X99	0.079	0.081	1.017
	15	B3	W30X99	0.076	0.078	1.027
	14	B3	W33X118	0.055	0.058	1.055
	13	B3	W33X118	0.052	0.057	1.084
	12	B3	W33X118	0.049	0.055	1.112
	11	B3	W33X118	0.049	0.053	1.070
	10	B3	W33X118	0.053	0.051	0.975
	9	B3	W33X118	0.053	0.053	1.007
	8	B3	W36X135	0.045	0.047	1.037
	7	B3	W36X135	0.044	0.052	1.183
	6	B3	W36X135	0.042	0.059	1.393
	5	B3	W36X135	0.041	0.065	1.599
	4	B3	W36X135	0.039	0.073	1.862
	3	B3	W36X135	0.040	0.084	2.106
	2	B3	W36X230	0.021	0.063	2.973
	MEZZ	B3	BOX24X36	0.012	0.055	4.564
D/1-D/2	RF	B63	W30X99	0.089	0.120	1.348
	18	B63	W30X99	0.103	0.141	1.372
	17	B63	W30X99	0.090	0.127	1.409
	16	B63	W30X99	0.086	0.125	1.446
	15	B63	W30X99	0.082	0.122	1.494
	14	B63	W33X118	0.060	0.102	1.703
	13	B63	W33X118	0.058	0.103	1.786
	12	B63	W33X118	0.055	0.102	1.879
	11	B63	W33X118	0.051	0.102	2.007
	10	B63	W33X118	0.052	0.103	1.970
	9	B63	W33X118	0.053	0.107	2.013
	8	B63	W36X135	0.044	0.101	2.281
	7	B63	W36X135	0.044	0.109	2.485
	6	B63	W36X135	0.043	0.118	2.785
	5	B63	W36X135	0.042	0.128	3.072
	4	B63	W36X135	0.041	0.139	3.409
	3	B63	W36X135	0.043	0.156	3.610
	2	B63	W36X230	0.021	0.117	5.648

Loc	Level	BEAM	Section	Existing M_U+/ phi*Mn+	Settlement M_U+/ phi*Mn+	norm_DCR
Y-DIR						
1/A-1/B	RF	B9	W30X99	0.087	0.146	1.678
	18	B9	W30X99	0.111	0.184	1.654
	17	B9	W30X99	0.106	0.177	1.674
	16	B9	W30X99	0.102	0.175	1.715
	15	B9	W30X99	0.097	0.173	1.780
	14	B9	W33X118	0.076	0.155	2.056
	13	B9	W33X118	0.073	0.158	2.167
	12	B9	W33X118	0.069	0.157	2.290
	11	B9	W33X118	0.064	0.157	2.465
	10	B9	W33X118	0.058	0.159	2.720
	9	B9	W33X118	0.056	0.165	2.933
	8	B9	W36X135	0.045	0.162	3.557
	7	B9	W36X135	0.045	0.171	3.801
	6	B9	W36X135	0.045	0.184	4.053
	5	B9	W36X135	0.045	0.196	4.332
	4	B9	W36X135	0.045	0.209	4.664
	3	B9	W36X135	0.047	0.233	4.972
	2	B9	W36X230	0.024	0.181	7.575
	MEZZ	B9	BOX24X36	0.011	0.194	17.449
1/B-1/C	RF	B31	W30X99	0.058	0.076	1.302
	18	B31	W30X99	0.059	0.071	1.205
	17	B31	W30X99	0.058	0.071	1.219
	16	B31	W30X99	0.057	0.070	1.219
	15	B31	W30X99	0.058	0.070	1.207
	14	B31	W33X118	0.044	0.059	1.344
	13	B31	W33X118	0.044	0.059	1.356
	12	B31	W33X118	0.044	0.061	1.367
	11	B31	W33X118	0.045	0.062	1.380
	10	B31	W33X118	0.046	0.067	1.471
	9	B31	W33X118	0.046	0.072	1.559
	8	B31	W36X135	0.038	0.062	1.636
	7	B31	W36X135	0.038	0.065	1.723
	6	B31	W36X135	0.038	0.068	1.802
	5	B31	W36X135	0.038	0.071	1.878
	4	B31	W36X135	0.038	0.075	1.992
	3	B31	W36X135	0.038	0.081	2.152
	2	B31	W36X230	0.020	0.061	3.076
	MEZZ	B31	BOX24X36	0.004	0.088	19.897
1/C-1/D	RF	B56	W30X99	0.087	0.142	1.631
	18	B56	W30X99	0.111	0.181	1.629
	17	B56	W30X99	0.106	0.175	1.658
	16	B56	W30X99	0.102	0.174	1.710
	15	B56	W30X99	0.097	0.173	1.783
	14	B56	W33X118	0.076	0.154	2.045
	13	B56	W33X118	0.073	0.157	2.156
	12	B56	W33X118	0.069	0.157	2.285
	11	B56	W33X118	0.064	0.157	2.461
	10	B56	W33X118	0.058	0.158	2.706
	9	B56	W33X118	0.056	0.164	2.904
	8	B56	W36X135	0.045	0.158	3.470
	7	B56	W36X135	0.045	0.167	3.691
	6	B56	W36X135	0.045	0.178	3.923
	5	B56	W36X135	0.045	0.189	4.177
	4	B56	W36X135	0.045	0.201	4.477
	3	B56	W36X135	0.047	0.222	4.744
	2	B56	W36X230	0.024	0.172	7.210
	MEZZ	B56	BOX24X36	0.011	0.160	14.417
4/A-4/B	RF	B7	W30X99	0.181	0.230	1.273
	18	B7	W30X99	0.216	0.273	1.267
	17	B7	W30X99	0.200	0.256	1.281
	16	B7	W30X99	0.189	0.246	1.303
	15	B7	W30X99	0.178	0.238	1.337
	14	B7	W33X118	0.149	0.212	1.423
	13	B7	W33X118	0.143	0.211	1.475
	12	B7	W33X118	0.133	0.204	1.538
	11	B7	W33X118	0.121	0.196	1.626
	10	B7	W33X118	0.109	0.192	1.755
	9	B7	W33X118	0.104	0.195	1.878
	8	B7	W36X135	0.087	0.185	2.115
	7	B7	W36X135	0.084	0.191	2.281
	6	B7	W36X135	0.080	0.200	2.482
	5	B7	W36X135	0.077	0.208	2.713
	4	B7	W36X135	0.072	0.217	3.008
	3	B7	W36X135	0.072	0.238	3.322
	2	B7	W36X230	0.040	0.178	4.436

	MEZZ	B63	BOX24X36	0.009	0.114	12.450
D/2-D/3	RF	B64	W30X99	0.060	0.060	1.000
	18	B64	W30X99	0.066	0.069	1.053
	17	B64	W30X99	0.071	0.064	0.909
	16	B64	W30X99	0.072	0.065	0.900
	15	B64	W30X99	0.073	0.066	0.909
	14	B64	W33X118	0.058	0.051	0.878
	13	B64	W33X118	0.059	0.054	0.918
	12	B64	W33X118	0.059	0.055	0.934
	11	B64	W33X118	0.059	0.056	0.951
	10	B64	W33X118	0.059	0.059	0.999
	9	B64	W33X118	0.058	0.061	1.047
	8	B64	W36X135	0.049	0.052	1.058
	7	B64	W36X135	0.048	0.054	1.114
	6	B64	W36X135	0.047	0.055	1.169
	5	B64	W36X135	0.046	0.056	1.225
	4	B64	W36X135	0.045	0.058	1.303
	3	B64	W36X135	0.044	0.063	1.439
	2	B64	W36X230	0.025	0.037	1.453
	MEZZ	B64	BOX24X36	0.005	0.050	11.069
D/3-D/4	RF	B65	W30X99	0.058	0.080	1.377
	18	B65	W30X99	0.078	0.106	1.357
	17	B65	W30X99	0.082	0.111	1.349
	16	B65	W30X99	0.079	0.109	1.370
	15	B65	W30X99	0.076	0.107	1.412
	14	B65	W33X118	0.055	0.088	1.619
	13	B65	W33X118	0.052	0.089	1.703
	12	B65	W33X118	0.049	0.089	1.792
	11	B65	W33X118	0.049	0.088	1.781
	10	B65	W33X118	0.053	0.089	1.685
	9	B65	W33X118	0.053	0.093	1.758
	8	B65	W36X135	0.045	0.089	1.966
	7	B65	W36X135	0.044	0.097	2.203
	6	B65	W36X135	0.042	0.107	2.538
	5	B65	W36X135	0.041	0.117	2.864
	4	B65	W36X135	0.039	0.128	3.275
	3	B65	W36X135	0.040	0.145	3.648
	2	B65	W36X230	0.021	0.115	5.409
	MEZZ	B65	BOX24X36	0.012	0.114	9.265
			max	0.103	0.156	12.450
			count	0	0	93

	MEZZ	B7	BOX24X36	0.022	0.167	7.683
4/B-4/C	RF	B35	W30X99	0.146	0.153	1.051
	18	B35	W30X99	0.122	0.130	1.062
	17	B35	W30X99	0.120	0.128	1.064
	16	B35	W30X99	0.117	0.125	1.066
	15	B35	W30X99	0.115	0.122	1.067
	14	B35	W33X118	0.092	0.102	1.103
	13	B35	W33X118	0.088	0.096	1.097
	12	B35	W33X118	0.087	0.096	1.107
	11	B35	W33X118	0.085	0.095	1.118
	10	B35	W33X118	0.081	0.093	1.141
	9	B35	W33X118	0.082	0.097	1.184
	8	B35	W36X135	0.067	0.079	1.174
	7	B35	W36X135	0.066	0.082	1.239
	6	B35	W36X135	0.066	0.084	1.260
	5	B35	W36X135	0.067	0.086	1.279
	4	B35	W36X135	0.068	0.088	1.309
	3	B35	W36X135	0.068	0.092	1.353
	2	B35	W36X230	0.038	0.057	1.503
	MEZZ	B35	BOX24X36	0.026	0.051	1.972
4/C-4/D	RF	B60	W30X99	0.181	0.214	1.184
	18	B60	W30X99	0.216	0.258	1.197
	17	B60	W30X99	0.200	0.243	1.217
	16	B60	W30X99	0.189	0.235	1.243
	15	B60	W30X99	0.178	0.227	1.278
	14	B60	W33X118	0.149	0.201	1.347
	13	B60	W33X118	0.143	0.200	1.393
	12	B60	W33X118	0.133	0.193	1.455
	11	B60	W33X118	0.121	0.186	1.541
	10	B60	W33X118	0.109	0.181	1.654
	9	B60	W33X118	0.104	0.182	1.759
	8	B60	W36X135	0.087	0.171	1.954
	7	B60	W36X135	0.084	0.176	2.099
	6	B60	W36X135	0.080	0.183	2.281
	5	B60	W36X135	0.077	0.191	2.491
	4	B60	W36X135	0.072	0.199	2.754
	3	B60	W36X135	0.072	0.217	3.031
	2	B60	W36X230	0.040	0.162	4.039
	MEZZ	B60	BOX24X36	0.022	0.149	6.830
			max	0.216	0.273	19.897
			count	0	0	114

C.1.2 MF Beams-Seismic
(ref. Report Section 5.C & 5.D)

"Existing" indicates DCR under existing building condition per Report Section 3.A & 5.C

"Settlement" indicates DCR under existing building condition **combined** with excavation induced ground movements per Report Section 3.B & 5.D

"norm DCR" indicates DCR comparison per Report Section 3.C.ii

MF Beams under Seismic Loads

C_1C_2 = 1.0 , m_max < 6 when T > 1.0
J = 2.0 , High Seismicity
Existing foundation systems as force-controlled: 10.12.3
CEBC 2016, 403.4 10% Threshold

Loc	Level	BEAM	Section	Existing Q_{UD}/ m_e*Q_{CE}	Settlement Q_{UD}/ m_e*Q_{CE}	norm_DCR
X-DIR				Q_{UD}/ m_e*Q_{CE}	Q_{UD}/ m_e*Q_{CE}	norm_DCR
A/1-A/2	RF	B1	W30X99	0.077	0.078	1.008
	18	B1	W30X99	0.130	0.130	1.005
	17	B1	W30X99	0.181	0.182	1.003
	16	B1	W30X99	0.224	0.225	1.003
	15	B1	W30X99	0.248	0.249	1.003
	14	B1	W33X118	0.236	0.237	1.004
	13	B1	W33X118	0.239	0.240	1.005
	12	B1	W33X118	0.255	0.257	1.006
	11	B1	W33X118	0.271	0.273	1.006
	10	B1	W33X118	0.276	0.278	1.008
	9	B1	W33X118	0.274	0.276	1.009
	8	B1	W36X135	0.254	0.257	1.012
	7	B1	W36X135	0.255	0.258	1.014
	6	B1	W36X135	0.264	0.269	1.017
	5	B1	W36X135	0.275	0.281	1.019
	4	B1	W36X135	0.283	0.289	1.022
	3	B1	W36X135	0.293	0.301	1.026
	2	B1	W36X230	0.257	0.264	1.027
	MEZZ	B1	BOX24X36	0.679	0.705	1.037
A/2-A/3	RF	B2	W30X99	0.074	0.075	1.002
	18	B2	W30X99	0.128	0.129	1.003
	17	B2	W30X99	0.157	0.157	1.003
	16	B2	W30X99	0.189	0.190	1.002
	15	B2	W30X99	0.209	0.209	1.002
	14	B2	W33X118	0.201	0.201	1.003
	13	B2	W33X118	0.227	0.228	1.003
	12	B2	W33X118	0.234	0.235	1.003
	11	B2	W33X118	0.241	0.242	1.003
	10	B2	W33X118	0.262	0.263	1.003
	9	B2	W33X118	0.276	0.277	1.003
	8	B2	W36X135	0.251	0.252	1.004
	7	B2	W36X135	0.258	0.259	1.004
	6	B2	W36X135	0.264	0.265	1.004
	5	B2	W36X135	0.272	0.274	1.005
	4	B2	W36X135	0.281	0.283	1.005
	3	B2	W36X135	0.292	0.294	1.005
	2	B2	W36X230	0.243	0.244	1.005
	MEZZ	B2	BOX24X36	0.630	0.639	1.015
A/3-A/4	RF	B3	W30X99	0.075	0.075	0.997
	18	B3	W30X99	0.129	0.129	0.999
	17	B3	W30X99	0.183	0.183	1.000
	16	B3	W30X99	0.226	0.226	1.000
	15	B3	W30X99	0.250	0.250	1.001
	14	B3	W33X118	0.238	0.239	1.002
	13	B3	W33X118	0.241	0.242	1.002
	12	B3	W33X118	0.257	0.258	1.003
	11	B3	W33X118	0.273	0.274	1.003
	10	B3	W33X118	0.278	0.280	1.004
	9	B3	W33X118	0.276	0.277	1.006
	8	B3	W36X135	0.256	0.258	1.008
	7	B3	W36X135	0.256	0.259	1.010
	6	B3	W36X135	0.266	0.269	1.012
	5	B3	W36X135	0.277	0.281	1.015
	4	B3	W36X135	0.284	0.289	1.017
	3	B3	W36X135	0.294	0.300	1.020
	2	B3	W36X230	0.258	0.263	1.022
	MEZZ	B3	BOX24X36	0.684	0.702	1.026
D/1-D/2	RF	B63	W30X99	0.077	0.081	1.054
	18	B63	W30X99	0.130	0.135	1.039
	17	B63	W30X99	0.181	0.186	1.027
	16	B63	W30X99	0.224	0.230	1.023
	15	B63	W30X99	0.248	0.254	1.022
	14	B63	W33X118	0.236	0.242	1.024
	13	B63	W33X118	0.239	0.245	1.026
	12	B63	W33X118	0.255	0.262	1.026
	11	B63	W33X118	0.271	0.278	1.026

Loc	Level	BEAM	Section	Existing Q_{UD}/ m_e*Q_{CE}	Settlement Q_{UD}/ m_e*Q_{CE}	norm_DCR
Y-DIR						
1/A-1/B	RF	B9	W30X99	0.060	0.068	1.133
	18	B9	W30X99	0.106	0.116	1.093
	17	B9	W30X99	0.154	0.163	1.062
	16	B9	W30X99	0.193	0.203	1.051
	15	B9	W30X99	0.215	0.225	1.048
	14	B9	W33X118	0.204	0.214	1.053
	13	B9	W33X118	0.206	0.217	1.056
	12	B9	W33X118	0.220	0.232	1.055
	11	B9	W33X118	0.233	0.246	1.054
	10	B9	W33X118	0.237	0.251	1.057
	9	B9	W33X118	0.235	0.249	1.063
	8	B9	W36X135	0.217	0.232	1.073
	7	B9	W36X135	0.217	0.234	1.079
	6	B9	W36X135	0.226	0.244	1.084
	5	B9	W36X135	0.235	0.256	1.088
	4	B9	W36X135	0.241	0.264	1.093
	3	B9	W36X135	0.250	0.275	1.102
	2	B9	W36X230	0.219	0.241	1.098
	MEZZ	B9	BOX24X36	0.592	0.658	1.112
1/B-1/C	RF	B31	W30X99	0.070	0.070	0.998
	18	B31	W30X99	0.116	0.117	1.010
	17	B31	W30X99	0.140	0.141	1.008
	16	B31	W30X99	0.168	0.170	1.008
	15	B31	W30X99	0.186	0.187	1.009
	14	B31	W33X118	0.180	0.181	1.008
	13	B31	W33X118	0.203	0.205	1.010
	12	B31	W33X118	0.209	0.211	1.011
	11	B31	W33X118	0.215	0.217	1.011
	10	B31	W33X118	0.233	0.235	1.013
	9	B31	W33X118	0.243	0.247	1.014
	8	B31	W36X135	0.222	0.225	1.015
	7	B31	W36X135	0.227	0.231	1.016
	6	B31	W36X135	0.232	0.236	1.018
	5	B31	W36X135	0.237	0.242	1.019
	4	B31	W36X135	0.244	0.249	1.021
	3	B31	W36X135	0.251	0.257	1.024
	2	B31	W36X230	0.209	0.215	1.030
	MEZZ	B31	BOX24X36	0.546	0.581	1.064
1/C-1/D	RF	B56	W30X99	0.060	0.068	1.123
	18	B56	W30X99	0.106	0.116	1.089
	17	B56	W30X99	0.154	0.163	1.061
	16	B56	W30X99	0.193	0.203	1.051
	15	B56	W30X99	0.215	0.225	1.048
	14	B56	W33X118	0.204	0.214	1.053
	13	B56	W33X118	0.206	0.217	1.056
	12	B56	W33X118	0.220	0.232	1.055
	11	B56	W33X118	0.233	0.246	1.054
	10	B56	W33X118	0.237	0.251	1.057
	9	B56	W33X118	0.235	0.249	1.062
	8	B56	W36X135	0.217	0.232	1.070
	7	B56	W36X135	0.217	0.234	1.076
	6	B56	W36X135	0.226	0.244	1.080
	5	B56	W36X135	0.235	0.255	1.084
	4	B56	W36X135	0.241	0.263	1.088
	3	B56	W36X135	0.250	0.274	1.096
	2	B56	W36X230	0.219	0.239	1.092
	MEZZ	B56	BOX24X36	0.592	0.653	1.103
4/A-4/B	RF	B7	W30X99	0.094	0.100	1.071
	18	B7	W30X99	0.157	0.165	1.049
	17	B7	W30X99	0.218	0.226	1.034
	16	B7	W30X99	0.267	0.274	1.029
	15	B7	W30X99	0.292	0.300	1.028
	14	B7	W33X118	0.269	0.278	1.032
	13	B7	W33X118	0.269	0.278	1.035
	12	B7	W33X118	0.287	0.297	1.034
	11	B7	W33X118	0.305	0.315	1.034

	10	B63	W33X118	0.276	0.284	1.027
	9	B63	W33X118	0.274	0.282	1.030
	8	B63	W36X135	0.254	0.263	1.035
	7	B63	W36X135	0.255	0.264	1.038
	6	B63	W36X135	0.264	0.275	1.041
	5	B63	W36X135	0.275	0.288	1.044
	4	B63	W36X135	0.283	0.297	1.047
	3	B63	W36X135	0.293	0.309	1.053
	2	B63	W36X230	0.257	0.270	1.052
	MEZZ	B63	BOX24X36	0.680	0.723	1.063
D/2-D/3	RF	B64	W30X99	0.074	0.075	1.008
	18	B64	W30X99	0.128	0.130	1.010
	17	B64	W30X99	0.157	0.157	1.001
	16	B64	W30X99	0.189	0.189	1.001
	15	B64	W30X99	0.209	0.209	1.001
	14	B64	W33X118	0.201	0.201	1.001
	13	B64	W33X118	0.227	0.228	1.002
	12	B64	W33X118	0.234	0.235	1.002
	11	B64	W33X118	0.241	0.242	1.003
	10	B64	W33X118	0.262	0.263	1.004
	9	B64	W33X118	0.276	0.277	1.005
	8	B64	W36X135	0.251	0.252	1.005
	7	B64	W36X135	0.258	0.259	1.006
	6	B64	W36X135	0.264	0.266	1.007
	5	B64	W36X135	0.272	0.274	1.007
	4	B64	W36X135	0.281	0.284	1.008
	3	B64	W36X135	0.292	0.295	1.010
	2	B64	W36X230	0.243	0.244	1.006
	MEZZ	B64	BOX24X36	0.630	0.650	1.030
D/3-D/4	RF	B65	W30X99	0.075	0.078	1.039
	18	B65	W30X99	0.129	0.133	1.029
	17	B65	W30X99	0.183	0.187	1.021
	16	B65	W30X99	0.226	0.230	1.017
	15	B65	W30X99	0.250	0.254	1.017
	14	B65	W33X118	0.238	0.243	1.019
	13	B65	W33X118	0.241	0.246	1.021
	12	B65	W33X118	0.257	0.263	1.021
	11	B65	W33X118	0.273	0.279	1.021
	10	B65	W33X118	0.279	0.285	1.023
	9	B65	W33X118	0.276	0.283	1.026
	8	B65	W36X135	0.256	0.264	1.030
	7	B65	W36X135	0.256	0.265	1.034
	6	B65	W36X135	0.266	0.276	1.037
	5	B65	W36X135	0.277	0.288	1.040
	4	B65	W36X135	0.284	0.297	1.044
	3	B65	W36X135	0.294	0.309	1.049
	2	B65	W36X230	0.258	0.271	1.050
	MEZZ	B65	BOX24X36	0.683	0.722	1.058
			max	0.684	0.723	1.063
			count	0	0	0
				>1.0	>1.0	>1.1

	10	B7	W33X118	0.310	0.321	1.036
	9	B7	W33X118	0.306	0.318	1.040
	8	B7	W36X135	0.280	0.293	1.047
	7	B7	W36X135	0.281	0.296	1.052
	6	B7	W36X135	0.294	0.310	1.055
	5	B7	W36X135	0.308	0.326	1.058
	4	B7	W36X135	0.318	0.338	1.062
	3	B7	W36X135	0.330	0.353	1.069
	2	B7	W36X230	0.289	0.308	1.065
	MEZZ	B7	BOX24X36	0.778	0.837	1.075
4/B-4/C	RF	B35	W30X99	0.129	0.129	0.997
	18	B35	W30X99	0.181	0.182	1.003
	17	B35	W30X99	0.209	0.209	1.003
	16	B35	W30X99	0.241	0.241	1.003
	15	B35	W30X99	0.260	0.261	1.003
	14	B35	W33X118	0.250	0.251	1.004
	13	B35	W33X118	0.276	0.277	1.005
	12	B35	W33X118	0.282	0.283	1.005
	11	B35	W33X118	0.287	0.288	1.005
	10	B35	W33X118	0.307	0.308	1.006
	9	B35	W33X118	0.318	0.320	1.006
	8	B35	W36X135	0.293	0.295	1.006
	7	B35	W36X135	0.297	0.299	1.007
	6	B35	W36X135	0.300	0.303	1.008
	5	B35	W36X135	0.305	0.307	1.008
	4	B35	W36X135	0.309	0.312	1.009
	3	B35	W36X135	0.314	0.318	1.010
	2	B35	W36X230	0.268	0.270	1.008
	MEZZ	B35	BOX24X36	0.683	0.695	1.017
4/C-4/D	RF	B60	W30X99	0.094	0.098	1.047
	18	B60	W30X99	0.157	0.163	1.036
	17	B60	W30X99	0.218	0.224	1.026
	16	B60	W30X99	0.267	0.273	1.023
	15	B60	W30X99	0.292	0.299	1.023
	14	B60	W33X118	0.269	0.276	1.026
	13	B60	W33X118	0.269	0.277	1.029
	12	B60	W33X118	0.287	0.295	1.029
	11	B60	W33X118	0.305	0.314	1.029
	10	B60	W33X118	0.310	0.320	1.031
	9	B60	W33X118	0.306	0.316	1.035
	8	B60	W36X135	0.280	0.291	1.040
	7	B60	W36X135	0.281	0.293	1.044
	6	B60	W36X135	0.294	0.308	1.048
	5	B60	W36X135	0.308	0.323	1.051
	4	B60	W36X135	0.318	0.336	1.054
	3	B60	W36X135	0.330	0.350	1.060
	2	B60	W36X230	0.289	0.306	1.058
	MEZZ	B60	BOX24X36	0.778	0.830	1.067
			max	0.778	0.837	1.133
			count	0	0	5
				>1.0	>1.0	>1.1

"Existing" indicates DCR under existing building condition per Report Section 3.A & 5.A

"Settlement" indicates DCR under existing building condition **combined** with excavation induced ground movements per Report Section 3.B & 5.B

"norm DCR" indicates DCR comparison per Report Section 3.C.i

C.2.1 MF Columns-Gravity (ref. Report Section 5.A & 5.B)

MF Columns under Gravity Loads

CEBC 2016, 5% Threshold

X-DIR

Loc	Level	BEAM	Section	Existing M_U+/ phi*Mn+	Settlement M_U+/ phi*Mn+	norm_DCR
A/2	RF	C2	*W14X159	0.031	0.031	1.027
	18	C2	*W14X159	0.036	0.037	1.016
	17	C2	*W14X159	0.047	0.047	1.010
	16	C2	*W14X176	0.053	0.053	1.007
	15	C2	*W14X176	0.062	0.062	1.001
	14	C2	*W14X257	0.051	0.051	1.001
	13	C2	*W14X257	0.057	0.057	0.997
	12	C2	*W14X257	0.065	0.065	0.995
	11	C2	*W14X257	0.071	0.070	0.989
	10	C2	*W14X342	0.060	0.059	0.988
	9	C2	*W14X342	0.065	0.064	0.982
	8	C2	*W14X398	0.061	0.060	0.980
	7	C2	*W14X398	0.066	0.064	0.973
	6	C2	*W14X455	0.062	0.060	0.969
	5	C2	*W14X455	0.066	0.064	0.963
	4	C2	*W14X550	0.058	0.057	0.978
	3	C2	*W14X550	0.063	0.065	1.031
	2	C2	**BOX26X28	0.081	0.081	1.006
	MEZZ	C2	**BOX26X28	0.104	0.134	1.285
A/3	RF	C3	*W14X159	0.028	0.030	1.038
	18	C3	*W14X159	0.036	0.037	1.029
	17	C3	*W14X159	0.047	0.048	1.025
	16	C3	*W14X176	0.054	0.055	1.023
	15	C3	*W14X176	0.062	0.064	1.018
	14	C3	*W14X257	0.051	0.052	1.021
	13	C3	*W14X257	0.058	0.059	1.019
	12	C3	*W14X257	0.066	0.067	1.018
	11	C3	*W14X257	0.073	0.074	1.014
	10	C3	*W14X342	0.061	0.062	1.015
	9	C3	*W14X342	0.066	0.067	1.013
	8	C3	*W14X398	0.062	0.065	1.038
	7	C3	*W14X398	0.067	0.071	1.052
	6	C3	*W14X455	0.063	0.068	1.076
	5	C3	*W14X455	0.067	0.073	1.080
	4	C3	*W14X550	0.059	0.066	1.113
	3	C3	*W14X550	0.064	0.072	1.135
	2	C3	**BOX26X28	0.082	0.103	1.244
	MEZZ	C3	**BOX26X28	0.105	0.138	1.315
D/2	RF	C24	*W14X159	0.031	0.047	1.525
	18	C24	*W14X159	0.036	0.043	1.198
	17	C24	*W14X159	0.047	0.052	1.112
	16	C24	*W14X176	0.053	0.057	1.076
	15	C24	*W14X176	0.062	0.067	1.095
	14	C24	*W14X257	0.051	0.058	1.147
	13	C24	*W14X257	0.057	0.065	1.127
	12	C24	*W14X257	0.065	0.072	1.111
	11	C24	*W14X257	0.071	0.078	1.094
	10	C24	*W14X342	0.060	0.067	1.122
	9	C24	*W14X342	0.065	0.075	1.151
	8	C24	*W14X398	0.061	0.073	1.193
	7	C24	*W14X398	0.066	0.078	1.191
	6	C24	*W14X455	0.062	0.076	1.225

Y-DIR

Loc	Level	BEAM	Section	Existing M_U+/ phi*Mn+	Settlement M_U+/ phi*Mn+	norm_DCR
1/B	RF	C11	*W14X159	0.031	0.045	1.458
	18	C11	*W14X159	0.037	0.050	1.337
	17	C11	*W14X159	0.048	0.057	1.187
	16	C11	*W14X176	0.054	0.061	1.115
	15	C11	*W14X176	0.063	0.068	1.091
	14	C11	*W14X257	0.051	0.059	1.147
	13	C11	*W14X257	0.058	0.063	1.082
	12	C11	*W14X257	0.066	0.068	1.034
	11	C11	*W14X257	0.072	0.071	0.980
	10	C11	*W14X342	0.061	0.060	0.999
	9	C11	*W14X342	0.066	0.066	1.006
	8	C11	*W14X398	0.062	0.064	1.037
	7	C11	*W14X398	0.067	0.067	1.007
	6	C11	*W14X455	0.063	0.065	1.026
	5	C11	*W14X455	0.067	0.066	0.991
	4	C11	*W14X550	0.060	0.060	0.994
	3	C11	*W14X550	0.062	0.070	1.137
	2	C11	**BOX26X28	0.084	0.087	1.033
	MEZZ	C11	**BOX26X28	0.104	0.111	1.066
1/C	RF	C15	*W14X159	0.031	0.060	1.913
	18	C15	*W14X159	0.037	0.065	1.727
	17	C15	*W14X159	0.048	0.074	1.533
	16	C15	*W14X176	0.054	0.078	1.444
	15	C15	*W14X176	0.063	0.089	1.419
	14	C15	*W14X257	0.051	0.078	1.525
	13	C15	*W14X257	0.058	0.084	1.440
	12	C15	*W14X257	0.066	0.092	1.387
	11	C15	*W14X257	0.072	0.095	1.317
	10	C15	*W14X342	0.061	0.082	1.363
	9	C15	*W14X342	0.066	0.091	1.384
	8	C15	*W14X398	0.062	0.090	1.442
	7	C15	*W14X398	0.067	0.093	1.401
	6	C15	*W14X455	0.063	0.091	1.442
	5	C15	*W14X455	0.067	0.094	1.399
	4	C15	*W14X550	0.060	0.085	1.412
	3	C15	*W14X550	0.062	0.101	1.637
	2	C15	**BOX26X28	0.084	0.133	1.581
	MEZZ	C15	**BOX26X28	0.104	0.177	1.698
4/B	RF	C9	*W14X159	0.107	0.122	1.145
	18	C9	*W14X159	0.108	0.119	1.109
	17	C9	*W14X159	0.115	0.125	1.081
	16	C9	*W14X176	0.116	0.124	1.069
	15	C9	*W14X176	0.125	0.132	1.058
	14	C9	*W14X257	0.102	0.111	1.081
	13	C9	*W14X257	0.107	0.114	1.063
	12	C9	*W14X257	0.114	0.120	1.053
	11	C9	*W14X257	0.118	0.122	1.030
	10	C9	*W14X342	0.097	0.102	1.050
	9	C9	*W14X342	0.103	0.109	1.053
	8	C9	*W14X398	0.097	0.104	1.076
	7	C9	*W14X398	0.101	0.107	1.056
	6	C9	*W14X455	0.094	0.101	1.073

Bi-axial

Loc	Level	BEAM	Section	Existing M_U+/ phi*Mn+	Settlement M_U+/ phi*Mn+	norm_DCR
A/1	RF	C1	*BOX24X24X7/8	0.058	0.076	1.306
	18	C1	*BOX24X24X7/8	0.048	0.063	1.309
	17	C1	*BOX24X24X7/8	0.053	0.070	1.315
	16	C1	*BOX24X24X7/8	0.055	0.072	1.312
	15	C1	*BOX24X24X7/8	0.059	0.083	1.396
	14	C1	*BOX24X24X7/8	0.063	0.091	1.437
	13	C1	*BOX24X24X7/8	0.066	0.096	1.456
	12	C1	*BOX24X24X7/8	0.069	0.102	1.484
	11	C1	*BOX24X24X7/8	0.070	0.107	1.526
	10	C1	*BOX24X24X7/8	0.074	0.114	1.549
	9	C1	*BOX24X24X7/8	0.077	0.129	1.672
	8	C1	*BOX24X24X7/8	0.082	0.142	1.744
	7	C1	*BOX24X24X7/8	0.085	0.151	1.776
	6	C1	*BOX24X24X1	0.080	0.148	1.850
	5	C1	*BOX24X24X1	0.083	0.158	1.903
	4	C1	*BOX24X24X1.125	0.078	0.149	1.922
	3	C1	*BOX24X24X1.125	0.092	0.210	2.291
	2	C1	*BOX24X24X1.5	0.065	0.163	2.529
	MEZZ	C1	*BOX24X24X1.5	0.094	0.284	3.030
A/4	RF	C4	*BOX24X24X7/8	0.070	0.083	1.184
	18	C4	*BOX24X24X7/8	0.065	0.077	1.183
	17	C4	*BOX24X24X7/8	0.070	0.083	1.186
	16	C4	*BOX24X24X7/8	0.072	0.085	1.186
	15	C4	*BOX24X24X7/8	0.080	0.098	1.224
	14	C4	*BOX24X24X7/8	0.085	0.107	1.260
	13	C4	*BOX24X24X7/8	0.087	0.112	1.277
	12	C4	*BOX24X24X7/8	0.089	0.116	1.299
	11	C4	*BOX24X24X7/8	0.090	0.120	1.328
	10	C4	*BOX24X24X7/8	0.093	0.126	1.356
	9	C4	*BOX24X24X7/8	0.098	0.141	1.434
	8	C4	*BOX24X24X7/8	0.103	0.154	1.496
	7	C4	*BOX24X24X7/8	0.105	0.161	1.530
	6	C4	*BOX24X24X1	0.098	0.157	1.597
	5	C4	*BOX24X24X1	0.100	0.165	1.646
	4	C4	*BOX24X24X1.125	0.093	0.157	1.684
	3	C4	*BOX24X24X1.125	0.106	0.208	1.957
	2	C4	*BOX24X24X1.5	0.078	0.171	2.191
	MEZZ	C4	*BOX24X24X1.5	0.096	0.252	2.615
D/1	RF	C23	*BOX24X24X7/8	0.058	0.082	1.399
	18	C23	*BOX24X24X7/8	0.048	0.068	1.410
	17	C23	*BOX24X24X7/8	0.053	0.076	1.427
	16	C23	*BOX24X24X7/8	0.055	0.078	1.424
	15	C23	*BOX24X24X7/8	0.059	0.092	1.551
	14	C23	*BOX24X24X7/8	0.063	0.100	1.587
	13	C23	*BOX24X24X7/8	0.066	0.107	1.609
	12	C23	*BOX24X24X7/8	0.069	0.113	1.640
	11	C23	*BOX24X24X7/8	0.070	0.120	1.702
	10	C23	*BOX24X24X7/8	0.074	0.126	1.715
	9	C23	*BOX24X24X7/8	0.077	0.144	1.867
	8	C23	*BOX24X24X7/8	0.082	0.158	1.933
	7	C23	*BOX24X24X7/8	0.085	0.167	1.968
	6	C23	*BOX24X24X1	0.080	0.164	2.042

	5	C24	*W14X455	0.066	0.080	1.214
	4	C24	*W14X550	0.058	0.072	1.241
	3	C24	*W14X550	0.063	0.086	1.368
	2	C24	**BOX26X28	0.081	0.109	1.348
	MEZZ	C24	**BOX26X28	0.104	0.148	1.420
D/3	RF	C25	*W14X159	0.028	0.029	1.008
	18	C25	*W14X159	0.036	0.035	0.975
	17	C25	*W14X159	0.047	0.045	0.965
	16	C25	*W14X176	0.054	0.051	0.959
	15	C25	*W14X176	0.062	0.059	0.954
	14	C25	*W14X257	0.051	0.049	0.948
	13	C25	*W14X257	0.058	0.055	0.936
	12	C25	*W14X257	0.066	0.062	0.930
	11	C25	*W14X257	0.073	0.067	0.924
	10	C25	*W14X342	0.061	0.056	0.918
	9	C25	*W14X342	0.066	0.062	0.935
	8	C25	*W14X398	0.062	0.060	0.957
	7	C25	*W14X398	0.067	0.064	0.961
	6	C25	*W14X455	0.063	0.062	0.981
	5	C25	*W14X455	0.067	0.066	0.973
	4	C25	*W14X550	0.059	0.059	1.001
	3	C25	*W14X550	0.064	0.066	1.027
	2	C25	**BOX26X28	0.083	0.092	1.115
	MEZZ	C25	**BOX26X28	0.105	0.117	1.120
			max	0.105	0.148	1.525
			count	0	0	29
				>1.0	>1.0	>1.05

	5	C9	*W14X455	0.098	0.103	1.048
	4	C9	*W14X550	0.086	0.092	1.062
	3	C9	*W14X550	0.093	0.105	1.131
	2	C9	**BOX26X28	0.113	0.125	1.108
	MEZZ	C9	**BOX26X28	0.242	0.163	0.672
4/C	RF	C19	*W14X159	0.107	0.121	1.133
	18	C19	*W14X159	0.108	0.124	1.151
	17	C19	*W14X159	0.115	0.132	1.141
	16	C19	*W14X176	0.116	0.132	1.139
	15	C19	*W14X176	0.125	0.142	1.140
	14	C19	*W14X257	0.102	0.120	1.169
	13	C19	*W14X257	0.107	0.125	1.160
	12	C19	*W14X257	0.114	0.133	1.161
	11	C19	*W14X257	0.118	0.135	1.147
	10	C19	*W14X342	0.097	0.114	1.171
	9	C19	*W14X342	0.103	0.123	1.184
	8	C19	*W14X398	0.097	0.117	1.213
	7	C19	*W14X398	0.101	0.121	1.198
	6	C19	*W14X455	0.094	0.116	1.223
	5	C19	*W14X455	0.098	0.118	1.204
	4	C19	*W14X550	0.086	0.105	1.220
	3	C19	*W14X550	0.093	0.121	1.312
	2	C19	**BOX26X28	0.113	0.150	1.335
	MEZZ	C19	**BOX26X28	0.242	0.199	0.824
			max	0.242	0.199	1.913
			count	0	0	62
				>1.0	>1.0	>1.05

	5	C23	*BOX24X24X1	0.083	0.175	2.101
	4	C23	*BOX24X24X1.125	0.078	0.164	2.117
	3	C23	*BOX24X24X1.125	0.092	0.228	2.494
	2	C23	*BOX24X24X1.5	0.064	0.184	2.848
	MEZZ	C23	*BOX24X24X1.5	0.094	0.295	3.149
D/4	RF	C26	*BOX24X24X7/8	0.070	0.085	1.204
	18	C26	*BOX24X24X7/8	0.065	0.079	1.210
	17	C26	*BOX24X24X7/8	0.070	0.086	1.223
	16	C26	*BOX24X24X7/8	0.072	0.088	1.225
	15	C26	*BOX24X24X7/8	0.080	0.103	1.289
	14	C26	*BOX24X24X7/8	0.085	0.112	1.317
	13	C26	*BOX24X24X7/8	0.087	0.117	1.341
	12	C26	*BOX24X24X7/8	0.089	0.122	1.370
	11	C26	*BOX24X24X7/8	0.090	0.128	1.417
	10	C26	*BOX24X24X7/8	0.093	0.134	1.439
	9	C26	*BOX24X24X7/8	0.098	0.151	1.539
	8	C26	*BOX24X24X7/8	0.103	0.164	1.600
	7	C26	*BOX24X24X7/8	0.105	0.172	1.642
	6	C26	*BOX24X24X1	0.098	0.168	1.713
	5	C26	*BOX24X24X1	0.100	0.178	1.776
	4	C26	*BOX24X24X1.125	0.093	0.168	1.808
	3	C26	*BOX24X24X1.125	0.106	0.225	2.124
	2	C26	*BOX24X24X1.5	0.078	0.189	2.418
	MEZZ	C26	*BOX24X24X1.5	0.097	0.280	2.887
			max	0.106	0.295	3.149
			count	0	0	76
				>1.0	>1.0	>1.05

C.2.2 MF Columns - Seismic
(ref. Report Section 5.C & 5.D)

"Existing" indicates DCR under existing building condition per Report Section 3.A & 5.C

"Settlement" indicates DCR under existing building condition **combined** with excavation induced ground movements per Report Section 3.B & 5.D

"norm DCR" indicates DCR comparison per Report Section 3.C.ii

MF Columns under Seismic Loads

C_1C_2 = 1.0 , m_max < 6 when T > 1.0

J = 2.0 , High Seismicity

CEBC 2016, 403.4: 10% Threshold

Loc	Level	BEAM	Section	Exist Q_{UD}/m_e*Q_{CE}	Settlement Q_{UD}/m_e*Q_{CE}	norm_DCR
X-DIR						
A/2	RF	C2	*W14X159	0.080	0.081	1.002
	18	C2	*W14X159	0.118	0.118	0.999
	17	C2	*W14X159	0.156	0.156	0.999
	16	C2	*W14X176	0.179	0.178	0.999
	15	C2	*W14X176	0.200	0.199	0.999
	14	C2	*W14X257	0.170	0.170	0.998
	13	C2	*W14X257	0.179	0.178	0.996
	12	C2	*W14X257	0.196	0.195	0.995
	11	C2	*W14X257	0.199	0.198	0.994
	10	C2	*W14X342	0.171	0.170	0.993
	9	C2	*W14X342	0.180	0.179	0.992
	8	C2	*W14X398	0.166	0.165	0.991
	7	C2	*W14X398	0.168	0.166	0.990
	6	C2	*W14X455	0.159	0.157	0.990
	5	C2	*W14X455	0.161	0.159	0.988
	4	C2	*W14X550	0.141	0.139	0.986
	3	C2	*W14X550	0.159	0.157	0.989
	2	C2	**BOX26X28	0.265	0.262	0.988
	MEZZ	C2	**BOX26X28	0.276	0.274	0.995
A/3	RF	C3	*W14X159	0.080	0.080	1.002
	18	C3	*W14X159	0.119	0.120	1.005
	17	C3	*W14X159	0.157	0.158	1.004
	16	C3	*W14X176	0.180	0.181	1.004
	15	C3	*W14X176	0.201	0.202	1.005
	14	C3	*W14X257	0.172	0.173	1.005
	13	C3	*W14X257	0.180	0.181	1.006
	12	C3	*W14X257	0.197	0.198	1.006
	11	C3	*W14X257	0.200	0.201	1.006
	10	C3	*W14X342	0.172	0.173	1.006
	9	C3	*W14X342	0.181	0.182	1.007
	8	C3	*W14X398	0.167	0.168	1.008
	7	C3	*W14X398	0.169	0.170	1.008
	6	C3	*W14X455	0.159	0.160	1.008
	5	C3	*W14X455	0.161	0.162	1.008
	4	C3	*W14X550	0.141	0.142	1.008
	3	C3	*W14X550	0.159	0.160	1.009
	2	C3	**BOX26X28	0.266	0.269	1.009
	MEZZ	C3	**BOX26X28	0.274	0.278	1.013
D/2	RF	C24	*W14X159	0.080	0.083	1.032
	18	C24	*W14X159	0.118	0.120	1.016
	17	C24	*W14X159	0.156	0.157	1.011
	16	C24	*W14X176	0.179	0.180	1.008
	15	C24	*W14X176	0.200	0.201	1.007
	14	C24	*W14X257	0.170	0.172	1.008
	13	C24	*W14X257	0.179	0.180	1.005
	12	C24	*W14X257	0.196	0.196	1.003
	11	C24	*W14X257	0.199	0.199	1.000
	10	C24	*W14X342	0.171	0.171	1.000
	9	C24	*W14X342	0.180	0.180	1.000
	8	C24	*W14X398	0.166	0.166	1.001
	7	C24	*W14X398	0.168	0.168	0.999
	6	C24	*W14X455	0.159	0.158	1.000
	5	C24	*W14X455	0.161	0.160	0.997

Loc	Level	BEAM	Section	Exist Q_{UD}/m_e*Q_{CE}	Settlement Q_{UD}/m_e*Q_{CE}	norm_DCR
Y-DIR						
1/B	RF	C11	*W14X159	0.070	0.071	1.016
	18	C11	*W14X159	0.105	0.104	0.993
	17	C11	*W14X159	0.140	0.138	0.983
	16	C11	*W14X176	0.161	0.158	0.978
	15	C11	*W14X176	0.182	0.177	0.972
	14	C11	*W14X257	0.155	0.151	0.972
	13	C11	*W14X257	0.163	0.157	0.963
	12	C11	*W14X257	0.179	0.171	0.957
	11	C11	*W14X257	0.183	0.173	0.947
	10	C11	*W14X342	0.157	0.148	0.947
	9	C11	*W14X342	0.165	0.155	0.942
	8	C11	*W14X398	0.152	0.143	0.937
	7	C11	*W14X398	0.155	0.143	0.925
	6	C11	*W14X455	0.145	0.134	0.921
	5	C11	*W14X455	0.148	0.134	0.907
	4	C11	*W14X550	0.129	0.117	0.901
	3	C11	*W14X550	0.144	0.130	0.904
	2	C11	**BOX26X28	0.240	0.220	0.920
	MEZZ	C11	**BOX26X28	0.253	0.232	0.917
1/C	RF	C15	*W14X159	0.070	0.073	1.053
	18	C15	*W14X159	0.105	0.107	1.024
	17	C15	*W14X159	0.140	0.142	1.013
	16	C15	*W14X176	0.161	0.163	1.008
	15	C15	*W14X176	0.182	0.183	1.005
	14	C15	*W14X257	0.155	0.156	1.008
	13	C15	*W14X257	0.163	0.164	1.003
	12	C15	*W14X257	0.179	0.179	1.000
	11	C15	*W14X257	0.183	0.182	0.995
	10	C15	*W14X342	0.157	0.156	0.996
	9	C15	*W14X342	0.165	0.164	0.995
	8	C15	*W14X398	0.152	0.152	0.996
	7	C15	*W14X398	0.155	0.153	0.990
	6	C15	*W14X455	0.145	0.144	0.990
	5	C15	*W14X455	0.148	0.146	0.983
	4	C15	*W14X550	0.129	0.127	0.982
	3	C15	*W14X550	0.144	0.142	0.989
	2	C15	**BOX26X28	0.240	0.238	0.994
	MEZZ	C15	**BOX26X28	0.253	0.256	1.012
4/B	RF	C9	*W14X159	0.126	0.127	1.011
	18	C9	*W14X159	0.168	0.168	0.997
	17	C9	*W14X159	0.211	0.209	0.991
	16	C9	*W14X176	0.233	0.230	0.987
	15	C9	*W14X176	0.258	0.254	0.984
	14	C9	*W14X257	0.215	0.212	0.984
	13	C9	*W14X257	0.225	0.220	0.978
	12	C9	*W14X257	0.244	0.238	0.974
	11	C9	*W14X257	0.249	0.241	0.968
	10	C9	*W14X342	0.212	0.205	0.968
	9	C9	*W14X342	0.222	0.214	0.964
	8	C9	*W14X398	0.203	0.195	0.962
	7	C9	*W14X398	0.206	0.196	0.954
	6	C9	*W14X455	0.193	0.183	0.951
	5	C9	*W14X455	0.197	0.186	0.942

Loc	Level	BEAM	Section	Exist Q_{UD}/m_e*Q_{CE}	Settlement Q_{UD}/m_e*Q_{CE}	norm_DCR
Bi-axial						
A/1	RF	C1	*BOX24X24X7/8	0.137	0.142	1.037
	18	C1	*BOX24X24X7/8	0.207	0.210	1.014
	17	C1	*BOX24X24X7/8	0.234	0.237	1.014
	16	C1	*BOX24X24X7/8	0.271	0.277	1.023
	15	C1	*BOX24X24X7/8	0.435	0.441	1.014
	14	C1	*BOX24X24X7/8	0.366	0.376	1.030
	13	C1	*BOX24X24X7/8	0.402	0.414	1.029
	12	C1	*BOX24X24X7/8	0.440	0.451	1.024
	11	C1	*BOX24X24X7/8	0.529	0.540	1.021
	10	C1	*BOX24X24X7/8	0.505	0.583	1.153
	9	C1	*BOX24X24X7/8	0.667	0.693	1.040
	8	C1	*BOX24X24X7/8	0.645	0.677	1.050
	7	C1	*BOX24X24X7/8	0.698	0.734	1.051
	6	C1	*BOX24X24X1	0.531	0.581	1.094
	5	C1	*BOX24X24X1	0.600	0.658	1.096
	4	C1	*BOX24X24X1.125	0.467	0.529	1.131
	3	C1	*BOX24X24X1.125	0.575	0.664	1.154
	2	C1	*BOX24X24X1.5	0.496	0.578	1.166
	MEZZ	C1	*BOX24X24X1.5	0.587	0.728	1.240
A/4	RF	C4	*BOX24X24X7/8	0.181	0.189	1.046
	18	C4	*BOX24X24X7/8	0.253	0.258	1.018
	17	C4	*BOX24X24X7/8	0.286	0.292	1.020
	16	C4	*BOX24X24X7/8	0.350	0.360	1.026
	15	C4	*BOX24X24X7/8	0.537	0.550	1.023
	14	C4	*BOX24X24X7/8	0.447	0.462	1.034
	13	C4	*BOX24X24X7/8	0.488	0.505	1.034
	12	C4	*BOX24X24X7/8	0.529	0.547	1.035
	11	C4	*BOX24X24X7/8	0.628	0.688	1.096
	10	C4	*BOX24X24X7/8	0.649	0.679	1.047
	9	C4	*BOX24X24X7/8	0.767	0.804	1.049
	8	C4	*BOX24X24X7/8	0.737	0.781	1.060
	7	C4	*BOX24X24X7/8	0.797	0.847	1.063
	6	C4	*BOX24X24X1	0.608	0.667	1.098
	5	C4	*BOX24X24X1	0.688	0.760	1.105
	4	C4	*BOX24X24X1.125	0.534	0.606	1.133
	3	C4	*BOX24X24X1.125	0.661	0.769	1.164
	2	C4	*BOX24X24X1.5	0.568	0.667	1.175
	MEZZ	C4	*BOX24X24X1.5	0.682	0.858	1.258
D/1	RF	C23	*BOX24X24X7/8	0.146	0.154	1.054
	18	C23	*BOX24X24X7/8	0.214	0.219	1.023
	17	C23	*BOX24X24X7/8	0.246	0.253	1.029
	16	C23	*BOX24X24X7/8	0.288	0.299	1.036
	15	C23	*BOX24X24X7/8	0.453	0.467	1.032
	14	C23	*BOX24X24X7/8	0.383	0.400	1.044
	13	C23	*BOX24X24X7/8	0.419	0.438	1.046
	12	C23	*BOX24X24X7/8	0.456	0.478	1.047
	11	C23	*BOX24X24X7/8	0.543	0.568	1.045
	10	C23	*BOX24X24X7/8	0.520	0.612	1.176
	9	C23	*BOX24X24X7/8	0.679	0.726	1.069
	8	C23	*BOX24X24X7/8	0.658	0.713	1.083
	7	C23	*BOX24X24X7/8	0.710	0.772	1.087
	6	C23	*BOX24X24X1	0.540	0.613	1.136
	5	C23	*BOX24X24X1	0.609	0.697	1.144

	4	C24	*W14X550	0.141	0.140	0.996
	3	C24	*W14X550	0.159	0.159	1.002
	2	C24	**BOX26X28	0.265	0.265	1.000
	MEZZ	C24	**BOX26X28	0.276	0.281	1.016
D/3	RF	C25	*W14X159	0.080	0.079	0.998
	18	C25	*W14X159	0.119	0.118	0.994
	17	C25	*W14X159	0.157	0.156	0.991
	16	C25	*W14X176	0.180	0.178	0.989
	15	C25	*W14X176	0.201	0.199	0.987
	14	C25	*W14X257	0.172	0.170	0.987
	13	C25	*W14X257	0.180	0.177	0.983
	12	C25	*W14X257	0.197	0.193	0.981
	11	C25	*W14X257	0.200	0.195	0.977
	10	C25	*W14X342	0.172	0.168	0.977
	9	C25	*W14X342	0.181	0.176	0.975
	8	C25	*W14X398	0.167	0.162	0.973
	7	C25	*W14X398	0.169	0.163	0.967
	6	C25	*W14X455	0.159	0.153	0.965
	5	C25	*W14X455	0.161	0.155	0.959
	4	C25	*W14X550	0.141	0.135	0.956
	3	C25	*W14X550	0.159	0.152	0.958
	2	C25	**BOX26X28	0.266	0.257	0.967
	MEZZ	C25	**BOX26X28	0.275	0.265	0.963
			max	0.276	0.281	1.032
			count	0	0	0
				>1.0	>1.0	>1.1

	4	C9	*W14X550	0.173	0.163	0.939
	3	C9	*W14X550	0.192	0.181	0.941
	2	C9	**BOX26X28	0.325	0.308	0.950
	MEZZ	C9	**BOX26X28	0.448	0.330	0.737
4/C	RF	C19	*W14X159	0.126	0.128	1.021
	18	C19	*W14X159	0.168	0.169	1.007
	17	C19	*W14X159	0.211	0.211	1.003
	16	C19	*W14X176	0.233	0.233	1.001
	15	C19	*W14X176	0.258	0.258	0.999
	14	C19	*W14X257	0.215	0.215	1.000
	13	C19	*W14X257	0.225	0.224	0.997
	12	C19	*W14X257	0.244	0.243	0.995
	11	C19	*W14X257	0.249	0.247	0.992
	10	C19	*W14X342	0.212	0.210	0.993
	9	C19	*W14X342	0.222	0.220	0.991
	8	C19	*W14X398	0.203	0.201	0.991
	7	C19	*W14X398	0.206	0.203	0.987
	6	C19	*W14X455	0.193	0.190	0.986
	5	C19	*W14X455	0.197	0.193	0.980
	4	C19	*W14X550	0.173	0.170	0.979
	3	C19	*W14X550	0.192	0.189	0.982
	2	C19	**BOX26X28	0.325	0.320	0.986
	MEZZ	C19	**BOX26X28	0.448	0.345	0.771
			max	0.448	0.345	1.053
			count	0	0	0
				>1.0	>1.0	>1.1

	4	C23	*BOX24X24X1.125	0.472	0.558	1.182
	3	C23	*BOX24X24X1.125	0.584	0.708	1.214
	2	C23	*BOX24X24X1.5	0.496	0.608	1.226
	MEZZ	C23	*BOX24X24X1.5	0.594	0.784	1.321
D/4	RF	C26	*BOX24X24X7/8	0.178	0.185	1.038
	18	C26	*BOX24X24X7/8	0.249	0.254	1.018
	17	C26	*BOX24X24X7/8	0.283	0.288	1.017
	16	C26	*BOX24X24X7/8	0.345	0.354	1.025
	15	C26	*BOX24X24X7/8	0.532	0.542	1.019
	14	C26	*BOX24X24X7/8	0.442	0.455	1.029
	13	C26	*BOX24X24X7/8	0.484	0.498	1.029
	12	C26	*BOX24X24X7/8	0.524	0.540	1.030
	11	C26	*BOX24X24X7/8	0.624	0.684	1.096
	10	C26	*BOX24X24X7/8	0.645	0.674	1.045
	9	C26	*BOX24X24X7/8	0.764	0.799	1.046
	8	C26	*BOX24X24X7/8	0.733	0.777	1.059
	7	C26	*BOX24X24X7/8	0.794	0.843	1.062
	6	C26	*BOX24X24X1	0.606	0.669	1.104
	5	C26	*BOX24X24X1	0.686	0.763	1.112
	4	C26	*BOX24X24X1.125	0.533	0.611	1.148
	3	C26	*BOX24X24X1.125	0.659	0.778	1.181
	2	C26	*BOX24X24X1.5	0.568	0.678	1.194
	MEZZ	C26	*BOX24X24X1.5	0.706	0.925	1.310
			max	0.797	0.925	1.321
			count	0	0	23
				>1.0	>1.0	>1.1

C.2.3 Gravity Columns (ref. Report Section 5.A & 5.B)

"Settlement" indicates DCR under existing building condition **combined** with excavation induced ground movements per Report Section 3.B & 5.B

"Existing" indicates DCR under existing building condition per Report Section 3.A & 5.A

"norm DCR" indicates DCR comparison per Report Section 3.C.i

Non-Framed Columns

Loc	Level	BEAM	Section	Existing P_U+/ phi*Pn+	Settlement P_U+/ phi*Pn+	norm_DCR
5/A	MEZZ	C5	W8X31	0.118	0.116	0.983
5/D	MEZZ	C27	W8X31	0.118	0.118	0.998
5/A.6	RF	C8	*W12X58	0.047	0.046	0.987
	18	C8	*W12X58	0.071	0.071	0.995
	17	C8	*W12X58	0.097	0.097	0.999
	16	C8	*W12X58	0.124	0.124	1.001
	15	C8	*W12X58	0.151	0.151	1.002
	14	C8	*W12X58	0.177	0.178	1.003
	13	C8	*W12X58	0.204	0.205	1.004
	12	C8	*W12X65	0.193	0.194	1.005
	11	C8	*W12X65	0.215	0.216	1.005
	10	C8	*W12X65	0.238	0.239	1.006
	9	C8	*W12X65	0.260	0.261	1.006
	8	C8	*W12X87	0.210	0.211	1.006
	7	C8	*W12X87	0.227	0.228	1.006
	6	C8	*W12X87	0.244	0.245	1.007
	5	C8	*W12X87	0.260	0.262	1.007
	4	C8	*W12X87	0.277	0.279	1.007
	3	C8	*W12X87	0.294	0.296	1.007
	2	C8	*W12X170	0.253	0.255	1.007
	MEZZ	C8	*W12X170	0.268	0.270	1.008
5/B.5	RF	C14	*W14X82	0.071	0.071	1.007
	18	C14	*W14X82	0.104	0.106	1.010
	17	C14	*W14X82	0.139	0.140	1.012
	16	C14	*W14X82	0.175	0.177	1.012
	15	C14	*W14X82	0.213	0.216	1.013
	14	C14	*W14X82	0.251	0.255	1.013
	13	C14	*W14X82	0.290	0.294	1.013
	12	C14	*W14X90	0.266	0.270	1.013
	11	C14	*W14X90	0.298	0.302	1.014
	10	C14	*W14X90	0.329	0.334	1.014
	9	C14	*W14X90	0.361	0.366	1.014
	8	C14	*W14X109	0.325	0.329	1.014
	7	C14	*W14X109	0.351	0.356	1.014
	6	C14	*W14X120	0.342	0.347	1.014
	5	C14	*W14X120	0.367	0.372	1.015
	4	C14	*W14X132	0.355	0.361	1.015
	3	C14	*W14X132	0.378	0.383	1.015
	2	C14	*W14X193	0.365	0.370	1.015
	MEZZ	C14	*W14X193	0.379	0.385	1.016
5/C.4	RF	C22	*W12X58	0.047	0.049	1.034
	18	C22	*W12X58	0.071	0.073	1.030
	17	C22	*W12X58	0.097	0.100	1.028
	16	C22	*W12X58	0.124	0.127	1.026
	15	C22	*W12X58	0.151	0.155	1.025
	14	C22	*W12X58	0.177	0.182	1.025
	13	C22	*W12X58	0.204	0.209	1.024
	12	C22	*W12X65	0.193	0.197	1.024
	11	C22	*W12X65	0.215	0.220	1.024
	10	C22	*W12X65	0.238	0.243	1.023
	9	C22	*W12X65	0.260	0.266	1.023
	8	C22	*W12X87	0.210	0.215	1.023
	7	C22	*W12X87	0.227	0.232	1.023
	6	C22	*W12X87	0.244	0.249	1.023
	5	C22	*W12X87	0.260	0.266	1.022
	4	C22	*W12X87	0.277	0.284	1.022
	3	C22	*W12X87	0.294	0.301	1.022
	2	C22	*W12X170	0.253	0.259	1.022
	MEZZ	C22	*W12X170	0.268	0.274	1.022
			max	0.379	0.385	1.034
			count	0	0	0

Loc	Level	BEAM	Section	Existing P_U+/ phi*Pn+	Settlement P_U+/ phi*Pn+	norm_DCR
3/B	RF	C13	*W14X82	0.076	0.075	0.997
	18	C13	*W14X82	0.144	0.144	0.996
	17	C13	*W14X82	0.213	0.212	0.995
	16	C13	*W14X90	0.232	0.231	0.995
	15	C13	*W14X90	0.293	0.291	0.995
	14	C13	*W14X109	0.292	0.291	0.995
	13	C13	*W14X109	0.343	0.341	0.995
	12	C13	*W14X132	0.324	0.322	0.995
	11	C13	*W14X132	0.366	0.364	0.995
	10	C13	*W14X159	0.335	0.333	0.995
	9	C13	*W14X159	0.370	0.368	0.995
	8	C13	*W14X176	0.364	0.362	0.995
	7	C13	*W14X176	0.395	0.394	0.995
	6	C13	*W14X193	0.389	0.387	0.996
	5	C13	*W14X193	0.417	0.415	0.996
	4	C13	*W14X233	0.369	0.368	0.996
	3	C13	*W14X233	0.393	0.391	0.996
	2	C13	*W14X342	0.378	0.376	0.996
	MEZZ	C13	*W14X342	0.382	0.381	0.996
3/C	RF	C17	*W14X82	0.076	0.074	0.979
	18	C17	*W14X82	0.144	0.142	0.986
	17	C17	*W14X82	0.213	0.210	0.988
	16	C17	*W14X90	0.232	0.230	0.990
	15	C17	*W14X90	0.293	0.290	0.990
	14	C17	*W14X109	0.292	0.290	0.991
	13	C17	*W14X109	0.343	0.340	0.991
	12	C17	*W14X132	0.324	0.321	0.992
	11	C17	*W14X132	0.366	0.363	0.992
	10	C17	*W14X159	0.335	0.332	0.992
	9	C17	*W14X159	0.370	0.367	0.992
	8	C17	*W14X176	0.364	0.361	0.993
	7	C17	*W14X176	0.395	0.392	0.993
	6	C17	*W14X193	0.389	0.386	0.993
	5	C17	*W14X193	0.417	0.414	0.993
	4	C17	*W14X233	0.369	0.367	0.993
	3	C17	*W14X233	0.393	0.390	0.993
	2	C17	*W14X342	0.378	0.376	0.993
	MEZZ	C17	*W14X342	0.382	0.380	0.994
2/B	RF	C12	*W14X82	0.071	0.070	0.993
	18	C12	*W14X82	0.141	0.140	0.993
	17	C12	*W14X82	0.212	0.211	0.993
	16	C12	*W14X90	0.233	0.232	0.993
	15	C12	*W14X90	0.295	0.293	0.993
	14	C12	*W14X109	0.296	0.294	0.993
	13	C12	*W14X109	0.348	0.345	0.993
	12	C12	*W14X132	0.329	0.327	0.993
	11	C12	*W14X132	0.372	0.369	0.994
	10	C12	*W14X159	0.341	0.339	0.994
	9	C12	*W14X159	0.376	0.374	0.994
	8	C12	*W14X176	0.371	0.369	0.994
	7	C12	*W14X176	0.403	0.401	0.994
	6	C12	*W14X193	0.396	0.394	0.994
	5	C12	*W14X193	0.426	0.423	0.994
	4	C12	*W14X233	0.377	0.375	0.994
	3	C12	*W14X233	0.401	0.399	0.994
	2	C12	*W14X342	0.386	0.384	0.994
	MEZZ	C12	*W14X342	0.390	0.388	0.994
2/C	RF	C16	*W14X82	0.071	0.070	0.996
	18	C16	*W14X82	0.141	0.141	0.996
	17	C16	*W14X82	0.212	0.211	0.996
	16	C16	*W14X90	0.233	0.232	0.996
	15	C16	*W14X90	0.295	0.294	0.996
	14	C16	*W14X109	0.296	0.295	0.996
	13	C16	*W14X109	0.348	0.346	0.997
	12	C16	*W14X132	0.329	0.328	0.997
	11	C16	*W14X132	0.372	0.371	0.997
	10	C16	*W14X159	0.341	0.340	0.997
	9	C16	*W14X159	0.376	0.375	0.997
	8	C16	*W14X176	0.371	0.370	0.997
	7	C16	*W14X176	0.403	0.402	0.997
	6	C16	*W14X193	0.396	0.395	0.997
	5	C16	*W14X193	0.426	0.424	0.997
	4	C16	*W14X233	0.377	0.376	0.997
	3	C16	*W14X233	0.401	0.400	0.997
	2	C16	*W14X342	0.386	0.385	0.997
	MEZZ	C16	*W14X342	0.390	0.389	0.997
			max	0.426	0.424	0.997
			count	0	0	0

C.3.1 MF Connections-Seismic (ref. Report Section 5.C & 5.D)

"Existing" indicates DCR under existing building condition per Report Section 3.A & 5.C

"Settlement" indicates DCR under existing building condition **combined** with excavation induced ground movements per Report Section 3.B & 5.D

"norm DCR" indicates DCR comparison per Report Section 3.C.ii. Connection flexure checked as "deformation controlled" element; Connection shear checked as "force controlled" element per ASCE 41-13 guidelines

MF Connections under Seismic Loads

C_1C_2 = 1.0 , m_max < 6 when T > 1.0
J = 2.0 , High Seismicity
CEBC 2016, 403.4: 10% Threshold

Loc	Level	BEAM	Section	Exist Q_{UD}/m_e*Q_{CE}	Exist $Q_{UF}/k*Q_{CL}$	Settlement Q_{UD}/m_e*Q_{CE}	Settlement $Q_{UF}/k*Q_{CL}$	norm_DCR M	norm_DCR V
X-DIR									
A/1-A/2	RF	B1	W30X99	0.601	0.119	0.606	0.120	1.008	1.009
	18	B1	W30X99	1.011	0.209	1.016	0.210	1.005	1.005
	17	B1	W30X99	1.416	0.282	1.419	0.283	1.003	1.003
	16	B1	W30X99	1.751	0.347	1.756	0.348	1.003	1.003
	15	B1	W30X99	1.937	0.383	1.943	0.385	1.003	1.003
	14	B1	W33X118	2.137	0.419	2.145	0.421	1.004	1.004
	13	B1	W33X118	2.162	0.437	2.173	0.439	1.005	1.005
	12	B1	W33X118	2.310	0.464	2.322	0.467	1.006	1.006
	11	B1	W33X118	2.452	0.491	2.468	0.494	1.006	1.007
	10	B1	W33X118	2.501	0.512	2.520	0.516	1.008	1.008
	9	B1	W33X118	2.476	0.517	2.499	0.522	1.009	1.010
	8	B1	W36X135	2.355	0.521	2.383	0.527	1.012	1.013
	7	B1	W36X135	2.359	0.529	2.393	0.537	1.014	1.015
	6	B1	W36X135	2.270	0.552	2.308	0.562	1.017	1.018
	5	B1	W36X135	2.364	0.578	2.410	0.590	1.019	1.020
	4	B1	W36X135	2.430	0.600	2.484	0.614	1.022	1.023
	3	B1	W36X135	2.519	0.627	2.585	0.644	1.026	1.027
	2	B1	W36X230	1.914	0.971	1.965	1.000	1.027	1.029
	MEZZ	B1	BOX24X36	1.909	0.362	1.981	0.377	1.037	1.042
A/2-A/3	RF	B2	W30X99	0.580	0.138	0.582	0.138	1.002	1.005
	18	B2	W30X99	1.002	0.226	1.005	0.227	1.003	1.003
	17	B2	W30X99	1.225	0.272	1.228	0.273	1.003	1.003
	16	B2	W30X99	1.477	0.323	1.480	0.324	1.002	1.003
	15	B2	W30X99	1.629	0.355	1.633	0.356	1.002	1.003
	14	B2	W33X118	1.454	0.400	1.458	0.401	1.003	1.003
	13	B2	W33X118	1.645	0.450	1.650	0.451	1.003	1.003
	12	B2	W33X118	1.696	0.463	1.701	0.465	1.003	1.004
	11	B2	W33X118	1.745	0.476	1.750	0.478	1.003	1.004
	10	B2	W33X118	1.900	0.518	1.906	0.520	1.003	1.004
	9	B2	W33X118	1.996	0.543	2.002	0.545	1.003	1.004
	8	B2	W36X135	2.153	0.545	2.161	0.548	1.004	1.005
	7	B2	W36X135	2.213	0.560	2.222	0.563	1.004	1.006
	6	B2	W36X135	1.815	0.575	1.823	0.579	1.004	1.006
	5	B2	W36X135	1.870	0.592	1.879	0.596	1.005	1.006
	4	B2	W36X135	1.931	0.614	1.941	0.618	1.005	1.007
	3	B2	W36X135	2.007	0.637	2.018	0.642	1.005	1.007
	2	B2	W36X230	1.809	0.974	1.817	0.982	1.005	1.009
	MEZZ	B2	BOX24X36	1.769	0.355	1.795	0.358	1.015	1.010
A/3-A/4	RF	B3	W30X99	0.587	0.114	0.585	0.114	0.997	0.998
	18	B3	W30X99	1.007	0.206	1.006	0.206	0.999	0.999
	17	B3	W30X99	1.427	0.282	1.428	0.282	1.000	1.000
	16	B3	W30X99	1.765	0.347	1.765	0.347	1.000	1.000
	15	B3	W30X99	1.953	0.384	1.954	0.384	1.001	1.001
	14	B3	W33X118	2.157	0.421	2.160	0.421	1.002	1.002

Loc	Level	BEAM	Section	Exist Q_{UD}/m_e*Q_{CE}	Exist $Q_{UF}/k*Q_{CL}$	Settlement Q_{UD}/m_e*Q_{CE}	Settlement $Q_{UF}/k*Q_{CL}$	norm_DCR M	norm_DCR V
Y-DIR									
1/A-1/B	RF	B9	W30X99	0.470	0.098	0.533	0.112	1.133	1.139
	18	B9	W30X99	0.829	0.181	0.906	0.198	1.093	1.093
	17	B9	W30X99	1.199	0.252	1.274	0.268	1.062	1.065
	16	B9	W30X99	1.504	0.314	1.581	0.331	1.051	1.054
	15	B9	W30X99	1.677	0.349	1.757	0.367	1.048	1.050
	14	B9	W33X118	1.842	0.380	1.940	0.402	1.053	1.059
	13	B9	W33X118	1.862	0.396	1.967	0.420	1.056	1.060
	12	B9	W33X118	1.991	0.421	2.100	0.446	1.055	1.059
	11	B9	W33X118	2.113	0.445	2.228	0.472	1.054	1.059
	10	B9	W33X118	2.148	0.464	2.271	0.492	1.057	1.061
	9	B9	W33X118	2.123	0.468	2.257	0.499	1.063	1.066
	8	B9	W36X135	2.008	0.469	2.155	0.506	1.073	1.079
	7	B9	W36X135	2.011	0.477	2.171	0.517	1.079	1.084
	6	B9	W36X135	1.936	0.499	2.098	0.543	1.084	1.088
	5	B9	W36X135	2.017	0.522	2.194	0.570	1.088	1.092
	4	B9	W36X135	2.073	0.543	2.266	0.595	1.093	1.097
	3	B9	W36X135	2.144	0.566	2.362	0.625	1.102	1.104
	2	B9	W36X230	1.633	0.880	1.792	0.973	1.098	1.106
	MEZZ	B9	BOX24X36	1.663	0.334	1.850	0.377	1.112	1.128
1/B-1/C	RF	B31	W30X99	0.548	0.132	0.547	0.136	0.998	1.028
	18	B31	W30X99	0.903	0.208	0.912	0.213	1.010	1.022
	17	B31	W30X99	1.092	0.247	1.101	0.252	1.008	1.019
	16	B31	W30X99	1.312	0.293	1.323	0.298	1.008	1.017
	15	B31	W30X99	1.449	0.321	1.461	0.327	1.009	1.017
	14	B31	W33X118	1.303	0.365	1.314	0.372	1.008	1.019
	13	B31	W33X118	1.469	0.409	1.484	0.416	1.010	1.019
	12	B31	W33X118	1.513	0.420	1.529	0.428	1.011	1.019
	11	B31	W33X118	1.555	0.431	1.571	0.440	1.011	1.020
	10	B31	W33X118	1.684	0.467	1.705	0.477	1.013	1.020
	9	B31	W33X118	1.763	0.488	1.788	0.498	1.014	1.021
	8	B31	W36X135	1.905	0.491	1.933	0.503	1.015	1.024
	7	B31	W36X135	1.951	0.502	1.982	0.515	1.016	1.026
	6	B31	W36X135	1.591	0.513	1.620	0.527	1.018	1.027
	5	B31	W36X135	1.630	0.525	1.662	0.540	1.019	1.028
	4	B31	W36X135	1.673	0.541	1.708	0.557	1.021	1.029
	3	B31	W36X135	1.724	0.557	1.765	0.574	1.024	1.031
	2	B31	W36X230	1.556	0.853	1.602	0.882	1.030	1.035
	MEZZ	B31	BOX24X36	1.534	0.312	1.632	0.326	1.064	1.044
1/C-1/D	RF	B56	W30X99	0.470	0.098	0.529	0.109	1.123	1.116
	18	B56	W30X99	0.829	0.181	0.903	0.196	1.089	1.084
	17	B56	W30X99	1.199	0.252	1.272	0.267	1.061	1.060
	16	B56	W30X99	1.504	0.314	1.580	0.329	1.051	1.050
	15	B56	W30X99	1.677	0.349	1.758	0.366	1.048	1.048
	14	B56	W33X118	1.842	0.380	1.939	0.400	1.053	1.054

	13	B3	W33X118	2.183	0.439	2.188	0.440	1.002	1.003
	12	B3	W33X118	2.330	0.466	2.337	0.468	1.003	1.003
	11	B3	W33X118	2.472	0.493	2.481	0.494	1.003	1.003
	10	B3	W33X118	2.521	0.514	2.532	0.516	1.004	1.004
	9	B3	W33X118	2.495	0.519	2.510	0.522	1.006	1.006
	8	B3	W36X135	2.373	0.523	2.392	0.527	1.008	1.008
	7	B3	W36X135	2.376	0.531	2.400	0.537	1.010	1.010
	6	B3	W36X135	2.284	0.554	2.312	0.561	1.012	1.013
	5	B3	W36X135	2.376	0.579	2.411	0.588	1.015	1.015
	4	B3	W36X135	2.440	0.601	2.482	0.611	1.017	1.017
	3	B3	W36X135	2.527	0.627	2.578	0.640	1.020	1.020
	2	B3	W36X230	1.920	0.974	1.963	0.996	1.022	1.023
	MEZZ	B3	BOX24X36	1.922	0.364	1.972	0.374	1.026	1.028
D/1-D/2	RF	B63	W30X99	0.602	0.119	0.634	0.125	1.054	1.049
	18	B63	W30X99	1.011	0.209	1.051	0.217	1.039	1.036
	17	B63	W30X99	1.416	0.282	1.454	0.290	1.027	1.026
	16	B63	W30X99	1.751	0.347	1.791	0.355	1.023	1.022
	15	B63	W30X99	1.937	0.383	1.980	0.392	1.022	1.021
	14	B63	W33X118	2.137	0.419	2.189	0.429	1.024	1.024
	13	B63	W33X118	2.163	0.437	2.218	0.448	1.026	1.026
	12	B63	W33X118	2.310	0.464	2.369	0.476	1.026	1.026
	11	B63	W33X118	2.452	0.491	2.516	0.503	1.026	1.026
	10	B63	W33X118	2.501	0.512	2.570	0.526	1.027	1.027
	9	B63	W33X118	2.477	0.517	2.552	0.533	1.030	1.030
	8	B63	W36X135	2.355	0.521	2.437	0.539	1.035	1.035
	7	B63	W36X135	2.359	0.529	2.450	0.550	1.038	1.039
	6	B63	W36X135	2.270	0.552	2.364	0.575	1.041	1.042
	5	B63	W36X135	2.364	0.578	2.469	0.604	1.044	1.044
	4	B63	W36X135	2.430	0.600	2.546	0.629	1.047	1.048
	3	B63	W36X135	2.519	0.627	2.652	0.660	1.053	1.052
	2	B63	W36X230	1.914	0.971	2.012	1.023	1.052	1.053
	MEZZ	B63	BOX24X36	1.910	0.362	2.030	0.386	1.063	1.067
D/2-D/3	RF	B64	W30X99	0.580	0.138	0.585	0.139	1.008	1.006
	18	B64	W30X99	1.002	0.226	1.012	0.228	1.010	1.010
	17	B64	W30X99	1.225	0.272	1.227	0.272	1.001	1.002
	16	B64	W30X99	1.477	0.323	1.478	0.324	1.001	1.001
	15	B64	W30X99	1.629	0.355	1.631	0.355	1.001	1.002
	14	B64	W33X118	1.454	0.400	1.455	0.401	1.001	1.003
	13	B64	W33X118	1.645	0.450	1.648	0.451	1.002	1.003
	12	B64	W33X118	1.696	0.463	1.700	0.465	1.002	1.004
	11	B64	W33X118	1.746	0.476	1.750	0.478	1.003	1.005
	10	B64	W33X118	1.900	0.518	1.907	0.521	1.004	1.005
	9	B64	W33X118	1.996	0.543	2.005	0.547	1.005	1.006
	8	B64	W36X135	2.153	0.545	2.163	0.549	1.005	1.008
	7	B64	W36X135	2.213	0.560	2.226	0.565	1.006	1.009
	6	B64	W36X135	1.815	0.575	1.827	0.581	1.007	1.010
	5	B64	W36X135	1.870	0.592	1.884	0.599	1.007	1.011
	4	B64	W36X135	1.931	0.614	1.948	0.621	1.008	1.012
	3	B64	W36X135	2.007	0.637	2.028	0.646	1.010	1.013
	2	B64	W36X230	1.808	0.973	1.819	0.987	1.006	1.014
	MEZZ	B64	BOX24X36	1.771	0.355	1.825	0.362	1.030	1.021
D/3-D/4	RF	B65	W30X99	0.587	0.114	0.610	0.120	1.039	1.045
	18	B65	W30X99	1.007	0.206	1.036	0.212	1.029	1.030
	17	B65	W30X99	1.427	0.282	1.457	0.288	1.021	1.023
	16	B65	W30X99	1.765	0.347	1.795	0.354	1.017	1.019

	13	B56	W33X118	1.862	0.396	1.966	0.419	1.056	1.056
	12	B56	W33X118	1.991	0.421	2.099	0.445	1.055	1.055
	11	B56	W33X118	2.113	0.445	2.227	0.470	1.054	1.055
	10	B56	W33X118	2.148	0.464	2.270	0.490	1.057	1.058
	9	B56	W33X118	2.123	0.468	2.255	0.498	1.062	1.062
	8	B56	W36X135	2.008	0.469	2.150	0.503	1.070	1.072
	7	B56	W36X135	2.011	0.477	2.164	0.514	1.076	1.077
	6	B56	W36X135	1.936	0.499	2.091	0.539	1.080	1.081
	5	B56	W36X135	2.017	0.522	2.186	0.566	1.084	1.084
	4	B56	W36X135	2.073	0.543	2.256	0.591	1.088	1.089
	3	B56	W36X135	2.144	0.566	2.349	0.620	1.096	1.095
	2	B56	W36X230	1.633	0.880	1.783	0.963	1.092	1.095
	MEZZ	B56	BOX24X36	1.663	0.334	1.834	0.371	1.103	1.110
4/A-4/B	RF	B7	W30X99	0.730	0.155	0.782	0.168	1.071	1.087
	18	B7	W30X99	1.225	0.275	1.285	0.289	1.049	1.052
	17	B7	W30X99	1.704	0.375	1.762	0.389	1.034	1.038
	16	B7	W30X99	2.081	0.461	2.141	0.476	1.029	1.032
	15	B7	W30X99	2.277	0.507	2.340	0.522	1.028	1.030
	14	B7	W33X118	2.437	0.537	2.515	0.556	1.032	1.036
	13	B7	W33X118	2.434	0.558	2.518	0.579	1.035	1.038
	12	B7	W33X118	2.599	0.593	2.687	0.615	1.034	1.038
	11	B7	W33X118	2.760	0.628	2.853	0.652	1.034	1.038
	10	B7	W33X118	2.805	0.657	2.906	0.683	1.036	1.040
	9	B7	W33X118	2.766	0.665	2.878	0.693	1.040	1.043
	8	B7	W36X135	2.596	0.659	2.719	0.694	1.047	1.052
	7	B7	W36X135	2.604	0.674	2.739	0.712	1.052	1.056
	6	B7	W36X135	2.521	0.710	2.661	0.753	1.055	1.059
	5	B7	W36X135	2.643	0.750	2.797	0.797	1.058	1.062
	4	B7	W36X135	2.734	0.787	2.904	0.839	1.062	1.066
	3	B7	W36X135	2.833	0.825	3.028	0.884	1.069	1.071
	2	B7	W36X230	2.154	1.286	2.294	1.378	1.065	1.072
	MEZZ	B7	BOX24X36	2.188	0.499	2.353	0.541	1.075	1.085
4/B-4/C	RF	B35	W30X99	1.033	0.214	1.030	0.215	0.997	1.002
	18	B35	W30X99	1.448	0.266	1.453	0.268	1.003	1.006
	17	B35	W30X99	1.669	0.302	1.674	0.304	1.003	1.005
	16	B35	W30X99	1.926	0.344	1.932	0.346	1.003	1.005
	15	B35	W30X99	2.080	0.369	2.087	0.371	1.003	1.006
	14	B35	W33X118	1.809	0.421	1.815	0.424	1.004	1.007
	13	B35	W33X118	1.998	0.462	2.007	0.465	1.005	1.007
	12	B35	W33X118	2.040	0.471	2.049	0.475	1.005	1.008
	11	B35	W33X118	2.078	0.479	2.088	0.483	1.005	1.008
	10	B35	W33X118	2.220	0.511	2.232	0.515	1.006	1.008
	9	B35	W33X118	2.301	0.528	2.316	0.533	1.006	1.009
	8	B35	W36X135	2.516	0.537	2.532	0.543	1.006	1.011
	7	B35	W36X135	2.552	0.544	2.571	0.550	1.007	1.011
	6	B35	W36X135	2.063	0.550	2.079	0.557	1.008	1.012
	5	B35	W36X135	2.093	0.558	2.110	0.565	1.008	1.013
	4	B35	W36X135	2.125	0.568	2.144	0.575	1.009	1.013
	3	B35	W36X135	2.160	0.576	2.182	0.584	1.010	1.014
	2	B35	W36X230	1.995	0.894	2.011	0.909	1.008	1.016
	MEZZ	B35	BOX24X36	1.919	0.329	1.952	0.336	1.017	1.020
4/C-4/D	RF	B60	W30X99	0.730	0.155	0.765	0.163	1.047	1.050
	18	B60	W30X99	1.225	0.275	1.269	0.285	1.036	1.036
	17	B60	W30X99	1.704	0.375	1.749	0.385	1.026	1.027
	16	B60	W30X99	2.081	0.461	2.129	0.472	1.023	1.024

15	B65	W30X99	1.953	0.384	1.985	0.391	1.017	1.018
14	B65	W33X118	2.157	0.421	2.198	0.430	1.019	1.022
13	B65	W33X118	2.183	0.439	2.229	0.449	1.021	1.023
12	B65	W33X118	2.330	0.466	2.379	0.477	1.021	1.023
11	B65	W33X118	2.473	0.493	2.524	0.504	1.021	1.023
10	B65	W33X118	2.521	0.514	2.578	0.526	1.023	1.025
9	B65	W33X118	2.496	0.519	2.560	0.533	1.026	1.027
8	B65	W36X135	2.373	0.523	2.446	0.540	1.030	1.033
7	B65	W36X135	2.376	0.531	2.457	0.551	1.034	1.037
6	B65	W36X135	2.284	0.554	2.369	0.576	1.037	1.040
5	B65	W36X135	2.376	0.579	2.472	0.604	1.040	1.042
4	B65	W36X135	2.440	0.601	2.547	0.628	1.044	1.046
3	B65	W36X135	2.527	0.627	2.650	0.659	1.049	1.050
2	B65	W36X230	1.921	0.974	2.016	1.026	1.050	1.054
MEZZ	B65	BOX24X36	1.919	0.363	2.030	0.387	1.058	1.066
		total	114			max	1.063	1.067
		count	108	0	108	2	0	0
			>1.0	>1.0	>1.0	>1.0	>1.1	>1.1

15	B60	W30X99	2.277	0.507	2.329	0.519	1.023	1.024
14	B60	W33X118	2.437	0.537	2.501	0.552	1.026	1.028
13	B60	W33X118	2.434	0.558	2.503	0.574	1.029	1.030
12	B60	W33X118	2.599	0.593	2.673	0.611	1.029	1.030
11	B60	W33X118	2.760	0.628	2.841	0.648	1.029	1.031
10	B60	W33X118	2.805	0.657	2.892	0.678	1.031	1.033
9	B60	W33X118	2.766	0.665	2.863	0.688	1.035	1.036
8	B60	W36X135	2.596	0.659	2.701	0.687	1.040	1.042
7	B60	W36X135	2.604	0.674	2.720	0.705	1.044	1.046
6	B60	W36X135	2.521	0.710	2.642	0.746	1.048	1.049
5	B60	W36X135	2.643	0.750	2.777	0.790	1.051	1.052
4	B60	W36X135	2.734	0.787	2.883	0.831	1.054	1.056
3	B60	W36X135	2.833	0.825	3.003	0.875	1.060	1.061
2	B60	W36X230	2.154	1.286	2.278	1.364	1.058	1.061
MEZZ	B60	BOX24X36	2.187	0.499	2.333	0.535	1.067	1.071
		total	114			max	1.133	1.139
		count	106	2	106	2	5	6
			>1.0	>1.0	>1.0	>1.0	>1.1	>1.1

D.1 MF Connections-Threshold Settlement Magnitude (ref. Report Section 6)

"Existing" indicates DCR under existing building condition per Report Section 3.A & 5.C

"Settlement" indicates DCR under existing building condition **combined** with 88% of excavation induced ground movements per Report Section 3.B & 5.D

MF Connections

C_1C_2 = 1.0 , m_max < 6 when T > 1.0
J = 2.0 , High Seismicity
CEBC 2016, 403.4 10% Threshold

Threshold settlement for connection strengthening

0.88 H		max downward	-1.306
by iteration		max upward	0.123

"norm DCR" indicates DCR comparison per Report Section 3.C.ii. Connection flexure checked as "deformation controlled" element; Connection shear checked as "force controlled" element per ASCE 41-13 guidelines

Loc	Level	BEAM	Section	Exist Q_{UD}/m_e*Q_{CE}	Exist $Q_{UF}/k*Q_{CL}$	Settle Q_{UD}/m_e*Q_{CE}	Settle $Q_{UF}/k*Q_{CL}$	norm_DCR M	norm_DCR V
X-DIR									
A/1-A/2	RF	B1	W30X99	0.601	0.119	0.606	0.120	1.008	1.009
	18	B1	W30X99	1.011	0.209	1.016	0.210	1.005	1.005
	17	B1	W30X99	1.416	0.282	1.420	0.283	1.003	1.003
	16	B1	W30X99	1.751	0.347	1.756	0.348	1.003	1.003
	15	B1	W30X99	1.937	0.383	1.943	0.385	1.003	1.003
	14	B1	W33X118	2.137	0.419	2.144	0.421	1.004	1.004
	13	B1	W33X118	2.162	0.437	2.171	0.439	1.004	1.005
	12	B1	W33X118	2.310	0.464	2.321	0.467	1.005	1.005
	11	B1	W33X118	2.452	0.491	2.466	0.494	1.006	1.006
	10	B1	W33X118	2.501	0.512	2.518	0.515	1.007	1.007
	9	B1	W33X118	2.476	0.517	2.497	0.521	1.008	1.009
	8	B1	W36X135	2.355	0.521	2.380	0.527	1.011	1.011
	7	B1	W36X135	2.359	0.529	2.389	0.536	1.013	1.013
	6	B1	W36X135	2.270	0.552	2.304	0.561	1.015	1.016
	5	B1	W36X135	2.364	0.578	2.405	0.588	1.017	1.018
	4	B1	W36X135	2.430	0.600	2.478	0.612	1.020	1.020
	3	B1	W36X135	2.519	0.627	2.577	0.642	1.023	1.023
	2	B1	W36X230	1.914	0.971	1.959	0.996	1.024	1.026
	MEZZ	B1	BOX24X36	1.909	0.362	1.972	0.375	1.033	1.037
A/2-A/3	RF	B2	W30X99	0.580	0.138	0.581	0.138	1.002	1.004
	18	B2	W30X99	1.002	0.226	1.005	0.227	1.003	1.003
	17	B2	W30X99	1.225	0.272	1.228	0.273	1.003	1.003
	16	B2	W30X99	1.477	0.323	1.480	0.324	1.002	1.003
	15	B2	W30X99	1.629	0.355	1.633	0.355	1.002	1.003
	14	B2	W33X118	1.454	0.400	1.458	0.401	1.003	1.003
	13	B2	W33X118	1.645	0.450	1.649	0.451	1.003	1.003
	12	B2	W33X118	1.696	0.463	1.700	0.464	1.003	1.003
	11	B2	W33X118	1.745	0.476	1.750	0.477	1.003	1.003
	10	B2	W33X118	1.900	0.518	1.905	0.520	1.003	1.003
	9	B2	W33X118	1.996	0.543	2.002	0.545	1.003	1.004
	8	B2	W36X135	2.153	0.545	2.160	0.548	1.003	1.005
	7	B2	W36X135	2.213	0.560	2.221	0.563	1.004	1.005
	6	B2	W36X135	1.815	0.575	1.822	0.578	1.004	1.005
	5	B2	W36X135	1.870	0.592	1.878	0.596	1.004	1.006
	4	B2	W36X135	1.931	0.614	1.940	0.617	1.004	1.006
	3	B2	W36X135	2.007	0.637	2.017	0.641	1.005	1.006
	2	B2	W36X230	1.809	0.974	1.816	0.981	1.004	1.008
	MEZZ	B2	BOX24X36	1.769	0.355	1.792	0.358	1.013	1.008
A/3-A/4	RF	B3	W30X99	0.587	0.114	0.586	0.114	0.998	0.999
	18	B3	W30X99	1.007	0.206	1.007	0.206	1.000	1.000
	17	B3	W30X99	1.427	0.282	1.428	0.282	1.001	1.001
	16	B3	W30X99	1.765	0.347	1.766	0.347	1.001	1.001
	15	B3	W30X99	1.953	0.384	1.954	0.384	1.001	1.001
	14	B3	W33X118	2.157	0.421	2.160	0.421	1.002	1.002
	13	B3	W33X118	2.183	0.439	2.188	0.440	1.002	1.002
	12	B3	W33X118	2.330	0.466	2.336	0.467	1.003	1.003
	11	B3	W33X118	2.472	0.493	2.480	0.494	1.003	1.003
	10	B3	W33X118	2.521	0.514	2.531	0.516	1.004	1.004
	9	B3	W33X118	2.495	0.519	2.509	0.522	1.005	1.005
	8	B3	W36X135	2.373	0.523	2.390	0.527	1.007	1.007
	7	B3	W36X135	2.376	0.531	2.398	0.536	1.009	1.009
	6	B3	W36X135	2.284	0.554	2.309	0.560	1.011	1.011
	5	B3	W36X135	2.376	0.579	2.407	0.587	1.013	1.013
	4	B3	W36X135	2.440	0.601	2.477	0.610	1.015	1.015
	3	B3	W36X135	2.527	0.627	2.572	0.638	1.018	1.018
	2	B3	W36X230	1.920	0.974	1.958	0.993	1.020	1.020

	MEZZ	B3	BOX24X36	1.922	0.364	1.966	0.373	1.023	1.025
D/1-D/2	RF	B63	W30X99	0.602	0.119	0.631	0.124	1.048	1.044
	18	B63	W30X99	1.011	0.209	1.047	0.216	1.035	1.033
	17	B63	W30X99	1.416	0.282	1.450	0.289	1.024	1.023
	16	B63	W30X99	1.751	0.347	1.787	0.354	1.021	1.020
	15	B63	W30X99	1.937	0.383	1.975	0.391	1.019	1.019
	14	B63	W33X118	2.137	0.419	2.183	0.428	1.021	1.021
	13	B63	W33X118	2.163	0.437	2.212	0.447	1.023	1.023
	12	B63	W33X118	2.310	0.464	2.362	0.475	1.023	1.023
	11	B63	W33X118	2.452	0.491	2.508	0.502	1.023	1.023
	10	B63	W33X118	2.501	0.512	2.562	0.524	1.024	1.024
	9	B63	W33X118	2.477	0.517	2.543	0.531	1.027	1.027
	8	B63	W36X135	2.355	0.521	2.428	0.537	1.031	1.031
	7	B63	W36X135	2.359	0.529	2.440	0.547	1.034	1.034
	6	B63	W36X135	2.270	0.552	2.353	0.573	1.037	1.037
	5	B63	W36X135	2.364	0.578	2.456	0.600	1.039	1.039
	4	B63	W36X135	2.430	0.600	2.532	0.625	1.042	1.042
	3	B63	W36X135	2.519	0.627	2.636	0.656	1.046	1.046
	2	B63	W36X230	1.914	0.971	2.000	1.017	1.045	1.047
	MEZZ	B63	BOX24X36	1.910	0.362	2.016	0.384	1.055	1.059
D/2-D/3	RF	B64	W30X99	0.580	0.138	0.584	0.138	1.007	1.004
	18	B64	W30X99	1.002	0.226	1.011	0.228	1.009	1.009
	17	B64	W30X99	1.225	0.272	1.226	0.272	1.000	1.001
	16	B64	W30X99	1.477	0.323	1.477	0.324	1.000	1.000
	15	B64	W30X99	1.629	0.355	1.629	0.355	1.000	1.001
	14	B64	W33X118	1.454	0.400	1.454	0.400	1.000	1.001
	13	B64	W33X118	1.645	0.450	1.646	0.450	1.001	1.002
	12	B64	W33X118	1.696	0.463	1.698	0.464	1.001	1.002
	11	B64	W33X118	1.746	0.476	1.749	0.477	1.002	1.003
	10	B64	W33X118	1.900	0.518	1.905	0.520	1.003	1.004
	9	B64	W33X118	1.996	0.543	2.003	0.546	1.004	1.005
	8	B64	W36X135	2.153	0.545	2.161	0.549	1.004	1.006
	7	B64	W36X135	2.213	0.560	2.223	0.564	1.005	1.007
	6	B64	W36X135	1.815	0.575	1.825	0.580	1.006	1.008
	5	B64	W36X135	1.870	0.592	1.882	0.598	1.006	1.009
	4	B64	W36X135	1.931	0.614	1.945	0.620	1.007	1.010
	3	B64	W36X135	2.007	0.637	2.025	0.644	1.009	1.011
	2	B64	W36X230	1.808	0.973	1.817	0.985	1.005	1.012
	MEZZ	B64	BOX24X36	1.771	0.355	1.818	0.361	1.026	1.018
D/3-D/4	RF	B65	W30X99	0.587	0.114	0.608	0.119	1.035	1.041
	18	B65	W30X99	1.007	0.206	1.033	0.212	1.026	1.027
	17	B65	W30X99	1.427	0.282	1.454	0.288	1.019	1.021
	16	B65	W30X99	1.765	0.347	1.792	0.353	1.016	1.017
	15	B65	W30X99	1.953	0.384	1.982	0.390	1.015	1.016
	14	B65	W33X118	2.157	0.421	2.193	0.429	1.017	1.019
	13	B65	W33X118	2.183	0.439	2.223	0.448	1.018	1.020
	12	B65	W33X118	2.330	0.466	2.373	0.476	1.018	1.020
	11	B65	W33X118	2.473	0.493	2.518	0.503	1.019	1.021
	10	B65	W33X118	2.521	0.514	2.571	0.525	1.020	1.022
	9	B65	W33X118	2.496	0.519	2.552	0.531	1.023	1.024
	8	B65	W36X135	2.373	0.523	2.437	0.538	1.027	1.029
	7	B65	W36X135	2.376	0.531	2.448	0.548	1.030	1.032
	6	B65	W36X135	2.284	0.554	2.359	0.573	1.033	1.035
	5	B65	W36X135	2.376	0.579	2.460	0.601	1.035	1.037
	4	B65	W36X135	2.440	0.601	2.534	0.625	1.039	1.040
	3	B65	W36X135	2.527	0.627	2.635	0.655	1.043	1.044
	2	B65	W36X230	1.921	0.974	2.004	1.020	1.044	1.047
	MEZZ	B65	BOX24X36	1.919	0.363	2.017	0.384	1.051	1.058
			total	114		114			
			count(>1.0 or >1.1)	108	0	108	2	0	0

Loc	Level	BEAM	Section	Exist		Settle			
				Q_{UD}/m_e*Q_{CE}	$Q_{UF}/k*Q_{CL}$	Q_{UD}/m_e*Q_{CE}	$Q_{UF}/k*Q_{CL}$	norm_DCR M	norm_DCR V
Y-DIR									
1/A-1/B	RF	B9	W30X99	0.470	0.098	0.526	0.110	1.117	1.123
	18	B9	W30X99	0.829	0.181	0.897	0.196	1.082	1.082
	17	B9	W30X99	1.199	0.252	1.266	0.266	1.056	1.058
	16	B9	W30X99	1.504	0.314	1.573	0.329	1.045	1.048
	15	B9	W30X99	1.677	0.349	1.748	0.365	1.042	1.045
	14	B9	W33X118	1.842	0.380	1.929	0.399	1.047	1.052
	13	B9	W33X118	1.862	0.396	1.954	0.418	1.050	1.053
	12	B9	W33X118	1.991	0.421	2.087	0.443	1.048	1.052
	11	B9	W33X118	2.113	0.445	2.214	0.468	1.048	1.052
	10	B9	W33X118	2.148	0.464	2.257	0.489	1.051	1.054
	9	B9	W33X118	2.123	0.468	2.241	0.496	1.056	1.058
	8	B9	W36X135	2.008	0.469	2.137	0.501	1.064	1.069
	7	B9	W36X135	2.011	0.477	2.152	0.512	1.070	1.074
	6	B9	W36X135	1.936	0.499	2.079	0.537	1.074	1.078
	5	B9	W36X135	2.017	0.522	2.173	0.564	1.077	1.081
	4	B9	W36X135	2.073	0.543	2.243	0.589	1.082	1.085
	3	B9	W36X135	2.144	0.566	2.336	0.618	1.089	1.091
	2	B9	W36X230	1.633	0.880	1.773	0.962	1.086	1.094
	MEZZ	B9	BOX24X36	1.663	0.334	1.827	0.372	1.099	1.113
1/B-1/C	RF	B31	W30X99	0.548	0.132	0.548	0.135	0.998	1.025
	18	B31	W30X99	0.903	0.208	0.911	0.212	1.009	1.020
	17	B31	W30X99	1.092	0.247	1.100	0.251	1.007	1.017
	16	B31	W30X99	1.312	0.293	1.322	0.298	1.007	1.015
	15	B31	W30X99	1.449	0.321	1.460	0.326	1.008	1.015
	14	B31	W33X118	1.303	0.365	1.313	0.371	1.007	1.017
	13	B31	W33X118	1.469	0.409	1.483	0.415	1.009	1.016
	12	B31	W33X118	1.513	0.420	1.527	0.427	1.009	1.017
	11	B31	W33X118	1.555	0.431	1.570	0.439	1.010	1.017
	10	B31	W33X118	1.684	0.467	1.703	0.475	1.011	1.018
	9	B31	W33X118	1.763	0.488	1.786	0.497	1.013	1.019
	8	B31	W36X135	1.905	0.491	1.930	0.501	1.013	1.022
	7	B31	W36X135	1.951	0.502	1.979	0.513	1.015	1.023
	6	B31	W36X135	1.591	0.513	1.616	0.525	1.016	1.024
	5	B31	W36X135	1.630	0.525	1.658	0.538	1.017	1.025
	4	B31	W36X135	1.673	0.541	1.703	0.555	1.018	1.026
	3	B31	W36X135	1.724	0.557	1.760	0.572	1.021	1.027
	2	B31	W36X230	1.556	0.853	1.593	0.879	1.024	1.030
	MEZZ	B31	BOX24X36	1.534	0.312	1.620	0.324	1.056	1.039
1/C-1/D	RF	B56	W30X99	0.470	0.098	0.522	0.108	1.109	1.103
	18	B56	W30X99	0.829	0.181	0.894	0.194	1.079	1.075
	17	B56	W30X99	1.199	0.252	1.264	0.265	1.054	1.053
	16	B56	W30X99	1.504	0.314	1.572	0.328	1.045	1.045
	15	B56	W30X99	1.677	0.349	1.748	0.364	1.042	1.042
	14	B56	W33X118	1.842	0.380	1.928	0.398	1.046	1.048
	13	B56	W33X118	1.862	0.396	1.954	0.416	1.049	1.050
	12	B56	W33X118	1.991	0.421	2.086	0.442	1.048	1.049
	11	B56	W33X118	2.113	0.445	2.214	0.467	1.048	1.049
	10	B56	W33X118	2.148	0.464	2.256	0.487	1.050	1.051
	9	B56	W33X118	2.123	0.468	2.239	0.494	1.055	1.055
	8	B56	W36X135	2.008	0.469	2.133	0.499	1.062	1.063
	7	B56	W36X135	2.011	0.477	2.146	0.509	1.067	1.068
	6	B56	W36X135	1.936	0.499	2.073	0.534	1.071	1.071
	5	B56	W36X135	2.017	0.522	2.165	0.561	1.074	1.074
	4	B56	W36X135	2.073	0.543	2.234	0.585	1.078	1.078
	3	B56	W36X135	2.144	0.566	2.325	0.614	1.084	1.084
	2	B56	W36X230	1.633	0.880	1.765	0.954	1.081	1.084
	MEZZ	B56	BOX24X36	1.663	0.334	1.813	0.367	1.091	1.097
4/A-4/B	RF	B7	W30X99	0.730	0.155	0.776	0.167	1.063	1.078
	18	B7	W30X99	1.225	0.275	1.279	0.288	1.044	1.047
	17	B7	W30X99	1.704	0.375	1.757	0.388	1.031	1.034
	16	B7	W30X99	2.081	0.461	2.135	0.474	1.026	1.028
	15	B7	W30X99	2.277	0.507	2.333	0.520	1.025	1.027

	14	B7	W33X118	2.437	0.537	2.506	0.554	1.028	1.032
	13	B7	W33X118	2.434	0.558	2.508	0.577	1.030	1.034
	12	B7	W33X118	2.599	0.593	2.677	0.613	1.030	1.033
	11	B7	W33X118	2.760	0.628	2.842	0.649	1.030	1.033
	10	B7	W33X118	2.805	0.657	2.894	0.680	1.032	1.035
	9	B7	W33X118	2.766	0.665	2.865	0.690	1.036	1.038
	8	B7	W36X135	2.596	0.659	2.705	0.690	1.042	1.046
	7	B7	W36X135	2.604	0.674	2.724	0.707	1.046	1.050
	6	B7	W36X135	2.521	0.710	2.644	0.748	1.049	1.052
	5	B7	W36X135	2.643	0.750	2.779	0.791	1.051	1.055
	4	B7	W36X135	2.734	0.787	2.884	0.832	1.055	1.058
	3	B7	W36X135	2.833	0.825	3.004	0.877	1.060	1.063
	2	B7	W36X230	2.154	1.286	2.278	1.367	1.057	1.063
	MEZZ	B7	BOX24X36	2.188	0.499	2.333	0.536	1.067	1.075
4/B-4/C	RF	B35	W30X99	1.033	0.214	1.030	0.215	0.998	1.002
	18	B35	W30X99	1.448	0.266	1.453	0.268	1.003	1.005
	17	B35	W30X99	1.669	0.302	1.673	0.304	1.003	1.005
	16	B35	W30X99	1.926	0.344	1.931	0.346	1.003	1.005
	15	B35	W30X99	2.080	0.369	2.086	0.371	1.003	1.005
	14	B35	W33X118	1.809	0.421	1.815	0.424	1.003	1.006
	13	B35	W33X118	1.998	0.462	2.006	0.465	1.004	1.006
	12	B35	W33X118	2.040	0.471	2.048	0.474	1.004	1.007
	11	B35	W33X118	2.078	0.479	2.087	0.482	1.004	1.007
	10	B35	W33X118	2.220	0.511	2.231	0.515	1.005	1.007
	9	B35	W33X118	2.301	0.528	2.314	0.532	1.006	1.008
	8	B35	W36X135	2.516	0.537	2.531	0.542	1.006	1.009
	7	B35	W36X135	2.552	0.544	2.569	0.550	1.006	1.010
	6	B35	W36X135	2.063	0.550	2.077	0.556	1.007	1.011
	5	B35	W36X135	2.093	0.558	2.108	0.564	1.007	1.011
	4	B35	W36X135	2.125	0.568	2.142	0.574	1.008	1.012
	3	B35	W36X135	2.160	0.576	2.179	0.583	1.009	1.012
	2	B35	W36X230	1.995	0.894	2.009	0.907	1.007	1.015
	MEZZ	B35	BOX24X36	1.919	0.329	1.943	0.335	1.013	1.018
4/C-4/D	RF	B60	W30X99	0.730	0.155	0.761	0.162	1.043	1.045
	18	B60	W30X99	1.225	0.275	1.265	0.284	1.032	1.033
	17	B60	W30X99	1.704	0.375	1.745	0.384	1.024	1.025
	16	B60	W30X99	2.081	0.461	2.124	0.471	1.021	1.021
	15	B60	W30X99	2.277	0.507	2.323	0.517	1.020	1.021
	14	B60	W33X118	2.437	0.537	2.494	0.550	1.023	1.025
	13	B60	W33X118	2.434	0.558	2.495	0.572	1.025	1.026
	12	B60	W33X118	2.599	0.593	2.665	0.609	1.025	1.026
	11	B60	W33X118	2.760	0.628	2.831	0.645	1.026	1.027
	10	B60	W33X118	2.805	0.657	2.882	0.676	1.028	1.029
	9	B60	W33X118	2.766	0.665	2.852	0.686	1.031	1.032
	8	B60	W36X135	2.596	0.659	2.689	0.684	1.036	1.038
	7	B60	W36X135	2.604	0.674	2.707	0.701	1.039	1.041
	6	B60	W36X135	2.521	0.710	2.628	0.741	1.042	1.044
	5	B60	W36X135	2.643	0.750	2.761	0.785	1.045	1.046
	4	B60	W36X135	2.734	0.787	2.865	0.826	1.048	1.049
	3	B60	W36X135	2.833	0.825	2.983	0.869	1.053	1.054
	2	B60	W36X230	2.154	1.286	2.263	1.355	1.051	1.053
	MEZZ	B60	BOX24X36	2.187	0.499	2.316	0.530	1.059	1.063
			total	114		114			
		count(>1.0 or >1.1)		106	2	106	2	2	3

FDIC Building at 25 Jessie Street,

San Francisco, CA

Appendix C

Letter by Langan dated December 15, 2017, providing, Existing FDIC Building Pile Capacity; L-Pile analysis detailing existing pile foundation flexural and shear demands due to (a) excavation induced site movement; and (b) ASCE 41-13 seismic demands

December 15, 2017

Prepared by:

Nabih Youssef Associates

NYA Project: 17164.01

Prepared for:

Oceanwide Center LLP,

88 First Street, 6th Floor, San Francisco, CA 94105

15 December 2017

Ms. Linlin Huang
Oceanwide Center LLC
88 First Street, 6th Floor
San Francisco, California 94105

Subject: Geotechnical Analysis
FDIC Building – Pile Axial Capacity and Lateral Resistance
Oceanwide Center – 1st and Mission Streets
San Francisco, California
Project No.: 750621401

Dear Ms. Huang:

This letter presents the results of supplemental geotechnical analysis for the pile foundations supporting the FDIC Building at 25 Jessie Street, which is adjacent to the Oceanwide Center project in San Francisco, California. The Oceanwide Center project consists of construction of two new towers over three to four basement levels. The towers will be supported on drilled shafts that extend into bedrock. Construction of the planned basements and foundations will require excavations extending about 72 feet below the existing ground surface for Tower 1 and about 65 feet below the existing ground surface for Tower 2. An internally-braced cutoff wall, consisting of deep soil mixed (DSM) panels, is planned to temporarily support the excavation. We conducted a geotechnical investigation for this project and presented our findings and recommendations in a report dated 1 July 2015.

This supplemental analysis includes an estimation of axial pile capacities and lateral pile group resistance for the piles beneath the FDIC building to assist in the structural evaluation of the building. Based on the structural plans[1] reviewed, we understand the FDIC building is an 18-story steel-framed office building on a pile-supported foundation system consisting of 12-inch-square driven concrete piles. We understand the piles were driven to refusal, with planned pile tips approximately 67 feet below the existing ground surface (about Elevation -60 feet, SFCD), which locates the pile tips on a stratum of dense sand known locally as Colma Formation.

Ultimate Pile Capacities

The structural plans for the FDIC building indicate that the piles were originally designed for an allowable dead plus live load of 200 kips. Assuming a factor of safety of 2.0 for dead plus live loads, this is an ultimate capacity of 400 kips. We evaluated the estimated axial pile capacity using the subsurface information gathered from the Oceanwide Center investigation and conclude an ultimate compressive capacity of about 400 kips is appropriate. From our analysis, we conclude an ultimate uplift (tension) capacity of about 190 kips. This capacity assumes that

[1] "Ecker Square" structural plans prepared by Raj Desai Associates, Inc. and dated 15 June 1981.

the driven piles achieved a minimum embedment of about 10 feet in the dense Colma Formation sand.

Lateral Pier Analysis – Earthquake Loading

At the request of the team, we analyzed the lateral resistance of the piles and pile groups within the 25 Jessie Street seismic frame using loading parameters provided by Nabih Youssef Associates for their seismic evaluation of the structure. Using the estimated dead, live, and seismic load combinations provided by Nabih Youssef Associates, and presented on Figure A-1, we calculated the maximum axial and shear load demands on each of the pile caps for seismic loading in the east-west and north-south directions. These calculated loads are presented on Figure A-2.

For modeling the pile groups, we modeled the concrete pile layout for each pile cap within the seismic frame using the program Group (2016 v. 10.09 by Ensoft) based on the pile cap details presented in the sheet "S10, Pile & Pile Cap Details" of the structural plans. The pile caps were modeled as embedded below the ground surface, as shown on the structural plans (Sheet S3 and S10). We performed our analysis for free-head conditions of 12-inch-square pre-cast pre-stressed piles. When the design axial load is in compression, we used a modulus of elasticity equal to 4.9 x 10^6 pounds per square inch (psi)[2] and a moment of inertia equal to 1,728 in^4. When subjecting the pile groups to a net uplift case, a value equal to half of the theoretical modulus of elasticity was used. The concrete strength was modeled as 6,500 psi, as shown on Sheet S10 of the structural plans.

The twelve pile groups were analyzed for axial compression and shear loading in the east, west, north, and south loading directions. Four pile groups were analyzed for axial tension and shear loading in the east, west, north and south loading directions. For each loading condition, the maximum deflection, maximum bending moment, depth to maximum bending moment, and maximum shear load in any individual pile within the pile group was calculated. The results are presented in Figures A-3 through A-18.

Lateral Pile Analysis – Excavation-Induced Deformations

Construction of the planned basements and foundations at Oceanwide Center Development will require excavations about 65 feet below the existing ground surface for Tower 2 and 76 feet below the existing ground surface for Tower 1. Brierley and Associates has performed a 3-dimensional numerical analysis of the excavation for Towers 1 and 2. The excavation-induced ground deformations and lateral wall movements were presented in memorandum dated 7 July 2017[3]. The pile foundations at 25 Jessie Street will be subjected to lateral soil movements during the excavation process as the shoring walls deflect laterally. The differential lateral soil movement will induce shear and associated bending moments in the concrete piles.

[2] Assumes modulus of elasticity (E) = $33*\gamma^{1.5}_{concrete}\sqrt{(f'_c)}$

[3] "Oceanwide Center, 526 Mission Street, San Francisco, 3D Finite Element Analysis Stage 1: Tower 2 Excavation (Rev. 1)" and "Oceanwide Center, 526 Mission Street, San Francisco, 3D Finite Element Analysis Stage 2: Tower 1 Excavation (Rev. 1)"

To estimate the loads and moments imposed on the pile foundations at 25 Jessie Street during the excavation process, we modeled the soil deformations (i.e. soil movement) along the length of the piles using program L-Pile (2016 version 9 by Ensoft). The soil movements were interpreted from the soil and wall deformations presented in Brierley and Associates' analysis. The piles were analyzed for estimated deflections in both the north-south and east-west directions. The piles were modeled as 12-inch-square, pre-cast, pre-stressed piles with a free head condition and an axial load of 100 and 200 kips. The assumed soil deformation profiles at Columns 3, 5, 73, and 75 and the results of our analyses are presented on Figure B-1 through Figure B-16.

We trust this letter provides the information needed. If you have any questions, please call.

Sincerely yours,
Langan Engineering & Environmental Services, Inc.

Justin Ray, PE
Project Engineer

Scott A. Walker, GE
Senior Associate

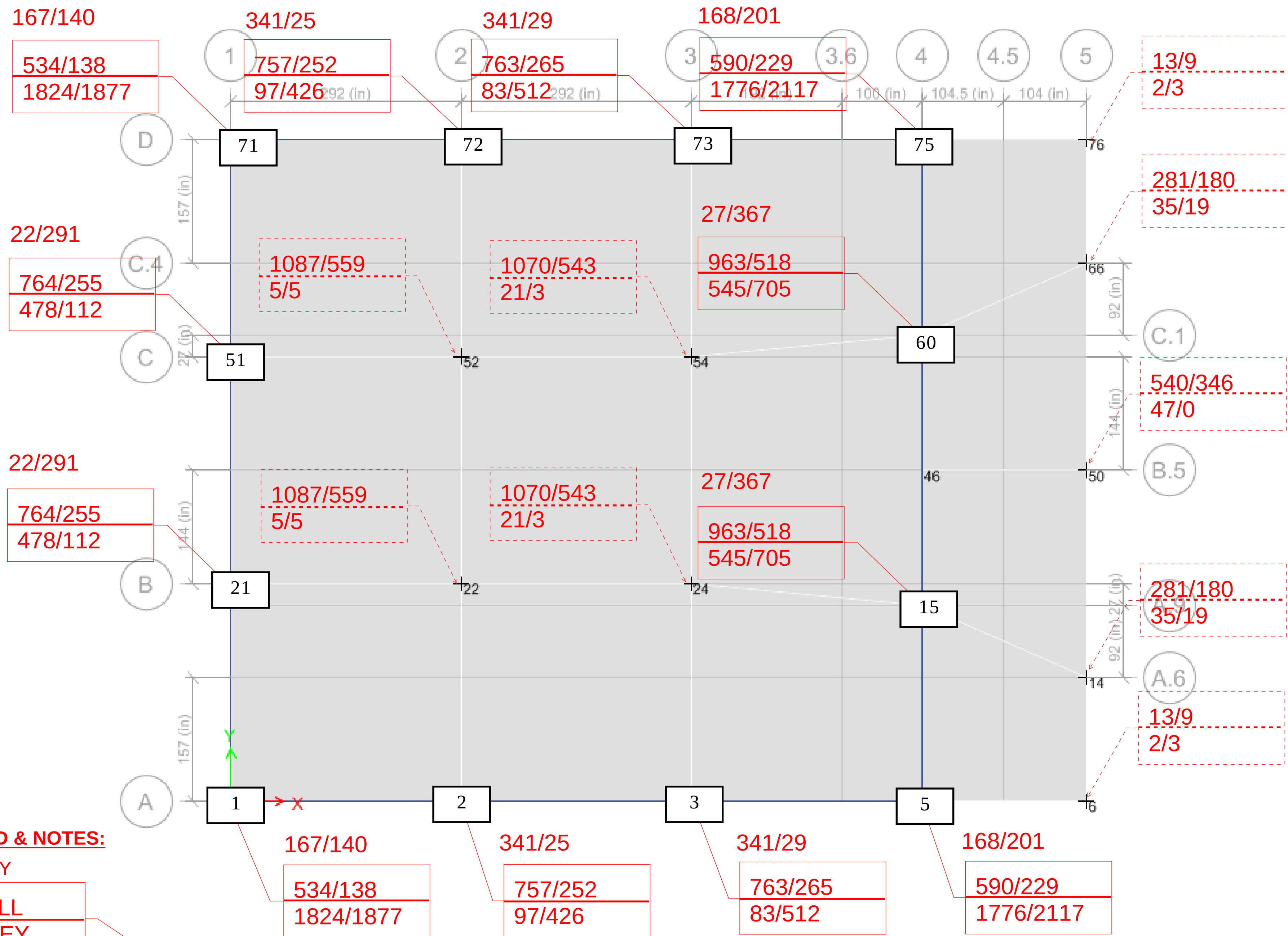
750621401.60_SAW_GTK Evaluation_FDIC Piles

Attachments: Figures A-1 through A-18 and Figures B-1 through B-16.

FIGURES

FORCE ON PILES PER ASCE 41

75 Column Number



LEGEND & NOTES:

VX / VY

DL / LL

EX / EY

INDICATES VERTICAL LOAD DEMAND AT BASE OF COLUMN (DL= DEAD LOAD; LL = LIVE LOAD; EX = SEISMIC ACTION EAST-WEST X DIR.; EY = SEISMIC ACTION NORTH-SOUTH Y DIR.); VX, VY = COLUMN BASE SHEAR IN X/Y DIR.

UNIT: Kips

1. SEISMIC FORCES INCLUDED ACCIDENTAL TORSIONAL EFFECTS.
2. SOLID BOXES ARE FOR SEISMIC FRAME COLUMNS. DASHED BOXES ARE FOR GRAVITY COLUMNS.

Figure A-1

Pile Cap Loading Detail
25 Jessie, SF, CA
KLW
11/1/2017

Column No.	Pile Cap Type	Pile Cap Thickness ft	Pile Cap Thickness in	Top of Pile Cap Elevation (ft) Project Datum	Top of Pile Cap Elevation (ft) SFCD	Forces on Piles Caps (kips) VX	VY	DL	LL	EX	EY	Model North (-z) Direction	Calculated Loads, Directions from Map: Axial Load under downward EQ in East-West (kips) = 1.1D+0.275L+Ex (except at corners where Eq = Ex+0.3Ey)	Axial Load under upward EQ in East-West (kips) =0.9D-Ex	Axial Load under downward EQ in North-South Direction (kips) = 1.1D+0.275L+Ey (except at corners where Eq = Ey+0.3Ex)	Axial Load under upward EQ in North-South Direction (kips) =0.9D-Ey	Shear at Column along Frame Line in East-West Direction (Vx average) (kips) (colors indicate shear walls)	Average Shear along Frame Line in North-South Direction (Vy average) (kips) (colors indicate shear walls)
1	7	4.5	54	-5.50	1.95	167	140	534	138	1824	1877	South	3012	-1343	3050	-1396	254	216
2	7	4.5	54	-5.50	1.95	341	25	757	252	97	426	South	999	584	1328	255	254	25
3	7	4.5	54	-5.50	1.95	341	29	763	265	83	512	South	995	604	1424	175	254	29
5	8	4.5	54	-13.17	-5.72	168	201	590	229	1776	2117	North	3123	-1245	3362	-1586	254	284
15	10	4.25	51	-13.17	-5.72	27	367	963	518	545	705	North	1747	322	1907	162	27	284
21	7	4.5	54	-5.50	1.95	22	291	764	255	478	112	West	1389	210	1023	576	22	216
51	7	4.5	54	-5.50	1.95	22	291	764	255	478	112	West	1389	210	1023	576	22	216
60	10	4.25	51	-13.17	-5.72	27	367	963	518	545	705	North	1747	322	1907	162	27	284
71	7	4.5	54	-5.50	1.95	167	140	534	138	1824	1877	North	3012	-1343	3050	-1396	254	216
72	7	4.5	54	-5.50	1.95	341	25	757	252	97	426	North	999	584	1328	255	254	25
73	7	4.5	54	-5.50	1.95	341	29	763	265	83	512	North	995	604	1424	175	254	29
75	8	4.5	54	-5.50	1.95	168	201	590	229	1776	2117	North	3123	-1245	3362	-1586	254	284

Pile Tip Elevation (ft)	
Project Datum	SFCD
-67	-59.55

f'c (psi)	6500
wc (pcf)	150
Ec* (psi)	4887733

Shear Modulus, G (psi)	2036556

From: Sudharshan Navalpakkam [mailto:snavalpakkam@nyase.com]
Sent: Friday, September 01, 2017 4:38 PM
To: Linlin Huang; Scott Walker; Justin Ray; Dae-Hwan Kim; Michael Gemmill
Subject: RE: 25 Jessie FDIC Building Pile evaluation - Estimated Foundation demands for Geotech review - Load Combinations

All,

Per our conference call yesterday, please see below for follow-up info. on the ASCE 41 load combinations we need to use to evaluate the pile foundations:

ASCE 41-13 has two load combinations for seismic loads:

1. 1.1D + 0.275L +/- EQ – this load combination governs for downward load (with positive, i.e, downward EQ)
2. 0.9D +/- EQ – this load combination governs for uplift load case (with negative EQ)

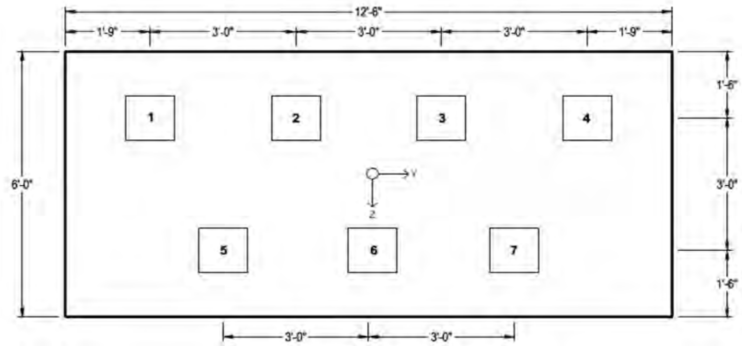
where D=dead load; L=live load & EQ= seismic load.

EQ may be taken as the maximum of Ex or Ey for all columns, except the (4) corner columns.
At the (4) corner columns, EQ =100% EX + 30% EY or 100% EY + 30% EX because they are subjected to biaxial loading. So the easiest way to implement this is to use maximum(1.0EX+0.3EY, 0.3EX+1.0EY).

*Note: For the four cases that experience net axial tension, 50% of the gross EI was used assuming a cracked pile cross section

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/6/2017

North



Column 1

Shear Load Direction	East
Axial Load (kips)	3,012
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.36	808,000	41	35,800
Pile #	5,6,7	5	5	1

Shear Load Direction	West
Axial Load (kips)	3,012
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.36	808,000	41	35,800
Pile #	5,6,7	7	7	4

Shear Load Direction	North
Axial Load (kips)	3,050
Shear Load (kips)	216

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.27	618,000	41	27,100
Pile #	All	5 and 7	5 and 7	5 and 7

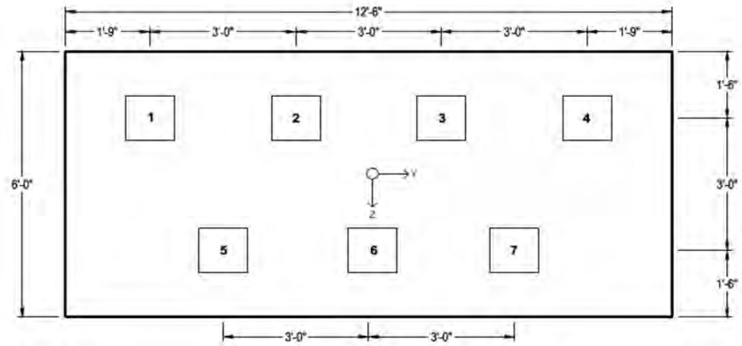
Shear Load Direction	South
Axial Load (kips)	3,050
Shear Load (kips)	216

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.27	621,000	41	28,400
Pile #	All	1 and 4	1 and 4	1 and 4

Figure A-3

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/27/2017

North



Column 1

Shear Load Direction	East
Axial Load (kips)	-1,343
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.39	580,000	34	34,900
Pile #	5,6,7	5	5	5

Shear Load Direction	West
Axial Load (kips)	-1,343
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.39	580,000	34	34,900
Pile #	5,6,7	7	7	7

Shear Load Direction	North
Axial Load (kips)	-1,396
Shear Load (kips)	216

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.30	446,000	34	26,700
Pile #	All	5 and 7	5 and 7	5 and 7

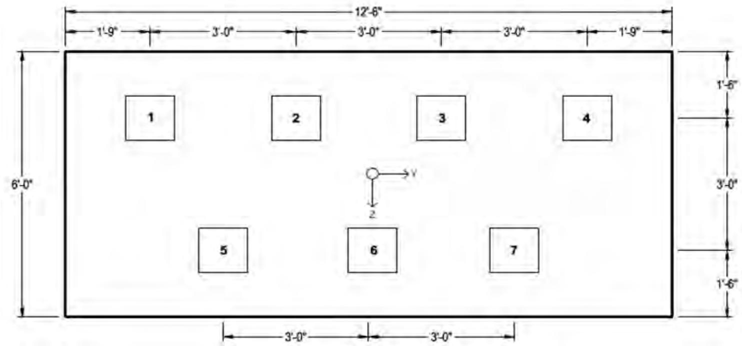
Shear Load Direction	South
Axial Load (kips)	-1,396
Shear Load (kips)	216

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.30	455,000	34	27,200
Pile #	All	1 and 4	1 and 4	1 and 4

Figure A-4

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/6/2017

North



Column 2

Shear Load Direction	East
Axial Load (kips)	999
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.35	753,000	41	35,600
Pile #	5,6,7	5	5	5

Shear Load Direction	West
Axial Load (kips)	999
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.35	753,000	41	35,600
Pile #	5,6,7	7	7	7

Shear Load Direction	North
Axial Load (kips)	1,328
Shear Load (kips)	25

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.03	62,400	41	2,960
Pile #	All	5 and 7	5 and 7	5 and 7

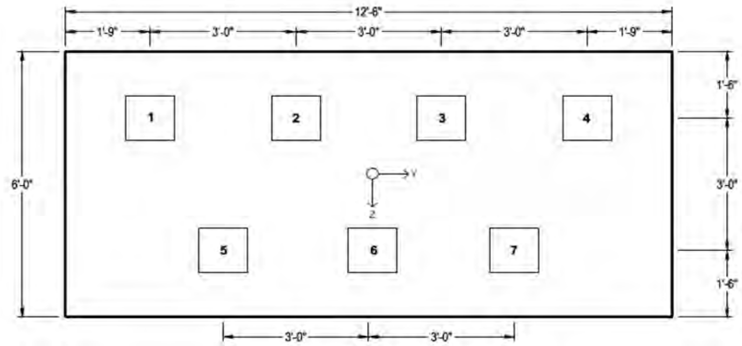
Shear Load Direction	South
Axial Load (kips)	1,328
Shear Load (kips)	25

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.03	75,900	41	3,670
Pile #	All	1 and 4	1 and 4	1 and 4

Figure A-5

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/6/2017

North



Column 3

Shear Load Direction	East
Axial Load (kips)	995
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.35	753,000	41	35,600
Pile #	5,6,7	5	5	5

Shear Load Direction	West
Axial Load (kips)	995
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.35	753,000	41	35,600
Pile #	5,6,7	7	7	7

Shear Load Direction	North
Axial Load (kips)	1,424
Shear Load (kips)	29

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.03	72,600	41	3,430
Pile #	All	5 and 7	5 and 7	5 and 7

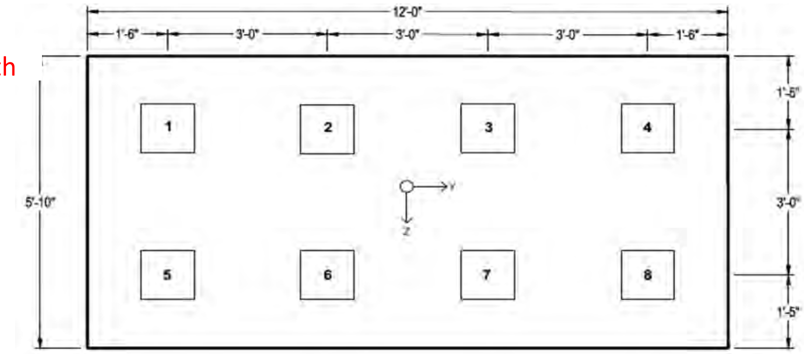
Shear Load Direction	South
Axial Load (kips)	1,424
Shear Load (kips)	29

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.03	76,100	41	3,670
Pile #	All	1 and 4	1 and 4	1 and 4

Figure A-6

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/6/2017

North



Column 5

Shear Load Direction	East
Axial Load (kips)	3,123
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	1.07	1,600,000	59	36,300
Pile #	All	4 and 8	4 and 8	4 and 8

Shear Load Direction	West
Axial Load (kips)	3,123
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	1.07	1,600,000	59	36,300
Pile #	All	1 and 5	1 and 5	1 and 5

Shear Load Direction	North
Axial Load (kips)	3,362
Shear Load (kips)	284

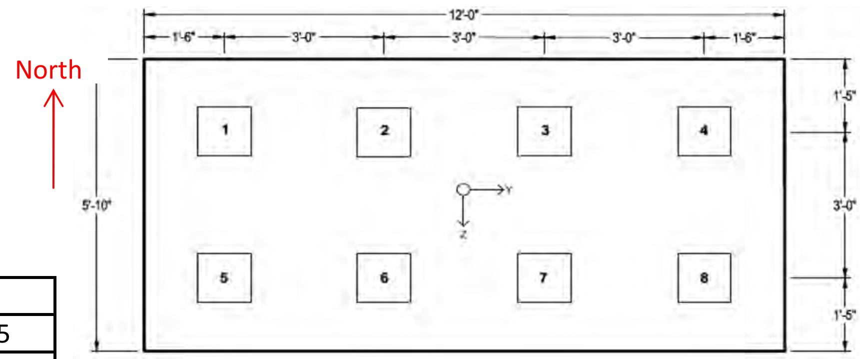
	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	1.21	1,780,000	65	37,500
Pile #	All	1 and 4	1 and 4	1 and 4

Shear Load Direction	South
Axial Load (kips)	3,362
Shear Load (kips)	284

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	1.21	1,780,000	65	37,500
Pile #	All	5 and 8	5 and 8	5 and 8

Figure A-7

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/27/2017



Column 5

Shear Load Direction	East
Axial Load (kips)	-1,245
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	1.17	1,080,000	53	35,200
Pile #	All	4 and 8	4 and 8	4 and 8

Shear Load Direction	West
Axial Load (kips)	-1,245
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	1.17	1,080,000	53	35,200
Pile #	All	1 and 5	1 and 5	1 and 5

Shear Load Direction	North
Axial Load (kips)	-1,586
Shear Load (kips)	284

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	1.26	1,150,000	53	36,500
Pile #	All	1 and 4	1 and 4	1 and 4

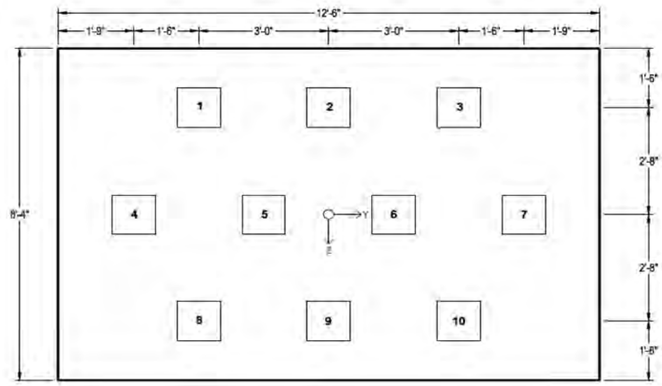
Shear Load Direction	South
Axial Load (kips)	-1,586
Shear Load (kips)	284

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	1.26	1,150,000	53	36,500
Pile #	All	5 and 8	5 and 8	5 and 8

Figure A-8

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/6/2017

North



Column 15

Shear Load Direction	East
Axial Load (kips)	1,747
Shear Load (kips)	27

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.04	83,600	48	3,100
Pile #	All	7	7	7

Shear Load Direction	West
Axial Load (kips)	1,747
Shear Load (kips)	27

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.04	83,600	48	3,100
Pile #	All	4	4	4

Shear Load Direction	North
Axial Load (kips)	1,907
Shear Load (kips)	284

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.90	1,320,000	65	32,400
Pile #	All	1 and 3	1 and 3	1 and 3

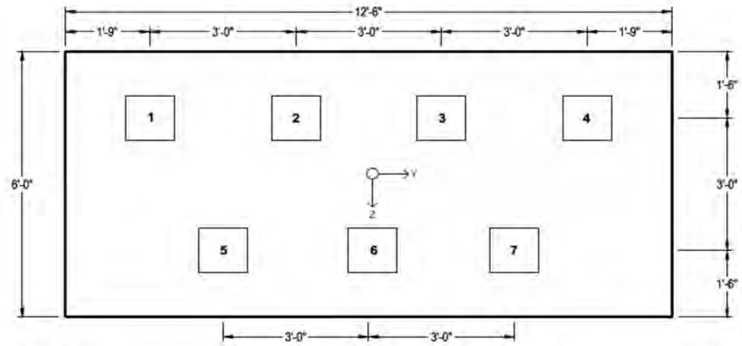
Shear Load Direction	South
Axial Load (kips)	1,907
Shear Load (kips)	284

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.90	1,320,000	65	32,400
Pile #	All	8 and 10	8 and 10	8 and 10

Figure A-9

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/6/2017

→ North



Column 21

Shear Load Direction	East
Axial Load (kips)	1,389
Shear Load (kips)	22

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.02	55,000	41	2,600
Pile #	All	5 and 7	5 and 7	5 and 7

Shear Load Direction	West
Axial Load (kips)	1,389
Shear Load (kips)	22

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.03	76,000	41	3,670
Pile #	All	1 and 4	1 and 4	1 and 4

Shear Load Direction	North
Axial Load (kips)	1,023
Shear Load (kips)	216

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.29	634,000	41	29,900
Pile #	5,6, 7	7	7	4 and 7

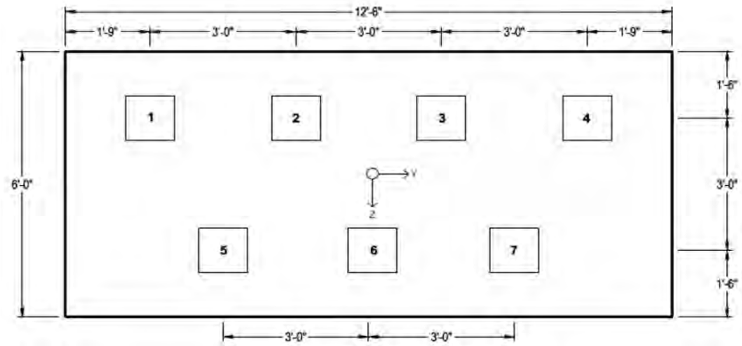
Shear Load Direction	South
Axial Load (kips)	1,023
Shear Load (kips)	216

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.29	634,000	41	29,900
Pile #	5,6, 7	5	5	1 and 5

Figure A-10

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/6/2017

→ North



Column 51

Shear Load Direction	East
Axial Load (kips)	1,389
Shear Load (kips)	22

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.02	55,000	41	2,600
Pile #	All	5 and 7	5 and 7	5 and 7

Shear Load Direction	West
Axial Load (kips)	1,389
Shear Load (kips)	22

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.03	76,000	41	3,670
Pile #	All	1 and 4	1 and 4	1 and 4

Shear Load Direction	North
Axial Load (kips)	1,023
Shear Load (kips)	216

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.29	634,000	41	29,900
Pile #	5,6, 7	7	7	4 and 7

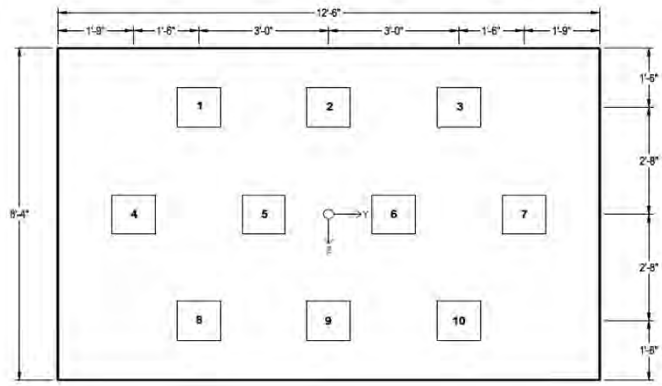
Shear Load Direction	South
Axial Load (kips)	1,023
Shear Load (kips)	216

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.29	634,000	41	29,900
Pile #	5,6, 7	5	5	1 and 5

Figure A-11

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/6/2017

North



Column 60

Shear Load Direction	East
Axial Load (kips)	1,747
Shear Load (kips)	27

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.04	83,600	48	3,100
Pile #	All	7	7	7

Shear Load Direction	West
Axial Load (kips)	1,747
Shear Load (kips)	27

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.04	83,600	48	3,100
Pile #	All	4	4	4

Shear Load Direction	North
Axial Load (kips)	1,907
Shear Load (kips)	284

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.90	1,320,000	65	32,400
Pile #	All	1 and 3	1 and 3	1 and 3

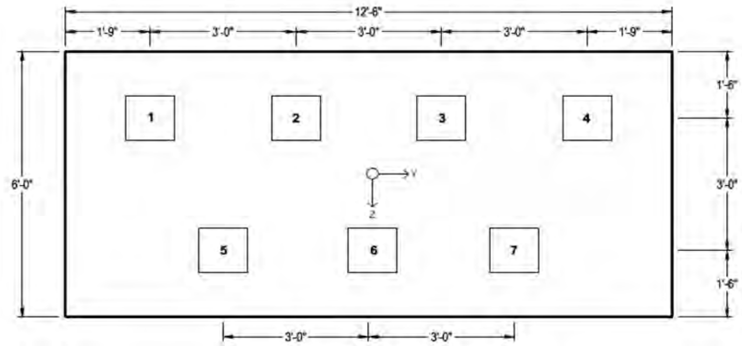
Shear Load Direction	South
Axial Load (kips)	1,907
Shear Load (kips)	284

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.90	1,320,000	65	32,400
Pile #	All	8 and 10	8 and 10	8 and 10

Figure A-12

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
9/20/2017

North



Column 71

Shear Load Direction	East
Axial Load (kips)	3,012
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.36	808,000	41	35,800
Pile #	5, 6, and 7	7	7	4

Shear Load Direction	West
Axial Load (kips)	3,012
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.363	808,000	41	35,800
Pile #	5, 6, and 7	5	5	1

Shear Load Direction	North
Axial Load (kips)	3,050
Shear Load (kips)	216

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.27	621,000	41	28,400
Pile #	All	1 and 4	1 and 4	1 and 4

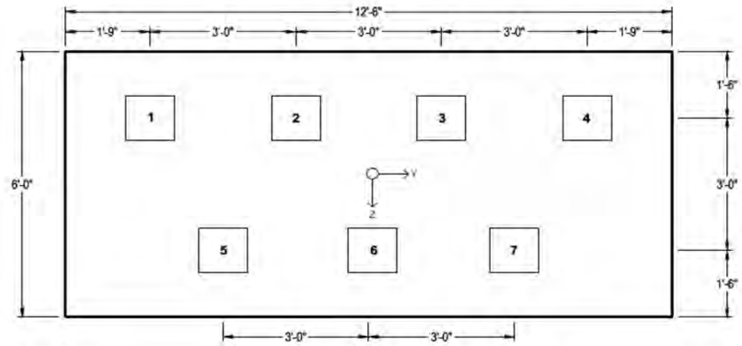
Shear Load Direction	South
Axial Load (kips)	3,050
Shear Load (kips)	216

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.27	618,000	41	27,100
Pile #	All	5 and 7	5 and 7	5 and 7

Figure A-13

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/27/2017

North



Column 71

Shear Load Direction	East
Axial Load (kips)	-1,343
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.33	705,000	41	35,900
Pile #	5, 6, and 7	7	7	7

Shear Load Direction	West
Axial Load (kips)	-1,343
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.33	705,000	41	35,900
Pile #	5, 6, and 7	5	5	5

Shear Load Direction	North
Axial Load (kips)	-1,396
Shear Load (kips)	216

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.25	556,000	41	28,400
Pile #	All	1 and 4	1 and 4	1 and 4

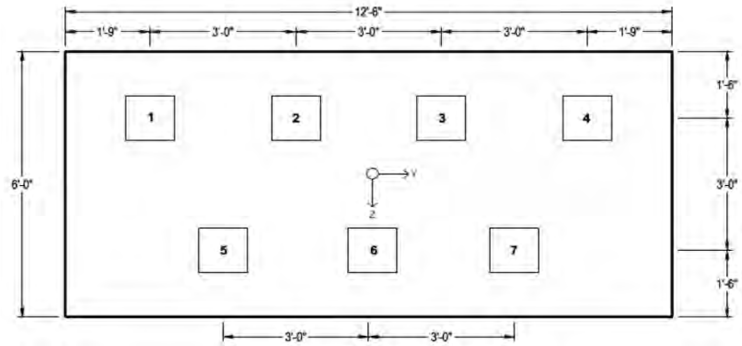
Shear Load Direction	South
Axial Load (kips)	-1,396
Shear Load (kips)	216

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.25	546,000	41	27,700
Pile #	All	5 and 7	5 and 7	5 and 7

Figure A-14

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/6/2017

North



Column 72

Shear Load Direction	East
Axial Load (kips)	999
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.35	753,000	41	35,600
Pile #	5, 6, and 7	7	7	7

Shear Load Direction	West
Axial Load (kips)	999
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.35	753,000	41	35,600
Pile #	5, 6, and 7	5	5	5

Shear Load Direction	North
Axial Load (kips)	1,328
Shear Load (kips)	25

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.03	75,900	41	3,670
Pile #	All	1 and 4	1 and 4	1 and 4

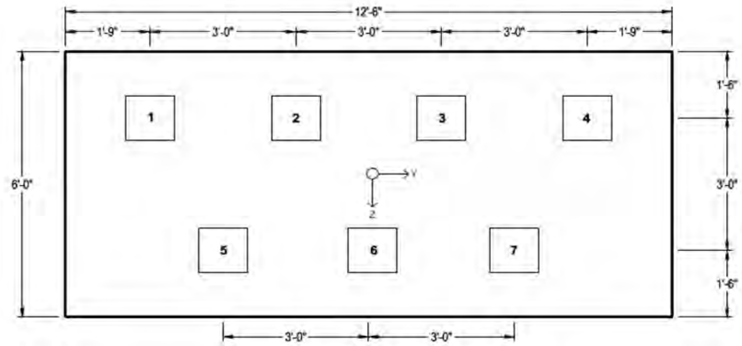
Shear Load Direction	South
Axial Load (kips)	1,328
Shear Load (kips)	25

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.03	74,900	41	3,550
Pile #	All	5 and 7	5 and 7	5 and 7

Figure A-15

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/6/2017

North



Column 73

Shear Load Direction	East
Axial Load (kips)	995
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.35	753,000	41	35,600
Pile #	5, 6, and 7	7	7	7

Shear Load Direction	West
Axial Load (kips)	995
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.35	753,000	41	35,600
Pile #	5, 6, and 7	5	5	5

Shear Load Direction	North
Axial Load (kips)	1,424
Shear Load (kips)	29

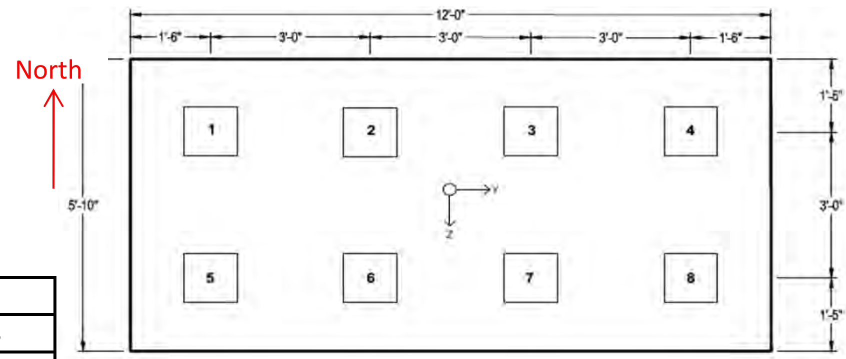
	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.03	76,100	41	3,670
Pile #	All	1 and 4	1 and 4	1 and 4

Shear Load Direction	South
Axial Load (kips)	1,424
Shear Load (kips)	29

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.03	72,600	41	3,430
Pile #	All	5 and 7	5 and 7	5 and 7

Figure A-16

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/6/2017



Column 75

Shear Load Direction	East
Axial Load (kips)	3,123
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.31	695,000	41	31,600
Pile #	All	4 and 8	4 and 8	4 and 8

Shear Load Direction	West
Axial Load (kips)	3,123
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.309	695,000	41	31,600
Pile #	All	1 and 5	1 and 5	1 and 5

Shear Load Direction	North
Axial Load (kips)	3,362
Shear Load (kips)	284

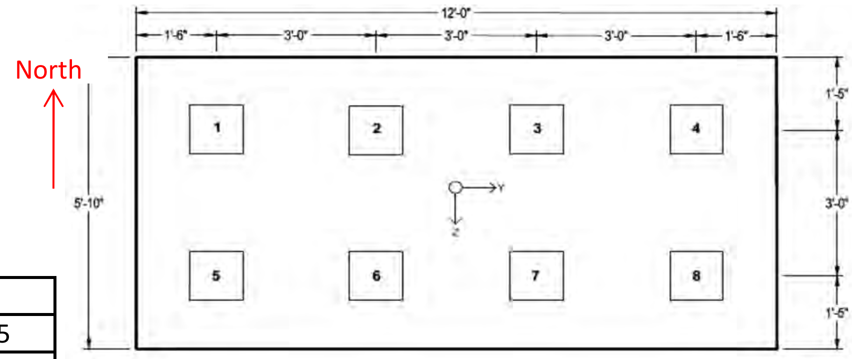
	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.33	739,000	41	33,100
Pile #	All	1 and 4	1 and 4	1 and 4

Shear Load Direction	South
Axial Load (kips)	3,362
Shear Load (kips)	284

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.33	739,000	41	33,100
Pile #	All	5 and 8	5 and 8	5 and 8

Figure A-17

25 Jessie Street
San Francisco, CA
Pile Response using Group v8.0
KLW
10/27/2017



Column 75

Shear Load Direction	East
Axial Load (kips)	-1,245
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.29	626,000	41	31,700
Pile #	All	4 and 8	4 and 8	4 and 8

Shear Load Direction	West
Axial Load (kips)	-1,245
Shear Load (kips)	254

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Y-Direction	Z-direction	Z-direction	Y-Direction
Maximum	0.29	626,000	41	31,700
Pile #	All	1 and 5	1 and 5	1 and 5

Shear Load Direction	North
Axial Load (kips)	-1,586
Shear Load (kips)	284

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.30	658,000	41	33,300
Pile #	All	1 and 4	1 and 4	1 and 4

Shear Load Direction	South
Axial Load (kips)	-1,586
Shear Load (kips)	284

	Deflection (in)	Bending Moment (lb-in)	Depth to Maximum Moment (in)	Shear (lbs)
	Z-Direction	Y-direction	Y-direction	Z-Direction
Maximum	0.30	658,000	41	33,300
Pile #	All	5 and 8	5 and 8	5 and 8

Column 3 - North-South Deflection

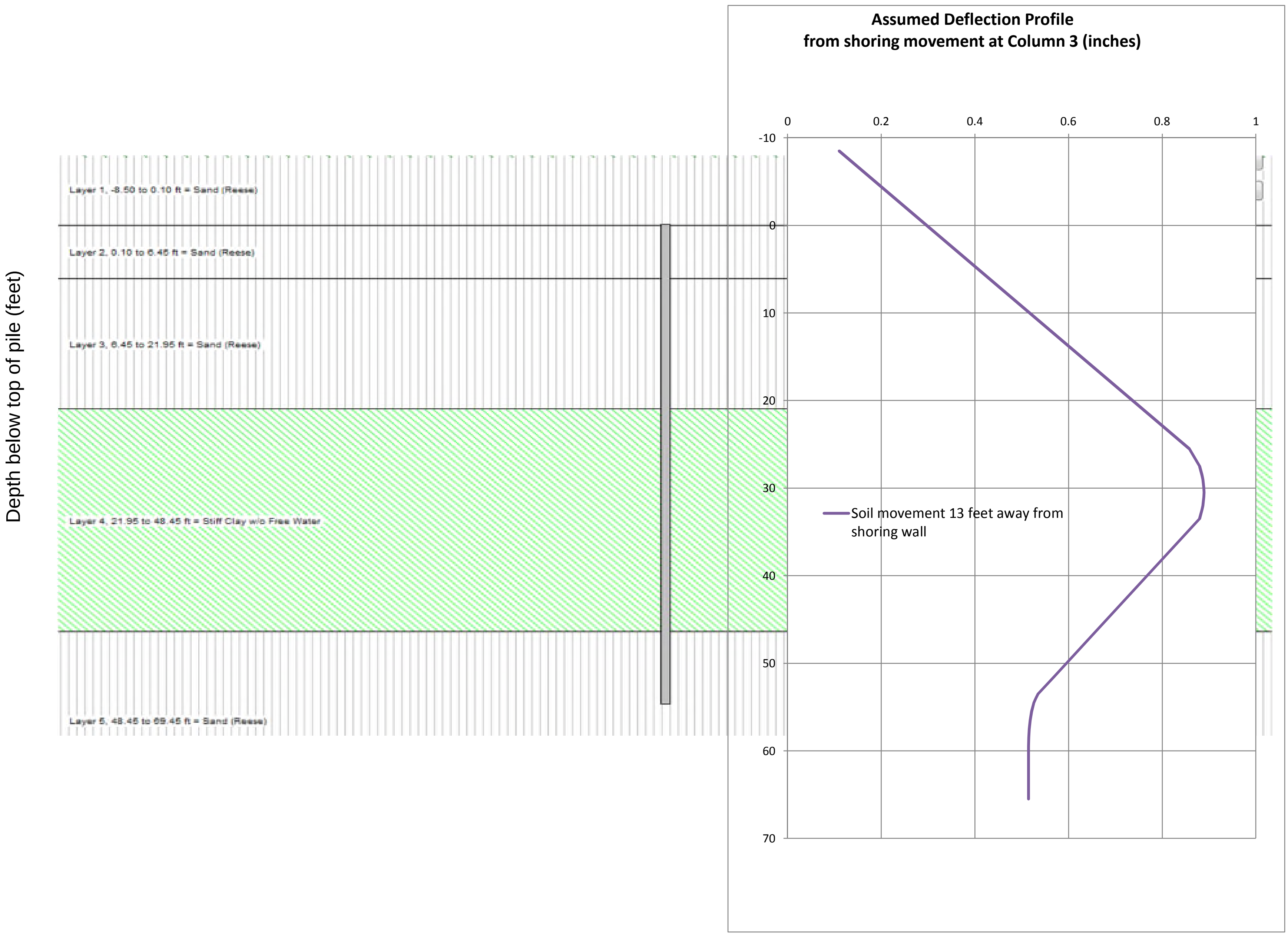


Figure B-1

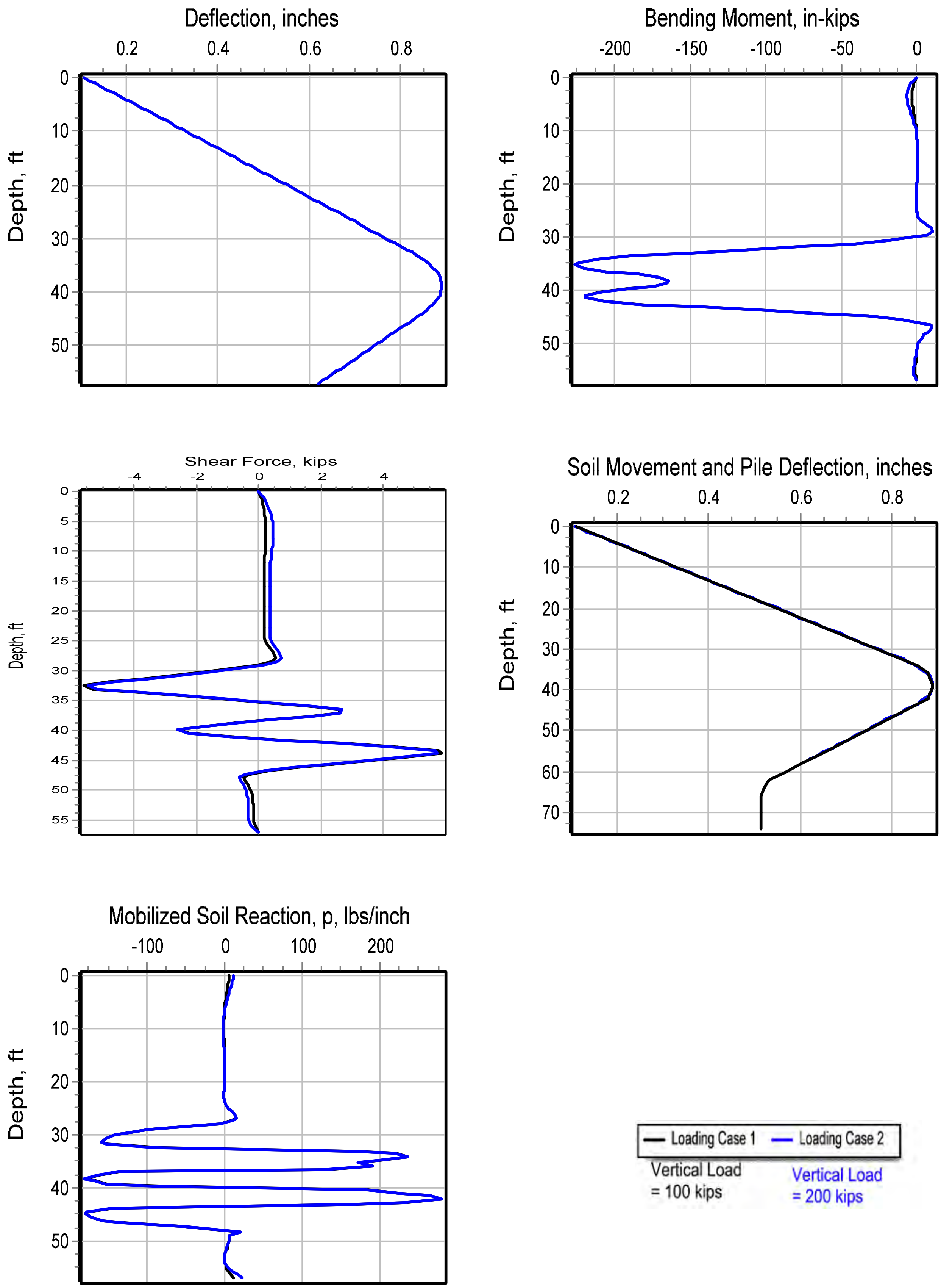

Deflection, inches
Depth, ft
Bending Moment, in-kips
Depth, ft
Shear Force, kips
Depth, ft
Soil Movement and Pile Deflection, inches
Depth, ft
Mobilized Soil Reaction, p, lbs/inch
Depth, ft
Loading Case 1
Loading Case 2
Vertical Load = 100 kips
Vertical Load = 200 kips

Figure B-2

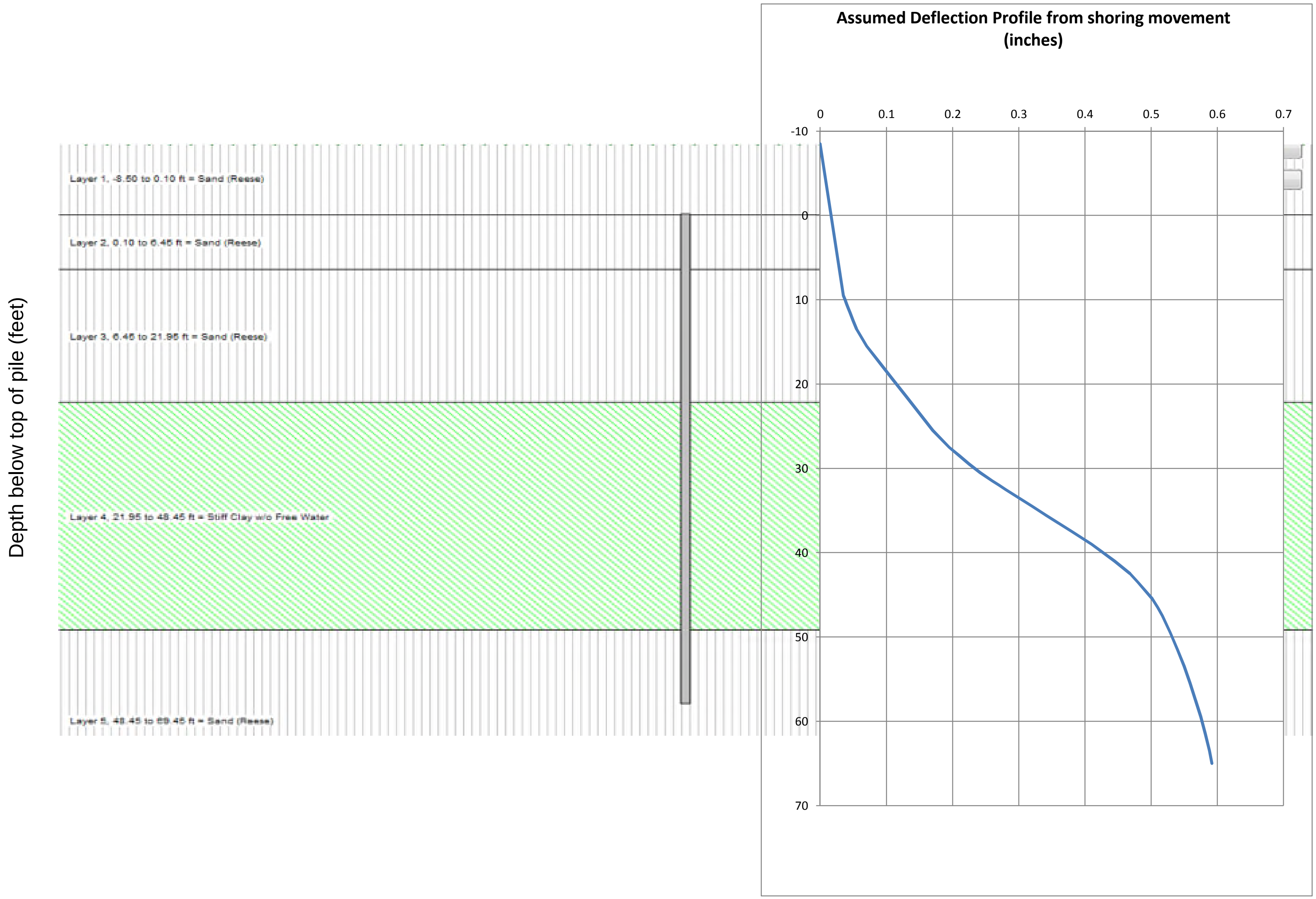

Assumed Deflection Profile from shoring movement (inches)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
-10
0
10
20
30
40
50
60
70
Depth below top of pile (feet)
Layer 1, -8.50 to 0.10 ft = Sand (Reese)
Layer 2, 0.10 to 6.45 ft = Sand (Reese)
Layer 3, 6.45 to 21.95 ft = Sand (Reese)
Layer 4, 21.95 to 48.45 ft = Stiff Clay w/o Free Water
Layer 5, 48.45 to 69.45 ft = Sand (Reese)

Figure B-3

Column 3 - West-East Deflection

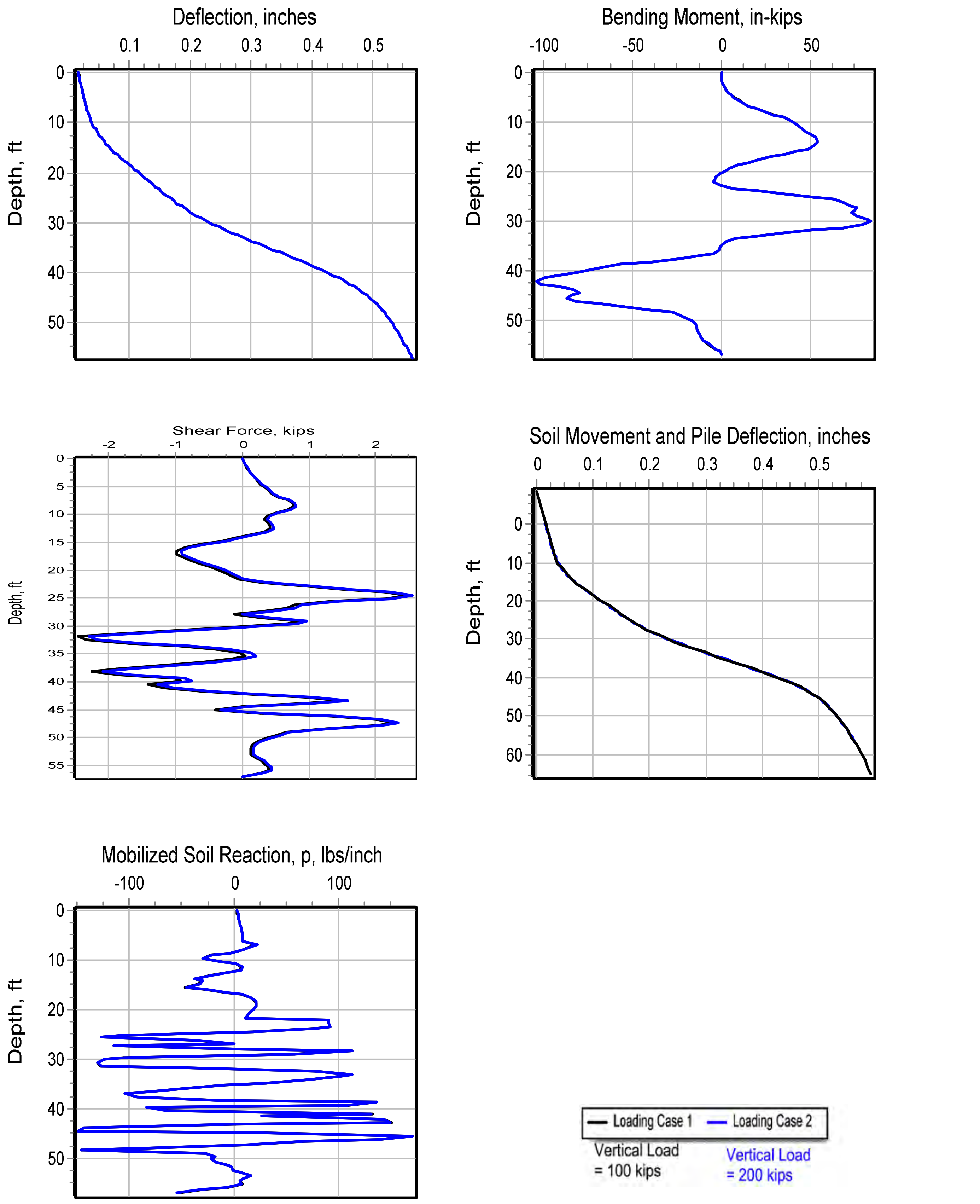


Figure B-4

Column 5 - North-South Deflection

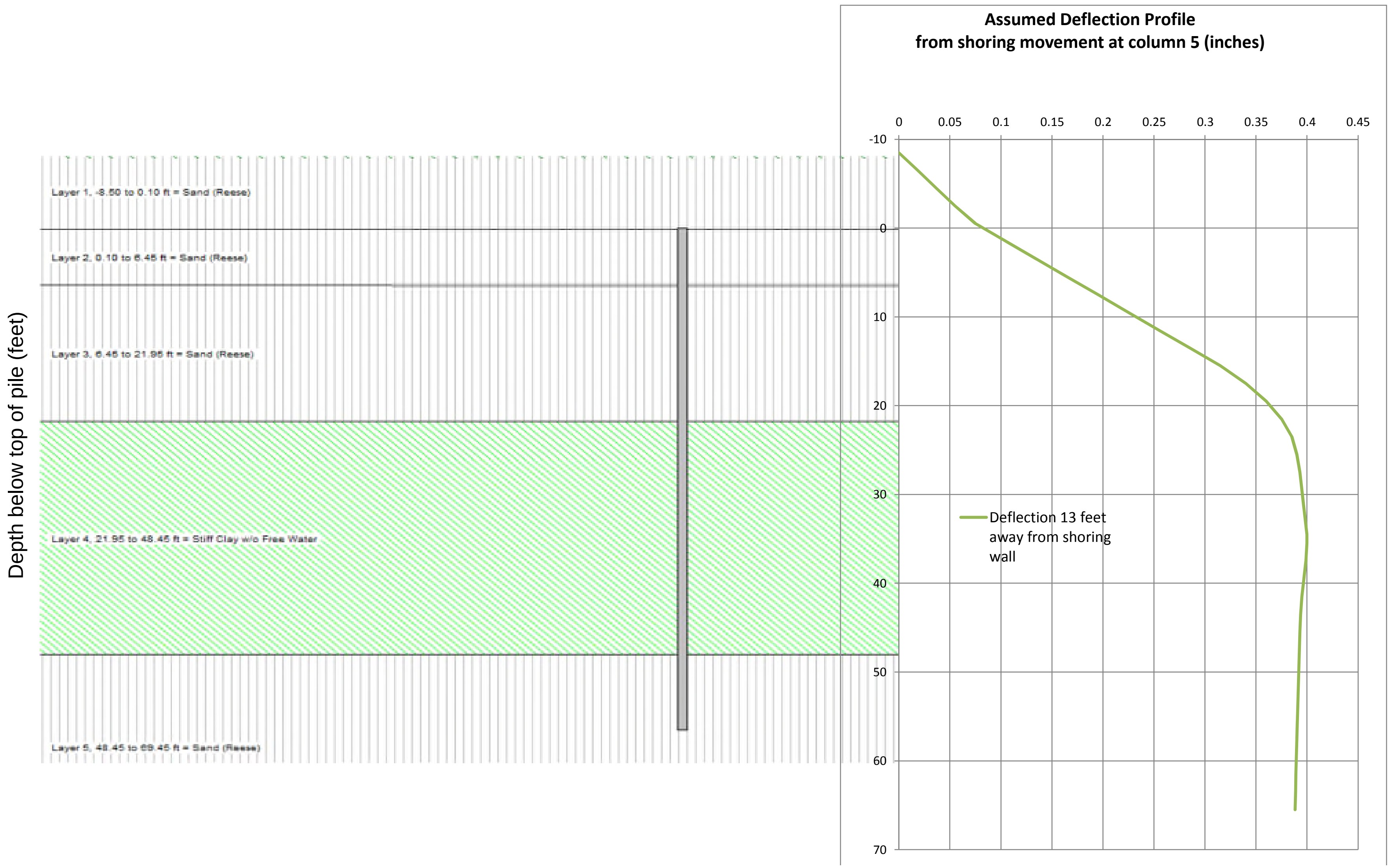


Figure B-5

Column 5 - North-South Deflection

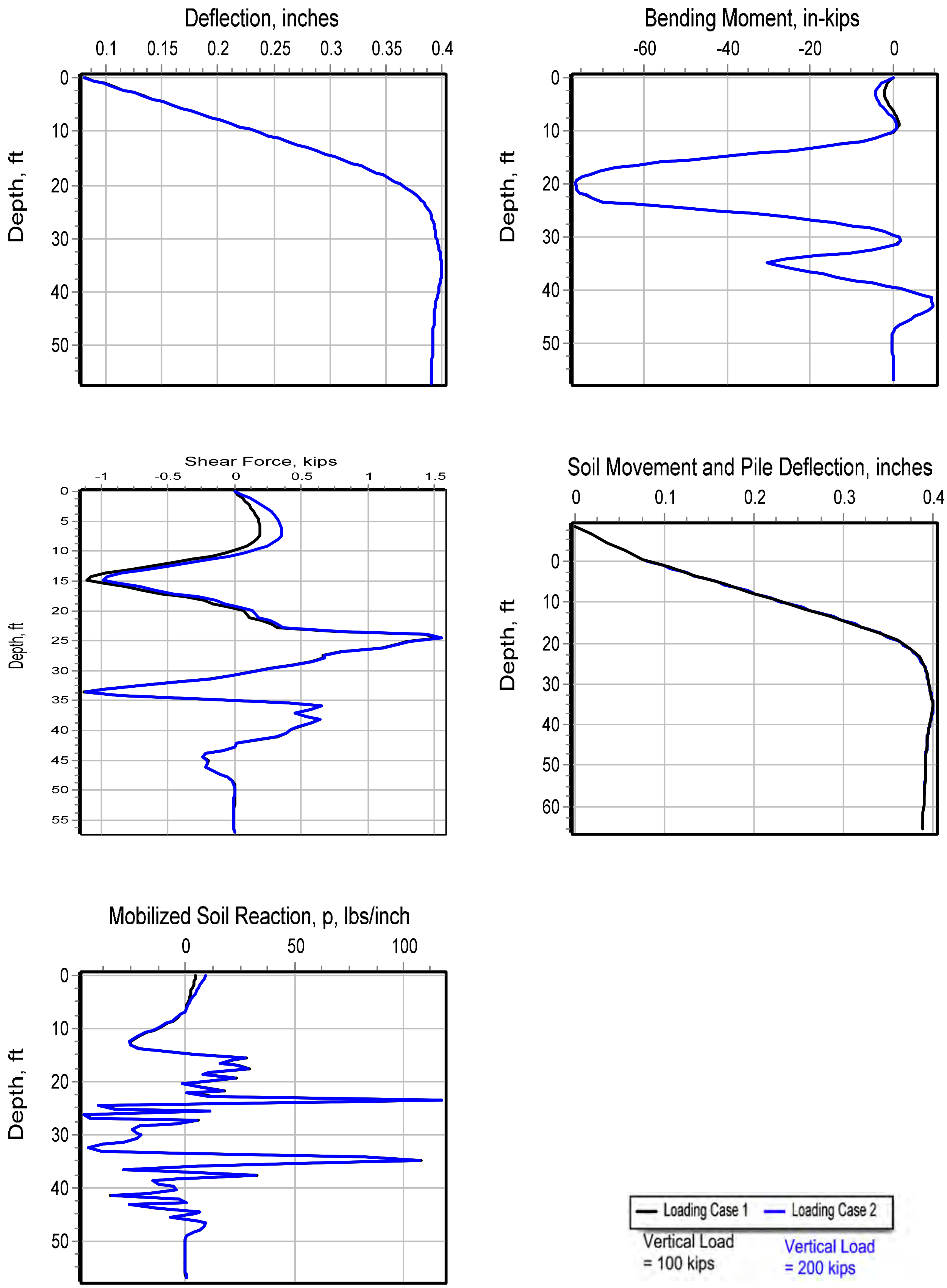


Figure B-6

Column 5 - West-East Deflection

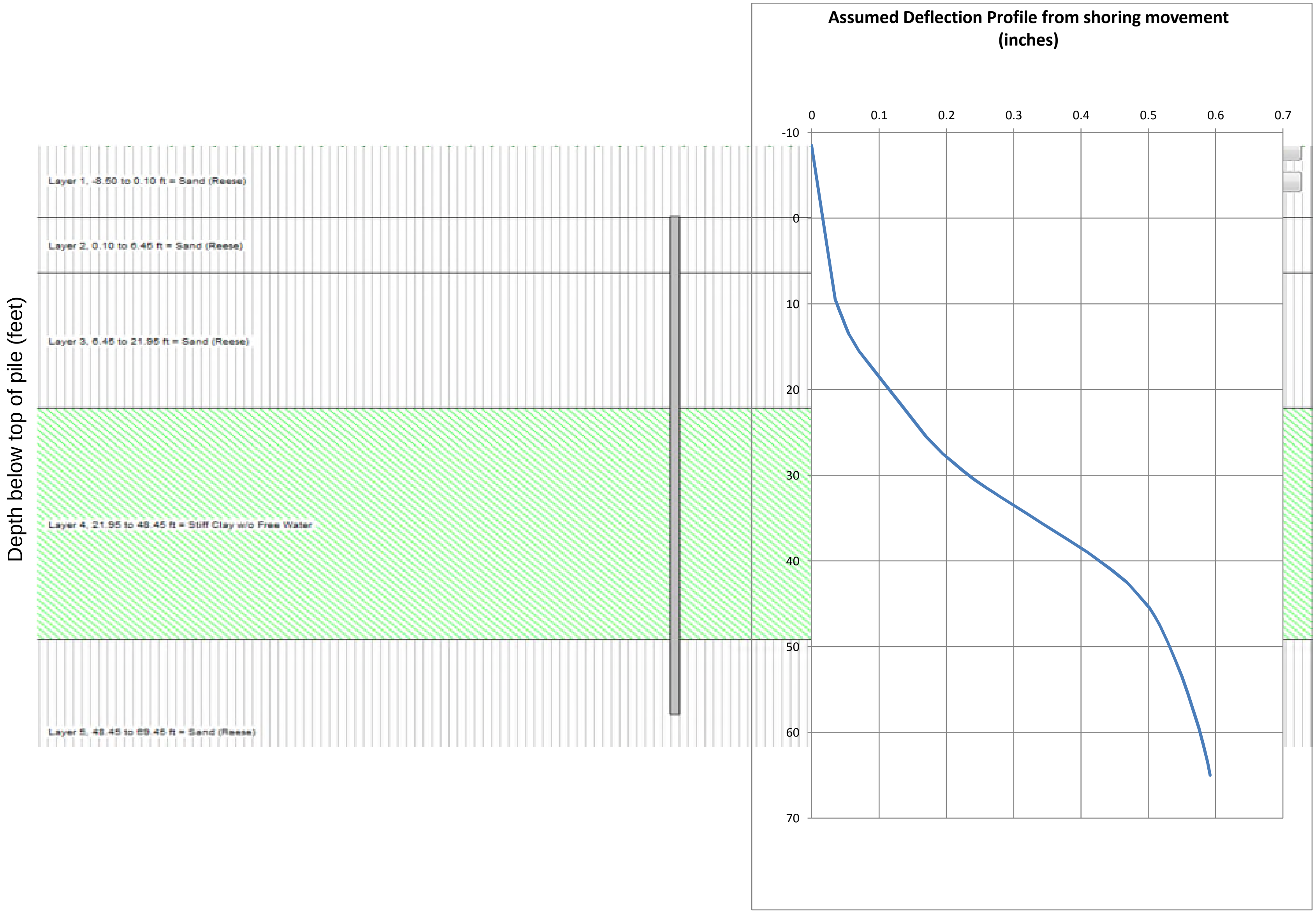


Figure B-7

Column 5 - West-East Deflection

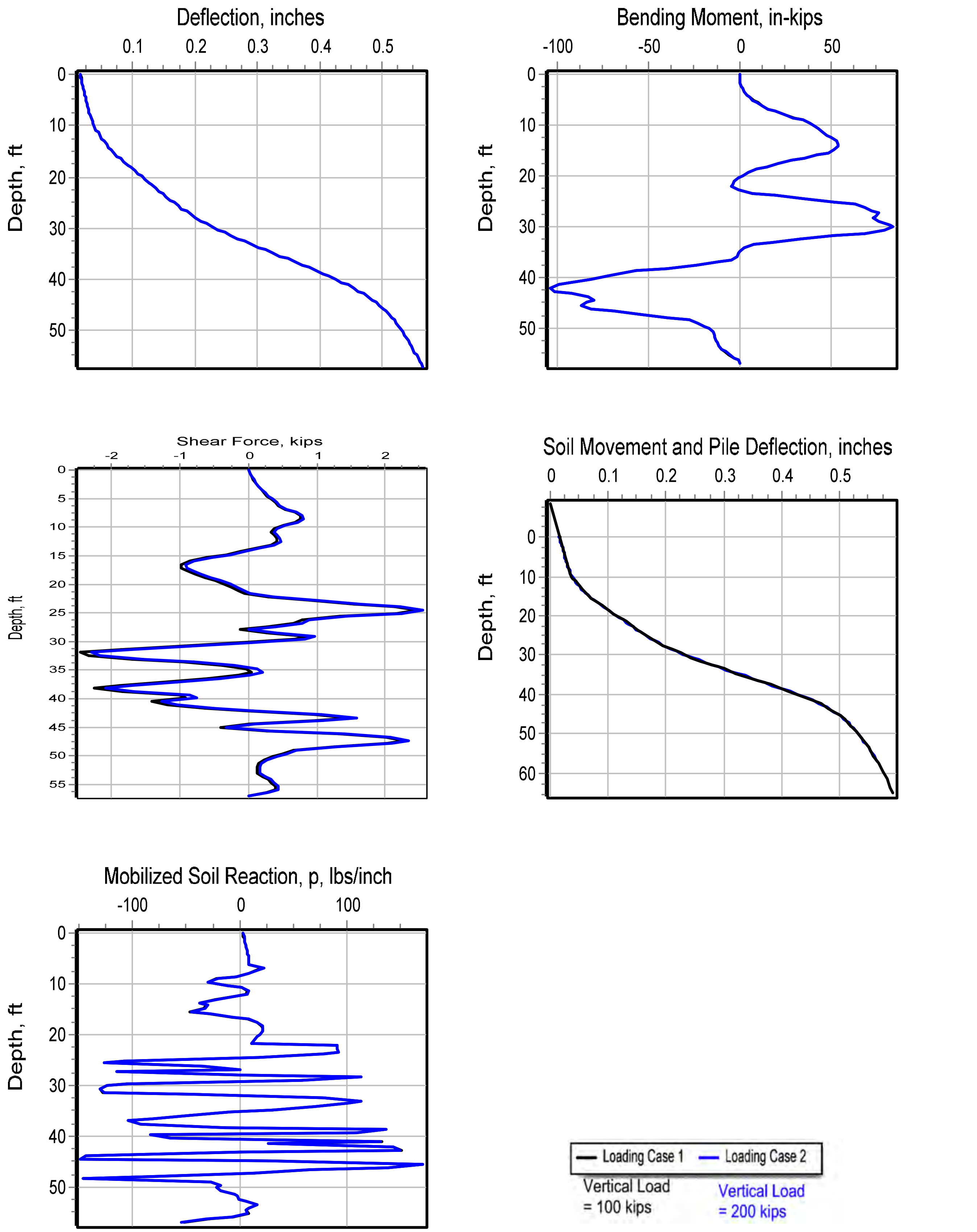


Figure B-8

Column 73 - North-South Deflection

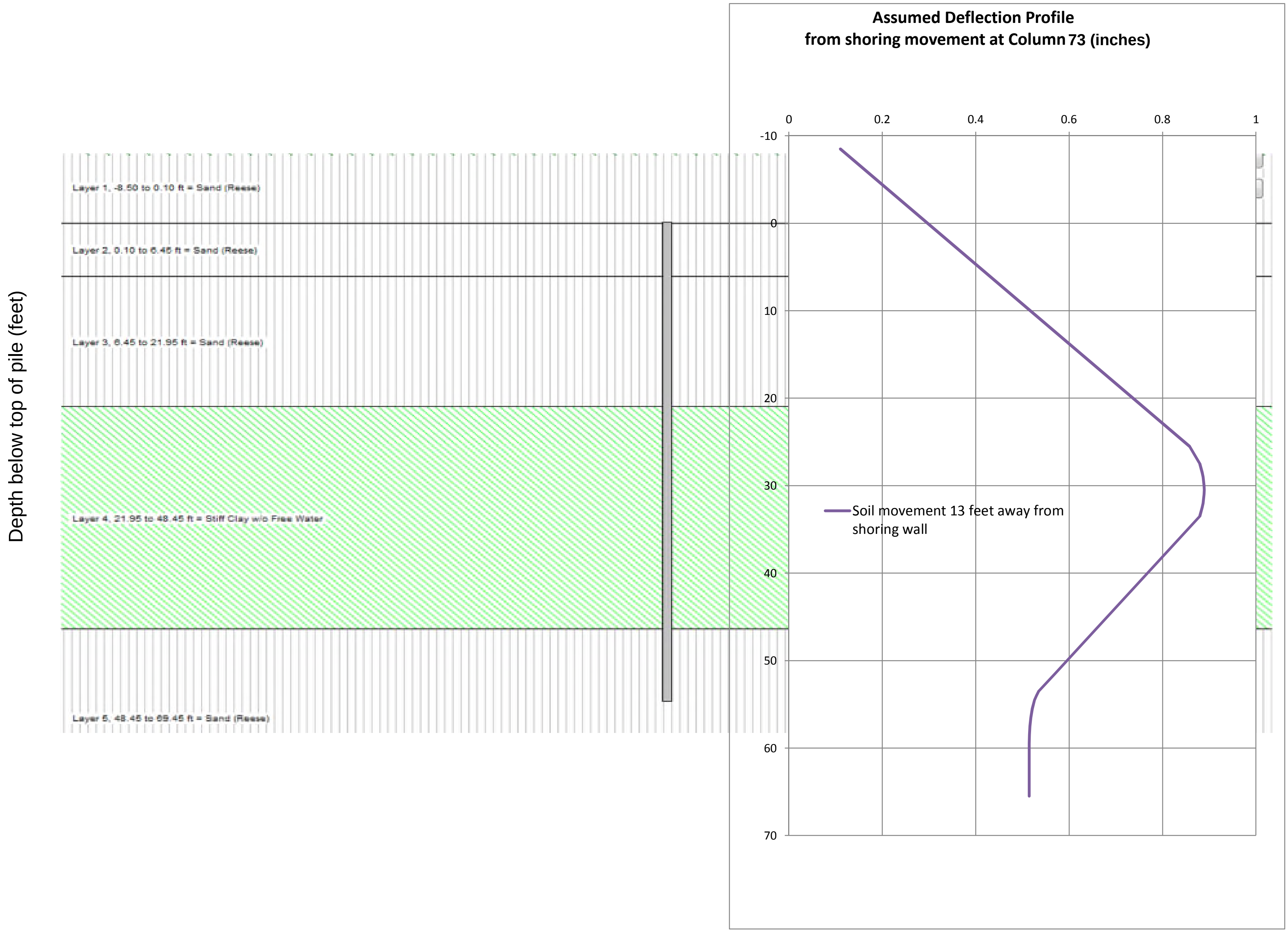
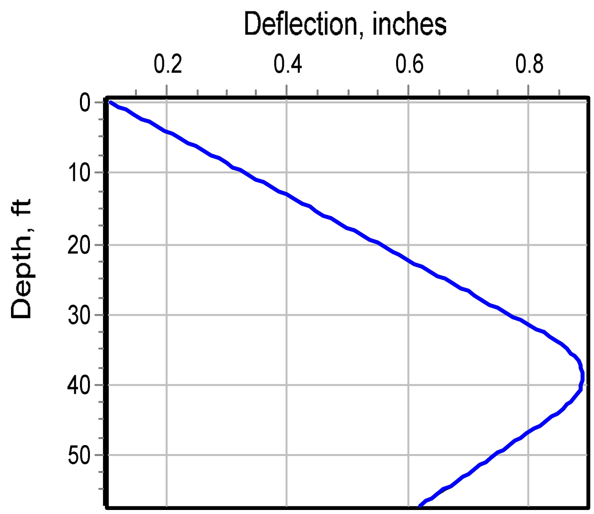
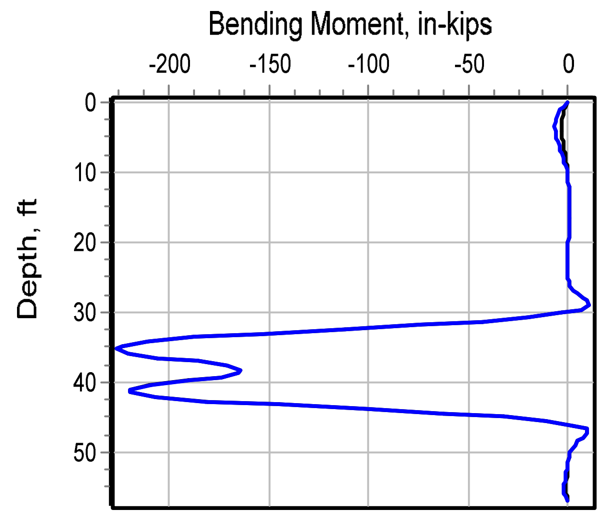
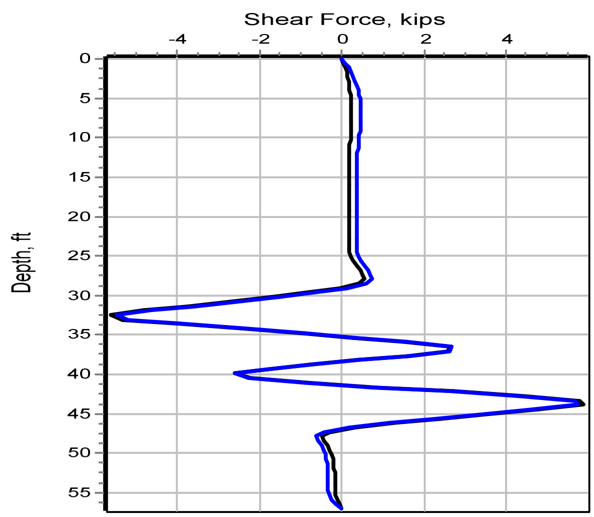
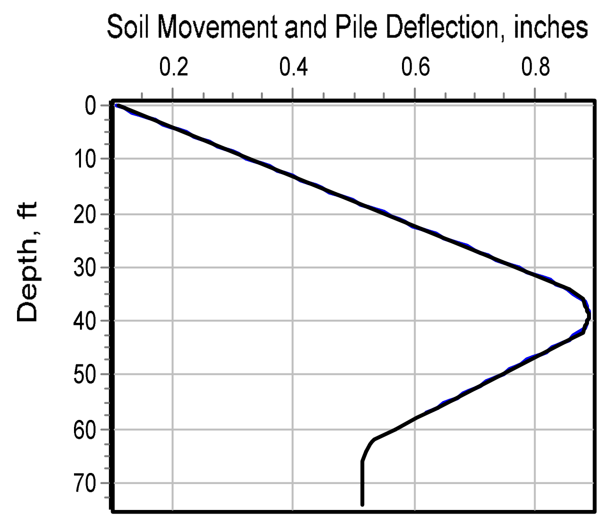


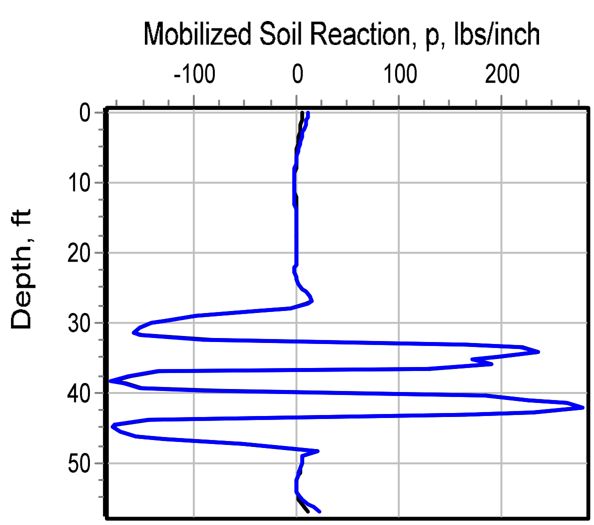
Figure B-9

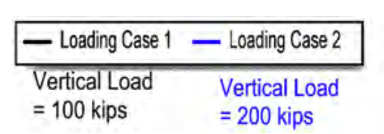

Deflection, inches
0.2
0.4
0.6
0.8
Depth, ft
0
10
20
30
40
50


Bending Moment, in-kips
-200
-150
-100
-50
0
Depth, ft
0
10
20
30
40
50


Shear Force, kips
-4
-2
0
2
4
Depth, ft
0
5
10
15
20
25
30
35
40
45
50
55


Soil Movement and Pile Deflection, inches
0.2
0.4
0.6
0.8
Depth, ft
0
10
20
30
40
50
60
70


Mobilized Soil Reaction, p, lbs/inch
-100
0
100
200
Depth, ft
0
10
20
30
40
50


Loading Case 1
Loading Case 2
Vertical Load
= 100 kips
Vertical Load
= 200 kips

Column 73 - West-East Deflection

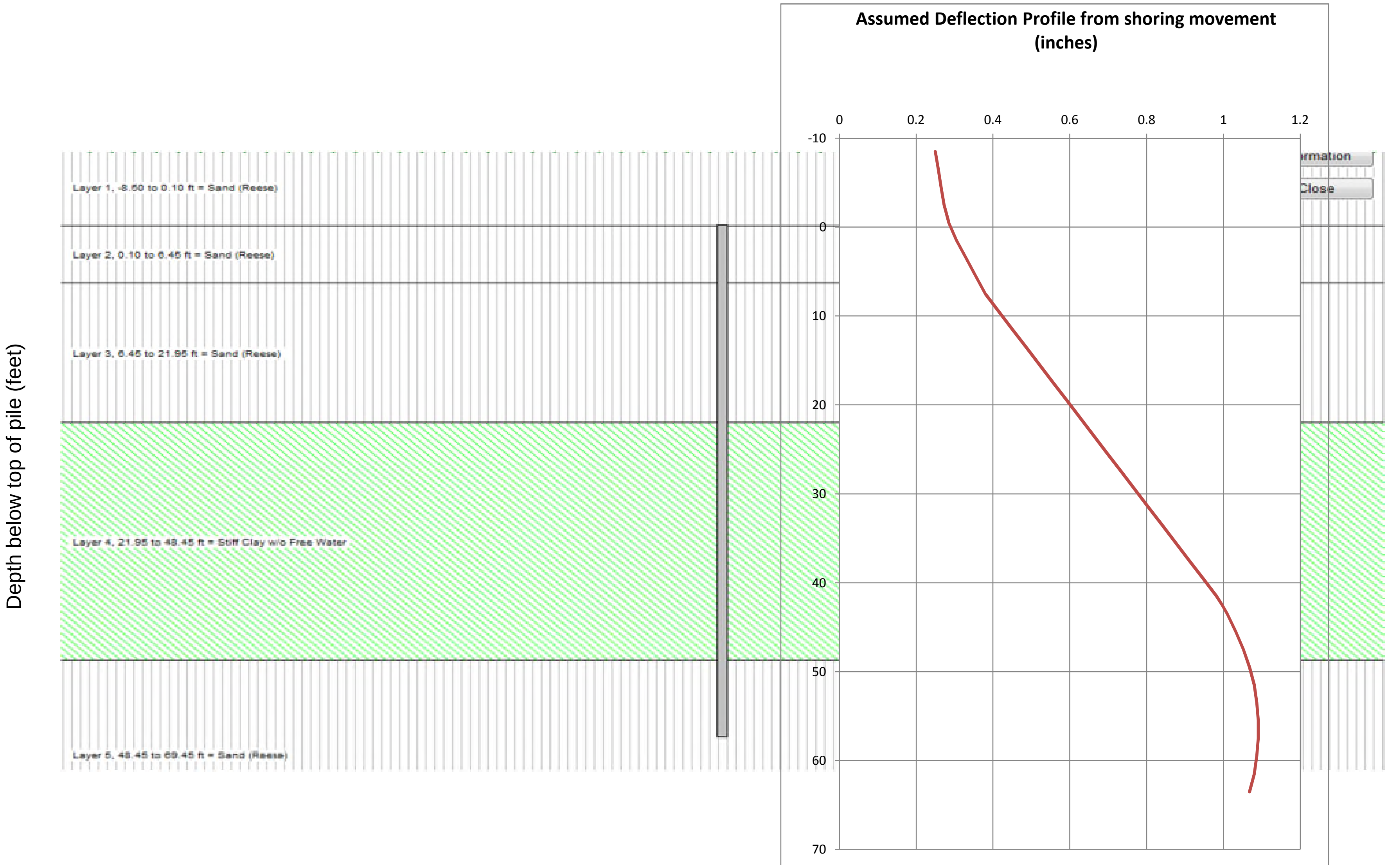
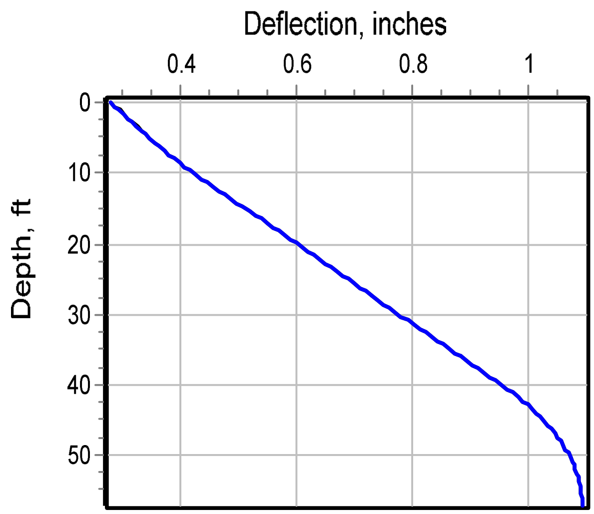
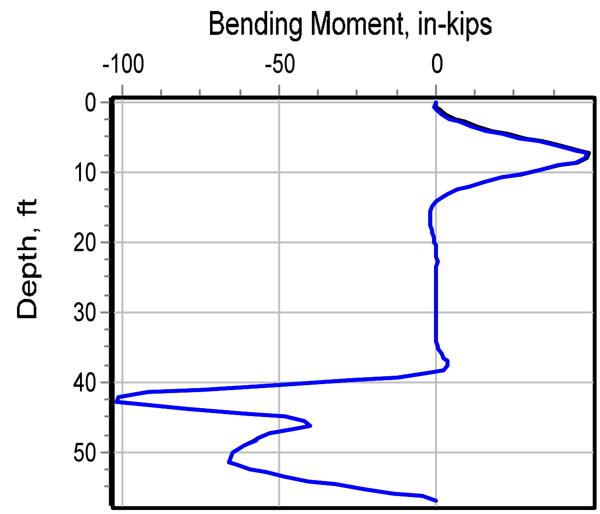
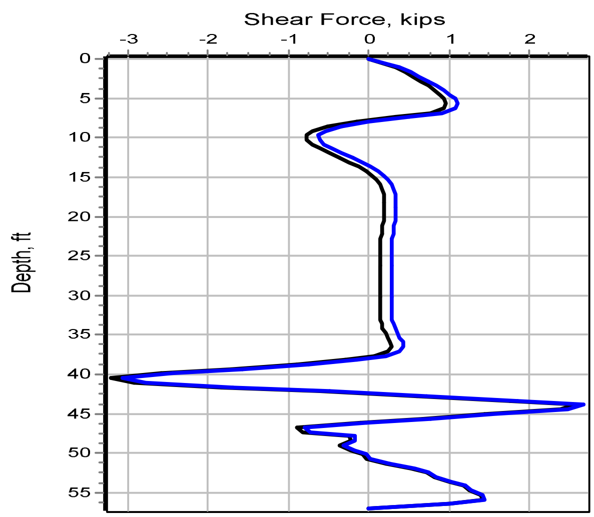


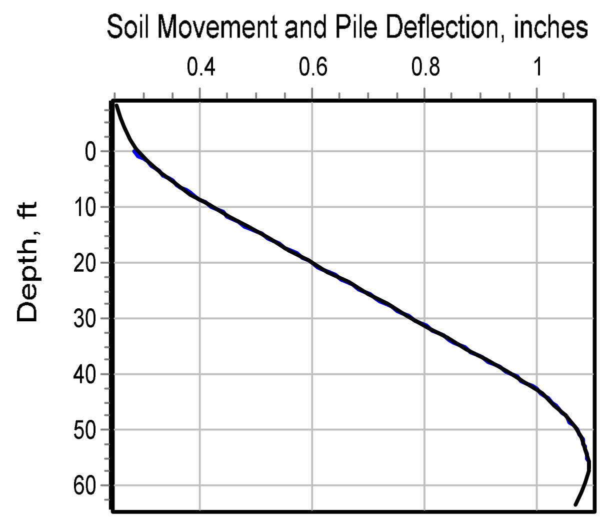
Figure B-11

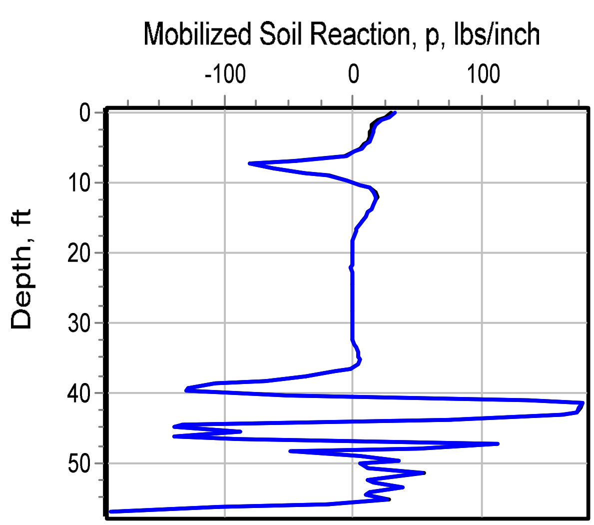
Column 73 - West-East Deflection











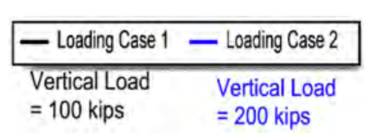


Figure B-12

Column 75 - North-South Deflection

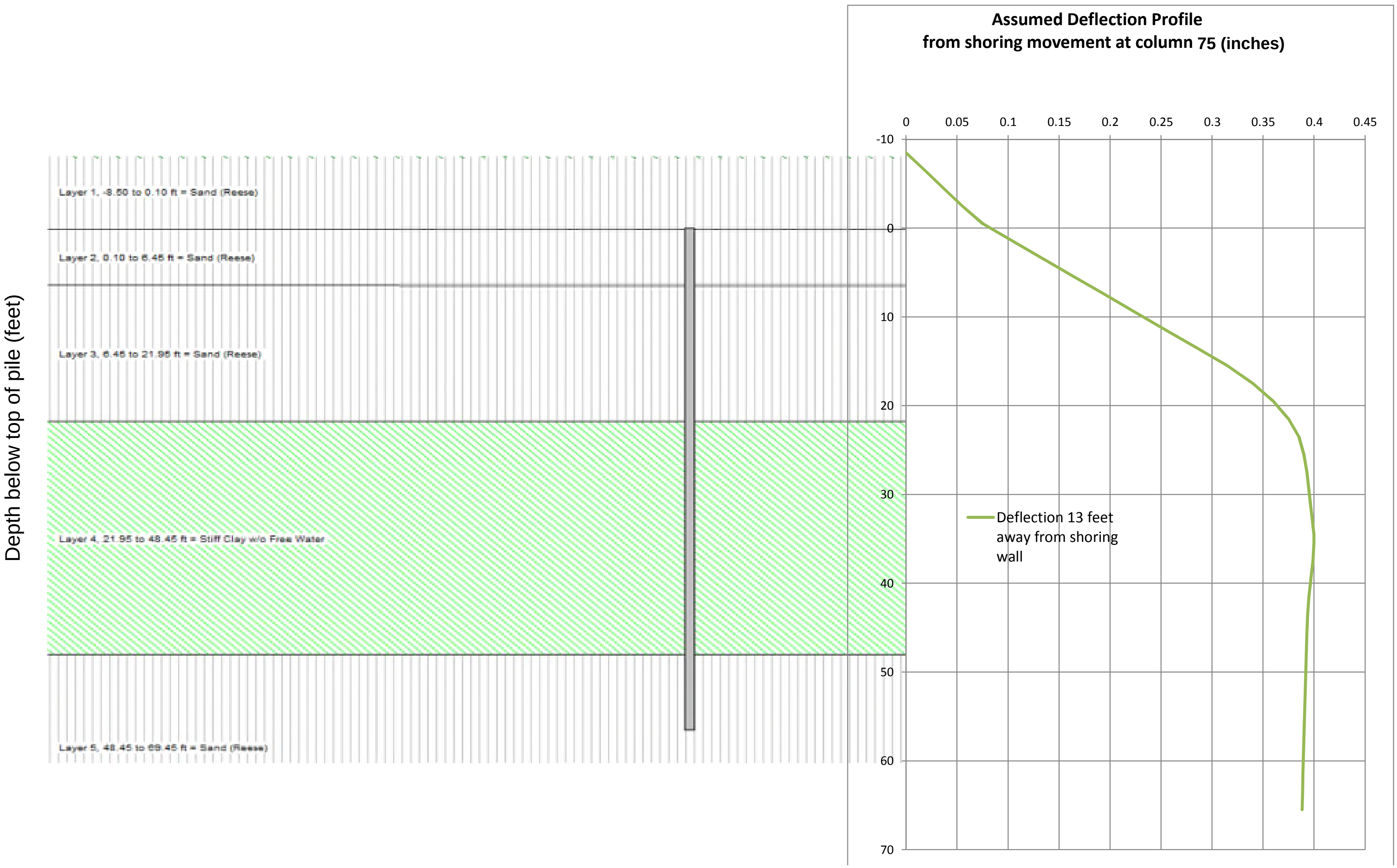


Figure B-13

Column 75 - North-South Deflection

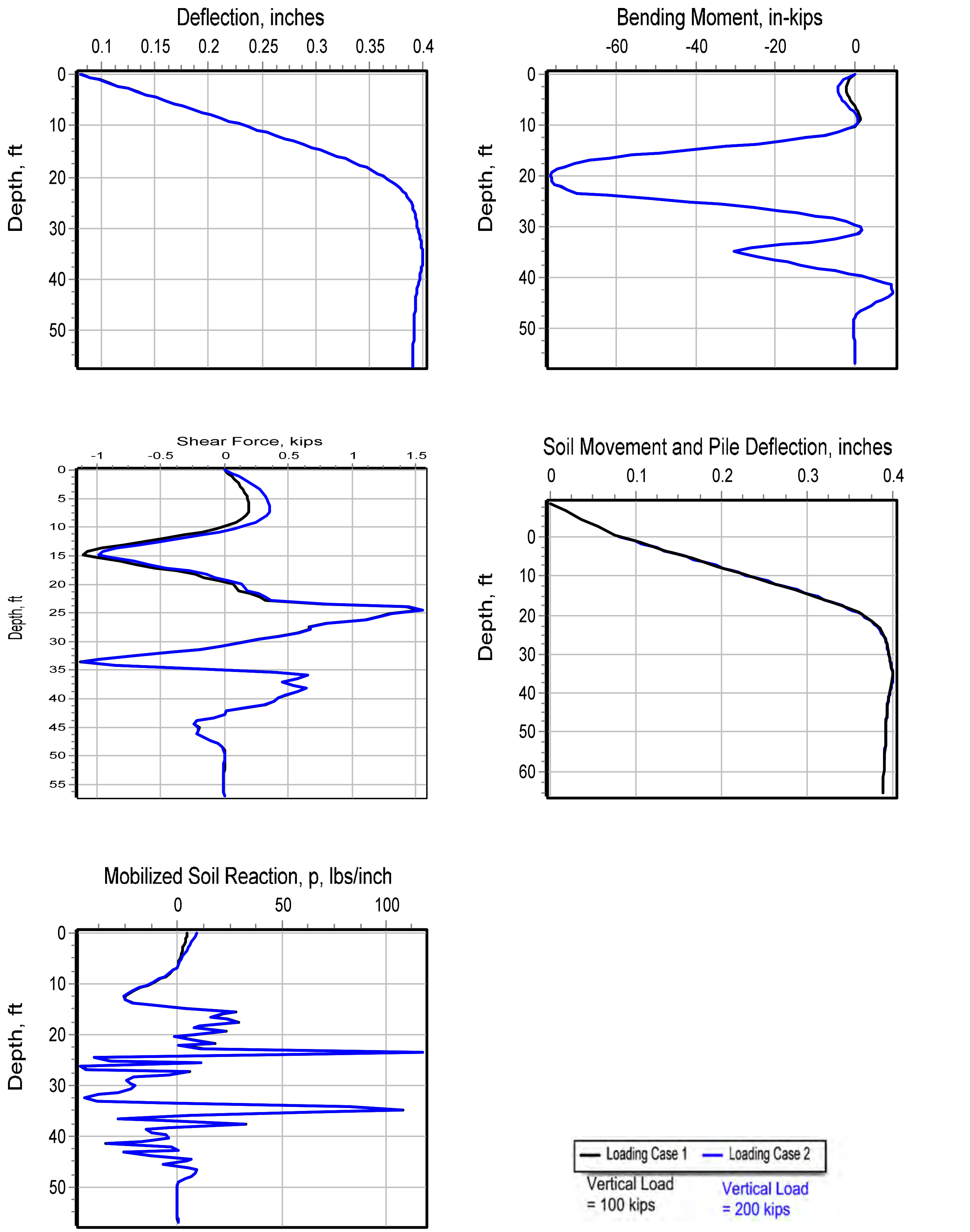


Figure B-14

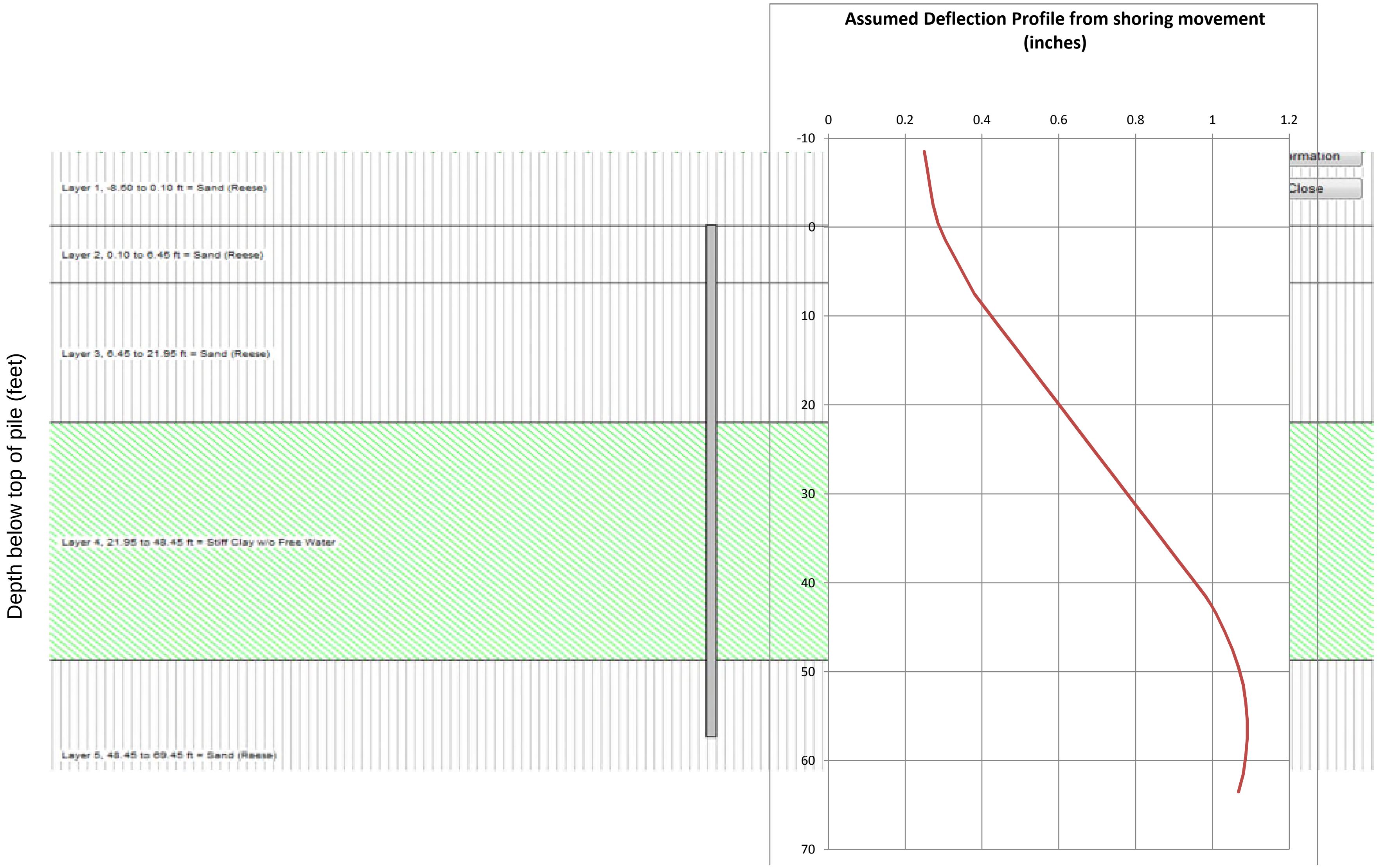
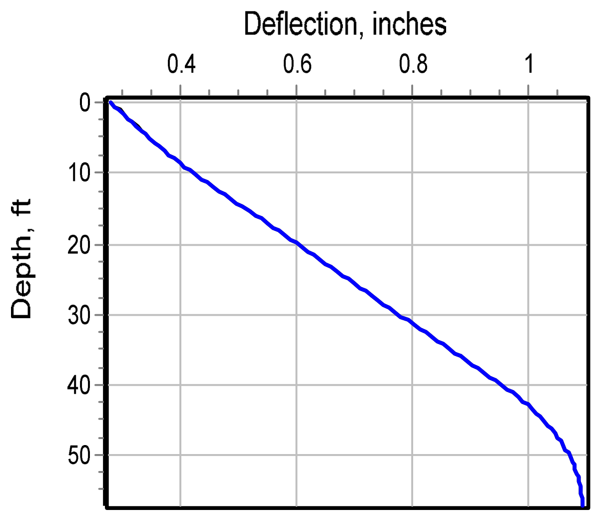
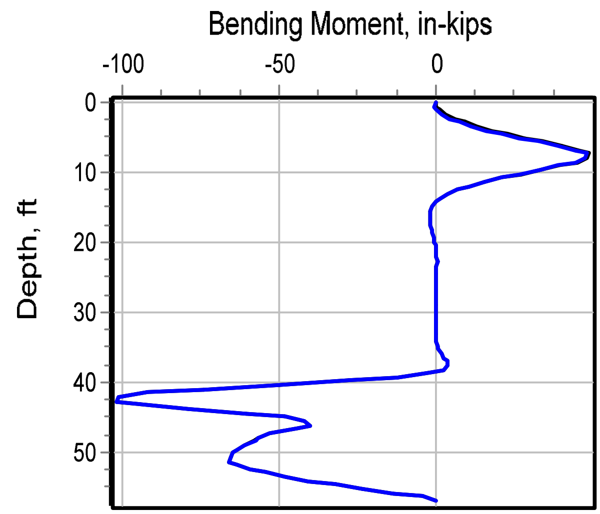
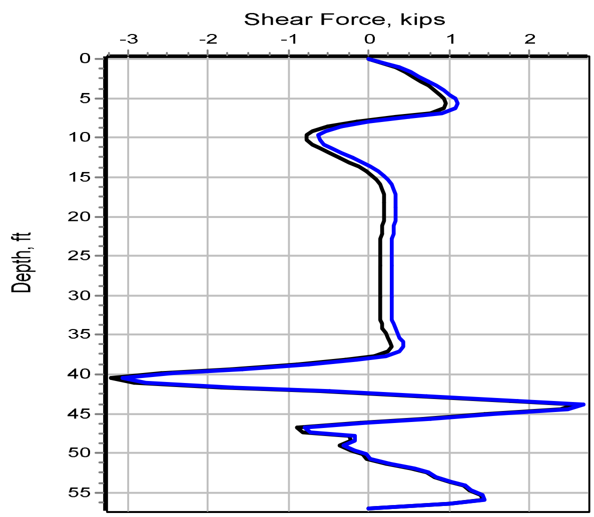
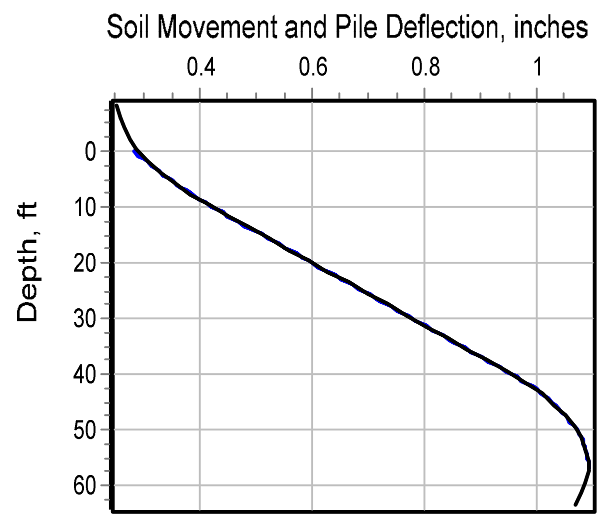

Assumed Deflection Profile from shoring movement (inches)
0
0.2
0.4
0.6
0.8
1
1.2
-10
0
10
20
30
40
50
60
70
Depth below top of pile (feet)
Layer 1, -8.50 to 0.10 ft = Sand (Reese)
Layer 2, 0.10 to 6.45 ft = Sand (Reese)
Layer 3, 6.45 to 21.95 ft = Sand (Reese)
Layer 4, 21.95 to 48.45 ft = Stiff Clay w/o Free Water
Layer 5, 48.45 to 69.45 ft = Sand (Reese)
Close

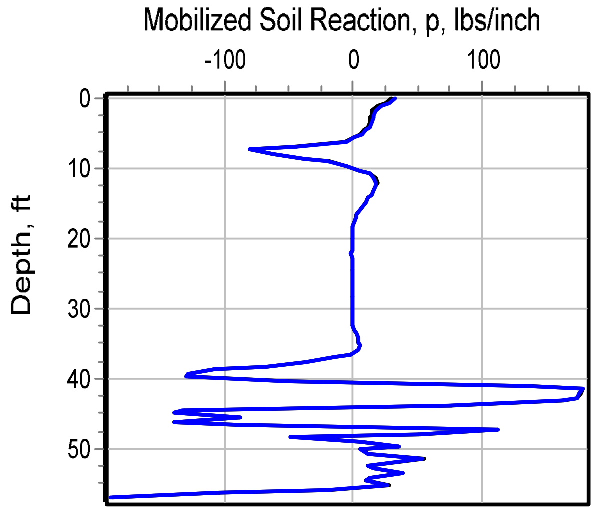
Figure B-15

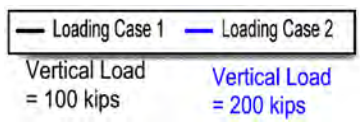

Deflection, inches
0.4
0.6
0.8
1
Depth, ft
0
10
20
30
40
50


Bending Moment, in-kips
-100
-50
0
Depth, ft
0
10
20
30
40
50


Shear Force, kips
-3
-2
-1
0
1
2
Depth, ft
0
5
10
15
20
25
30
35
40
45
50
55


Soil Movement and Pile Deflection, inches
0.4
0.6
0.8
1
Depth, ft
0
10
20
30
40
50
60


Mobilized Soil Reaction, p, lbs/inch
-100
0
100
Depth, ft
0
10
20
30
40
50


Loading Case 1
Loading Case 2
Vertical Load
= 100 kips
Vertical Load
= 200 kips