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MEMORANDUM

Date: August 19, 2015

From: Marie Ennis, Gabriel Pardo

To: John Shedd

Company: Chautauqua Institution

c:

Project: Chautauqua Institution Amphitheater Study: Narrative and Questions

Project #: J3262.02

Old Structures Engineering (OSE) has prepared a written narrative to accompany the Option A and Option B structural schematics we sent on July 15th. We have updated the drawings to allow better coordination with the attached narrative to aid in further discussion/review.

Serena Sturm Architects (SSA) provided a series of questions by email and letter; we also received questions from Ciminelli by forwarded email. We are attaching the questions posed and our responses.

Please let us know if you would like us to provide any further clarification, and if you would like us to participate in a conference call or meeting.

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August 19, 2015

The Chautauqua Institution

1 Ames Avenue

Chautauqua, New York 14722

Att: Mr. John Shedd, AIA

Director of Operations,

Administrator of Architecture

& Land Use Regulations

Dear Mr. Shedd:

The following is a brief narrative to accompany the two options for structural work shown in the Old Structures Engineering (OSE) drawings originally dated July 15, 2015. The drawings have been revised to better coordinate with the sequence description narrative, and to address a comment from Wendel Architecture and Engineering regarding helical piles.

Background

OSE was asked by the Chautauqua Institution to evaluate whether it is technically feasible to reconfigure the amphitheater to improve capacity and functionality while retaining the original steel roof truss structure. The two schematic options developed by OSE seek to retain the steel roof trusses without disassembly and reassembly of the entire roof. The analysis takes into account only the structural aspect of retaining the trusses while implementing some of the improvements shown in the proposed new building design documents prepared by Serena Sturm Architects, Wendel Architecture & Engineering, and Mitchell Kurtz Architect. Three significant features of the new building design that are accommodated in the OSE schemes are reducing the number of columns, rebuilding/reconfiguring the side roofs, and changing the shape of the bowl. In addition to programmatic changes, the new side roofs can also provide a way to stabilize the existing structure against lateral drift.

The two options presented by OSE will accommodate added weight in the attic at the line of the new longitudinal trusses and at the new perimeter low roofs. If additional equipment loads are required in the central attic, we recommend new transverse trusses be installed in those bays between the original trusses to remain. These new trusses would be supported on the new longitudinal trusses.

It should be noted that not all aspects of the new building design are compatible with retaining the existing roof. Further, the analysis of schedule and cost will be provided by others.

The options presented are schematic only; coupon samples of the existing steel would be tested, further analysis performed, all new components fully designed and detailed, and the proposed sequence further refined based on detailed design. The goal is to provide the Chautauqua Institution with further information in order fully evaluate the feasibility of keeping the roof.

Clearly the two options presented are more challenging from a construction means-and-methods and scheduling point of view than demolition of the amphitheater and construction of a new building. As with many historic buildings, the existing structure is not perfectly plumb, and various existing conditions must be considered and accommodated during the detailed design phase. Contractors with demonstrated expertise in working with existing buildings, particularly foundation work directly adjacent to structure to remain, are essential to dealing with the inevitable "unforeseen conditions" that typically arise on projects preserving or adapting historic structures. The benefit of the added effort is the retention of a significant architectural feature of the historic amphitheater.

Option A: Drawings S-SEQ-001, S-SEQ-100, S-SEQ-101

STEP 1

A) Install tilt meters and movement gages prior to beginning construction to allow the team to remotely monitor the existing structure throughout construction.

B) Remove portions of ceiling as needed to access to existing trusses, top of columns, space along column line, side roofs.

C) Reinforce portions of the steel roof trusses that were found to be overstressed in OSE's analysis of the existing structure. This work will consist of field bolting new steel side pieces to portions of existing chords. Install temporary longitudinal cross bracing. [A.1/S-SEQ-100]

D) Construct new longitudinal trusses that "sandwich" the existing timber trusses that run along the tops of the existing columns just above the ceiling. The detailing of the new trusses must accommodate the non-plumb existing conditions. Coordinate this sequence with Step 2E. [A.1/S-SEQ-100]

STEP 2

E) In coordination with Step 1D, remove a section of the side roof structure in the bay where the first length of longitudinal truss is to be installed. After installing the new longitudinal truss section, construct new steel side roof structure to support gravity loads and provide lateral bracing to the original steel roof structure. Install new cross bracing above the ceiling of the existing roof. Move on the next bay and repeat until all longitudinal trusses are installed, and side roofs constructed. [A.2, A.2.1/S-SEQ-100]

STEP 3

F) Install temporary shoring towers to allow the removal of existing columns. The work must proceed sequentially addressing one column at a time, and coordinated with the new footing/column (see next step). [A.3/S-SEQ-100]

STEP 4

G) Install new footing on bedrock; install new column on footing. Connect to new column to support the longitudinal truss above the ceiling. Transfer load. [A.4/S-SEQ-101]

STEP 5

H) Repeat shoring, column removal, new footing/column installation until all new columns are in place, loads are transferred and existing columns removed. [A.5/S-SEQ-101]

STEP 6

I) Excavate for new bowl construction.

Option B: Drawings S-SEQ-001, S-SEQ-200, S-SEQ-201, S-SEQ-202

STEP 1

A) Install tilt meters and movement gages prior to beginning construction to allow the team to remotely monitor the existing structure throughout construction.

B) Remove portions of ceiling as needed to access to existing trusses, top of columns, space along column line, side roofs.

C) Reinforce portions of the steel roof trusses that were found to be overstressed in OSE's analysis of the existing structure. This work will consist of field bolting new steel side pieces to portions of existing chords. Install temporary longitudinal cross bracing. [B.1/S-SEQ-200]

D) Construct new longitudinal trusses that "sandwich" the existing timber trusses that run along the tops of the existing columns just above the ceiling. The detailing of the new trusses must accommodate the non-plumb existing conditions. Coordinate this sequence with Step 2E.

STEP 2

E) In coordination with Step 1D, remove a section of the side roof structure in the bay where the first length of longitudinal truss is to be installed. After installing the new longitudinal truss section, construct new steel side roof structure to support gravity loads and provide lateral bracing to the original steel roof structure. Install new cross bracing above the ceiling of the existing roof. Move on the next bay and repeat until all longitudinal trusses are installed, and side roofs constructed. [B.1, B.2.1/S-SEQ-200]

STEP 3

F) Install upper section of new columns on mini-caissons/mini-piles and grillage beams. Transfer load. [B.3/S-SEQ-201]

STEP 4

G) Remove existing columns adjacent to the first new column. [B.4/S-SEQ.201]

STEP 5

H) Install new footing and splice bottom section of column to upper portion. Transfer load. [B.5/S-SEQ-201]

STEP 6

I) Repeat two previous steps one column at a time until all new columns are in place. [B.6/S-SEQ.201]

STEP 7

J) Excavate for new bowl structure. [B.7/S-SEQ-202]

Attached are a list of questions posed by Serena Sturm Architects and their structural engineer Wendel Architecture and Engineering, and by LP Ciminelli, along with OSE's responses. Please do not hesitate to contact me if you have any questions.

Sincerely yours,

Marie Ennis, PE

Principal

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Old Structures Engineering, PC (OSE) prepared the two options looking at the structural and constructibility aspect of the work only. We did not review schedule or cost. Many questions/comments refer to schedule and cost. The following questions from consultants for the new amphitheater project were given to us by the Chautauqua Institution.[1] We revised our drawings to clarify the suggested sequence based on their feedback.

Serena Sturm & Wendel Engineering Questions/Comments:

OSE Option A

Step 1:

The existing trusses/columns are not uniformly spaced, therefore fabrication and fitment of the new longitudinal trusses will be difficult, and field re-work is likely needed.

The report does not address the removal or shoring/temporary support of the existing "side roof" trusses. To facilitate the installation of the new outboard longitudinal truss, the existing "side roof" trusses must be removed in their entirety or temporarily supported and have enough material removed to facilitate the installation of the new longitudinal truss.

Step 2:

The installation of the new cross bracing above the ceiling will likely be difficult to install physically in place, and will likely require that much of the existing ceiling material be removed.

Step 3:

We realize that the helical pile are likely a place holder for some sort of deep foundation system, but we suggest that the helical piles be revised to micro piles as it is atypical to use a helical pile to bear on top of bed rock. Also, it is unlikely to be able to drive helical piles through fragmented/weathered rock to get proper bearing on sound bedrock.

Step 4:

Step 4 likely creates a stability issue if helical piles are used (i.e. to unbraced length of helical pile vs. overturning moment capacity). Again, we recommend that micro piles, socketed into sound bedrock be used in lieu of helical piles.

Step 5:

It is likely that the column by column approach as well as the need to be re-locating the temporary bracing would have a negative impact on the schedule. During the DD phase

1 It should be noted that reference was made in the comments that a scheme the consultant team had developed previously was similar to the OSE designs. OSE did not have access to this design at the time we developed our scheme and therefore we have not commented on the suggested similarity.

when the design team was investigating a similar approach, the duration of the construction was required to be completed within one off-season.

Step 6:

Note A: "Longitudinal truss shall be connected to new east end building to provide lateral stability". It is not clear if the modifications presented in Option A create a self-supporting structure or if the structure transfers loads into the "New Building" as shown as Out of Scope. Due to the limited amount of space that the "New Building" occupies, it is unlikely that the new building will be able to support any magnitude of lateral load.

Drawing S-SEQ-001.00

Note D "The two options presented will accommodate some added weight..." It is not clear if these criteria meet the new program needs of an additional 20 tons per truss.

OSE Option B:

Step 1:

The existing trusses/columns are not uniformly spaced, therefore fabrication and fitment of the new longitudinal trusses will be difficult, and field re-work is likely needed.

The report does not address the removal or shoring/temporary support of the existing "side roof" trusses. To facilitate the installation of the new outboard longitudinal truss, the existing "side roof" trusses must be removed in their entirety or temporarily supported and have enough material removed to facilitate the installation of the new longitudinal truss.

Step 2:

The installation of the new cross bracing above the ceiling will likely be difficult to do physically in place, and will likely require that the existing ceiling material be removed.

Step 3:

We realize that the helical pile are likely a place holder for some sort of deep foundation system, but we suggest that the helical piles be revised to micro piles as it is atypical to use a helical pile to bear on top of bed rock. Also, it is unlikely to be able to drive helical piles through fragmented/weathered rock to get proper bearing on sound bedrock.

Option B places new columns at the mid bay location between the existing columns. The design team was tasked with keeping the remaining columns at existing column locations. Moving the new columns as shown would likely create a need for wholesale changes to the bowl design and seating configuration.

Step 4:

We realize that the helical pile are likely a place holder for some sort of deep foundation system, but we suggest that the helical piles be revised to micro piles as it is atypical to *use a helical pile to bear on top of bed rock. Also, it is unlikely to be able to drive helical piles through fragmented/weathered rock to get proper bearing on sound bedrock.*

Option B appears that it would improve the schedule over Option A as all foundations/columns can be installed at the same time, vs. the step by step approach as shown in Option A.

Step 5:

Step 5 likely creates a stability issue if helical piles are used (i.e. to unbraced length of helical pile vs. overturning moment capacity). Again, we recommend that micro piles, socketed into sound bedrock be used in lieu of helical piles.

Step 6 & 7:

Note A: "Longitudinal truss shall be connected to new east end building to provide lateral stability". It is not clear if the modifications presented in Option A create a self-supporting structure of if the structure transfers loads into the "New Building" as shown as Out of Scope. Due to the limited amount of space that the "New Building" occupies, it is unlikely that the new building will be able to support any magnitude of lateral load.

General Comments:

The approach of using new longitudinal trusses, new outboard trusses in conjunction with reinforcing the existing main roof trusses is very similar to approach the design team had shown during the Design Development phase of the project. It was deemed that this reinforcement method was not feasible due to cost and schedule implications.

Any work done to reinforce the Amphitheatre roof structure should result in a stable free standing structure. It appears in both schemes that Old Structures is relying on the remainder of the new building to carry lateral loads. This is not feasible as there must be a building joint between the Amphitheatre roof and the back of house due to vastly different structure types which will moved differently.

Constructibility

The installation of the longitudinal trusses on both sides of the existing Front of House roof structure will be extremely challenging but doable given the time and field documentation necessary. The existing truss structure that will connect on the new longitudinal trusses will not be perfectly square, plumb, or symmetrical, which will add to this difficult installation.

Design Criteria
It is not clear if the load criteria meet the new program needs adding 20 tons per truss.

It is not clear how this design approach would accommodate the programmatic improvements to the attic space above and in front of the stage.

Schedule

Additional time will be required to develop accurate in field measurement prior to final detailing of shop drawings. This is an activity best accomplished after removal and access is acquired to the column tops and bearing conditions of the exiting trusses. This means that the shop drawing process will need to begin prior to demolition and then verified and revised as necessary once these conditions becomes accessible potentially impacting the ability to preorder necessary material based on the fabrication schedule.

The columns will be installed prior to bowl excavation is thus out of sequence. The result is that work will need to take place in and around all of the new structural columns, and thus will be more time consuming.

Using the proposed methods will require a lot of field work in addition to field verifications, design, fabrication of new longitudinal trusses, bracing and reinforcement elements for the existing roof trusses.

Option B appears that it would improve the schedule over Option A as all foundations/columns can be installed at the same time, vs. the step by step approach as shown in Option A.

Preservation

The rework of the new interior column to truss connection and installation of the cross bracing required between the existing trusses bottom chord will require the estimated removal of at least a third to all of the existing ceiling fabric in the central curved ceiling areas. This means virtually full removal due to the effort of patching required to maintain it's use/replacement, our CM is considering full removal of the existing bead board ceiling, as a result.

We have reviewed the Old Structures Inc. concept of how to retain the existing center roof structure in the Amp project while maintaining our current design goals and objectives. The approach of using new longitudinal trusses, new outboard trusses in conjunction with reinforcing the existing main roof trusses is very similar to the approach the design team had shown during the Design Development phase of the project. We find our analysis of the impacts on project constructibility, schedule and cost implications to be consistent as well.

OSE Response

Option A

Step 1:

Steel fabrication: Our experience with older steel buildings - their repair and reinforcement - is that each project is unique. The steel work must be clearly detailed, and the steel fabricator must submit shop and erection drawings with sufficient information to demonstrate their understanding of the required work. Ideally field re-work is kept to a minimum; proposed field modification methods need to be submitted for review prior to construction. Staging and rigging will also be critical aspects of the work.

Side roofs: We have revised our schematic drawings and narrative to better describe the phasing and coordination between the longitudinal truss installation and the removal and reconstruction of the side roofs.

Step 2:

Yes, at least portions of the ceiling must be removed to gain access to existing and to install new structure. As to the cross bracing, this work is similar to some of the retrofit previously installed in the amphitheater attic (e.g., Albert Kreutter circa 1978), so it is feasible.

Step 3:

Yes, the helical piles are a place holder. We agree that micro-piles or mini-caissons can bear on, or be socketed into, rock as needed. The drawings have been revised to eliminate reference to helical piles.

Step 4:

See response to Step 3 comment.

Step 5:

OSE looked at the feasibility of saving the roof, not cost and schedule.

Step 6:

Although OSE did not review the new building design, we believe that any load transfer between front-of-house/back-of-house could be accommodated, for example, with shear walls or braced frames, moment frames. A seismic gap may or may not be required, depending on the seismic analysis of the existing building. Given the relative lightness of the roof structure, we believe it is possible that the wind and uneven snow loads govern (which means no separation required). Either way, the existing structure can be detailed to be completely independent of back-of-house structure as needed.

Option B

Step 1:

See Option A Step 1.

Step 2:

See Option A Step 2.

Step 3:

See Option A Step 3.

The general notes on S-SEQ-001 state that not all of the design goals for the full demolition/new building could be accommodated and keep the main roof in place, therefore other non-structural aspects of the design would need to be revised accordingly.

Step 4:

We agree that Option B has some advantages over Option A.

Step 5:

Resolved by using micro-piles or mini-caissons.

Steps 6 & 7:

See Option A Step 6.

Additional Questions from Marty Serena

1.) Would we need to remove the perimeter roof structure to re-enforce the existing structure?

The two options Old Structures presented included restructuring the side roofs to provide lateral support to the main roof steel trusses, however, the building could be reinforced without removing the perimeter roof structure. This approach would need to include column replacement and/or reinforcement, truss reinforcement, and footing upgrades/new footings. By not engaging the perimeter structure for lateral stability, the columns must behave as cantilevers fixed at the base. Therefore, saving the main roof without altering/rebuilding the side roofs is feasible, but it will be a more complicated solution since the column footings will need rock anchors to resist uplift forces, and the reinforcement and new elements will be heavier than if we engage a new perimeter roof structure.

2.) How much of the ceiling fabric would need to be removed?

The ceiling will need to be removed for access to the areas getting new structure, and to the elements that will be reinforced. So the entire ceiling in a strip along the two main roof column lines will need to be removed to allow for the new longitudinal trusses, existing truss connections, etc.

3.) Would the roof fabric be impacted by the remediation?

We do not anticipate major work affecting the roof fabric unless damaged or distressed wooden roof members are discovered during field work. It may be feasible to reinforce the roof trusses with field bolted details versus field welding to reduce the fire risk; this needs to be explored more fully during design/detailing. If new trusses were to be introduced between existing trusses to support equipment and workers, the roof would have to be opened in those locations.

4.) How much area of the bowl would be disturbed to execute the temporary support and necessary foundation work in the bowl?

The new steel columns and the foundations will bear on the existing bedrock. The amount of excavation will therefore be determined by the elevation of the existing footings, the depth of the bedrock, and the angle of repose (stable slope) of the existing soil. As a rough number the excavation can be determined by the column spacing (± 20'). Assuming that the excavation will not interfere with the adjoining footings we can assume a 20'x20' area of excavation around each column.

LP Ciminelli Questions/Comments

- *The installation of the longitudinal trusses on both sides of the existing FOH roof structure will be extremely challenging. Raising them up with the existing structure in place, and trying to 'shoehorn' them and shim them into position while the weight of the existing roof structure exists will be very challenging. The frame of the existing structure that will bear on the new longitudinal trusses will not be square, plumb, or symmetrical, which will add to this difficult installation.*
- *The installation of the cross bracing between the existing trusses will require the full removal of the existing bead board ceiling, which will render this material unusable for reinstallation; therefore, after the cross bracing is installed, a new ceiling will be required for installation - so when this work is complete an audience member will look up and see nothing of the existing facility components, despite all of the cost and effort invested to "preserve" the existing structure.*
- *Shoring towers and 'one at a time' replacement of column footings and columns will be extremely time consuming. There will be as much time and effort that will go into the safe construction of shoring towers as there will be the replacement columns themselves - and you will not benefit from the efficiency of doing any one of these operations all at one time. And this work will all be individually be performed through the full depth of the overburden, as this plan calls for excavation of the bowl to take place after the columns are replaced.*
- *The excavation of the bowl, according to the Old Structures proposed sequence, occurs after the replacement columns are installed. This will require this work to take place working in and around all of the new structural columns, and will be more time consuming and costly than for mass excavation to occur without the columns in place as our current design and construction schedule/sequence dictates.*
- *In summary and in our opinion, the time and expense involved with the process shown on the Old Structures documents will require the Amp to remain unusable during one summer season, and will add several million dollars to the cost of the project.*
- *I reviewed both Options (A and B) of the schematic drawings produced by Old Structure Engineering. Both options are doable, but very costly and very time consuming. I'm aware there is limited time for construction. Using the proposed methods will require a lot of field work in addition to field verifications, design, fabrication of new longitudinal trusses, bracing and reinforcement elements for the existing roof trusses. Each existing column (out of 16) will be replaced one at a time, requiring expensive heli-*

cal piles to install the temporary foundations for temporary supports/towers for the existing structure. In short, the construction using one of these methods will take approximately (8) months and will add cost for some work which is going to be abandoned later (i.e. excavation, demolitions, helical piles, temporary towers, etc.).

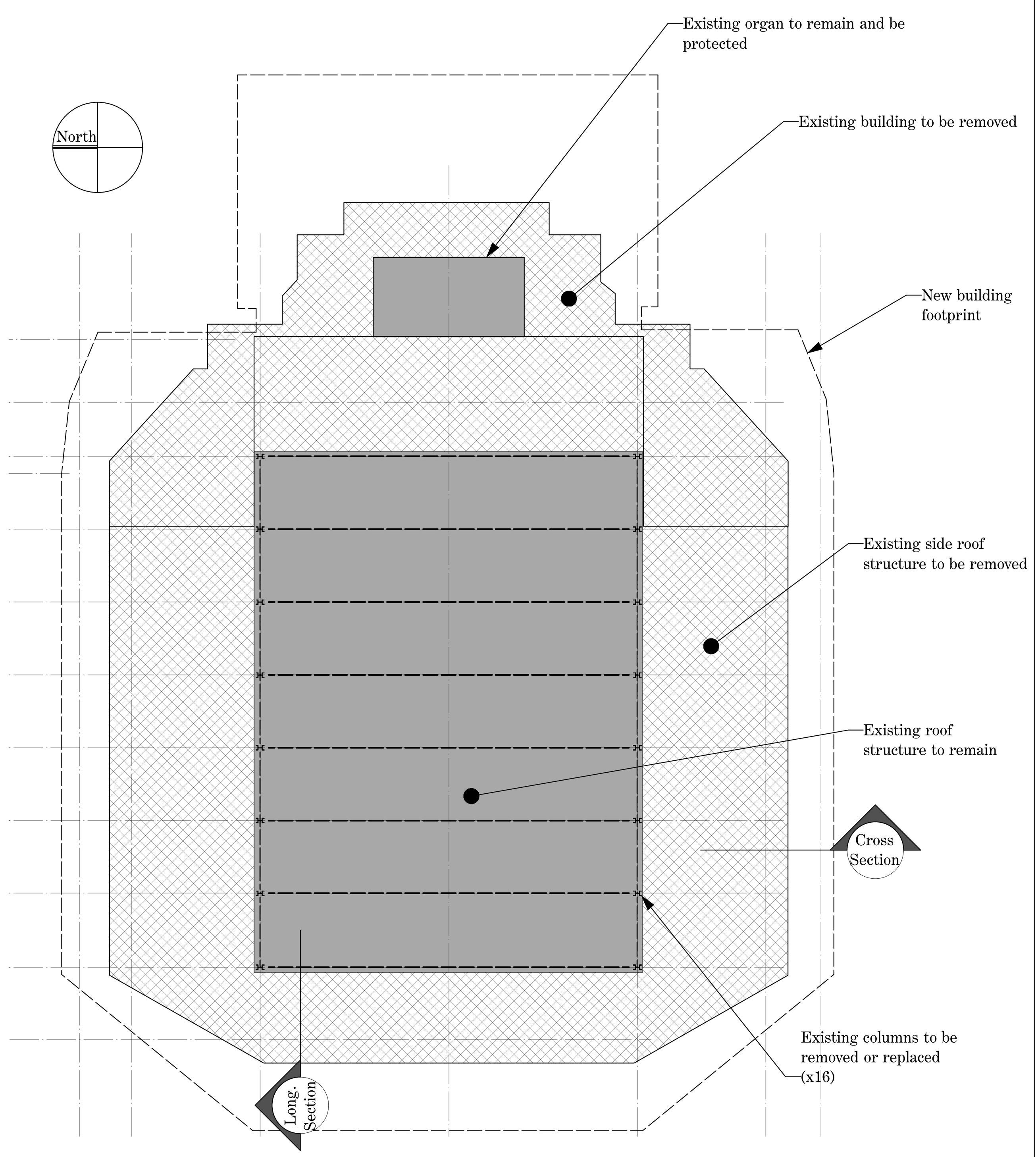
- *Saving the roof structure will add approximately eight months to the schedule.*

OSE Response

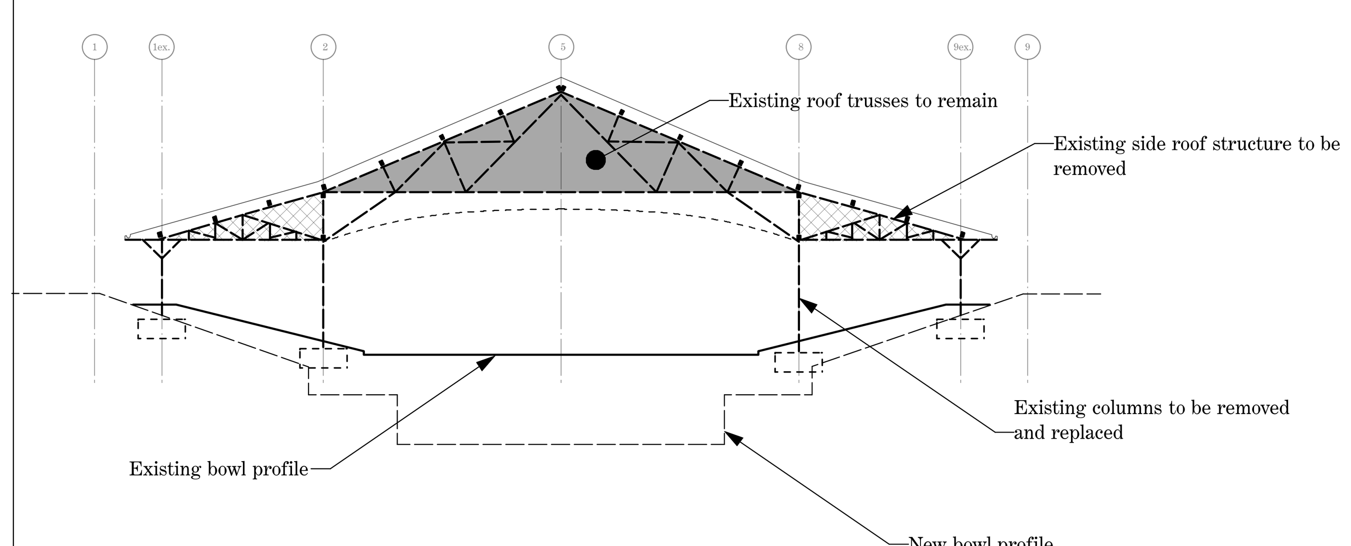
The comments are primarily about the challenges of implementing the work, nor does he distinguish between Options A and B (which are distinctly different). Historic preservation standards do impose additional requirements on a project, especially for National Register properties.

As to the schedule, we were not asked to address that. Again, there is often additional time required when restoring/adapting/modifying historic structures. Our question: was this based on the analysis Ciminelli did for the Serena Sturm Architects DD submission showing saving part of the front-of-house roof? Does the added time/expense account for the deletion of scope, e.g., wholesale demolition of the amphitheater while protecting the organ? Were the trusses reinforced in-situ, or disassembled and reassembled?

Existing Building



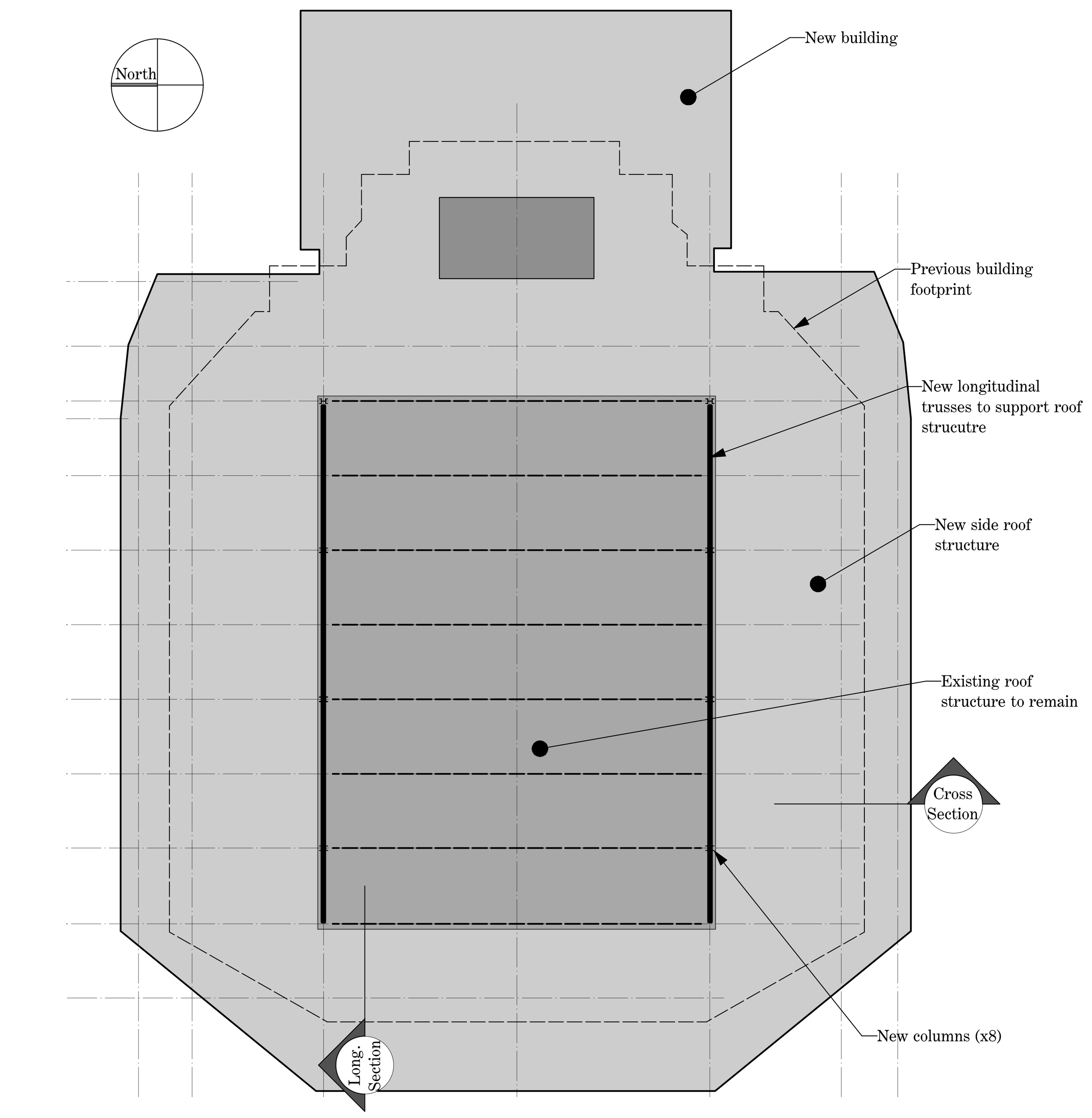
1 Key Plan - Aerial View - Ex. Building
Scale: 1/32" = 1'-0"



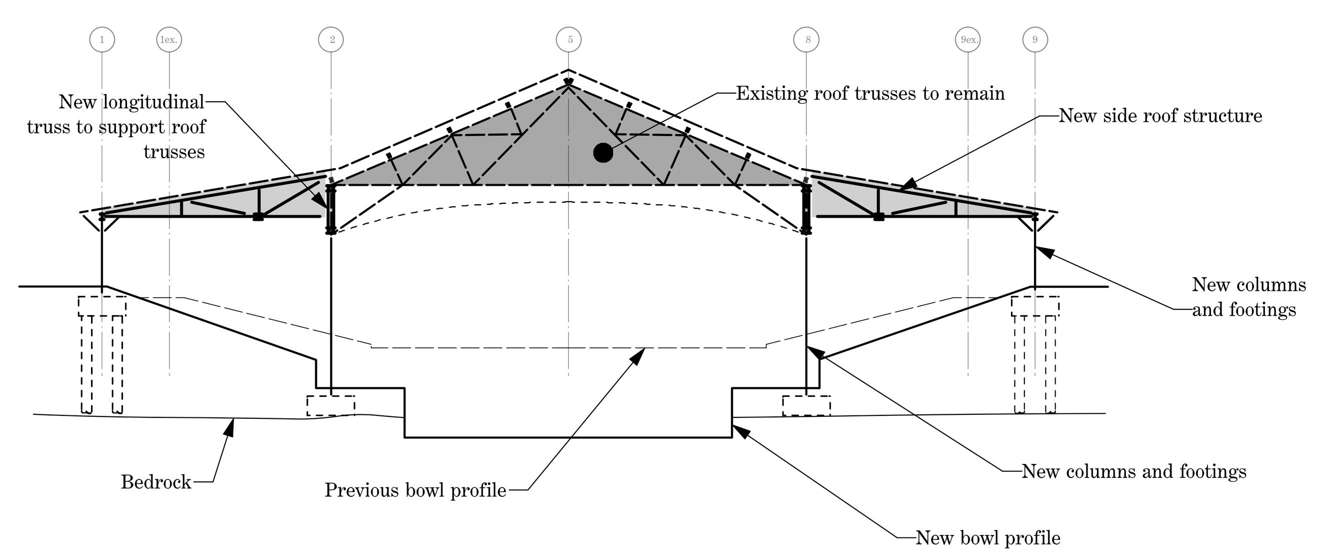
2 Key Plan - Cross Section- Ex. Building
Scale: 1/32" = 1'-0"

Notes:
A. Existing roof trusses to be reinforced and to remain.
B. Existing side roof structure shall be removed by phases combined with new construction in a manner to provide lateral stability to the existing structure to remain. See narrative on sequence drawings for details.

Proposed Building



3 Key Plan - Aerial View - Proposed Building
Scale: 1/32" = 1'-0"



4 Key Plan - Cross Section- Proposed Building
Scale: 1/32" = 1'-0"

Notes:
A. See drawings SEQ-100s & 200s for the two different sequence proposals of demolition and construction of the main roof structure.
B. See drawings S-200 & S-300 for schematic design of the existing truss reinforcement and the new elements supporting the main roof.
C. See structural drawings of Serena Sturm Architects dated 01/05/2015 for structural design other than main roof structure.
D. New structure surrounding the existing structure to remain shall be designed to provide lateral stability to the existing structure in the long and short direction.

General Notes:

A. The purpose of this schematic design set is to evaluate options to retain the original ampitheater steel roof trusses without disassembly and reassembly of the roof. Old Structures Engineering has reviewed only the structural aspect of retaining the trusses while implementing some of the improvements shown in the proposed new building design documents prepared by Serena Sturm Architects, Wendel Architecture & Engineering, and Mitchell Kurtz Architect. Not all aspects of that design are compatible with retaining the existing roof.

B. The existing structure to remain should be monitored for movement during the proposed sequence of work. Tilt meters that can remotely collect live data are recommended.

C. Assumptions have been made about the existing column footings. Test pits will be required to confirm as-built conditions, as well as input from a geotechnical engineer.

D. The two options presented will accommodate some added weight in the attic at the line of the new longitudinal trusses. If additional equipment loads are required in the attic, we recommend new transverse trusses be installed in those bays between the original trusses to remain. These new trusses would be supported on the new longitudinal trusses.

Old Structures Engineering, PC

111 Broadway
Suite 1405
New York, NY 10006

tel: 212-244-4546
fax: 917-591-2189
information@oldstructures.com

Revisions

No.	Date	Description
01	07/15/15	Proposed Sequence
02	08/03/15	Updated Sequence

PROGRESS SET

Chautauqua Institution
Amphitheater.
Demo-Construction Sequence

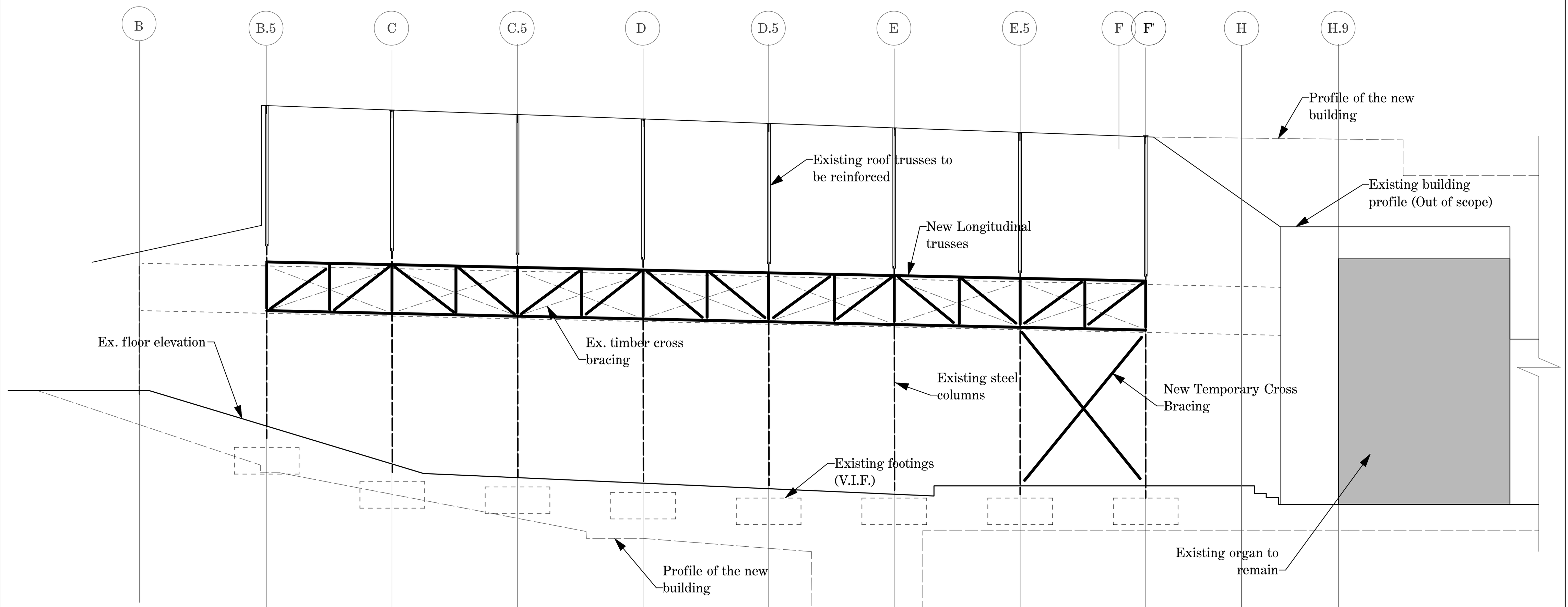
Proposed Sequence.
Key Plan & Notes

Scale: As Shown
Issue Date: May 15, 2015
Drawn by: GP
Project #: J3262.01

Drawing No.
S-SEQ-001.00

OPTION A

STEP 1



A.1 STEP 1 - Longitudinal Section. Grid Lines 2 & 8
Scale: 1/16" = 1'-0"

STEP 1

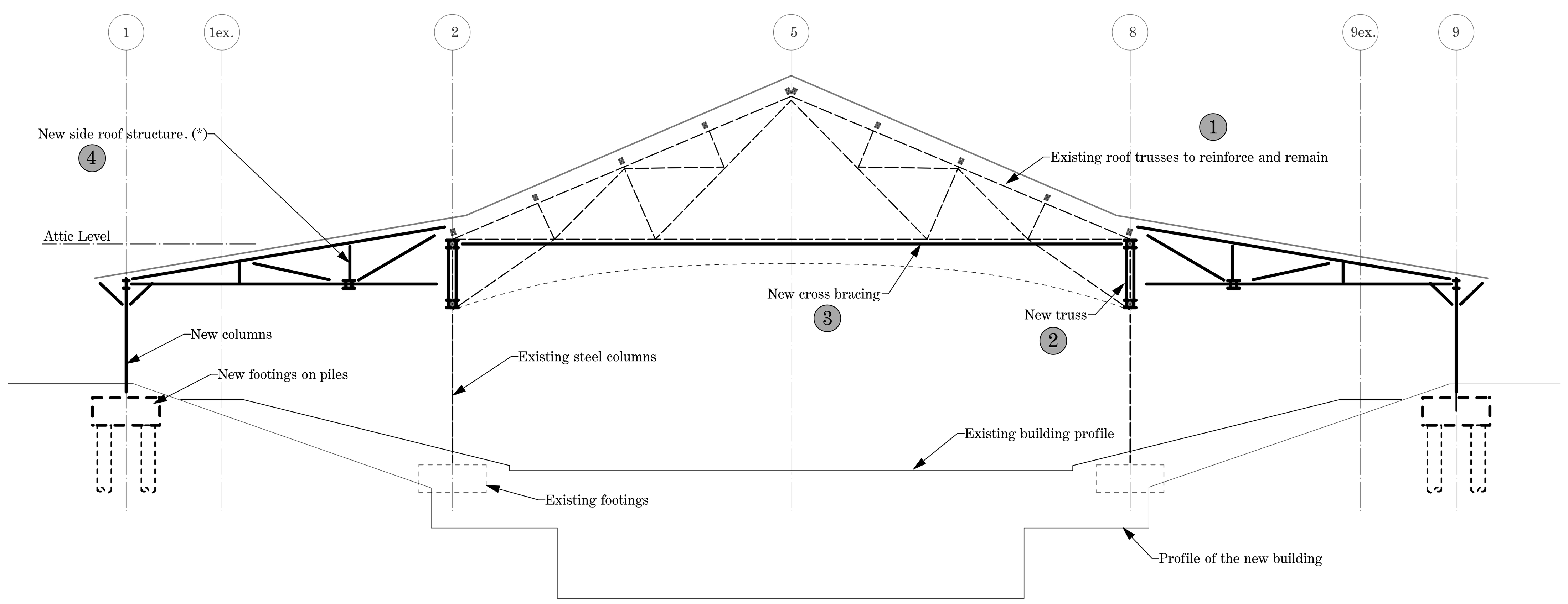
A) Install tilt meters and movement gages prior to beginning construction to allow the team to remotely monitor the existing structure throughout construction.

B) Remove portions of ceiling as needed to access to existing trusses, top of columns, space along column line, side roofs.

C) Reinforce portions of the steel roof trusses that were found to be overstressed in OSE's analysis of the existing structure. This work will consist of field bolting new steel side pieces to portions of existing chords. Install temporary longitudinal cross bracing.

D) Construct new longitudinal trusses that "sandwich" the existing timber trusses that run along the tops of the existing columns just above the ceiling. The detailing of the new trusses must accommodate the non-plumb existing conditions. Coordinate this sequence with Step 2E.

STEP 2



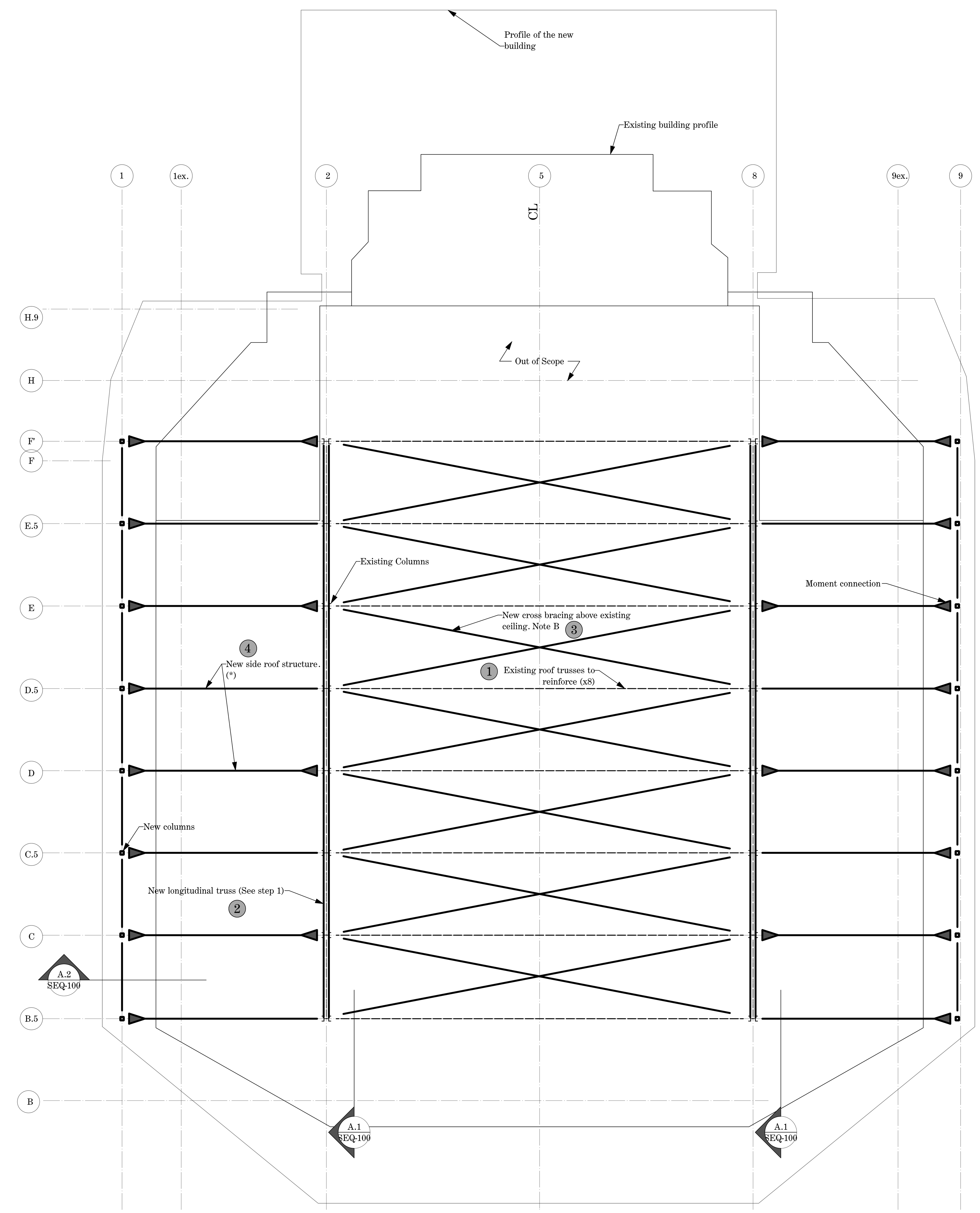
(*) New side roof structure to be similar to the structure shown in detail 12/S-301 of the Chautauqua Amphitheater project of Serena Sturm Architects dated 01/05/2015.

A.2 STEP 2 - Cross Section
Scale: 1/16" = 1'-0"

STEP 2

E) In coordination with Step 1D, remove a section of the side roof structure in the bay where the first length of longitudinal truss is to be installed. After installing the new longitudinal truss section, construct new steel side roof structure to support gravity loads and provide lateral bracing to the original steel roof structure. Install new cross bracing above the ceiling of the existing roof, and reinstall cross bracing in the plane of the roof. Move on the next bay and repeat until all longitudinal trusses are installed, and side roofs constructed. [A.2, A.2.1/S-SEQ-100]

STEP 2



(*) The new cross bracing above ceiling will be determined depending upon the design of the new side roof structure.

A.2.1 STEP 2 - Attic Plan
Scale: 1/16" = 1'-0"

Old Structures Engineering, PC

111 Broadway
Suite 1405
New York, NY 10006

tel: 212-244-4546
fax: 917-591-2189
information@oldstructures.com

Revisions

No.	Date	Description
01	07/15/15	Proposed Sequence
02	08/03/15	Updated Sequence

PROGRESS SET

Chautauqua Institution Amphitheater.
Demo-Construction Sequence

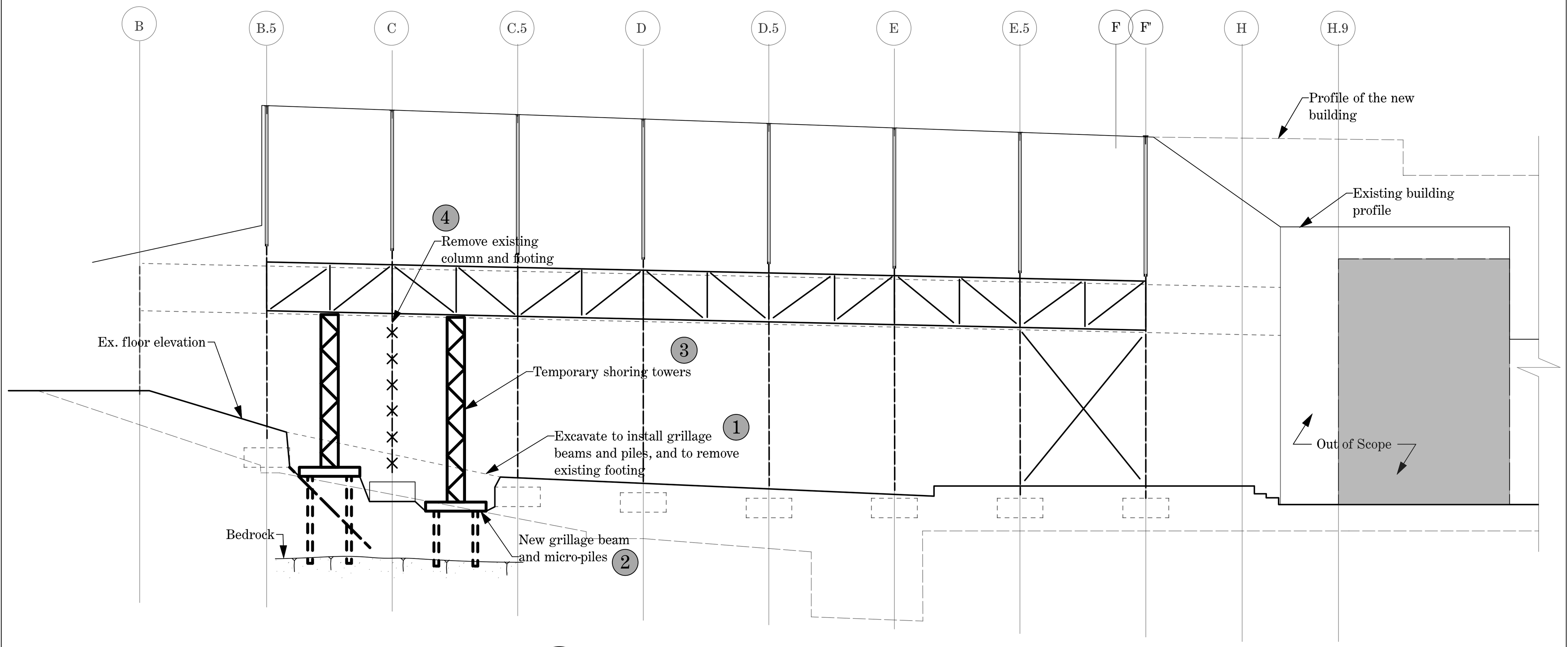
Proposed Sequence.
OPTION A - Steps 1 to 2

Scale: As Shown
Issue Date: May 15, 2015
Drawn by: GP
Project #: J3262.01

Drawing No.
S-SEQ-100.00

OPTION A

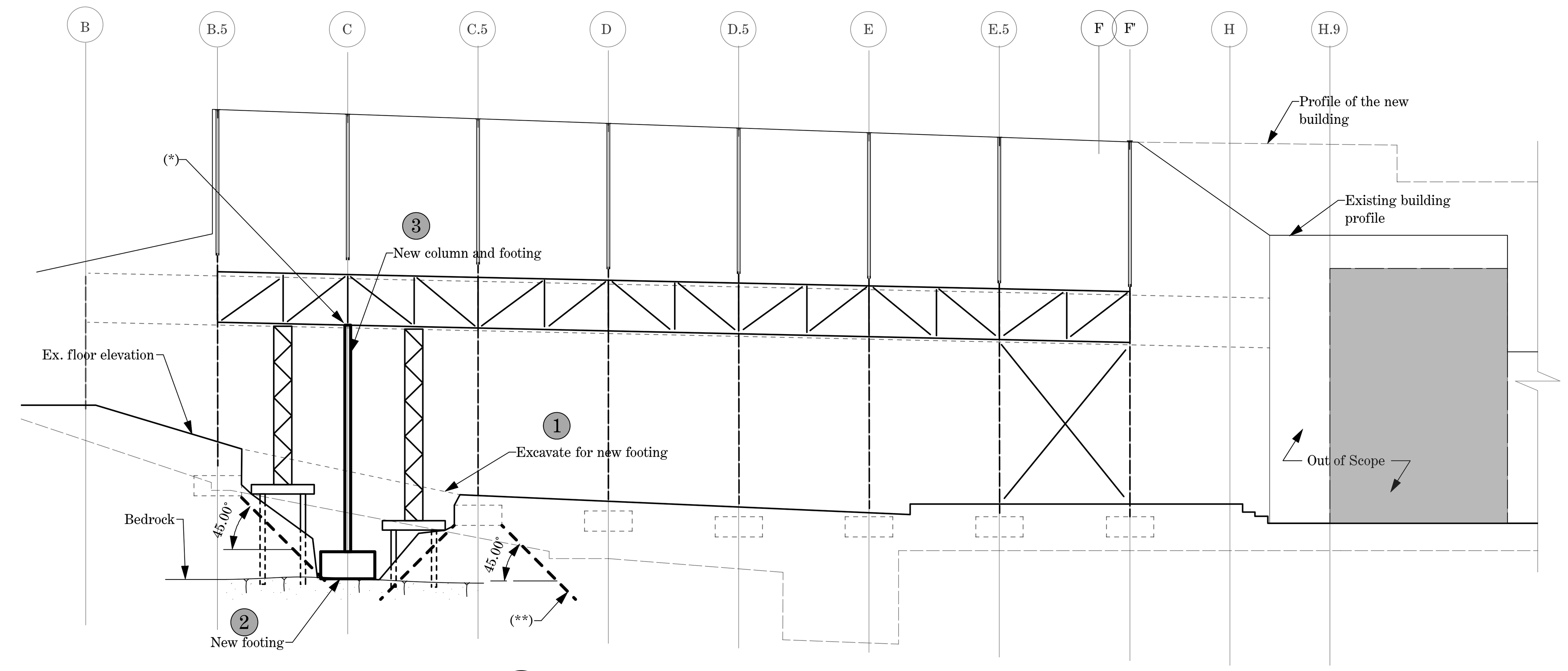
STEP 3



A.3 STEP 3 - Longitudinal Section. Grid Lines 2 & 8
Scale: 1/16" = 1'-0"

STEP 3
F) Install temporary shoring towers to allow the removal of existing columns. Temporary shoring towers and footings shall be designed to support a vertical load of 60 kips. The work must proceed sequentially addressing one column at a time, and coordinated with the new footing/column (see next step).

STEP 4

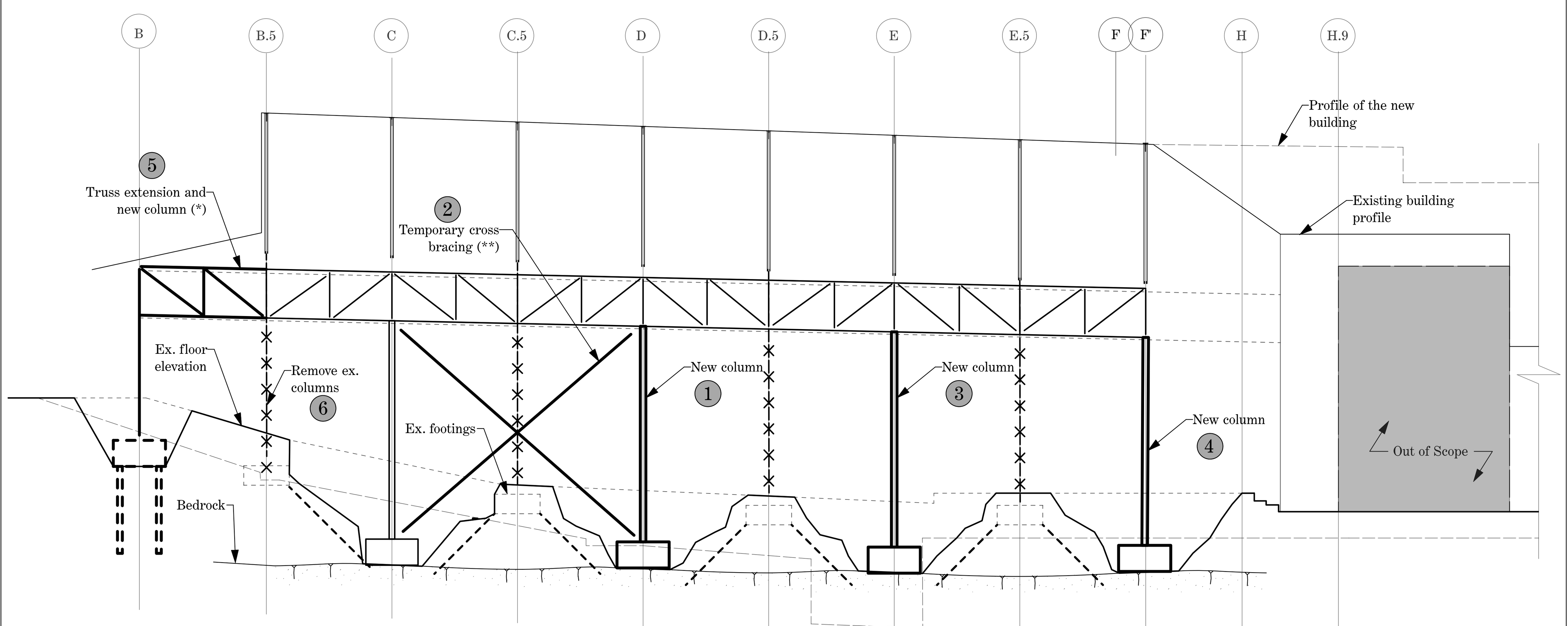


(*) Connect new steel column with new truss and with structure of the side roofs. The latter connection will be a moment connection.
(**) Excavation for new footing shall maintain the soil below the existing footings within a 45º angle (Geotechnical engineer to confirm).

A.4 STEP 4 - Longitudinal Section. Grid Lines 2 & 8
Scale: 1/16" = 1'-0"

STEP 4
G) Install new footing on bedrock; install new column on footing. Connect to new column to support the longitudinal truss above the ceiling. Transfer load.

STEP 5

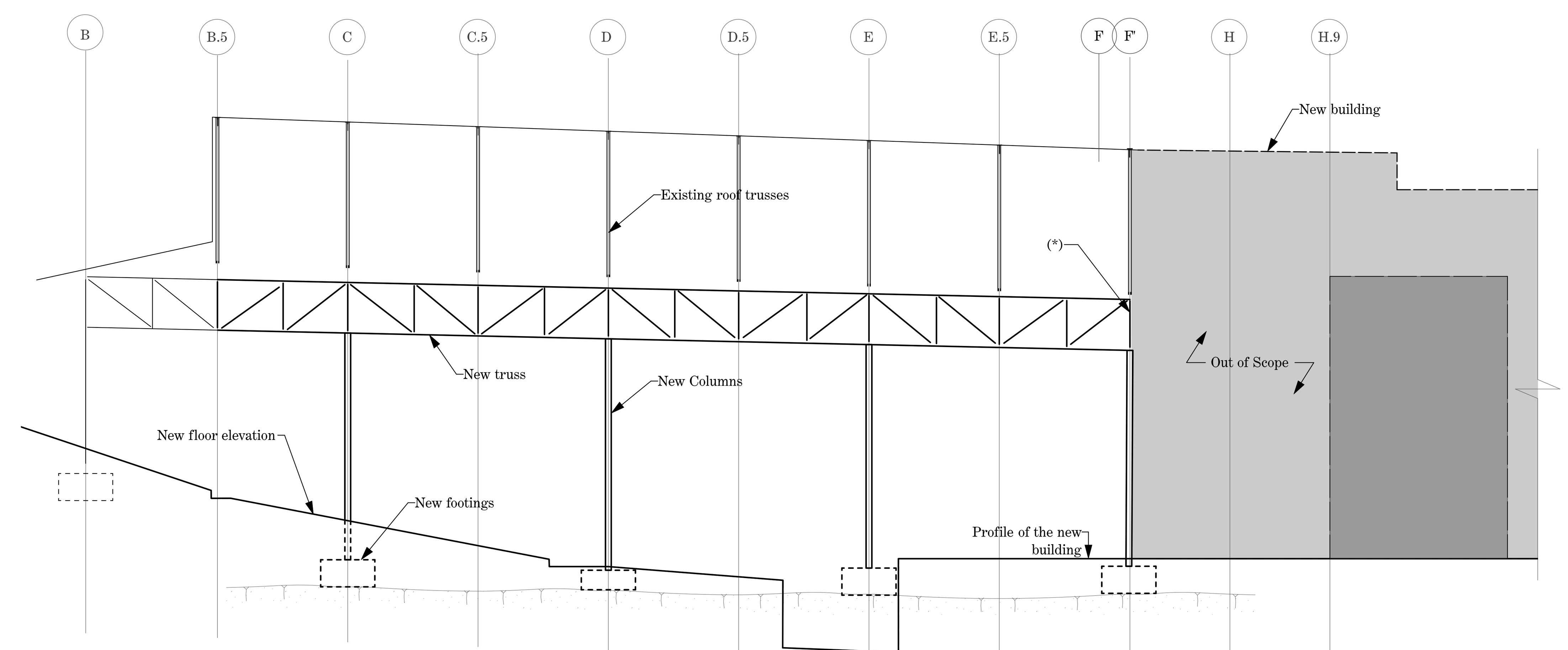


(*) New column and longitudinal truss extension are not part of original building. See Serena Sturm drawings for details.
(**) Relocate new temporary bracing between new columns until new structure and building at the east end are capable to provide lateral stability to the structure.

A.5 STEP 5 - Longitudinal Section. Grid Lines 2 & 8
Scale: 1/16" = 1'-0"

STEP 5
H) Repeat shoring, column removal, new footing/column installation until all new columns are in place, loads are transferred and existing columns removed.

STEP 6



(*) Longitudinal truss shall be connected to the new east end building to provide lateral stability.

A.6 STEP 6 - Longitudinal Section. Final Result
Scale: 1/16" = 1'-0"

STEP 6
I) Excavate for new bowl construction.

Old Structures Engineering, PC
111 Broadway
Suite 1405
New York, NY 10006

tel: 212-244-4546
fax: 917-591-2189
information@oldstructures.com

Revisions

No.	Date	Description
01	07/15/15	Proposed Sequence
02	08/03/15	Updated Sequence

PROGRESS SET

Chautauqua Institution
Amphitheater.
Demo-Construction Sequence

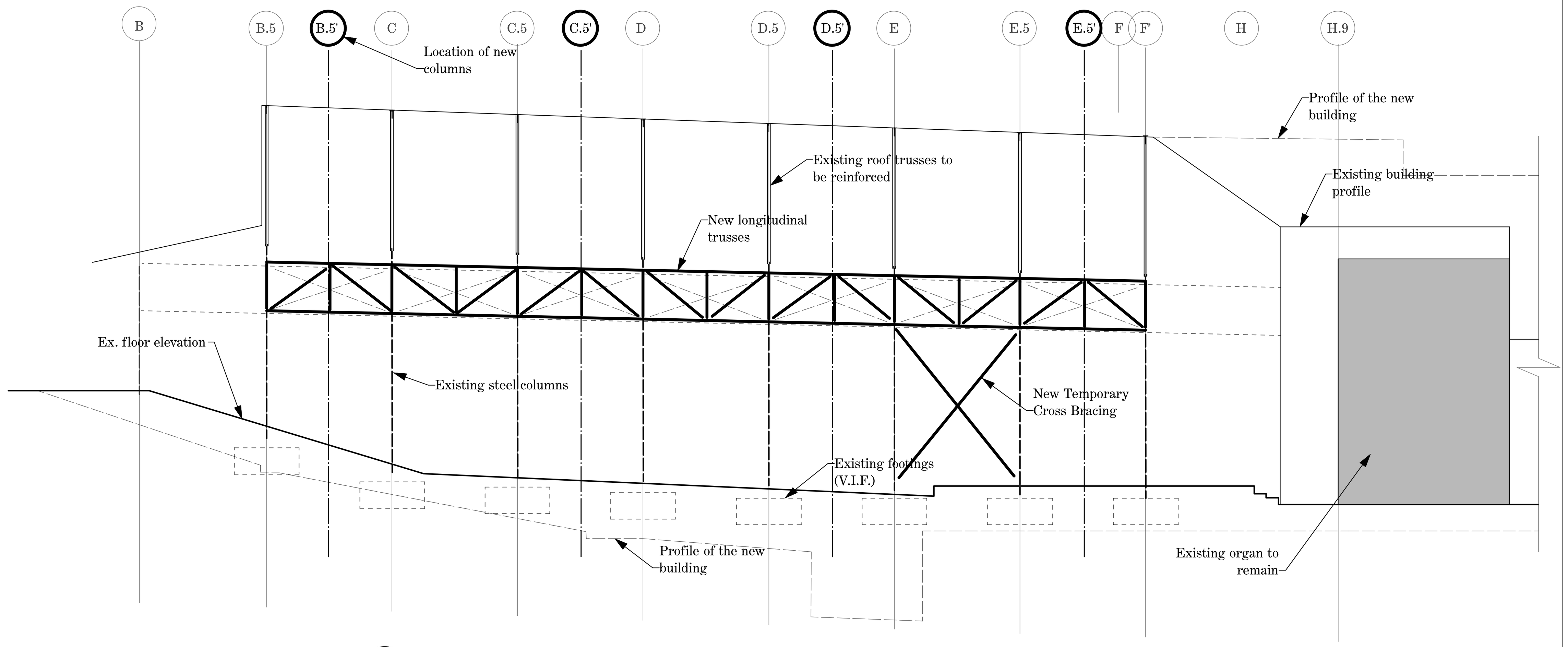
Proposed Sequence.
OPTION A - Ste[s 3 to 6

Scale: As Shown
Issue Date: May 15, 2015
Drawn by: GP
Project #: J3262.01

Drawing No.
S-SEQ-101.00

OPTION B

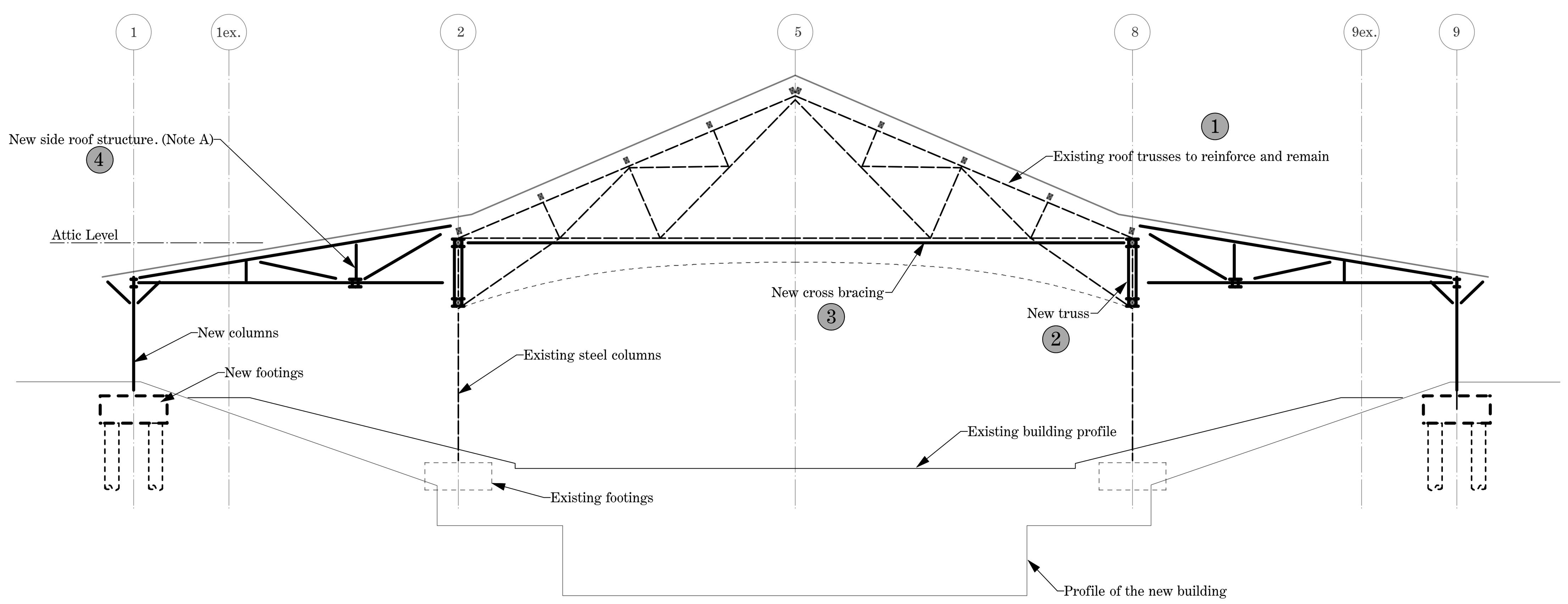
STEP 1



B.1 STEP 1 - Longitudinal Section. Grid Lines 2 & 8
Scale: 1/16" = 1'-0"

STEP 1
A) Install tilt meters and movement gages prior to beginning construction to allow the team to remotely monitor the existing structure throughout construction.
B) Remove portions of ceiling as needed to access to existing trusses, top of columns, space along column line, side roofs.
C) Reinforce portions of the steel roof trusses that were found to be overstressed in OSE's analysis of the existing structure. This work will consist of field bolting new steel side pieces to portions of existing chords. Install temporary longitudinal cross bracing.
D) Construct new longitudinal trusses that "sandwich" the existing timber trusses that run along the tops of the existing columns just above the ceiling. The detailing of the new trusses must accommodate the non-plumb existing conditions. Coordinate this sequence with Step 2E.

STEP 2

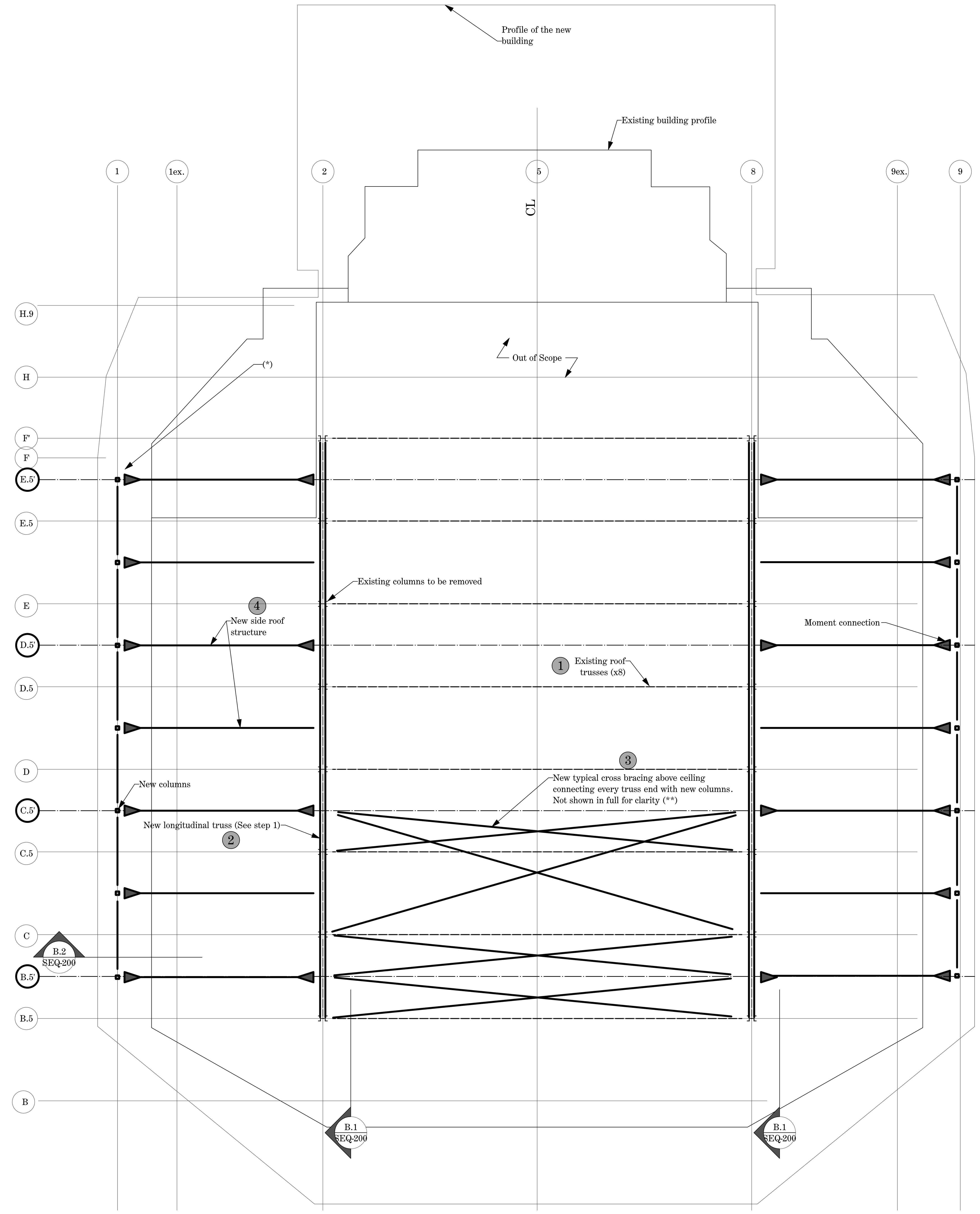


(*) New side roof structure to be similar to the structure shown in detail 12/S-301 of the Chautauqua Amphitheater project of Serena Sturm Architects dated 01/05/2015.

B.2 STEP 2 - Cross Section
Scale: 1/16" = 1'-0"

STEP 2
E) In coordination with Step 1D, remove a section of the side roof structure in the bay where the first length of longitudinal truss is to be installed. After installing the new longitudinal truss section, construct new steel side roof structure to support gravity loads and provide lateral bracing to the original steel roof structure. Install new cross bracing above the ceiling of the existing roof, and reinstall cross bracing in the plane of the roof. Move on the next bay and repeat until all longitudinal trusses are installed, and side roofs constructed.
[B.1, B.2.1/S-SEQ-200]

STEP 2



(*) New exterior columns are shown aligned with the new interior columns. These locations differ from the locations shown in the proposed design from Serena Sturm.
(**) The new cross bracing above ceiling will be determined depending upon the design of the new side roof structure.

B.2.1 STEP 2 - Attic Plan
Scale: 1/16" = 1'-0"

Old Structures Engineering, PC
111 Broadway
Suite 1405
New York, NY 10006

tel: 212-244-4546
fax: 917-591-2189
information@oldstructures.com

Revisions

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01	07/15/15	Proposed Sequence
02	08/03/15	Updated Sequence

PROGRESS SET

Chautauqua Institution
Amphitheater
Demo-Construction Sequence

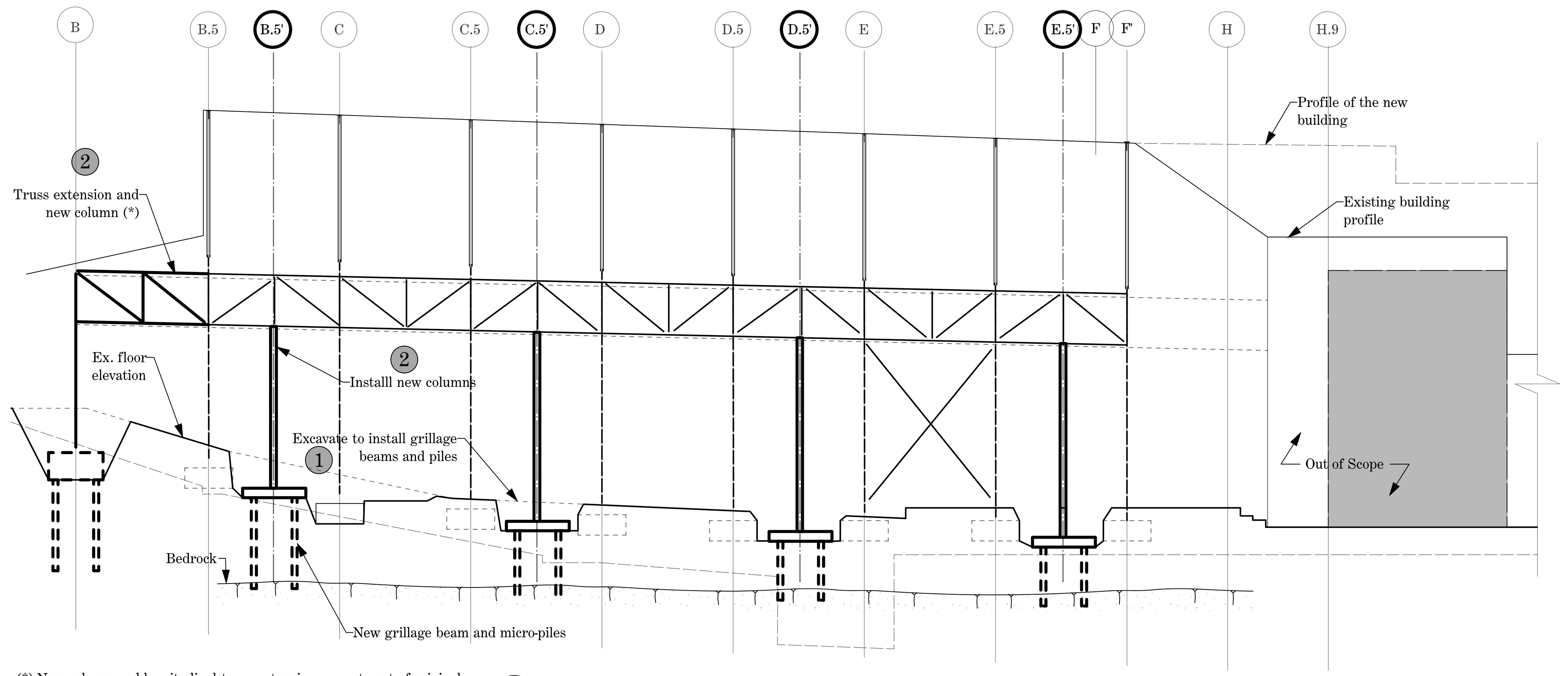
Proposed Sequence.
OPTION B - Steps 1 to 2

Scale: As Shown
Issue Date: May 15, 2015
Drawn by: GP
Project #: J3262.01

Drawing No.
S-SEQ-200.00

OPTION B

STEP 3

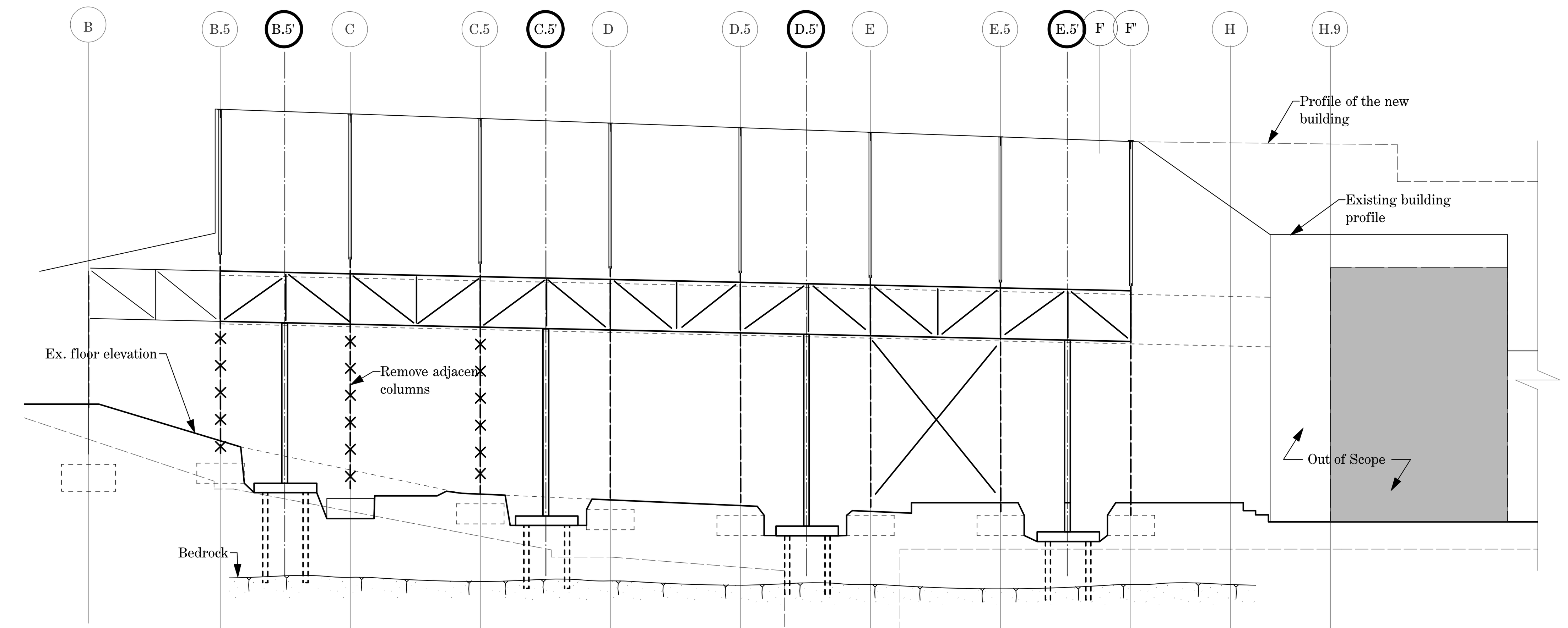


(*) New column and longitudinal truss extension are not part of original building. See Serena Sturm drawings for details.

B.3 STEP 3 - Longitudinal Section. Grid Lines 2 & 8
Scale: 1/16" = 1'-0"

STEP 3
F) Install upper section of new columns on mini-caissons/mini-piles and grillage beams. Transfer load.

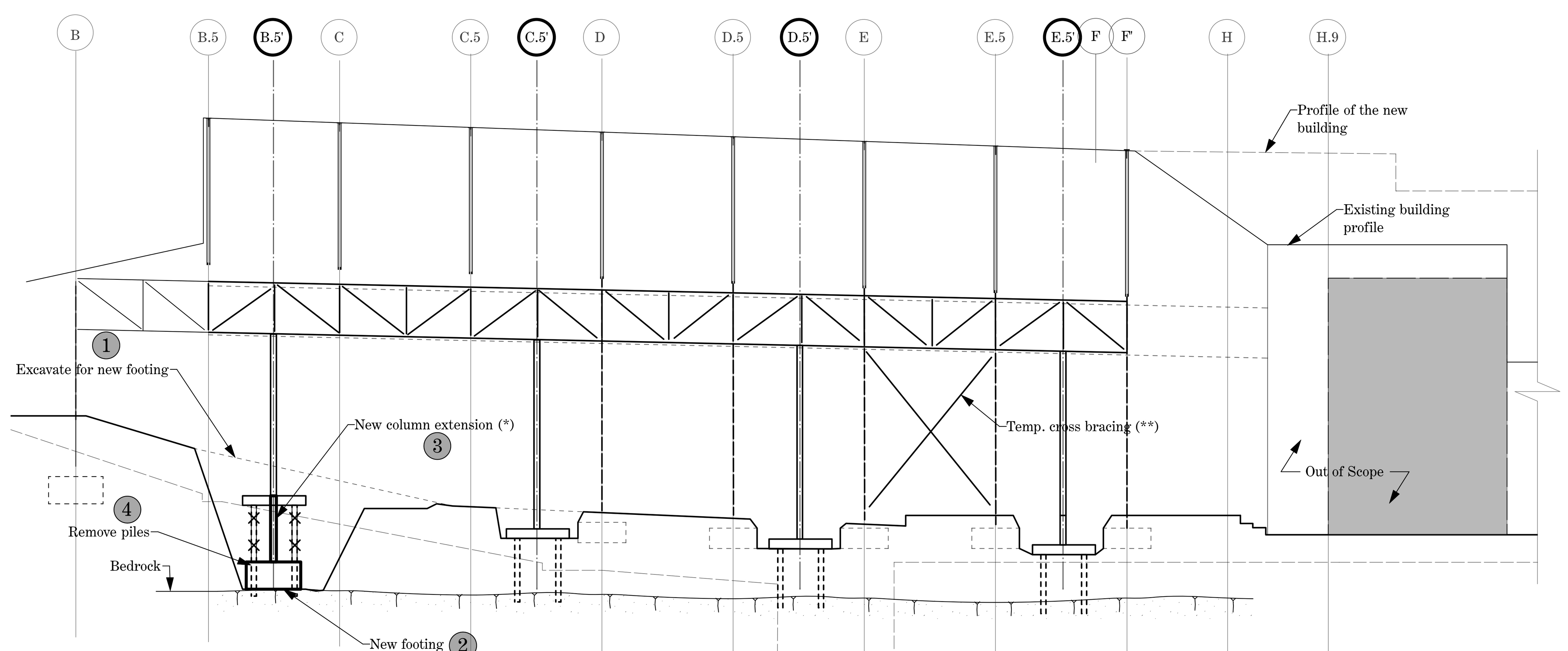
STEP 4



B.4 STEP 4 - Longitudinal Section. Grid Lines 2 & 8
Scale: 1/16" = 1'-0"

STEP 4
G) Remove existing columns adjacent to the first new column.

STEP 5

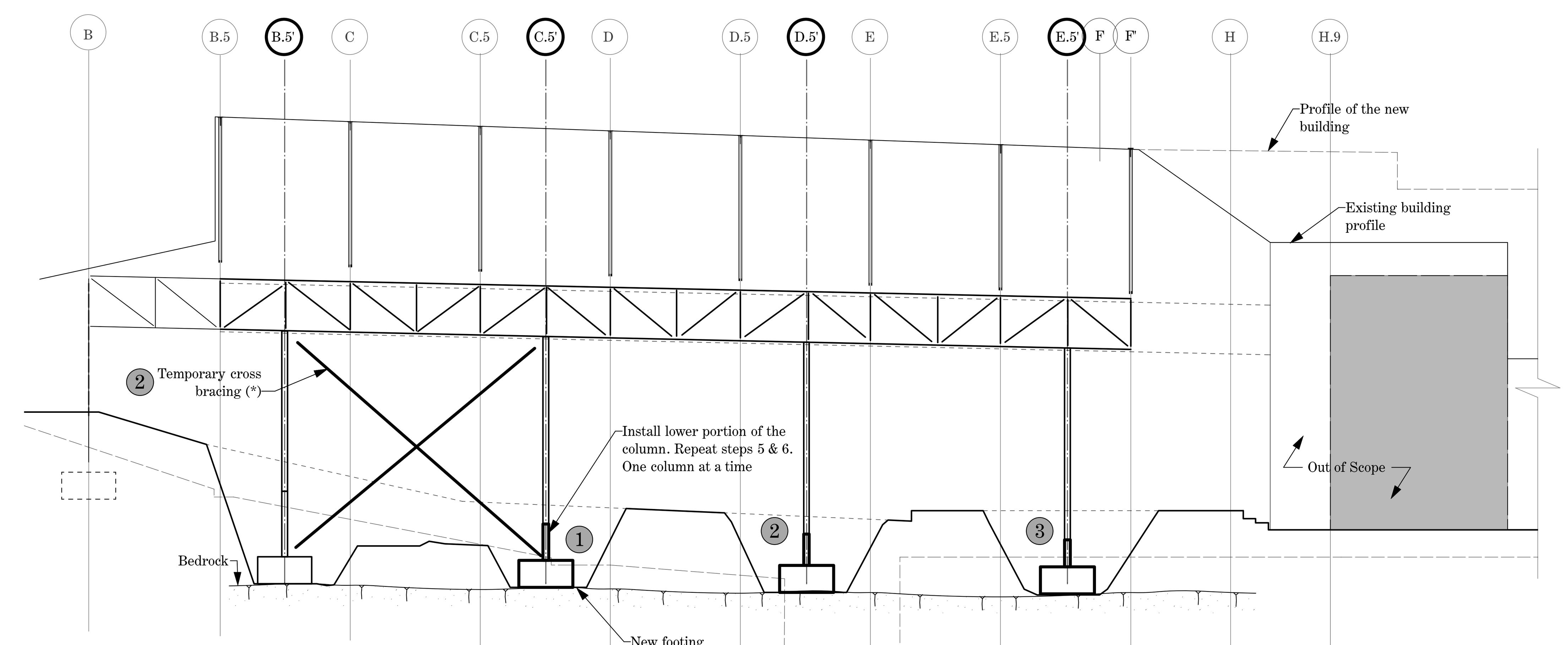


(*) Install new footing, jack new column, install lower portion of the column, and remove helical piles.
(**) Remove cross bracing as new columns are installed, see step 6

B.5 STEP 5 - Longitudinal Section. Grid Lines 2 & 8
Scale: 1/16" = 1'-0"

STEP 5
H) Install new footing and splice bottom section of column to upper portion. Transfer load.

STEP 6



(*) Relocate new temporary bracing between new columns until new building at the east end is capable to provide lateral stability to the structure.

B.6 STEP 6 - Longitudinal Section. Grid Lines 2 & 8
Scale: 1/16" = 1'-0"

STEP 6
I) Repeat two previous steps one column at a time until all new columns are in place.

Old Structures Engineering, PC

111 Broadway
Suite 1405
New York, NY 10006

tel: 212-244-4546
fax: 917-591-2189
information@oldstructures.com

Revisions

No.	Date	Description
01	07/15/15	Proposed Sequence
02	08/03/15	Updated Sequence

PROGRESS SET

Chautauqua Institution
Amphitheater.
Demo-Construction Sequence

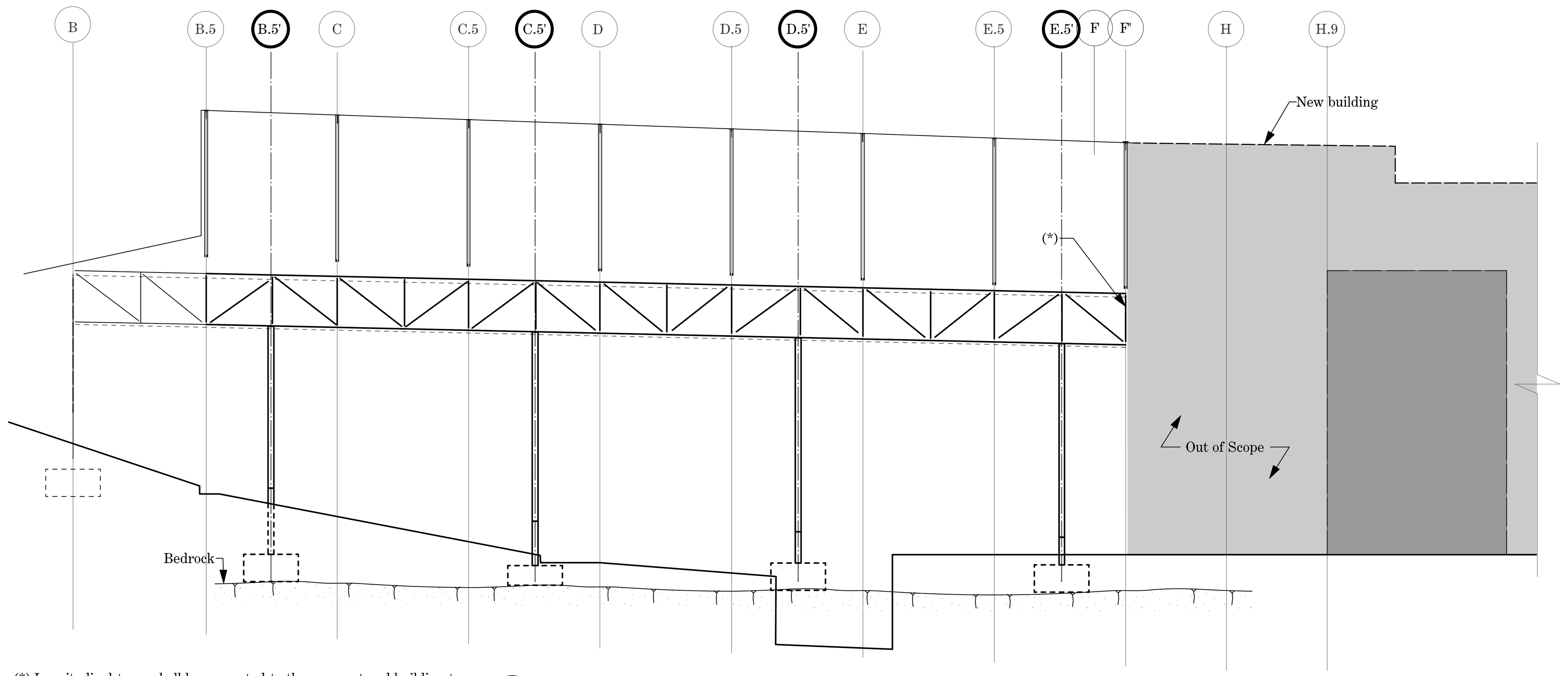
Proposed Sequence.
OPTION B - Steps 4 to 6

Scale: As Shown
Issue Date: May 15, 2015
Drawn by: GP
Project #: J3262.01

Drawing No.
S-SEQ-201.00

OPTION B

STEP 7



(*) Longitudinal truss shall be connected to the new east end building to provide lateral stability.

B.7 STEP 7 - Longitudinal Section. Grid Lines 2 & 8
Scale: 1/16" = 1'-0"

STEP 7
J) Excavate for new bowl structure.

Old Structures Engineering, PC

111 Broadway
Suite 1405
New York, NY 10006

tel: 212-244-4546
fax: 917-591-2189
information@oldstructures.com

Revisions

No.	Date	Description
01	07/15/15	Proposed Sequence
02	08/03/15	Updated Sequence

PROGRESS SET

Chautauqua Institution
Amphitheater.
Demo-Construction Sequence

Proposed Sequence.
OPTION B - Step 7

Scale: As Shown
Issue Date: May 15, 2015
Drawn by: GP
Project #: J3262.01

Drawing No.
S-SEQ-202.00

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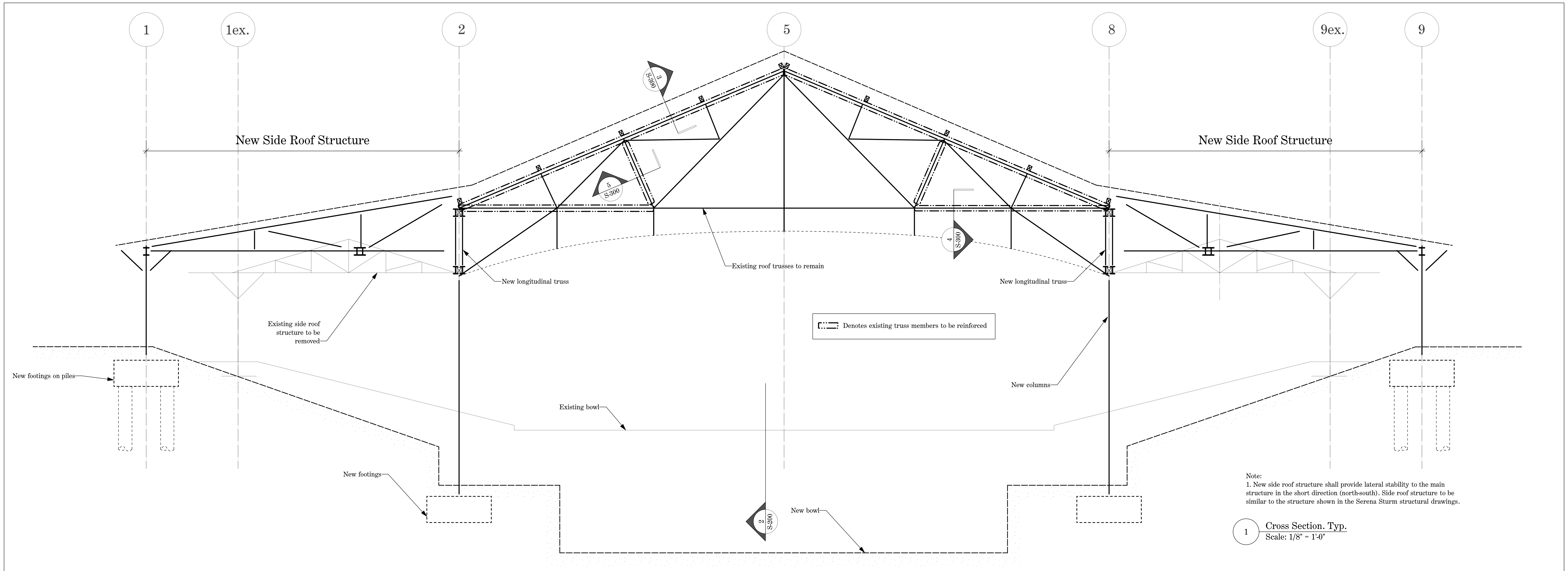
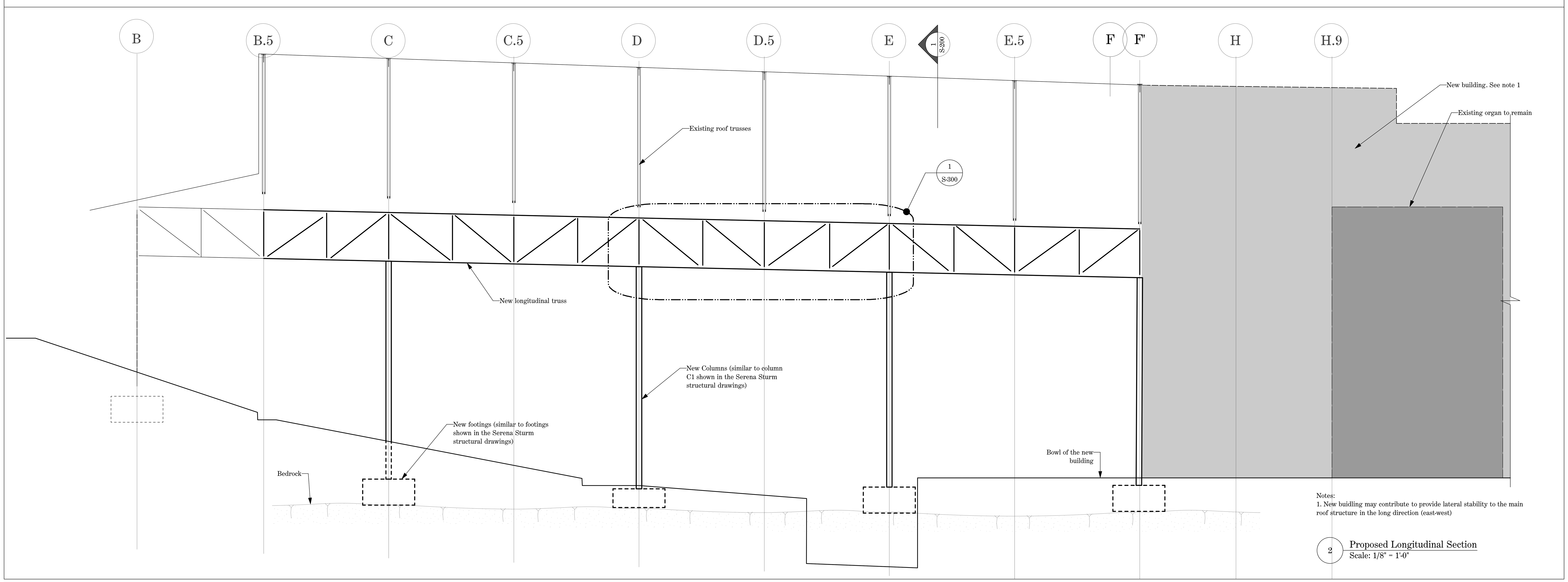
111 Broadway
Suite 1405
New York, NY 10006

tel: 212-244-4546
fax: 917-591-2189
information@oldstructures.com



Note:
1. New side roof structure shall provide lateral stability to the main structure in the short direction (north-south). Side roof structure to be similar to the structure shown in the Serena Sturm structural drawings.

1 Cross Section. Typ.
Scale: 1/8" = 1'-0"



Notes:
1. New building may contribute to provide lateral stability to the main roof structure in the long direction (east-west)

2 Proposed Longitudinal Section
Scale: 1/8" = 1'-0"

Revisions

No.	Date	Description
01	07/15/15	Schematic Design
02	08/03/15	Updated Schematic Design

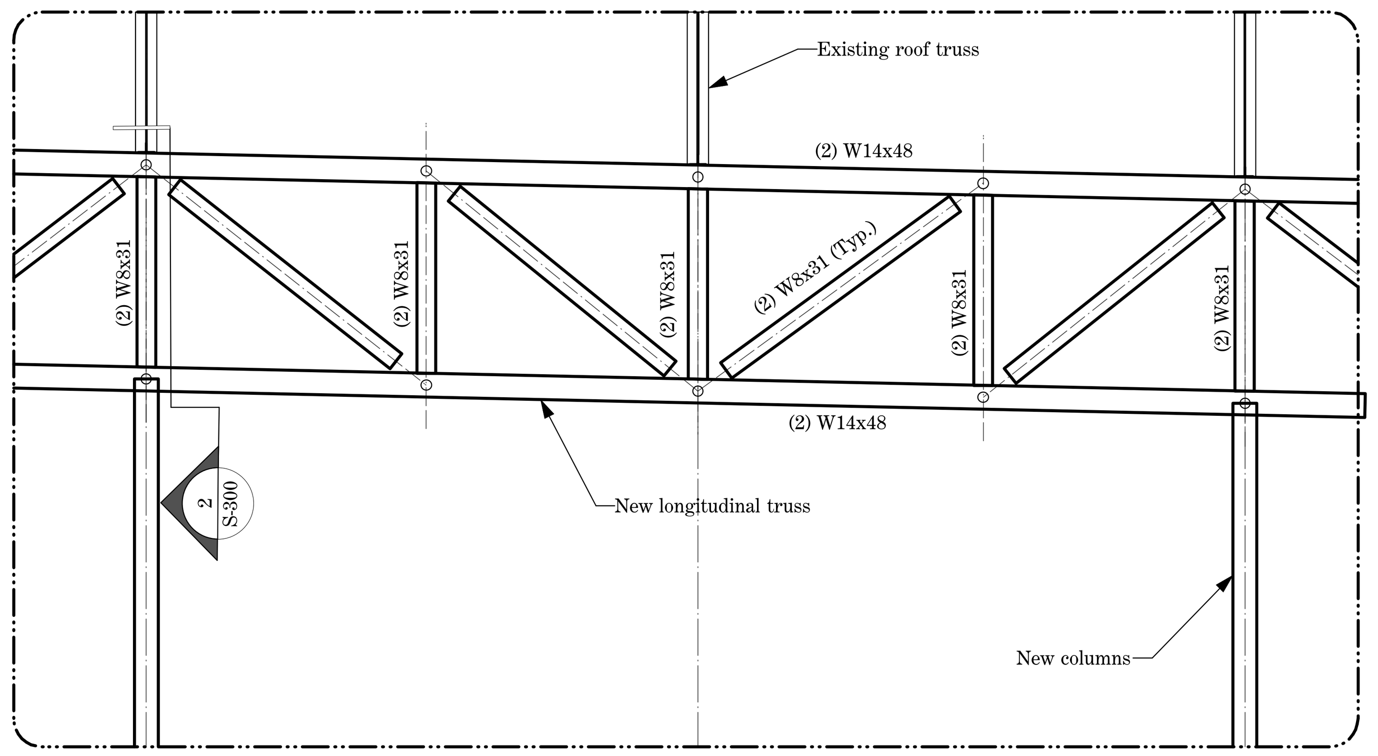
PROGRESS SET

Chautauqua Institution
Amphitheater -
Conceptual Design

Building Sections

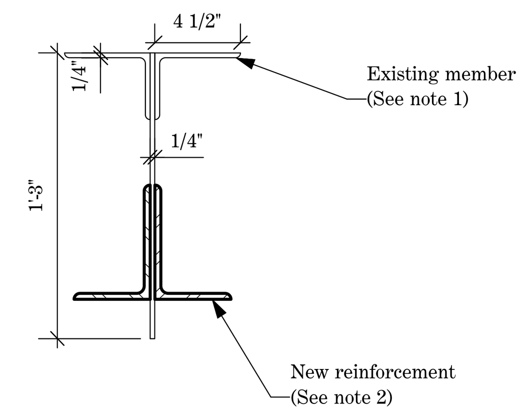
Scale: As Shown
Issue Date: July 15, 2015
Drawn by: GP
Project #: J3262.01

Drawing No.
S-200.00



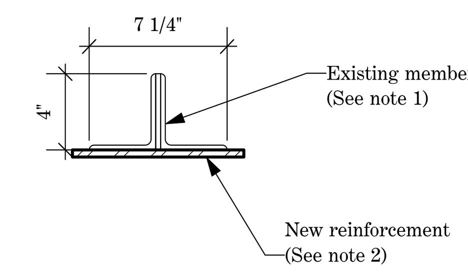
Notes:
1. Member sizes and truss layout are for reference only.

1 Typical New Truss @ Grid Lines 2 & 8
Scale: 3/16" = 1'-0"



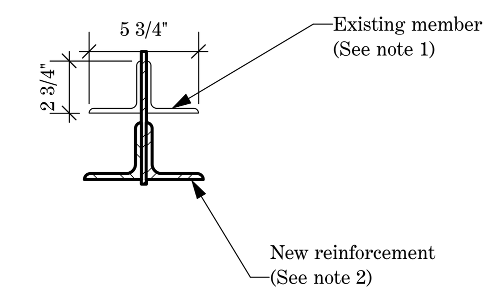
Note:
1. Existing member: (2) L4-1/2"x3-1/2"x1/4" + # 1/4"x15" plate (V.I.F.)
2. New reinforcement: (2) L6x4x5/16

3 Truss Top Chord Reinforcement
Scale: 1 1/2" = 1'-0"



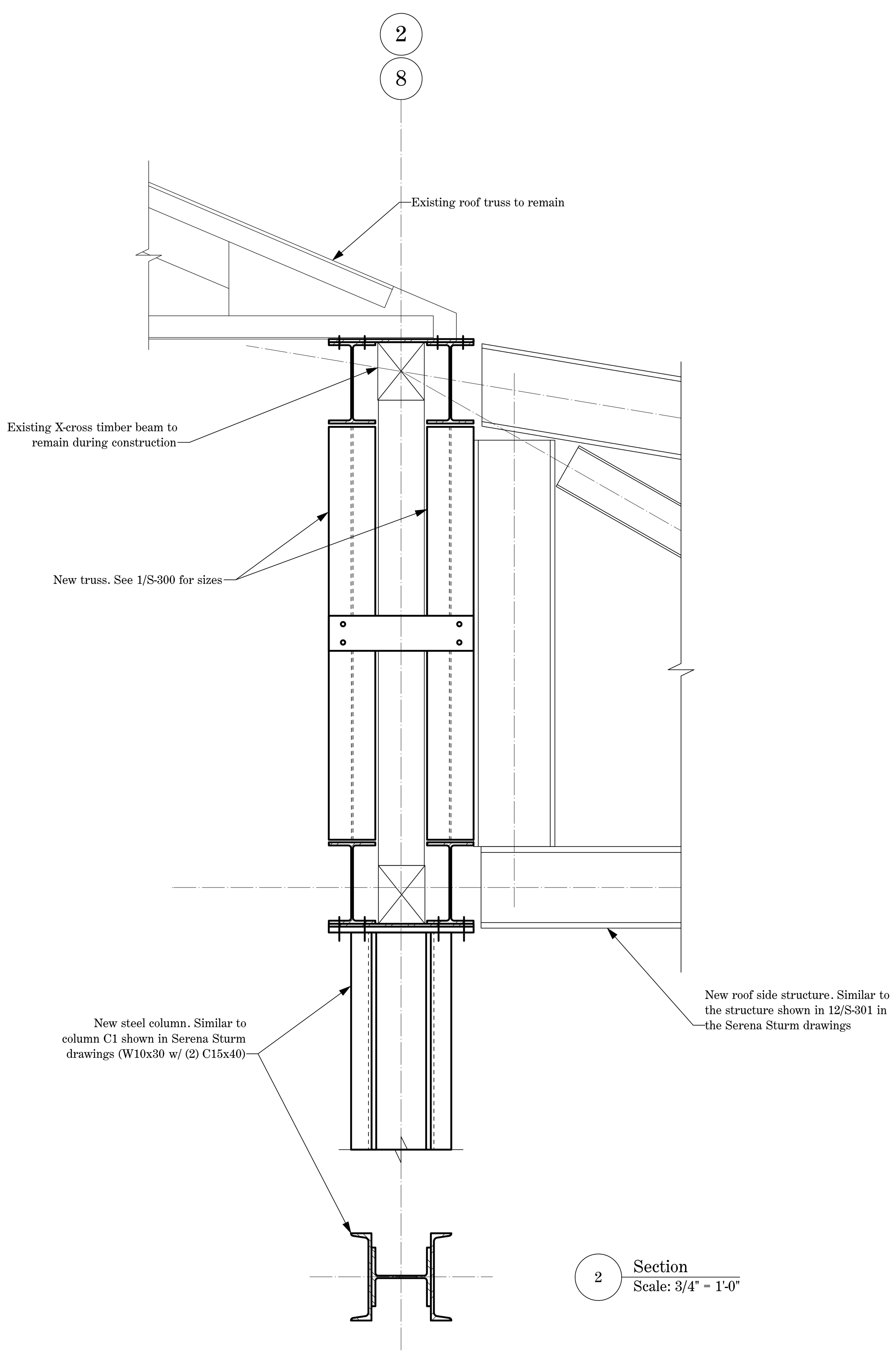
Note:
1. Existing member: (2) L4"x3-1/2"x1/4" + # 1/4"x4" plate (V.I.F.)
2. New reinforcement: # 9"x 3/8" plate

4 Truss Bottom Chord (Ends) Reinforcement
Scale: 1 1/2" = 1'-0"



Note:
1. Existing member: (2) 2-3/4"x2-3/4"x1/4" angles (V.I.F.)
2. New reinforcement: (2) L3x3x5/16 + #7"x1/4" plate

5 Truss Diagonal Reinforcement
Scale: 1 1/2" = 1'-0"



2 Section
Scale: 3/4" = 1'-0"

Old Structures Engineering, PC

111 Broadway
Suite 1405
New York, NY 10006

tel: 212-244-4546
fax: 917-591-2189
information@oldstructures.com

Revisions

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01	07/15/15	Schematic Design
02	08/03/15	Updated Schematic Design

PROGRESS SET

Chautauqua Institution
Amphitheater -
Conceptual Design

Details

Scale: As Shown
Issue Date: July 15, 2015
Drawn by: GP
Project #: J3262.01

Drawing No.
S-300.00