Memorandum

TO: Mr. Chris Yates - Oberlin City Hall ***DATE:*** April 7, 2022
FROM: J. Alberts, P.E.; N. Kacynski, P.E.; B. Klingerman ***FKE PROJ. NO:*** 22-025

SUBJECT: Permanent Shoring System for Support of Existing Floor Slab
Historic Gasholder Building
Oberlin, Ohio

In accordance with our proposal dated March 2, 2022, we have developed a final design and details for the permanent shoring system to be constructed as support for the existing floor slab in the Historic Gasholder Building. We understand this design will be advertised for bidding to construct the design.

The Historic Gasholder Building, constructed in 1889, is a historic landmark in Oberlin, Ohio with a brick exterior, concrete floors, and a timber roof. The building is approximately 50 feet in diameter and contains a single ground level floor and a basement. The main floor was constructed of minimally reinforced concrete with embedded steel beams and is roughly 13 to 18 inches thick. Originally the floor spanned the entire 50-foot diameter without intermediate supports however, over time significant cracking of the slab has been observed and various repairs/shoring solutions have been implemented.

Based on the inspection report prepared by KS Associates in July of 2019, the following repairs/shoring solutions are currently in place:

- Center Masonry Column between the basement slab and ground level slab. Constructed in 2014.
- Steel support frame centered on slab extending from basement slab to ground level slab, consisting of 4 beams and 8 columns. Approximate footprint of 22.3' x 21'. Installation date is unknown, but significant deterioration is present on the steel frame (estimated section loss of up to 20%).
- Temporary Shoring has been installed beneath the embedded steel beams in the ground level slab. Temporary shoring generally consists of a scaffolding type structure with screw jacks extended against a wooden block to support the embedded beams. Significant deterioration was noted, with up to 100% section loss.

In addition to the inspection report by KS Associates, FKE performed a site visit to conduct a building inspection, concrete coring, and a concrete analysis. The analysis and concrete coring concluded that the original main floor slab has a compression strength of at least 5500 pounds per square inch and the slab contains minimal reinforcing bars aside from the embedded steel beams mentioned above. For further information on the field investigation, see the attached "Daily Field Report" dated 9/1/2021.

The City of Oberlin has requested we design a permanent shoring system as a replacement for the current systems in place. The permanent shoring system design is shown herein and generally consists of a 32-foot outside diameter, 12-inch-thick reinforced concrete wall spanning vertically, roughly 16 feet, from the basement floor to the existing ground level floor slab. The proposed wall will rest on the existing basement floor slab. Inside of the concrete wall, cellular grout will be placed filling the annular space entirely. Access/return holes will be drilled through the existing main floor slab to pour the cellular grout. Placement of material will be deemed complete when it is seeping through each return hole. All existing shoring and support systems within the proposed 32-foot diameter wall will be abandoned in place, and existing shoring outside of the limits of the wall can be removed following completion of grouting.

After completion of the concrete wall and grouting operations, the central 32 feet of the 50-foot diameter floor slab will be fully supported. The remaining span, between the edge of the new concrete wall and the existing foundation, will be approximately 9 feet. Based on our previous memorandum "Support of Existing Floor Slab", dated 9/13/2021, and the associated field investigation, the existing concrete slab will be able to safely span this distance and support all anticipated future loads.

If conditions differ significantly from those assumed, or if you require further assistance, please do not hesitate to contact FK Engineering.

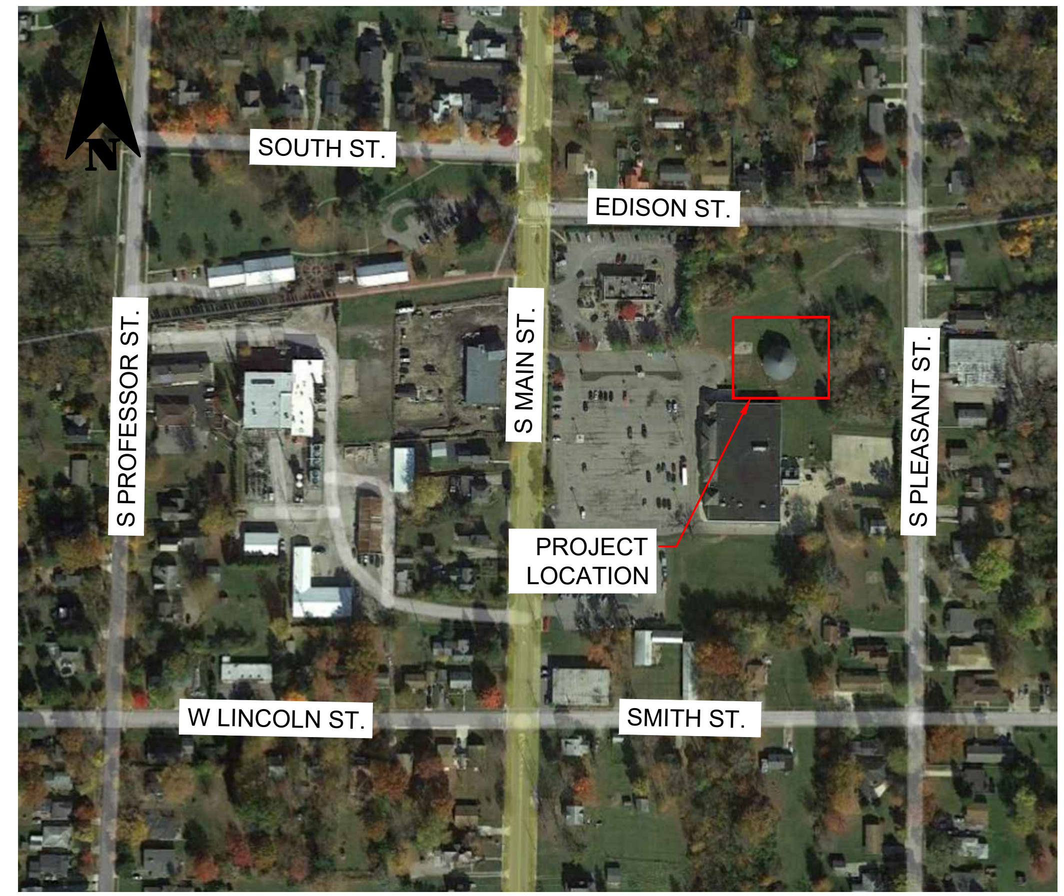
References:

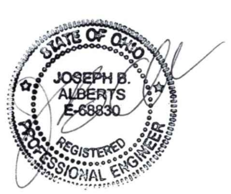
Support of Existing Floor Slab Memo dated 9/13/21 prepared by FKE
ACI 318-11
Communication with the City of Oberlin
ASCE 7-10

Design Drawings

OBERLIN GAS HOLDER BUILDING

CITY OF OBERLIN, OHIO





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CONCRETE:

1. ALL STRUCTURAL CONCRETE TO HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS.
2. ALL REINFORCING STEEL TO BE ASTM A615 DEFORMED, FY = 60 KSI.
3. ALL CONCRETE MATERIALS, MIXING, TESTING, FORMING AND PLACEMENT SHALL BE IN ACCORDANCE WITH THE CURRENT ODOT CONSTRUCTION AND MATERIAL SPECIFICATIONS.
4. SUBMIT THE JOB MIX FORMULA (JMF) TO THE ENGINEER A MINIMUM OF 10 DAYS PRIOR TO PLACING CONCRETE.
5. FOR CONCRETE POURS WITH DIMENSIONS 5-FOOT OR GREATER, DEVELOP A MIX DESIGN FOR MASS CONCRETE AS WELL AS A THERMAL CONTROL PLAN AND SUBMIT EACH TO THE ENGINEER FOR APPROVAL ALONG WITH THE JMF.
6. NOTIFY ENGINEER A MINIMUM OF 24 HOURS PRIOR TO COMMENCEMENT OF CONCRETING OPERATIONS.
7. NORMAL WEIGHT CONCRETE TO BE USED EXCEPT WHERE NOTED OTHERWISE.
8. FURNISH TO ENGINEER COPIES OF ALL DELIVERY TICKETS FOR EACH LOAD OF CONCRETE DELIVERED TO THE SITE.
9. OBTAIN CEMENTITIOUS MATERIALS FROM THE SAME SOURCE THROUGHOUT.
10. ALL CONCRETE SHALL BE MACHINE MIXED. HAND MIXING WILL NOT BE PERMITTED.
11. CONCRETE SHALL BE CONVEYED AS RAPIDLY AS PRACTICABLE TO THE POINT OF DEPOSIT BY METHODS WHICH PREVENT THE SEPARATION OR LOSS OF THE INGREDIENTS. DISCHARGE OF THE CONCRETE TO ITS POINT OF DEPOSIT SHALL BE COMPLETED WITHIN 90 MINUTES OF THE INITIAL MIXING.
12. THE CONTRACTOR SHALL MAKE CYLINDERS FOR COMPRESSIVE STRENGTH TESTS AS WELL AS SLUMP TESTS FOR CONSISTENCY AND TESTS FOR AIR CONTENT CONCURRENTLY AT THE JOBSITE.
13. A MINIMUM OF ONE TEST FOR SLUMP AND ONE TEST FOR AIR CONTENT SHALL BE TAKEN FOR EACH 25 CUBIC YARDS, OR PORTION THEREOF, OF CONCRETE PLACED. MINIMUM OF ONE TEST FOR SLUMP AND ONE TEST FOR AIR CONTENT PER LIFT. THE ENGINEER MAY ORDER ADDITIONAL TESTING TO ASSURE QUALITY CONCRETE SHOULD TEST RESULTS SO DICTATE. TESTS MAY ALSO BE MADE BY THE ENGINEER WHEN CONCRETE IS BEING PLACED.
14. AIR CONTENT TESTS SHALL BE IN ACCORDANCE WITH ASTM C231 OR C173.
15. THE CONSISTENCY OF CONCRETE MIXES SHALL BE DETERMINED BY THE SLUMP CONE TEST AS SPECIFIED IN ASTM C143.
16. COMPRESSION TEST SPECIMENS SHALL BE PREPARED IN ACCORDANCE WITH ASTM C31 WITH 1 SET OF 4 STANDARD CYLINDERS FOR EACH COMPRESSIVE-STRENGTH TEST, UNLESS OTHERWISE DIRECTED. COMPRESSIVE-STRENGTH TESTS SHALL FOLLOW ASTM C39 WITH 1 SET FOR EACH DAY'S POUR EXCEEDING 5 CYDS. MINIMUM OF ONE SET OF 4 STANDARD CYLINDERS FOR EACH LIFT. TEST 1 SPECIMEN AT 7 DAYS, 2 SPECIMENS AT 28 DAYS AND HOLD 1 SPECIMEN IN RESERVE FOR LATER TESTING IF REQUIRED.
17. CONCRETE MATERIALS SHALL BE SO FURNISHED, HANDLED, AND STORED AS TO PRECLUDE INCLUSION OF FOREIGN MATTER AND PERMIT EASY ACCESS FOR INSPECTION. HANDLING METHODS AND STORAGE FACILITIES SHALL BE SUBJECT TO THE APPROVAL OF THE ENGINEER.
18. CONCRETE SHALL BE COMPOSED OF A MIXTURE OF PORTLAND CEMENT, FINE AGGREGATE, COARSE AGGREGATE, FLY ASH, ADMIXTURES WHEN SPECIFIED AND WATER. THE MATERIALS AND METHODS USED SHALL PRODUCE A DENSE, HOMOGENOUS IMPERVIOUS, DURABLE AND WORKABLE CONCRETE OF THE HIGHEST QUALITY AND WITHOUT DEFECTS OF ANY KIND.
19. CONCRETE FORMS SHALL BE A SMOOTH SURFACE FREE FROM DISTORTION AND OF SUFFICIENT STRENGTH TO RESIST FORCES APPLIED DURING THE PROCESS OF PLACING CONCRETE AGAINST THEM. CURVED FORMS SHALL BE ACCURATELY FORMED TO TRUE RADIUS AND HELD TO MAINTAIN THE TRUE CURVE DURING THE PROCESS OF PLACING CONCRETE.
20. ASSEMBLE FORMWORK TO PERMIT EASY STRIPPING AND DISMANTLING WITHOUT DAMAGING CONCRETE.
21. READY MIX CONCRETE FROM AN APPROVED SOURCE SHALL BE USED UNLESS ON-THE-SITE MIXING IS AUTHORIZED BY THE ENGINEER. THE PLANT AND TRANSPORTATION EQUIPMENT AND THE METHODS USED FOR PRODUCING AND DELIVERING THE READY-MIXED CONCRETE SHALL CONFORM TO THE CURRENT ASTM STANDARD C94 EXCEPT AS OTHERWISE MODIFIED HEREIN.
22. THE ENGINEER'S DETERMINATION OF "FAILURE TO MEET STRENGTH REQUIREMENTS" OF ASTM C94, SHALL BE FINAL AND CONCLUSIVE UPON THE CONTRACTOR. SUCH DETERMINATION WILL BE BASED ON TESTS AND OTHER FACTUAL DATA DEEMED PERTINENT BY THE ENGINEER.
23. STEEL REINFORCEMENT SHALL BE PROPERLY SPACED AND HELD IN THE CORRECT POSITION DURING THE PLACING OF CONCRETE BY THE USE OF DEVICES OR METHODS MEETING THE APPROVAL OF THE ENGINEER.
24. SPLICING OF STEEL REINFORCEMENT BARS SHALL BE ACCOMPLISHED BY LAPPING AND SECURELY WIRING THE BARS TOGETHER. THE BARS SHALL BE LAPPED AS SPECIFIED HEREIN.
25. CONCRETE SHALL NOT EXCEED A FREEFALL DISTANCE MORE THAN 6 INCHES TO THE TOP OF THE REINFORCING STEEL OR 5 FEET IN OTHER STRUCTURAL APPLICATIONS.
26. CONCRETE SHALL BE THOROUGHLY CONSOLIDATED WITH THE USE OF MECHANICAL VIBRATION OR ENGINEER APPROVED EQUIVELANT. CONSOLIDATION SHALL CONFORM TO ACI 309. VIBRATORS SHALL BE USED AT 18" TO 30" INTERVALS IN THE CONCRETE. MECHANICAL VIBRATION SHALL BE APPLIED DIRECTLY TO THE CONCRETE, UNLESS OTHERWISE APPROVED BY THE ENGINEER. INTENSITY OF THE VIBRATION SHALL BE SUFFICIENT TO CAUSE SETTLEMENT OF THE CONCRETE INTO PLACE AND TO PRODUCE MONOLITHIC JOINING WITH THE PRECEDING LAYER. VIBRATIONS SHALL NOT BE CONTINUED IN ANY ONE LOCATION TO THE EXTENT THAT POOLS OF GROUT ARE FORMED.
27. CONCRETE FORMWORK AND ASSOCIATED SUPPORTS MAY NEED TO BE CAST AND LEFT IN PLACE FOR INTERIOR OF CONCRETE WALL.

CONCRETE REINFORCEMENT:

1. ALL REINFORCING STEEL MATERIAL AND PLACEMENT SHALL COMPLY WITH THE CURRENT ODOT CONSTRUCTION AND MATERIAL SPECIFICATIONS.
2. ALL REINFORCING STEEL SHALL BE FREE FROM DEFECTS AND BENDS NOT SHOWN ON THE DRAWINGS.
3. BARS USED FOR CONCRETE REINFORCEMENT SHALL BE FABRICATED IN ACCORDANCE WITH THE FABRICATING TOLERANCES GIVEN IN ACI 315.
4. STORE REINFORCEMENT AND ACCESSORIES ABOVE GROUND ON PLATFORMS, SKIDS OR OTHER SUPPORTS AND PROTECT FROM WEATHER AT ALL TIMES WITH SUITABLE COVERAGE. REINFORCEMENT SHALL BE STORED IN AN ORDERLY MANNER PLAINLY MARKED TO FACILITATE INSPECTION AND CHECKING.
5. PROTECT REINFORCEMENT FROM RUSTING, DEFORMING, BENDING, KINKING AND OTHER DAMAGE.
6. NEWLY ROLLED DEFORMED BILLET-STEEL BARS FOR CONCRETE REINFORCEMENT SHALL CONFORM TO ASTM A615, GRADE 60, UNLESS OTHERWISE INDICATED. BAR SIZES NO. 3 AND LARGER SHALL BE DEFORMED.
7. REINFORCING SHALL BE MILLED AND COLD BENT. CONFORM TO DIMENSIONS INDICATED AND MEET THE REQUIREMENTS OF ACI SP-66.
8. TIE WIRE SHALL BE OF MILD STEEL OR ANNEALED IRON, 16 GAGE OR HEAVIER.
9. USE BOLSTERS, CHAIRS, SPACERS AND OTHER DEVICES FOR SPACING, SUPPORTING, AND FASTENING REINFORCING BARS AND WELDED WIRE FABRIC IN PLACE. USE WIRE BAR-TYPE SUPPORTS COMPLYING WITH CRSI SPECIFICATIONS.
10. BEFORE PLACING IN FORM, THOROUGHLY CLEAN REINFORCEMENT AND ACCESSORIES FREE OF MORTAR, OIL, DIRT, LOOSE MILL SCALE, LOOSE OR THICK RUST, AND COATINGS OF ANY CHARACTER THAT WOULD DESTROY OR REDUCE THE BOND WITH THE CONCRETE.
11. ACCURATELY PLACE REINFORCING BARS AND SECURE IN POSITION USING TIE WIRE WITH ENDS POINTED AWAY FROM FORMS.
12. PLACING BARS ON LAYERS OF FRESH CONCRETE AS THE WORK PROGRESSES, AND ADJUSTING BARS DURING THE PLACEMENT OF CONCRETE IS NOT PERMITTED.
13. DO NOT FIELD BEND BARS UNLESS INDICATED OR AUTHORIZED BY THE ENGINEER. DO NOT STRAIGHTEN OR BEND IN MANNER INJURIOUS TO STEEL OR CONCRETE.
14. DO NOT PLACE BARS THAT HAVE KINKS AND BENDS OTHER THAN SHOWN ON APPROVED SHOP DRAWINGS. REJECT AND REMOVE SUCH DAMAGED BARS AND REPLACE AT NO ADDITIONAL COMPENSATION.
15. DO NOT USE HEAT TO BEND OR STRAIGHTEN REINFORCING STEEL.
16. IN CASE THERE IS A DELAY IN PLACING CONCRETE AFTER THE STEEL HAS BEEN PLACED, THE STEEL SHALL BE REINSPECTED AND, WHEN NECESSARY, RECLEANED PRIOR TO PLACEMENT OF CONCRETE.
17. THE MINIMUM CENTER-TO-CENTER DISTANCE BETWEEN PARALLEL BARS SHALL BE TWO AND ONE-HALF TIMES THE DIAMETER OF THE BARS. END-HOOKED BARS SHALL HAVE A MINIMUM CENTER TO CENTER SPACING OF TWO TIMES THE DIAMETER OF THE BARS. IN NO CASE SHALL THE CLEAR SPACING BETWEEN BARS BE LESS THAN ONE INCH, NOR LESS THAN ONE AND ONE-THIRD TIMES THE MAXIMUM SIZE OF THE COARSE AGGREGATE.
18. THE CLEAR DISTANCE BETWEEN THE REINFORCING STEEL AND THE FACE OF THE CONCRETE SHALL BE MAINTAINED AT ALL POINTS IN ORDER THAT THE DESIGNED STRENGTH OF THE STRUCTURE SHALL NOT BE REDUCED.
19. ALL REINFORCEMENT SHALL BE SUPPORTED AND FASTENED TOGETHER TO PREVEND DISPLACEMENT BY CONSTRUCTION LOADS OR THE PLACING OF CONCRETE.
20. VERTICAL BARS SHALL BE OFFSET AT LEAST ONE BAR DIAMETER AT LAPPED SPLICES.
21. ALL SPLICES NOT INDICATED ON THE PLANS SHALL BE SUBJECT TO ACCEPTANCE. MECHANICAL CONNECTIONS FOR REINFORCING BARS THAT MAY BE USED SHALL BE SUBJECT TO ACCEPTANCE.
22. DO NOT FIELD CUT REINFORCEMENT WITHOUT ENGINEERS PERMISSION.
23. UNLESS PERMITTED BY THE ENGINEER, REINFORCEMENT SHALL NOT BE BENT AFTER BEING EMBEDDED IN HARDENED CONCRETE.
24. DOWELS AND EXPOSED REINFORCING BARS INTENDED FOR BONDING WITH FUTURE CONSTRUCTION SHALL BE PROTECTED FROM CORROSION IN A MANNER APPROVED BY THE ENGINEER. ALL DOWELS SHALL BE PLACED BEFORE THE CONCRETE IS PLACED.

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OBERLIN GAS HOLDER BUILDING
SHORING SYSTEM - GENERAL NOTES
OBERLIN, OHIO

FIGURE NO. 1

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CELLULAR GROUT:

1. MAXIMUM UNIT WEIGHT OF CLSM TO BE 100 PCF.
2. MINIMUM 28 DAY COMPRESSIVE STRENGTH OF CELLULAR GROUT TO BE 200 PSI.
3. ALL GROUT MATERIALS, MIXING, TESTING, AND PLACING TO BE IN ACCORDANCE WITH THE CURRENT ODOT CONSTRUCTION AND MATERIAL SPECIFICATIONS.
4. SUBMIT A TEST REPORT OF SPECIFIED MATERIAL PROPERTIES TO BE USED TO THE ENGINEER A MINIMUM OF 10 DAYS PRIOR TO PLACEMENT. THE MIX DESIGN SHALL SHOW SOURCE AND TYPE OR CLASS OF MATERIALS AND BATCH PROPORTIONS.
5. THE CONTRACTOR SHALL MAKE CYLINDERS AND PERFORM FLOW CONSISTENCY AND DENSITY TESTS AT THE JOBSITE. THE TESTING SHALL BE PERFORMED PRIOR TO PLACEMENT. SAMPLING AND TESTING SHALL BE IN ACCORDANCE WITH ASTM 5971, ASTM D4832, ASTM D6103, ASTM 6023, AND ASTM D4832.
6. A MINIMUM OF FOUR 3X6 CYLINDERS, ONE FLOW CONSISTENCY TEST, AND ONE DENSITY TEST SHALL BE PERFORMED FOR EACH DAY'S POUR EXCEEDING 5 CYDS PLUS ADDITIONAL COLLECTION AND TESTING FOR EACH 50 CYDS MORE THAN THE FIRST 25 CYDS PLACED IN ANY ONE DAY. ENGINEER MAY ORDER ADDITIONAL TESTING TO ASSURE QUALITY CLSM. ONE CYLINDER SHALL BE TESTED AT 7 DAYS, ONE AT 28 DAYS AND THE OTHER TWO IN RESERVE FOR LATER TESTING IF REQUIRED, UNLESS DIRECTED OTHERWISE BY ENGINEER.
7. CLSM SHALL CONSIST OF VARIABLE QUANTITIES OF TYPE 1 PORTLAND CEMENT CONFORMING WITH ASTM C150, FOAMING AGENT, AND WATER MIXED TOGETHER AND UTILIZED AS A CONTROLLED LOW DENSITY FILL. OPTIONAL MATERIALS MAY BE USED WITH THE APPROVAL OF THE ENGINEER.
8. FOAMING AGENT SHALL CONFORM TO ASTM C796.
9. IF USED, FLY ASH SHALL MEET THE REQUIREMENTS OF ASTM C618 CLASS C OR CLASS F WITH NO LIMIT ON LOSS OF IGNITION AND SHALL BE COMPATIBLE WITH FOAMING AGENT.
10. IF USED, AIR-ENTRAINING ADMIXTURE SHALL BE USED IN ACCORDANCE WITH THE FOAM MANUFACTURERE'S RECOMMENDATION AND SHALL BE INCLUDED IN THE MIX DESIGN AND TRIAL BATCHES.
11. PRIOR TO THE PLACEMENT OF CELLULAR GROUT, THE SURFACES SHALL BE CLEAR OF ALL DEBRIS AND ANY WATER ON THE SURFACE SHALL BE REMOVED.
12. CELLULAR GROUT SHALL BE PLACED IN A MAXIMUM OF 4-FOOT LIFTS.
13. A MINIMUM TIME BETWEEN LIFT PLACEMENTS SHALL PASS SUCH THAT THE PRECEDING LIFT IS ALLOWED TO CURE AND COOL TO A TEMPERATURE OF 90 DEGREES FAHRENHEIT PRIOR TO PLACEMENT OF SUBSEQUENT LIFTS.
14. THE BATCHING EQUIPMENT WILL HAVE DEVICES DESIGNED TO MEASURE THE SPECIFIED QUANTITIES OF EACH COMPONENT MATERIAL, AND MIXING WILL BE OF SUFFICIENT DURATION TO INSURE UNIFORM CONSISTENCY OF THE MIXTURE. NO WATER WILL BE ADDED TO THE MIXTURE AFTER BATCHING.
15. PLACEMENT SHALL BE DONE SO EVENLY WITHIN THE SUPPORT WALLS SUCH THAT THE HEIGHT OF THE MATERIAL IS APPROXIMATELY LEVEL THROUGHOUT.

GENERAL NOTES

1. ALL WORK AND MATERIALS SHALL BE IN ACCORDANCE WITH THE CURRENT ODOT CONSTRUCTION AND MATERIAL SPECIFICATIONS.
2. THE FIGURES SHOWN ON THESE SHEETS PRESENT THE DESIGN FOR THE 32-FOOT DIAMETER SUPPORT WALL FOR THE MAIN FLOOR SLAB IN FOR THE OBERLIN GAS HOLDER BUILDING PROJECT.
3. ROUGHEN ALL JOINT SURFACES TO ICRI ROUGHNESS OF 6 ($\frac{1}{4}$" AMPLITUDE).
4. FILL THE INSIDE OF THE STRUCTURAL WALL WITH CLSM. PLACE LIFTS IN NOT GREATER THAN 4 FEET. DO NOT PLACE CLSM MATERIAL UNTIL ALL STRUCTURAL CONCRETE HAS REACHED A MINIMUM COMPRESSIVE STRENGTH OF 4,000 PSI.
5. SUPPORT WALL TO BE CONSTRUCTED ON TOP OF EXISTING BASEMENT FLOOR. THOROUGHLY POWERWASH AND REMOVE ALL DEBRIS FROM BASEMENT FLOOR SURFACE AND THE BOTTOM OF THE GROUND LEVEL FLOOR SLAB BEFORE FORMING/POURING CONCRETE.
6. PROVIDE 2" COVER ON ALL STEEL.
7. PROVIDE 47" CLASS B LAP SPLICES FOR ALL HORIZONTAL STEEL. ALL SPLICES TO BE STAGGERED AT LEAST 24 INCHES. ADJACENT HOOP REINFORCEMENT LAP SPLICES SHALL NOT COINCIDE IN VERTICAL ARRAY MORE FREQUENTLY THAN EVERY THIRD BAR.
8. TERMINATE ALL NON-CONTINUOUS BAR ENDS WITH 90° OR 180° STD. HOOKS.
9. SUBMIT REINFORCING STEEL SHOP DRAWINGS FOR ENGINEER REVIEW. DETAIL IN ACCORDANCE WITH ACI-318-11.
10. SUBMIT DETAILS FOR ENGINEER'S REVIEW REGARDING THE METHOD OF PLACEMENT OF THE FINAL POUR OF THE CONCRETE WALL TO ENSURE CONTINUOUS CONTACT BETWEEN THE NEWLY CONSTRUCTED WALL AND EXISTING SLAB.
11. IF ADDITIONAL RELIEF/ACCESS HOLES ARE REQUIRED BEYOND THOSE SHOWN ON THE PLANS, SUBMIT DETAILS TO ENGINEER FOR REVIEW.

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OBERLIN GAS HOLDER BUILDING
SHORING SYSTEM - GENERAL NOTES
OBERLIN, OHIO

FIGURE NO. 2

STATE OF OHIO JOSEPH B. ALBERTS E-68830 REGISTERED PROFESSIONAL ENGINEER

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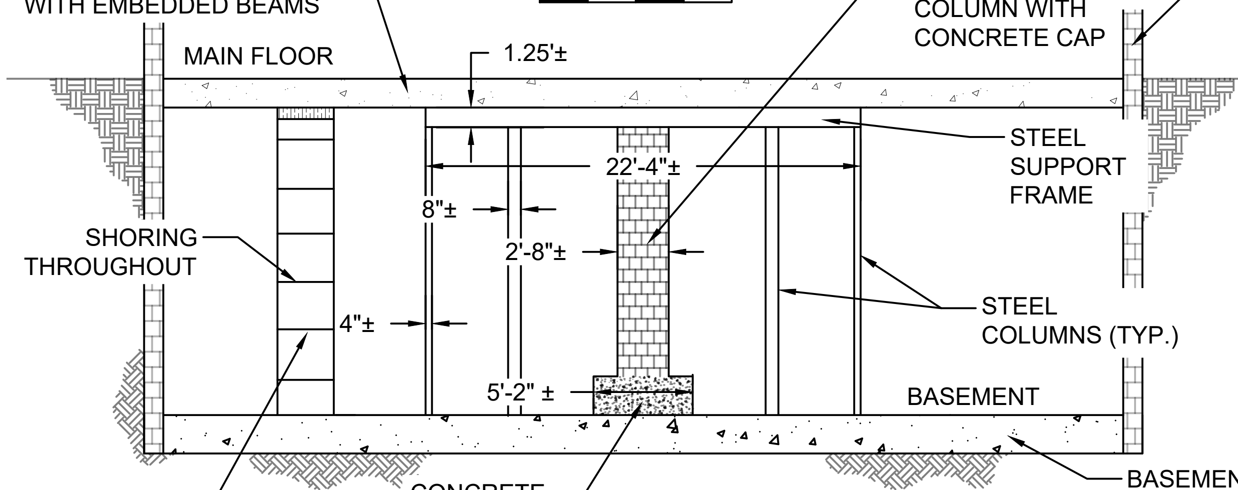
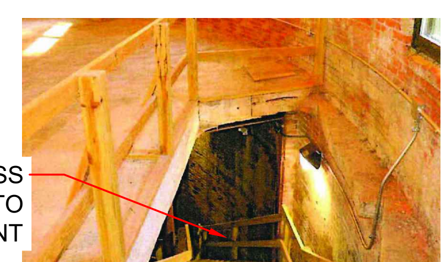
BASEMENT - SECTION AA

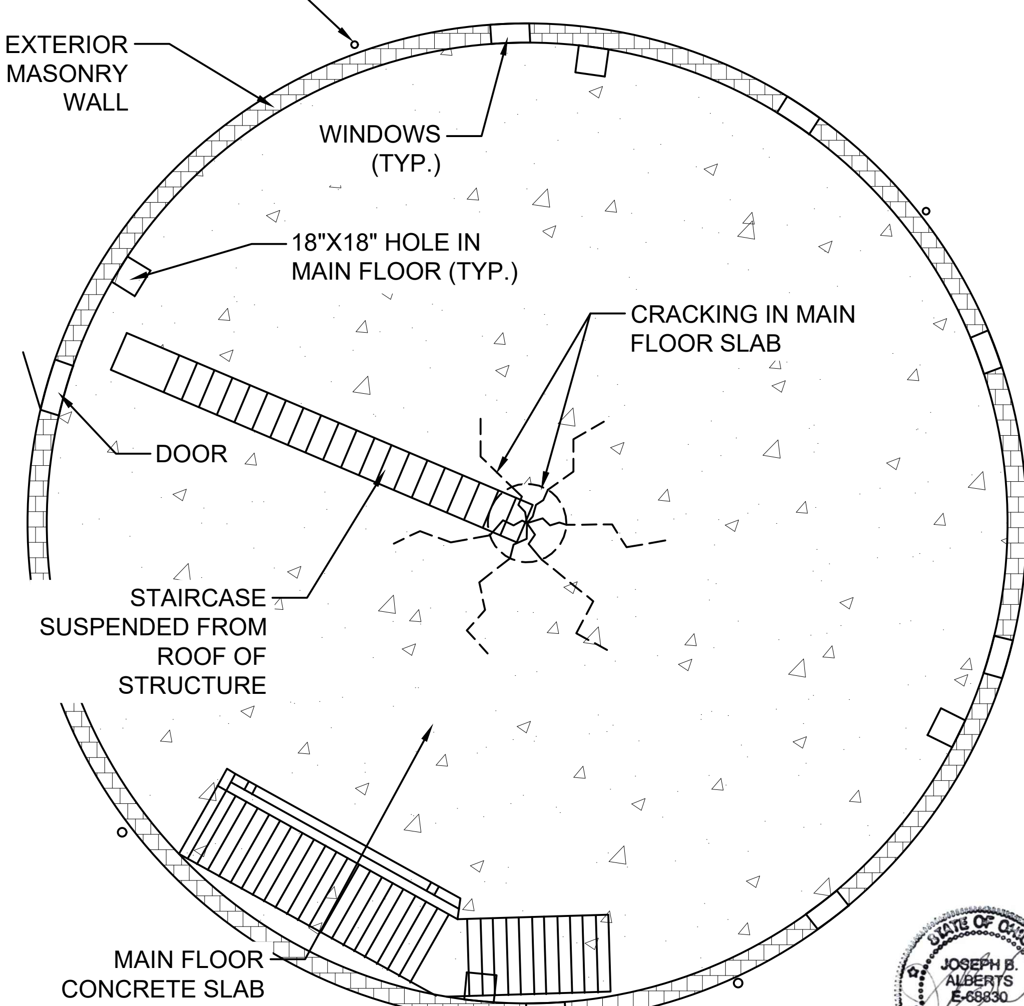
SCALE: 1" = 10'





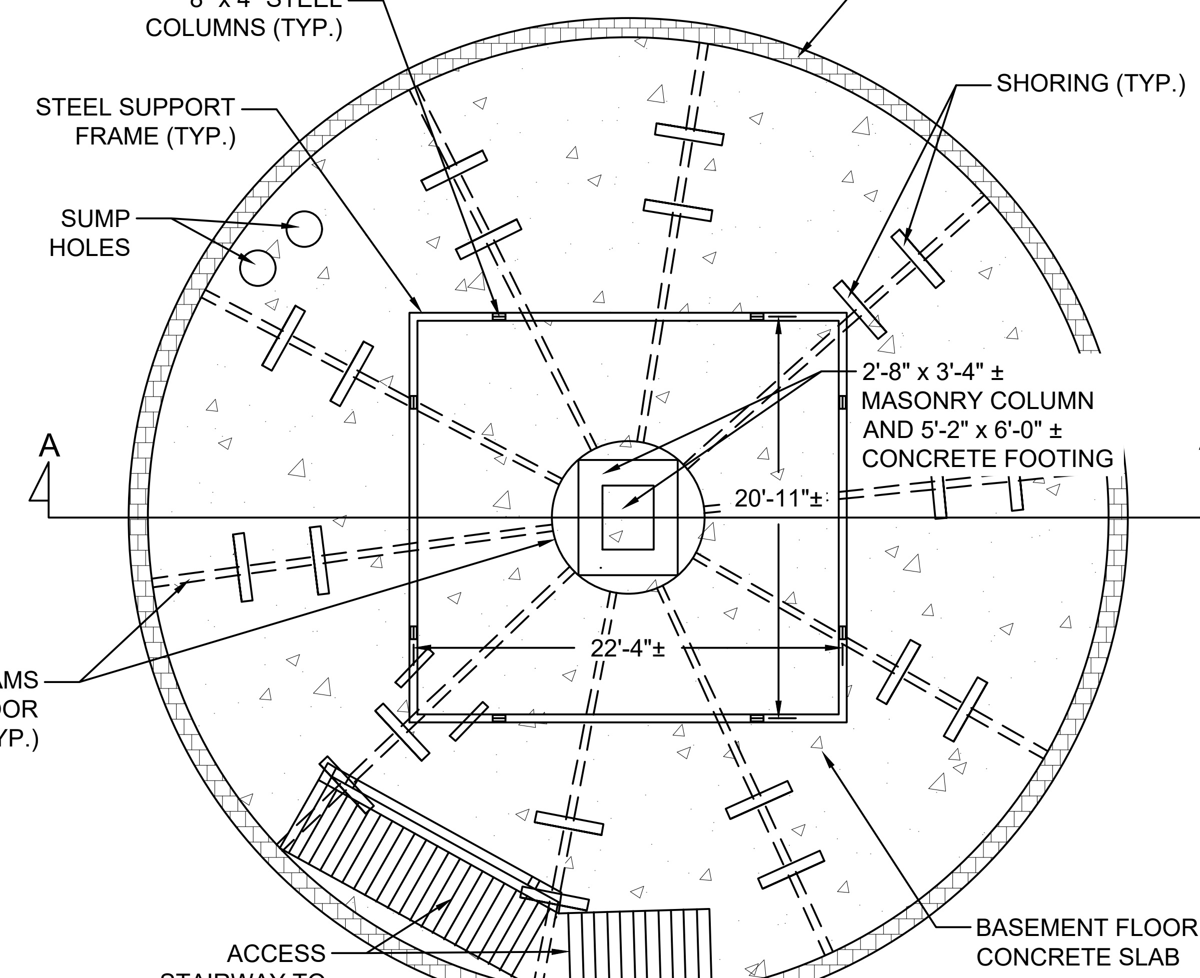
MAIN FLOOR - PLAN VIEW

SCALE: NTS



BASEMENT - PLAN VIEW

SCALE: NTS



STATE OF OHIO
JOSEPH B. ALBERTS
E-68830
REGISTERED PROFESSIONAL ENGINEER

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OBERLIN GAS HOLDER BUILDING
EXISTING CONDITIONS
OBERLIN, OHIO

FIGURE NO.
3

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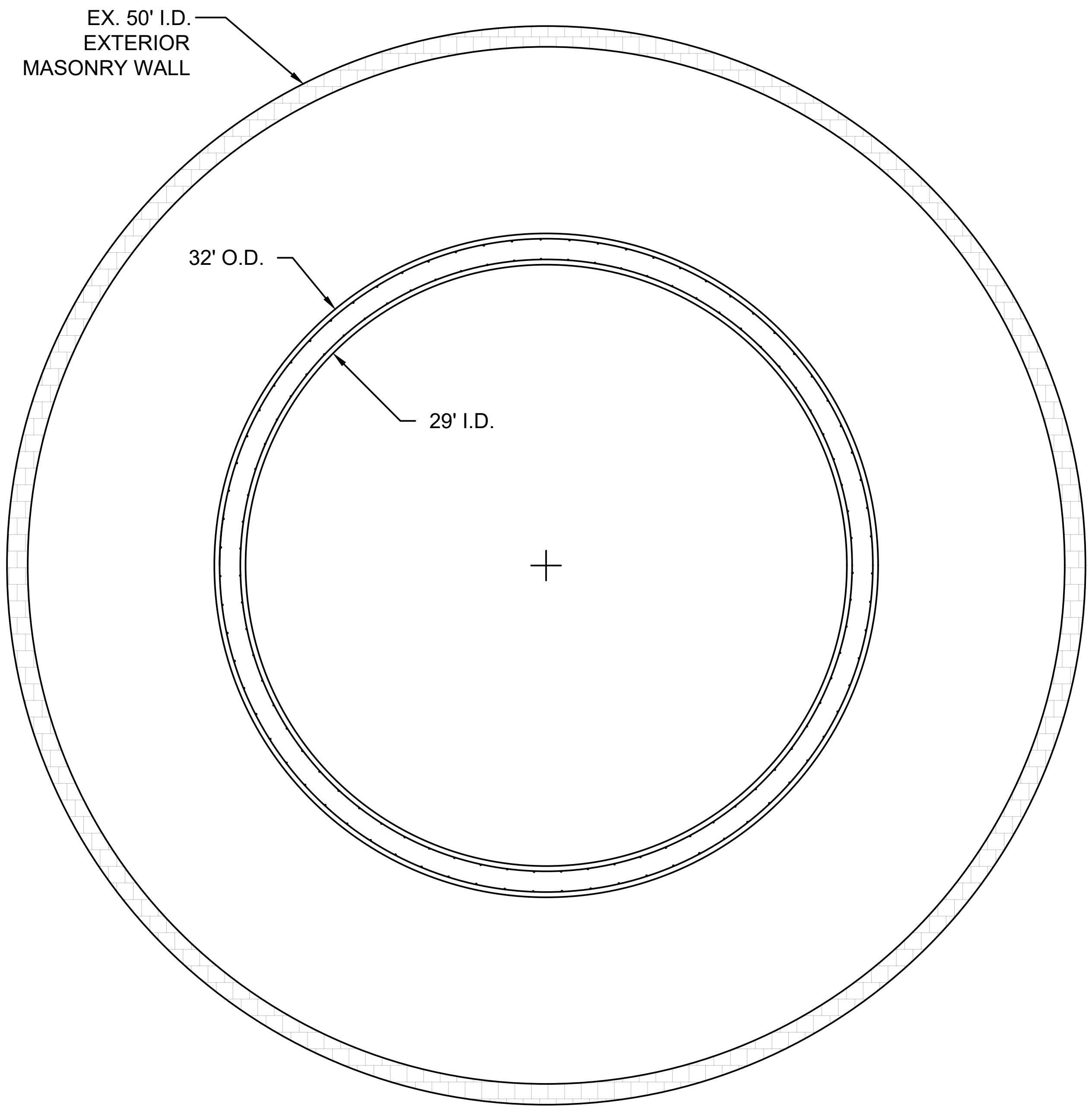
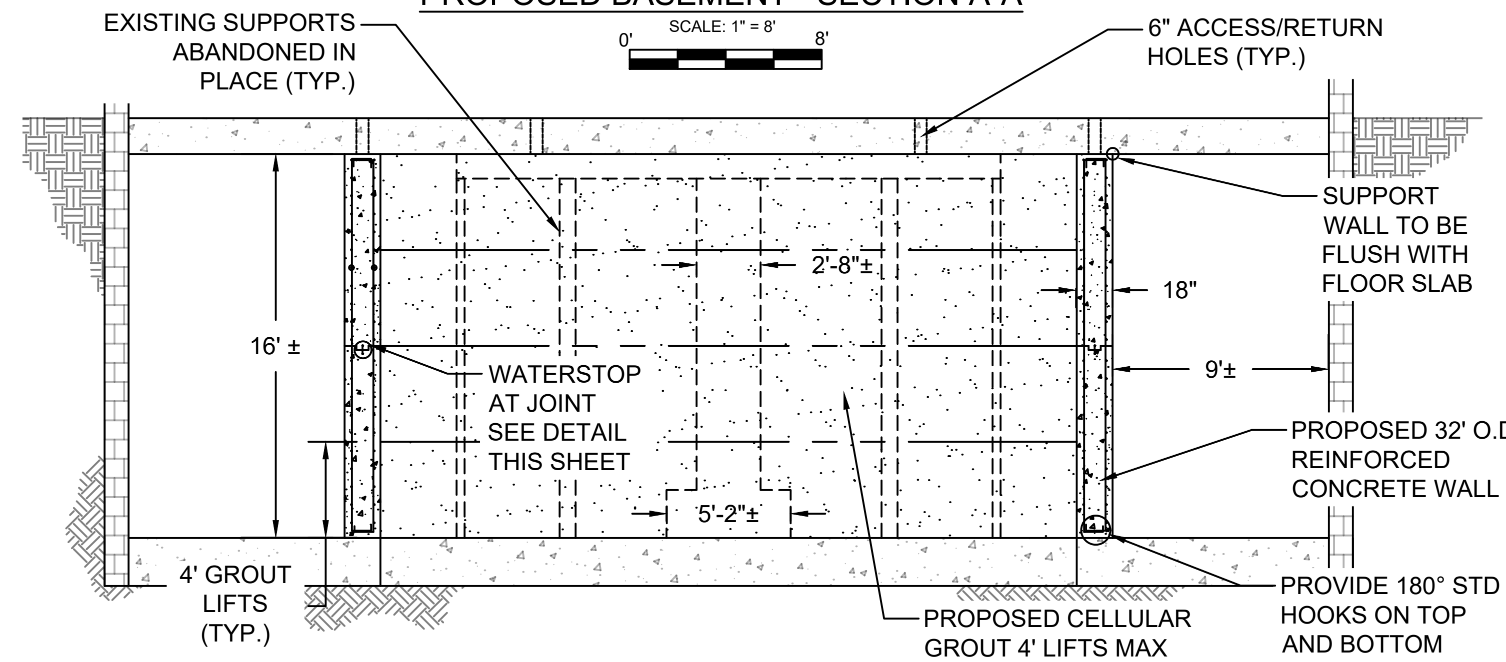
PROPOSED BASEMENT - PLAN VIEW

SCALE: 1" = 8'



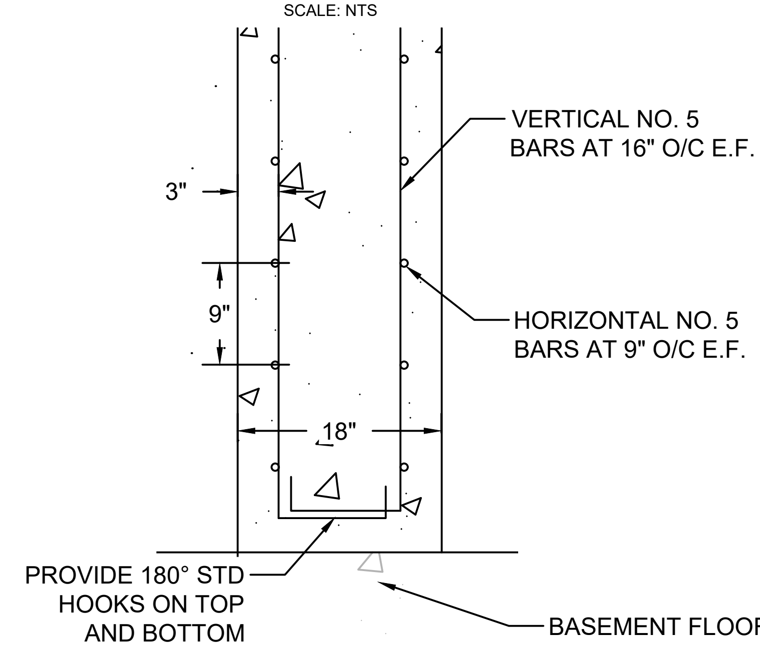
PROPOSED BASEMENT - SECTION A-A

SCALE: 1" = 8'



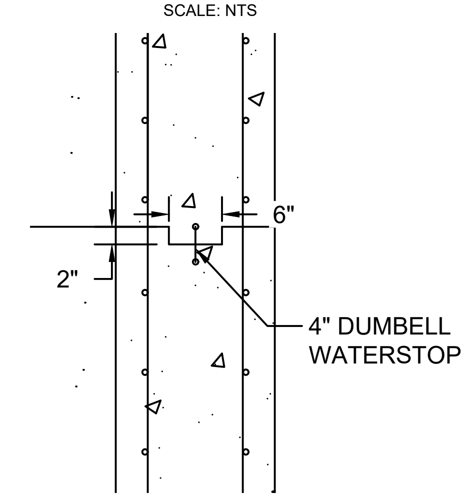
WALL DETAIL

SCALE: NTS



CONSTRUCTION JOINT DETAIL

SCALE: NTS



STATE OF OHIO
JOSEPH B. ALBERTS
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REGISTERED
PROFESSIONAL ENGINEER

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OBERLIN GAS HOLDER BUILDING
SHORING SYSTEM - PROPOSED MODIFICATIONS
OBERLIN, OHIO

FIGURE NO.
4

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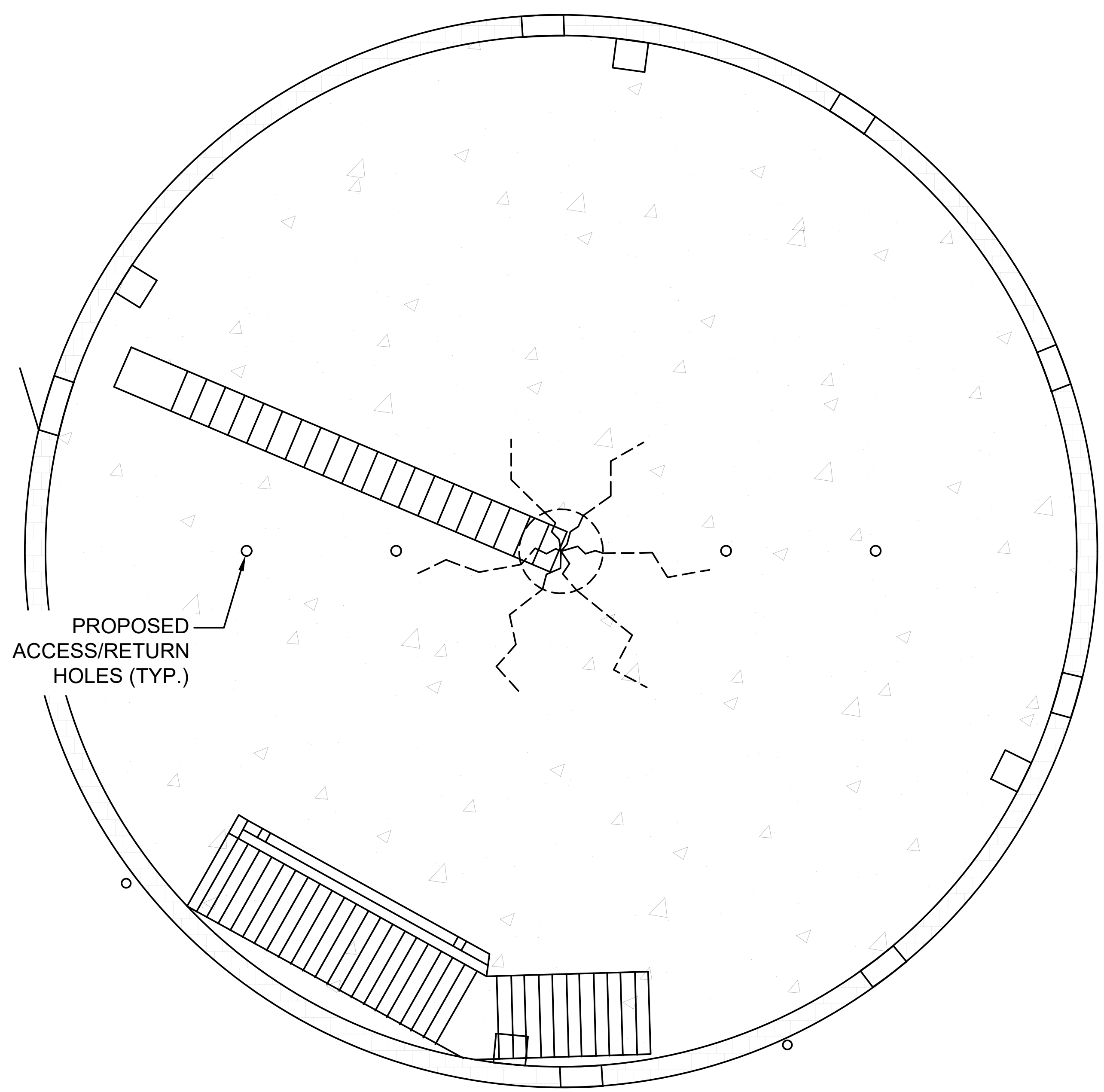
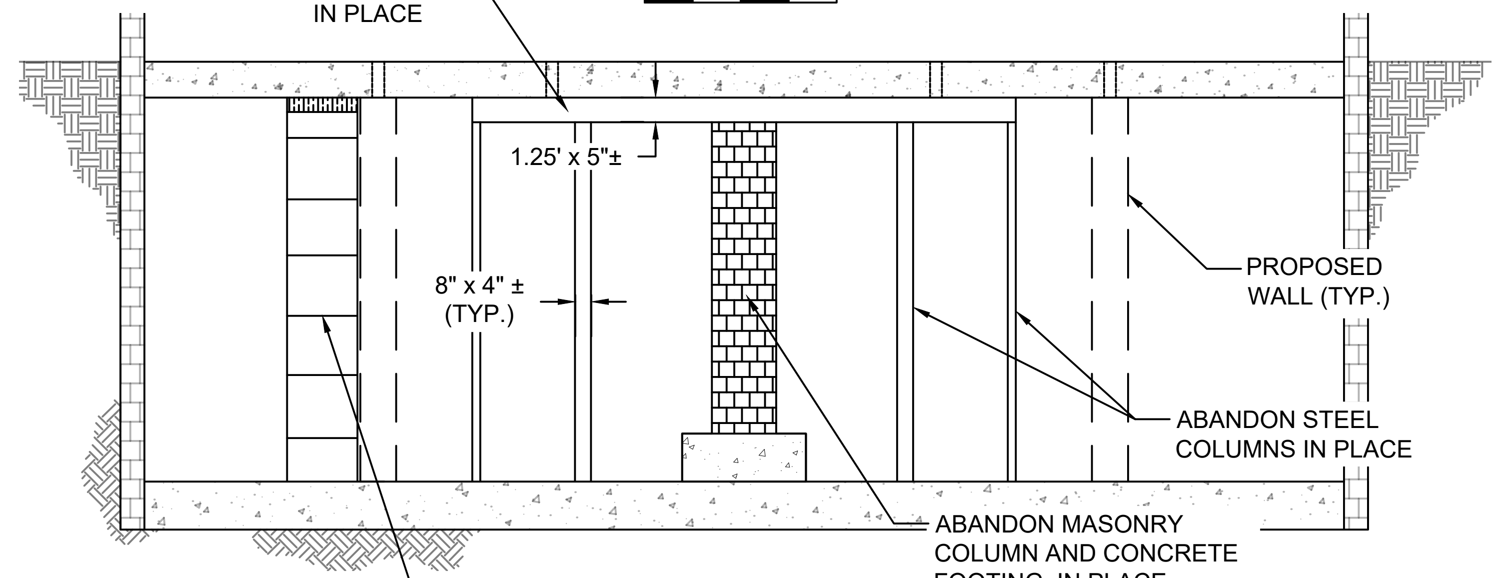
PROPOSED MAIN FLOOR - PLAN VIEW

SCALE: 1" = 8'



DEMO BASEMENT - SECTION A-A

SCALE: 1" = 8'



CONSTRUCTION SEQUENCE:

1. THOROUGHLY POWERWASH, CLEAN AND REMOVE ALL LOSE DEBRIS FROM EXISTING BASEMENT FLOOR AND BOTTOM OF MAIN FLOOR.
2. FORM AND POUR A MAXIMUM OF 8-FOOT HEIGHT OF THE SUPPORT WALL. ALLOW CONCRETE TO REACH COMPRESSIVE STRENGTH OF 3,000 PSI.
3. DRILL MINIMUM OF TWO 6-INCH DIAMETER HOLES IN THE EXISTING FLOOR SLAB. HOLES WILL BE USED TO ALLOW FOR PLACEMENT OF CONCRETE, PROVIDE VENTILATION, AND TO ALLOW MONITORING OF CONCRETE PLACEMENT.
4. FORM AND POUR THE SECOND HALF OF THE SUPPORT WALL. FILL FORMS UNTIL CONCRETE IS RETURNING THROUGH HOLES IN THE MAIN FLOOR. ALLOW CONCRETE TO REACH DESIGN STRENGTH.
5. DRILL MINIMUM OF TWO 6-INCH DIAMETER GROUT RETURN HOLES IN THE EXISTING FLOOR SLAB. HOLES WILL BE USED TO ALLOW FOR THE PLACEMENT OF GROUT, PROVIDE VENTILATION, AND TO ALLOW MONITORING OF GROUT PLACEMENT.
6. POUR GROUT IN MAXIMUM OF 4-FOOT LIFTS UNTIL THE AREA IS FULL AND GROUT IS RETURNING THROUGH DRILL HOLES. ALLOW SUFFICIENT TIME TO ELAPSE BETWEEN GROUT LIFTS AS SPECIFIED IN CELLULAR GROUT DETAILS ON SHEET 2. CELLULAR GROUT SHALL BE PLACED BY GRAVITY AFTER LEAVING THE DISCHARGE POINT. PRESSURE IN EXCESS OF 1 PSI THAT MAY INDUCE "UPLIFT" ON THE EXISTING FLOOR SLAB MUST BE PREVENTED.
7. BETWEEN GROUT POURS, USE SUMP PUMP TO REMOVE ANY BLEED AT THE SURFACE OF THE HARDENED GROUT.
8. WHEN CONCRETE HAS REACHED DESIGN STRENGTH AND CELLULAR GROUT PLACEMENT IS COMPLETE, SHORING OUTSIDE OF THE STRUCTURAL WALL MAY BE REMOVED.
9. PATCH ACCESS/RETURN HOLES IN MAIN FLOOR.

STATE OF OHIO
JOSEPH B. ALBERTS
E-68830
REGISTERED
PROFESSIONAL ENGINEER

FKE PROJECT No.: 22-025	CAD FILE NAME: 22-025.dwg
DESIGNED BY: BKK	PLOT DATE: 6-Apr-22
DRAWN BY: BKK	DRAWING SCALE: AS SHOWN
CHECKED BY: JBA	CREATED ON: 6-Apr-22

FKE
248.817.2946
Madison Heights, MI

REV #	DATE	REVISION TITLE
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---	---	---
---	---	---
---	---	---

OBERLIN GAS HOLDER BUILDING
SHORING SYSTEM - PROPOSED MODIFICATIONS
OBERLIN, OHIO

FIGURE NO.
5

S:\Project Files\2022 Project Files\22-025 Oberlin Gas Holder Bldg\CAD\22-025.dwg 4/6/2022 3:51 PM

Supporting Calculations

FKE

Excellence in Infrastructure
And Underground Engineering

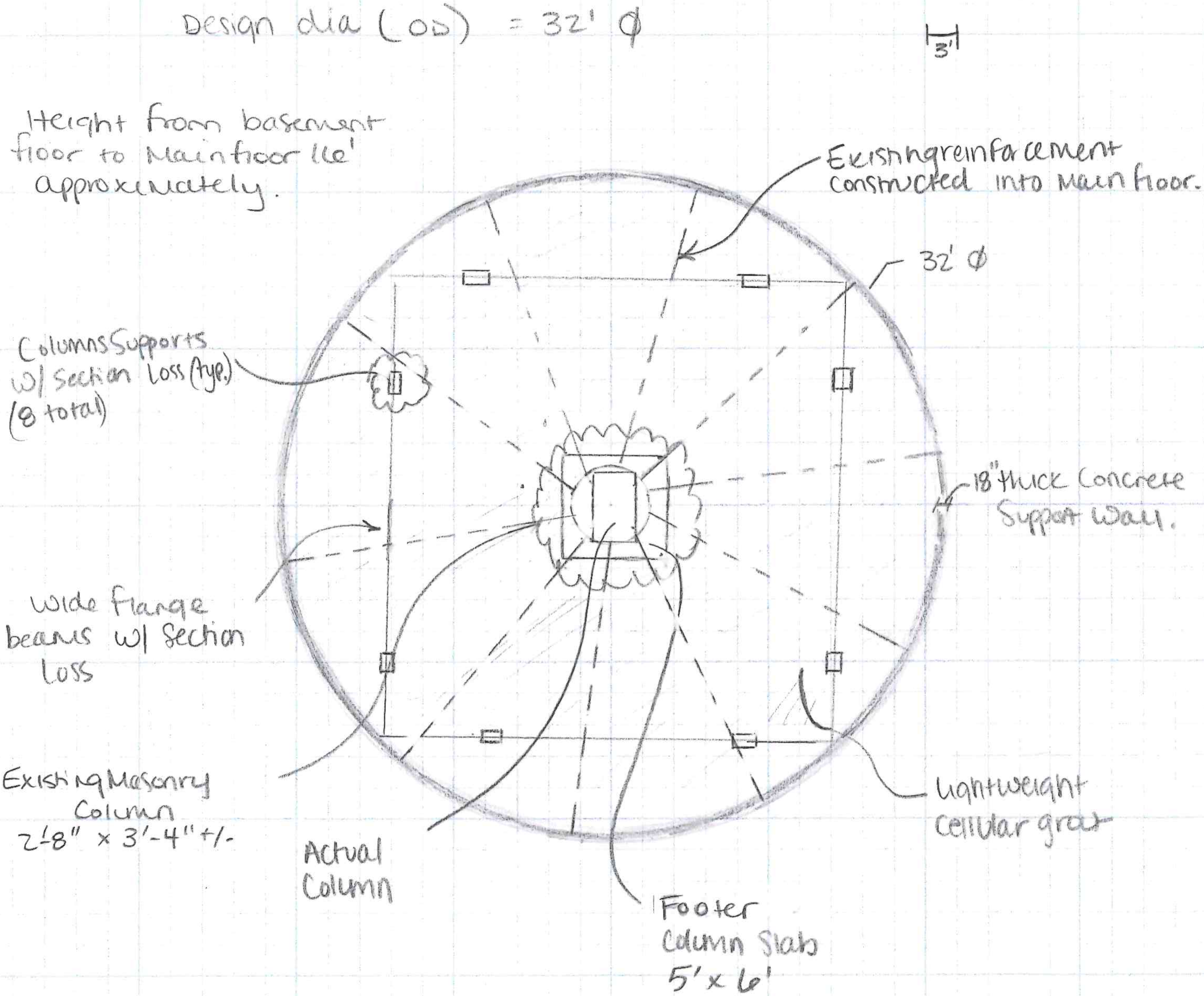
Job: oberlin gasholder Project No: 22-025 Sheet No: 1

Subject: Wall design By: BKK Date: 3/11/22

Checked By: NJK Date: 4/6/22

Design of Concrete Support wall

Design dia (OD) = 32' ⌀



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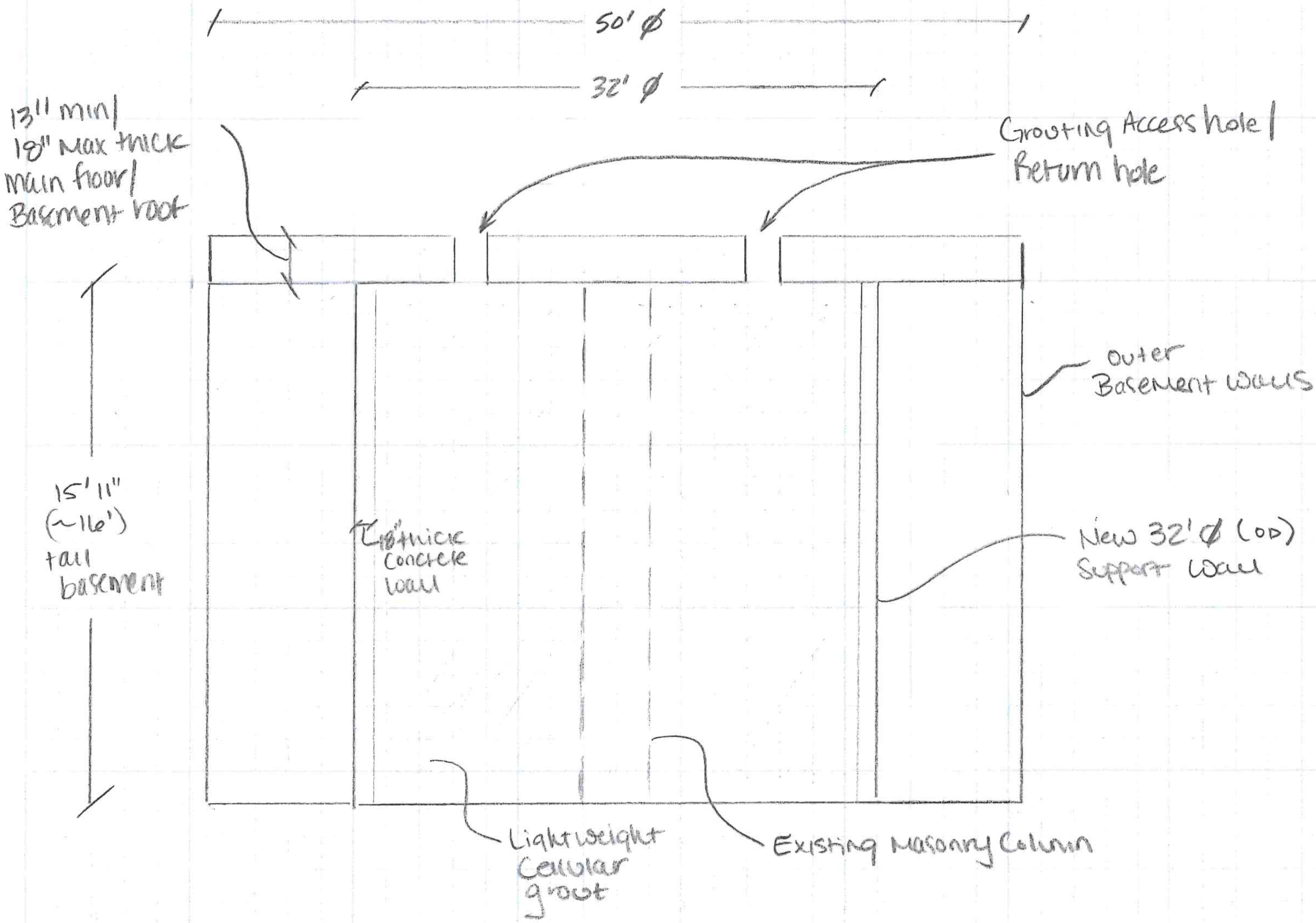
Job: oberlin gashouse | Project No: 22-025 | Sheet No: 2

Subject: wall design | By: BKK | Date: 3/11/22

Checked By: NJK | Date: 4/6/22



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And Underground Engineering

Job: Oberlin Gasholder Bldg. Project No: 22-025 Sheet No: 3

Subject: Wall design By: BKK Date: 3/11/22

Checked By: NJK Date: 4/6/22

Design wall to hold light weight Cellular grout.

Max pressure on walls, Building in 2 sections (actually will be less to control temperature

$100\ lb/ft^3 \cdot 8' = 800\ lb/ft^2 = 0.8\ K/ft^2$

Max thrust: press. · radius = $0.8\ K/ft^2 \cdot 16' \cdot 1'_{section} \approx 13\ K/ft$

(16' ← O.D.)

Assume base and Top are flexible, not fixed to the existing basement slab or roof.

$13K \cdot 1.6 = 20.8$ kips

↖ Treat as a live load

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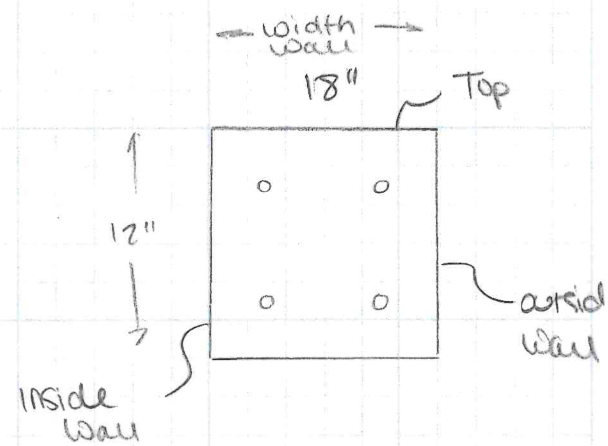
Job: oberlungaehalder | Project No: 22-025 | Sheet No: 4
Subject: Wall design | By: BKK | Date: 3/11/22
Checked By: NJK | Date: 4/6/22

Assume wall thickness is 18"

Determine required horizontal reinforcement.

(ACI 313-16) 6.2.4 $216 in^2 \cdot 0.0025 = 0.54 in^2$



Use #5 bars = $0.31 in^2$/1bar

$0.54 in^2 / 0.31 in^2 = 1.74$ bars/ft

Try @ 9" o/c Each face

$0.31 in^2 \cdot 12''/9'' = 0.413 in^2 \cdot 2$ faces $= 0.83 in^2 > 0.54 in^2$ ok.

$0.9 \cdot 60 ksi \cdot 0.83 in^2 = 44.8$ kips > 20.8 kips ∴ okay

↑ ϕ-factor for tension

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And Underground Engineering

Job: Oberlin Gashodder | Project No: 22-025 | Sheet No: 5

Subject: Wall design | By: BKK | Date: 3/11/22

Checked By: NJK | Date: 4/6/22

Determine required vertical reinforcement

$.002 \cdot 216 in^2 = 0.432 in^2$ req.

Use # 5 bars @ 16" o/c each face

$0.31 in^2 \cdot 12''/16 = 0.23 in^2 \times 2$ faces $= 0.46 in^2/ft > 0.43 in^2$ ∴ OK.

Determine required lap splice length for horizontal reinforcement

ACI 318-11, 12.2.2:

Using smaller than No. 6 bar (No 5)

$d_b = 0.625$

$2 \cdot d_b = 2 \cdot 0.625 = 1.25$ Clear Spacing $= 18'' - 6'' - 2 \cdot 0.625 = 10.75$

Clear cover $= 3''$

$2d_b = 1.25'' < 10.75''$

$d_b = 0.625'' < 3''$

$\therefore$ OK, use top case in table.

12.2 Commentary:

Normal weight Concrete: $\lambda = 1.0$

Uncoated reinf.: $\psi_e = 1.0$

>12'' Concrete cast below splice: $\psi_t = 1.3$

Check:

$\psi_t \cdot \psi_e = 1.3 < 1.7$ OK.

$$l_d = \left(\frac{f_y \psi_t \psi_e}{25 \lambda \sqrt{f'_c}} \right) d_b$$

$$l_d \left[\frac{60{,}000^{psi} \cdot 1.3 \cdot 1.0}{25 \cdot 1.0 \cdot \sqrt{3000 psi}} \right] 0.625'' = 35.6''$$

12.15.1 Class B Splice $= 1.3 l_d = 1.3 \cdot 35.6'' = 46.3'' \approx 47''$

Analyze if roof can withstand unsuported distance from support wall to inside Masonry Column.

Minimal reinforcement is present in Existing floor (Main floor) Slab. Analyze assuming plain concrete slab.

Use a live load of 100 psf (Prelim calcs see sheet 5) and loads similar to a lobby area.

ID = 29'
slab (header) smallest dim. = 2'8" = 2.7'

Load case 1.2D + 1.6L
maximum design load
18" thick (max)

$W_{conc.} = 1.5 \cdot 150\,pcf = 225\,psf$

$W_L = 100\,psf$

$W_U = 1.2 \cdot 225\,psf + 1.6 \cdot 100\,psf = 430\,psf = 0.43\,klf$

$$M_U = \frac{wl^2}{8} = \frac{0.43\,klf \cdot \left(\frac{29'}{2} - 1.35'\right)^2}{8} = 9.3\,k' = 112\ k''/ft$$

Analyze load capacity of existing embedded beams alone. Ten beams total embedded into main floor per ICS report.

Assume 30 ksi steel.

Length of beam from support wall to column header:

$29' - 2.7' = 26.3'/2 = 13.2'$ length unsupported beam
(I.D.) (smallest cap dimension)

Total area of floor needing supported =

$\pi(14.5^2) - (2.7 \times 2.7) = 653.23\ ft^2 / 10\ beams = 65.3\ ft^2/beam$

$65.3\ ft^2 / 13.2'_{length} = 4.9'_{width}$

Trib area = $13.2' \times 4.9'$

Analyze existing floor slab as reinforced concrete.
Assume some section loss is present, strength of steel is 30 ksi and strength of concrete is 3 ksi.

Tributary area of beams in slab = 13.2' x 4.9' (previous sheet)

$$a = \frac{3.83\text{in}^2 \cdot 30\text{ksi}}{0.85 \cdot 3\text{ksi} \cdot 58.8"} = 0.77"$$

3.83in^2 = Area W4x13

$d = 13" - 4.25"/2 = 10.9 \approx 11"$

$\phi M_n = 0.9 \cdot 3.82\text{in}^2 \cdot 30\text{ksi}\left(11 - \frac{0.77"}{2}\right) = 1095 \approx 1100\text{k}"$

Considering 20% Section Loss

$\phi M_n = 1100\text{k}" \cdot 0.8 = 880\text{k}"$

Sheet 7

$M_u = 112\ \text{k}"/\text{ft} \cdot 4.9' = 549\ \text{k}"$

$\phi M_n = 880\text{k}" > M_u = 549\ \text{k}"$ ∴ Okay

For analysis of 9' unsupported main floor from exterior wall to proposed inside support wall, see calcs performed on 9/9/21, attached in references.

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And Underground Engineering

Job: Oberlin Gasholder | Project No: 22-025 | Sheet No: 10

Subject: design check | By: BKK | Date: 4/6/22

Checked By: NJK | Date: 4/6/22

Analyze Loading of floor on Support Wall

Inner Diameter of Structural wall = 29'

Smallest length of Column (Masonry) in Middle = 2.7'

$29' - 2.7' = 26.3/2 = 13.15'$ From inside Structural wall to Masonry column.

9' unsupported from Exterior wall to Structural Support wall.

Tributary width of floor to be Supported by new Structural wall = $9'/2 + 13.2'/2 = 11.1$ ft.

$w_D = 11.1' \cdot 1.5' = 16.65 ft^2 \cdot 150 \frac{lb}{ft^3} = 2498\ lb/ft$ (1.5' = slab thickness)

$w_L = 11.1 \cdot 1' \cdot 100\ psf = 1110\ lb/ft$

$w_u = 1.2 \cdot 2498 \frac{lb}{ft} + 1.6 \cdot 1110\ lb/ft = 4774 \frac{lb}{ft} = 4.8\ k/ft \cdot 1ft$

$\phi P_n = 0.8 \phi 0.85 f'_c A_g$

$\phi = 0.65$

$f'c = 3000\ psi$

$A_g = 18'' \cdot 12'' = 216 in^2$

$0.8 \cdot 0.85 \cdot 0.65 \cdot 3000\ psi \cdot 216 in^2 = 286416\ lb = 286 K$

$286 k > (4.8 k/ft \cdot 1ft)$ ∴ OK.

Calculation References

FK Engineering Associates

Excellence in Infrastructure and Underground Engineering

Memorandum

STATE OF OHIO
JOSEPH B. ALBERTS
E-68830
REGISTERED PROFESSIONAL ENGINEER

TO: Mr. Joe Parisi – Northstar Contracting **DATE:** September 14, 2021
FROM: N. Kacynski, P.E., J. Alberts, P.E. – FKE ***FKE PROJ. NO:*** 21-113

SUBJECT: Support of Existing Floor Slab
Historical Gasholder Building
Oberlin, Ohio

In accordance with our discussions and our professional services agreement, we have performed an analysis of the proposed support for an existing floor slab in the Oberlin historical Gasholder Building

Based on our discussions with Northstar Contracting, and provided documents, we understand that support of a floor slab within the historical gasholder building is required. The building, constructed in 1888, is understood to have an approximately 50-foot diameter floor slab at the main building level which spans above a basement. A report prepared by KS associates indicates that this slab has numerous cracks which appear to propagate radially from the center of the slab. The slab itself, reported by the contractor to vary from 13 to 18 inches thick, contains minimal reinforcing bars (based on field investigations, refer to attached "Daily Field Report" dated 9/1/2021 for additional information) but does contain steel beams which were cast directly into the slabs during the original construction.

At this time, temporary shoring supports exist beneath the cast-in steel beams. Additionally, a rectangular support frame has been installed around the center of the slab. The members of this support frame are noted to be severely corroded, with some member areas exhibiting 100% section loss and column members that are tilting from their upright positions.

It is desired for all temporary shoring that is directly supporting the cast-in beams to be removed or cast into the permanent support system. To accomplish this, Northstar Contracting has proposed the construction of a circular wall from the basement elevation to beneath the floor slab. The proposed circular wall is to be 1-foot-thick and 32 feet in diameter. The area contained within the walls, including the existing support frame, is proposed to be filled with lightweight cellular grout. Once filled, the area of the floor slab within the footprint of the wall will be entirely supported and not require shoring. However, the existing floor slab would be required to span the distance from the existing building walls to the proposed 32-foot diameter wall. The purpose of this memo is to confirm that the existing slab can span between these locations.

Another permanent support option was proposed which consisted of a square wall, with wall lengths of 24 feet on each side and wall thicknesses of 1 foot. This square was proposed to be constructed at the center of the slab. Based on our analysis, this option is not feasible as the existing floor slab is not capable of spanning between the existing walls and the proposed square walls.

As minimal historical records are available, a site visit was made to the project location on September 1, 2021. Two concrete cores were taken from the existing slab to determine reinforcement quantities, locations, and concrete strength. Schmidt hammer readings were also taken at several locations on the slab to further aide in estimating concrete strength. The results of the field investigation indicated that minimal reinforcing steel is present in the slab, and that the concrete has a compressive strength greater than 4,000 psi. For additional details, please refer to the attached “Daily Field Report” dated 9/1/21.

Due to the age of the structure and minimal reinforcement present, for design purposes it was assumed that the slab would behave as a plain (non-reinforced) structural concrete slab spanning between the existing walls and the outside diameter of the proposed wall. A design live load of 100 psf was considered for the slab which corresponds to ASCE 7-10 recommended minimum design loadings for an assembly area lobby. Based on discussions with the contractor, we understand that the slab will not be required to resist live loads greater than human occupancy.

We also understand that Northstar Contracting will remove a part of the concrete surface by milling which will be up to approximately four inches of concrete floor removal in places. We have based our calculations assuming at least 12 inches of concrete will remain after the surface is removed. This surface will be replaced by a new 4-inch surface coat of concrete.

Based on the above assumptions, we have determined that the proposed method of supporting the floor slab is adequate and that following completion of the circular wall all shoring posts beneath the existing floor beams can be removed. Please note, for the purposes of this memorandum our scope is limited to evaluating the strength and capacity of the existing concrete slab and determining its ability to withstand that anticipated loads based on the contractor proposed support system.

Should conditions differ significantly from those assumed, or if you require further assistance, please do not hesitate to contact FK Engineering.

References:

Daily Field Report dated 9/1/21
Structural Assessment report prepared by KS Associates
Communication with Northstar Contracting
ACI 318-11
ASCE 7-10

Supporting Calculations

FKE

Excellence in Infrastructure
And Underground Engineering

Job: Oberlin Slab | Project No: 21-113 | Sheet No: 1

Subject: Slab Support | By: NSVe | Date: 9/9/21

Checked By: | Date:

The following pages examine the proposed permanent support of an existing failing circular slab in Oberlin Ohio.

The slab appears to be failing at its center, with cracking spreading outwards. Currently, shoring is in place to provide temporary support.

Existing permanent supports appear to be failing & @ a minimum have significant section loss based on a report prepared by others.

FKE

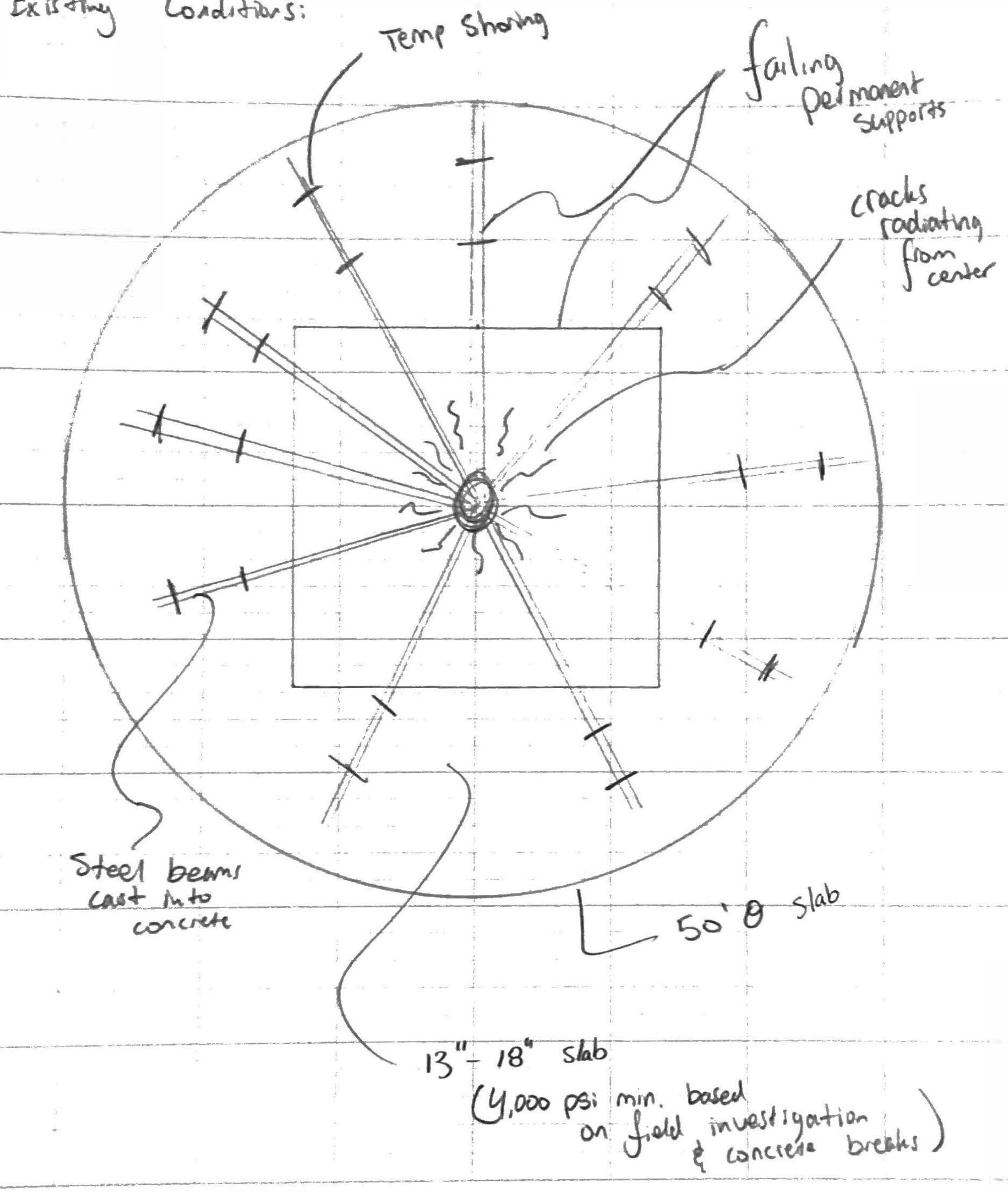
Excellence in Infrastructure And Underground Engineering

Job: Oberlin Slab | Project No: 21-113 | Sheet No: 2

Subject: Slab Support | By: NSK | Date: 9/9/21

Checked By: | Date:

Existing Conditions:



FKE

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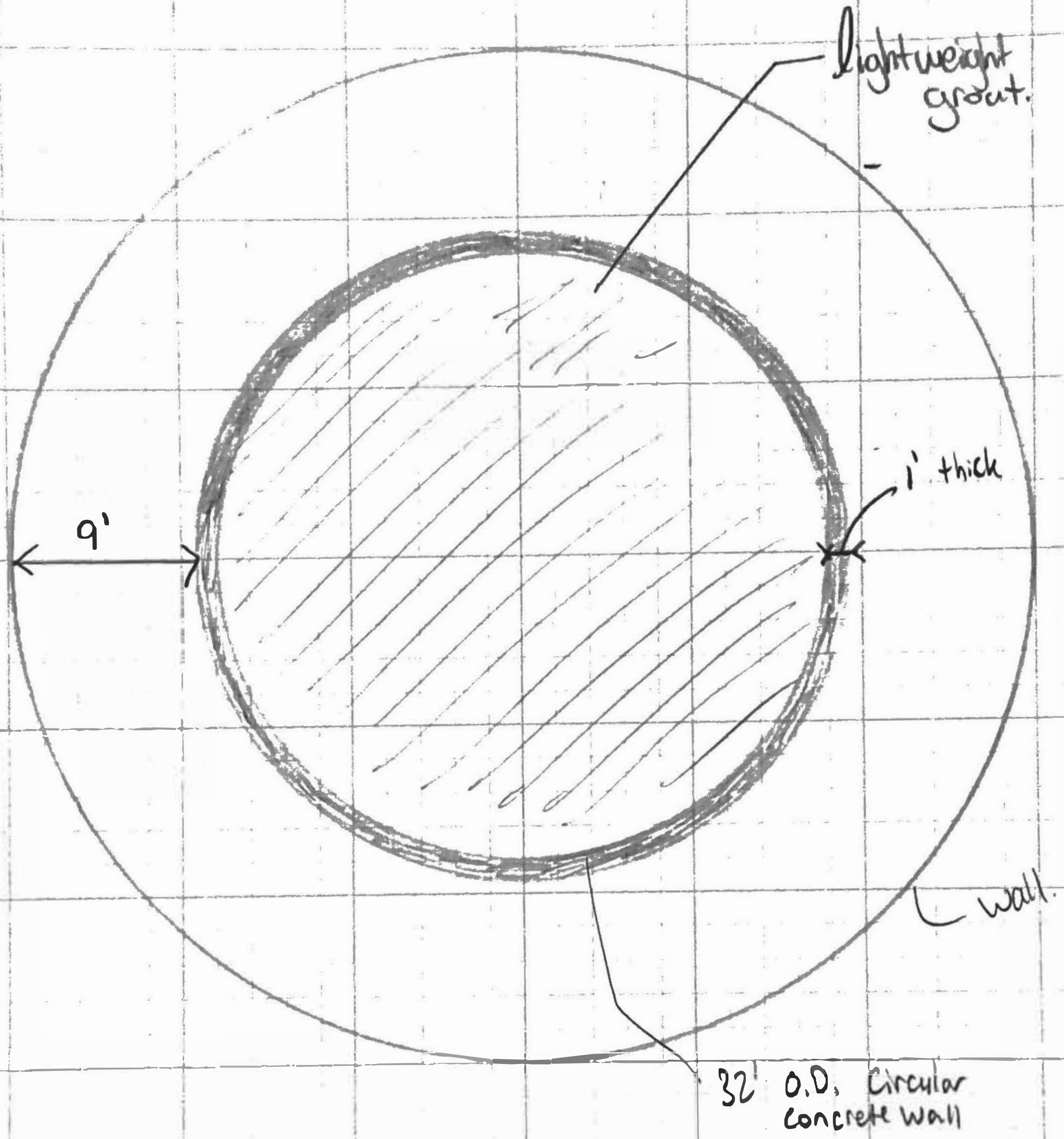
Job: Oberlin Slab | Project No: 21-113 | Sheet No: 3
Subject: Slab Support | By: NSK | Date: 9/9/21
Checked By: | Date:

Proposed Support:



FKE

Excellence in Infrastructure
And Underground Engineering

Job: Oberlin Slab
Subject: Slab Support
Project No: 21-113
By: NJK
Checked By:
Sheet No: 4
Date: 9/9/21
Date:

Based on field investigations, there is minimal reinforcement steel present in the existing slab. Further, the existing cast-in beams are likely significantly deteriorated.

Examine the capacity of the circular slab to span between the existing wall & the proposed 32' Ø circular wall Span ≈ 9' clear.

Use a live load of 100 psf.

Per contractor, the area is deemed as "commercial occupancy"

This was assumed to be similar the lobby area of a theatre or dining room/restaurant.

Load case: $1.2\,D + 1.6 \cdot L$

Max design load: Examine on per foot basis

$t_{conc} = 18''$ (max thickness)

$w_{conc} = 1.5 \cdot 150\ pcf = 225\ psf$

$w_L = 100\ psf$

$w_u = 1.2 \cdot 225\ psf + 1.6 \cdot 100\ psf = 430\ psf. = 0.43\ ksf$

$M_u = w l^2/8 = 0.43\ klf \cdot 9'^2/8 = 4.35\ k' = 52.3\ k''$

Determine Capacity of "Structural Plain Concrete" in accordance with ACI 318-11 Chapter 22.

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Excellence in Infrastructure And Underground Engineering

Job: Oberlin Slab | Project No: 21-113 | Sheet No: 6
Subject: Slab Support | By: NSU | Date: 9/9/21
Checked By: | Date:

Determine capacity of existing slab.

$M_u = 52.3$ k" (prev. sheet)

Examine on per foot basis

For tension controlled setions,

$\phi M_n = \phi 5 \cdot \sqrt{f'_c} \cdot S_m$ (eq 22-2)

$S_m = \frac{bh^2}{6} = 12" \cdot 13"^2 / 6 = 338 \text{ in}^3$

$f'_c = 4{,}000$ psi (based on field investigation)

$\phi = 0.6$ (ACI 9.3.5)

$\phi M_n = 0.6 \cdot 5 \cdot \sqrt{4{,}000} \cdot 338 \text{ in}^3 = 64{,}130$ lb" $= 64$ k"

$\phi M_n = 64$ k" $> M_u = 52.3$ k" $\therefore$ o.k.

NOTE: This is conservative as the thickest portion of slab was assumed for dead weight & the thinnest was assumed for resistance.

$S_m = \frac{bh^2}{2} = 12" \cdot \frac{12"^2}{6} = 288 \text{ in}^3$

$\phi = 0.6$

$\phi M_n = 0.6 \cdot 5 \cdot \sqrt{4{,}000} \cdot 288 = 54644$ lb" $= 54.6$ k"

$\phi M_n = 54.6$ k" $> M_u = 52.3$ K"

FKE

Excellence in Infrastructure And Underground Engineering

Job: Oberlin Slab | Project No: 21-114 | Sheet No: 7
Subject: Slab Support | By: NSK | Date: 9/9/21
Checked By: | Date:

Examine shear capacity of slab.

$V_u = (1.2 \cdot 225\ plf + 1.6 \cdot 100\ plf) \cdot 9'/2 = 1.94\ klf$

Examine on per foot basis

$\phi V_n = \phi \cdot 4/3 \cdot \sqrt{f'_c} \cdot b \cdot h$ (ACI 318-11 eq 22-9)

$b = 12''$ (per foot basis)

$h = 13''$ (min. depth reported by contractor)

$\phi = 0.6$ (ACI-318-11 9.3.5)

$\phi V_n = 0.6 \cdot 4/3 \cdot \sqrt{4{,}000\ psi} \cdot 12'' \cdot 13'' = 7890\ lbs = 7.8\ k/ft$

$\phi V_n = 7.8\ k > V_u = 1.94\ k \therefore$ o.k.

The existing slab is therefore capable of supporting its own weight & 100 psf live load weight with the proposed permanent support.

Calculation References

ASCE STANDARD

ASCE/SEI
7–10

Minimum Design Loads for Buildings and Other Structures

This document uses both the International System of Units (SI) and customary units

ASCE

SEI
ASCE
STRUCTURAL ENGINEERING INSTITUTE

Table 4-1 Minimum Uniformly Distributed Live Loads, L_o, and Minimum Concentrated Live Loads

Occupancy or Use	Uniform psf (kN/m²)	Conc. lb (kN)
Apartments (see Residential)		
Access floor systems		
Office use	50 (2.4)	2,000 (8.9)
Computer use	100 (4.79)	2,000 (8.9)
Armories and drill rooms	150 (7.18)[a]	
Assembly areas and theaters		
Fixed seats (fastened to floor)	60 (2.87)[a]	
Lobbies	100 (4.79)[a]	
Movable seats	100 (4.79)[a]	
Platforms (assembly)	100 (4.79)[a]	
Stage floors	150 (7.18)[a]	
Balconies and decks	1.5 times the live load for the occupancy served. Not required to exceed 100 psf (4.79 kN/m²)	
Catwalks for maintenance access	40 (1.92)	300 (1.33)
Corridors		
First floor	100 (4.79)	
Other floors, same as occupancy served except as indicated		
Dining rooms and restaurants	100 (4.79)[a]	
Dwellings (see Residential)		
Elevator machine room grating (on area of 2 in. by 2 in. (50 mm by 50 mm))		300 (1.33)
Finish light floor plate construction (on area of 1 in. by 1 in. (25 mm by 25 mm))		200 (0.89)
Fire escapes	100 (4.79)	
On single-family dwellings only	40 (1.92)	
Fixed ladders	See Section 4.5	
Garages		
Passenger vehicles only	40 (1.92)[a,b,c]	
Trucks and buses	[c]	
Handrails, guardrails, and grab bars	See Section 4.5	
Helipads	60 (2.87)[d,e] Nonreducible	[e,f,g]
Hospitals		
Operating rooms, laboratories	60 (2.87)	1,000 (4.45)
Patient rooms	40 (1.92)	1,000 (4.45)
Corridors above first floor	80 (3.83)	1,000 (4.45)
Hotels (see Residential)		
Libraries		
Reading rooms	60 (2.87)	1,000 (4.45)
Stack rooms	150 (7.18)[a,h]	1,000 (4.45)
Corridors above first floor	80 (3.83)	1,000 (4.45)
Manufacturing		
Light	125 (6.00)[a]	2,000 (8.90)
Heavy	250 (11.97)[a]	3,000 (13.40)

Continued

Table 4-1 (*Continued*)

Occupancy or Use	Uniform psf (kN/m²)	Conc. lb (kN)
Office buildings		
File and computer rooms shall be designed for heavier loads based on anticipated occupancy		
Lobbies and first-floor corridors	100 (4.79)	2,000 (8.90)
Offices	50 (2.40)	2,000 (8.90)
Corridors above first floor	80 (3.83)	2,000 (8.90)
Penal institutions		
Cell blocks	40 (1.92)	
Corridors	100 (4.79)	
Recreational uses		
Bowling alleys, poolrooms, and similar uses	75 (3.59)[a]	
Dance halls and ballrooms	100 (4.79)[a]	
Gymnasiums	100 (4.79)[a]	
Reviewing stands, grandstands, and bleachers	100 (4.79)[a,k]	
Stadiums and arenas with fixed seats (fastened to the floor)	60 (2.87)[a,k]	
Residential		
One- and two-family dwellings		
Uninhabitable attics without storage	10 (0.48)[l]	
Uninhabitable attics with storage	20 (0.96)[m]	
Habitable attics and sleeping areas	30 (1.44)	
All other areas except stairs	40 (1.92)	
All other residential occupancies		
Private rooms and corridors serving them	40 (1.92)	
Public rooms[a] and corridors serving them	100 (4.79)	
Roofs		
Ordinary flat, pitched, and curved roofs	20 (0.96)[n]	
Roofs used for roof gardens	100 (4.79)	
Roofs used for assembly purposes	Same as occupancy served	
Roofs used for other occupancies	[o]	[o]
Awnings and canopies		
Fabric construction supported by a skeleton structure	5 (0.24) nonreducible	300 (1.33) applied to skeleton structure
Screen enclosure support frame	5 (0.24) nonreducible and applied to the roof frame members only, not the screen	200 (0.89) applied to supporting roof frame members only
All other construction	20 (0.96)	
Primary roof members, exposed to a work floor		
Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage warehouses, and repair garages		2,000 (8.9)
All other primary roof members		300 (1.33)
All roof surfaces subject to maintenance workers		300 (1.33)
Schools		
Classrooms	40 (1.92)	1,000 (4.45)
Corridors above first floor	80 (3.83)	1,000 (4.45)
First-floor corridors	100 (4.79)	1,000 (4.45)
Scuttles, skylight ribs, and accessible ceilings		200 (0.89)
Sidewalks, vehicular driveways, and yards subject to trucking	250 (11.97)[a,p]	8,000 (35.60)[q]
Stairs and exit ways	100 (4.79)	300[r]
One- and two-family dwellings only	40 (1.92)	300[r]

Daily Field Report

Project:	NorthStar Oberlin Ohio	**Date:**	9/01/2021		
		Weather:	Sunny, 80 F		
Project No.:	21-113	**Report No.**	01		
		Sheet	1	**of**	3
Personnel:	FK Engineering (FKE) – Ben Schafer NorthStar Concrete – 2 workers				
Equipment:	Coring equipment, GoPro Fusion, Swiss Hammer				
Location:	265 S Main St, Oberlin, OH				

Summary:

Mr. Ben Schafer of FK Engineering (FKE) made a site visit to conduct a building inspection, concrete coring, and concrete analysis for the historic Gasholder Building.

Mr. Schafer arrived on site at approximately 12:00 P.M. A GoPro Fusion was used to inspect and record the top and bottom floors of the Gasholder building to review at a later time. After the video inspection a Swiss Hammer was used to test 3 locations of the concrete floor slab on the first level. The first test resulted in a hammer reading of 50, the second reading resulted in a hammer reading of 40, and the third test resulted in a hammer reading of 47. Those readings correlate to a compressive strength of 8000 psi, 5500 psi, and 7500 psi respectively. After the Swiss Hammer tests, 2 concrete cores were taken. The cores were 4 foot in diameter and approximately 4 inches long. The samples are going to be trimmed and the surface will be smoothed before they are compression tested. The core holes were filled back in with cement to ensure they were level with the floor slab. A location plan is attached below.

Mr. Schafer left site at approximately 2:00 P.M.

Field Representative: B. Schafer **Reviewed By: J. Alberts**

Figure 1: Swiss Hammer Corrolation Chart

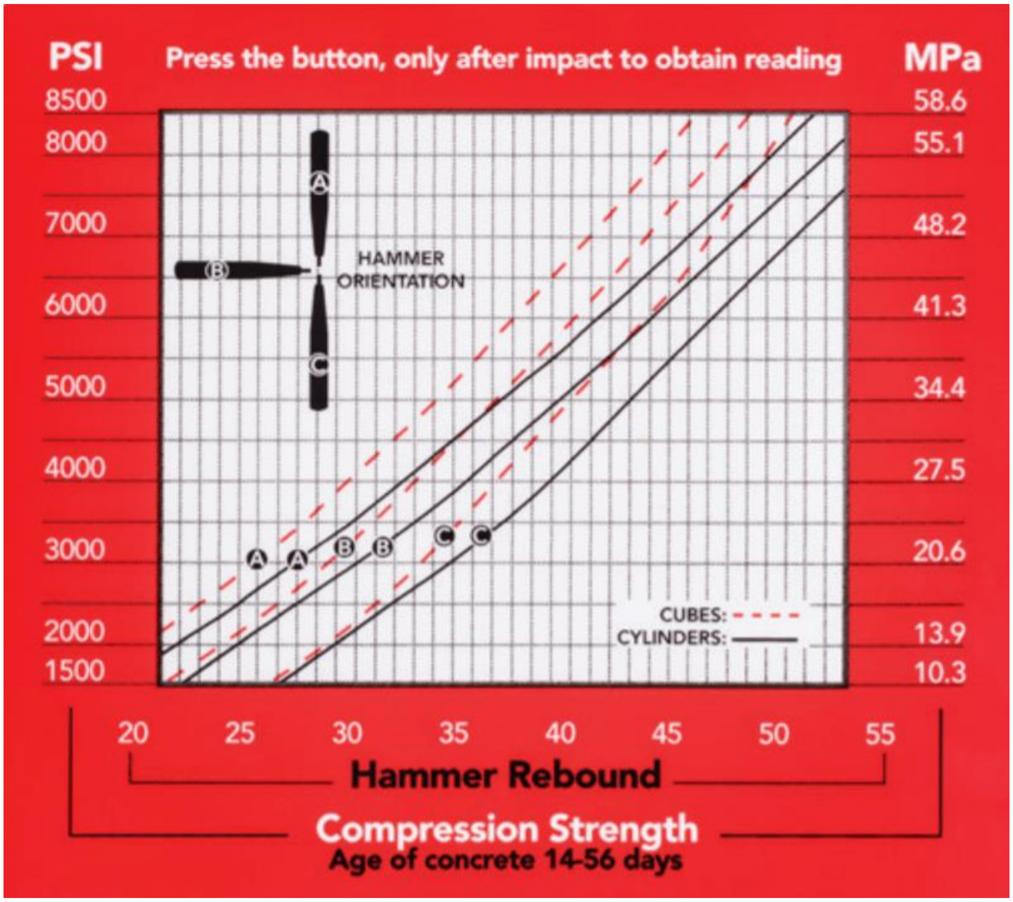
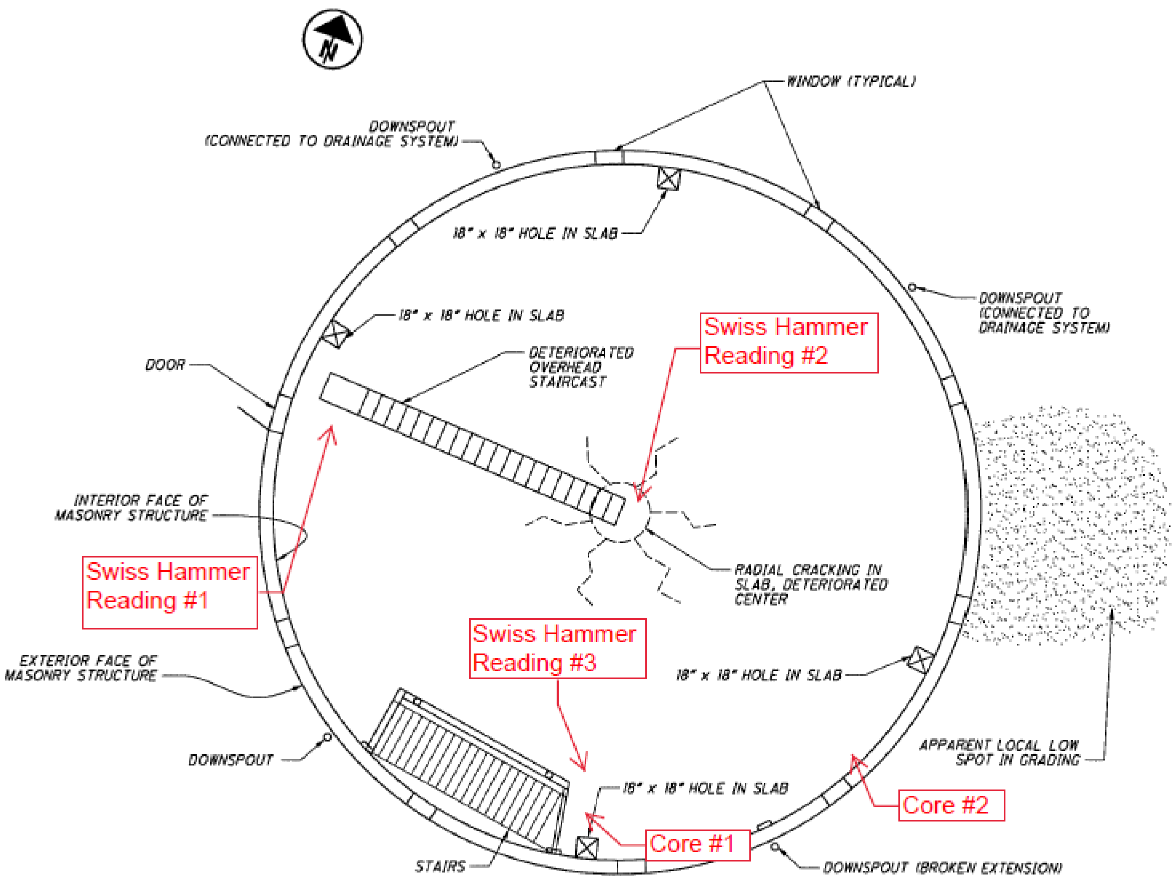


Figure 2: Location Plan



GROUND FLOOR PLAN
NOT TO SCALE

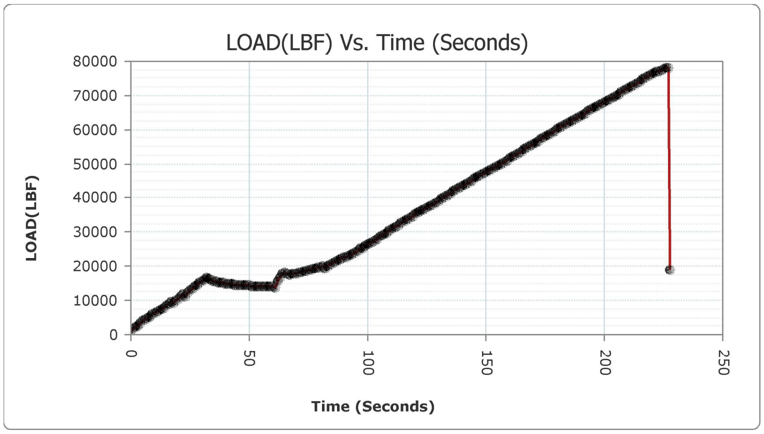
Field Representative: B. Schafer **Reviewed By: J. Alberts**

Concrete Test

Test Type: ASTM C39
9/7/2021

Sample Identification: 21-113_9-1-21
Machine ID: 6a2722

TYPE	PEAK VALUES	UNITS
LOAD	75004	LBF
Diameter	4.00	IN
Length	6.00	IN
Cross-Sectional Area	12.57	IN²
Sample Age	0.0	day(s)
Corrected Stress	5968.65	PSI
Average Pace Rate	32.40	PSI/SEC
Fracture Type	Type 3	
Correction Factor	0.960	
Temperature @ START	75.8	°F
Temperature @ FINISH	76.4	°F



READ #	TIME	LOAD	STRESS (PSI)
1	000:00:00	1009	80.29
2	000:00:01	1692	134.65

READ #	TIME	LOAD	STRESS (PSI)
3	000:00:02	2157	171.65
4	000:00:03	2707	215.42
5	000:00:04	3282	261.17
6	000:00:05	3940	313.54
7	000:00:06	4540	361.28
8	000:00:07	4854	386.27
9	000:00:08	5310	422.56
10	000:00:09	5832	464.10
11	000:00:10	6380	507.70
12	000:00:11	6758	537.78
13	000:00:12	7103	565.24
14	000:00:13	7443	592.30
15	000:00:14	7981	635.11
16	000:00:15	8527	678.56
17	000:00:16	9081	722.64
18	000:00:17	9600	763.94
19	000:00:18	9424	749.94
20	000:00:19	10037	798.72
21	000:00:20	10521	837.23
22	000:00:21	11079	881.64
23	000:00:22	11729	933.36
24	000:00:23	11330	901.61
25	000:00:24	12336	981.67
26	000:00:25	12997	1,034.27
27	000:00:26	13487	1,073.26
28	000:00:27	14053	1,118.30
29	000:00:28	14507	1,154.43
30	000:00:29	15075	1,199.63
31	000:00:30	15638	1,244.43
32	000:00:31	16110	1,281.99
33	000:00:32	16663	1,326.00
34	000:00:33	16388	1,304.12
35	000:00:34	15920	1,266.87
36	000:00:35	15667	1,246.74
37	000:00:36	15477	1,231.62
38	000:00:37	15331	1,220.00
39	000:00:38	15200	1,209.58
40	000:00:39	15089	1,200.74

READ #	TIME	LOAD	STRESS (PSI)
41	000:00:40	14992	1,193.03
42	000:00:41	14904	1,186.02
43	000:00:42	14823	1,179.58
44	000:00:43	14750	1,173.77
45	000:00:44	14681	1,168.28
46	000:00:45	14618	1,163.26
47	000:00:46	14557	1,158.41
48	000:00:47	14501	1,153.95
49	000:00:48	14449	1,149.81
50	000:00:49	14399	1,145.84
51	000:00:50	14350	1,141.94
52	000:00:51	14305	1,138.36
53	000:00:52	14263	1,135.01
54	000:00:53	14221	1,131.67
55	000:00:54	14181	1,128.49
56	000:00:55	14144	1,125.54
57	000:00:56	14106	1,122.52
58	000:00:57	14071	1,119.73
59	000:00:58	14037	1,117.03
60	000:00:59	14004	1,114.40
61	000:01:00	13972	1,111.86
62	000:01:01	13942	1,109.47
63	000:01:02	15565	1,238.62
64	000:01:03	16909	1,345.58
65	000:01:04	18001	1,432.47
66	000:01:05	18289	1,455.39
67	000:01:06	17771	1,414.17
68	000:01:07	17514	1,393.72
69	000:01:08	17983	1,431.04
70	000:01:09	17998	1,432.24
71	000:01:10	17905	1,424.83
72	000:01:11	18085	1,439.16
73	000:01:12	18308	1,456.90
74	000:01:13	18532	1,474.73
75	000:01:14	18759	1,492.79
76	000:01:15	18924	1,505.92
77	000:01:16	19121	1,521.60
78	000:01:17	19304	1,536.16

READ #	TIME	LOAD	STRESS (PSI)
79	000:01:18	19498	1,551.60
80	000:01:19	19541	1,555.02
81	000:01:20	19831	1,578.10
82	000:01:21	20097	1,599.27
83	000:01:22	19493	1,551.20
84	000:01:23	20002	1,591.71
85	000:01:24	20539	1,634.44
86	000:01:25	20934	1,665.87
87	000:01:26	21221	1,688.71
88	000:01:27	21517	1,712.27
89	000:01:28	21848	1,738.61
90	000:01:29	22170	1,764.23
91	000:01:30	22533	1,793.12
92	000:01:31	22869	1,819.86
93	000:01:32	23178	1,844.45
94	000:01:33	23507	1,870.63
95	000:01:34	23929	1,904.21
96	000:01:35	24341	1,937.00
97	000:01:36	24743	1,968.99
98	000:01:37	25152	2,001.53
99	000:01:38	25476	2,027.32
100	000:01:39	25920	2,062.65
101	000:01:40	26372	2,098.62
102	000:01:41	26809	2,133.39
103	000:01:42	27226	2,166.58
104	000:01:43	27625	2,198.33
105	000:01:44	28051	2,232.23
106	000:01:45	28477	2,266.13
107	000:01:46	28891	2,299.07
108	000:01:47	29355	2,336.00
109	000:01:48	29837	2,374.35
110	000:01:49	30328	2,413.43
111	000:01:50	30829	2,453.29
112	000:01:51	31285	2,489.58
113	000:01:52	31735	2,525.39
114	000:01:53	32149	2,558.34
115	000:01:54	32615	2,595.42
116	000:01:55	33049	2,629.96

READ #	TIME	LOAD	STRESS (PSI)
117	000:01:56	33451	2,661.95
118	000:01:57	33866	2,694.97
119	000:01:58	34312	2,730.46
120	000:01:59	34761	2,766.19
121	000:02:00	35213	2,802.16
122	000:02:01	35600	2,832.96
123	000:02:02	35995	2,864.39
124	000:02:03	36345	2,892.24
125	000:02:04	36730	2,922.88
126	000:02:05	37117	2,953.68
127	000:02:06	37506	2,984.63
128	000:02:07	37909	3,016.70
129	000:02:08	38330	3,050.20
130	000:02:09	38747	3,083.39
131	000:02:10	39197	3,119.20
132	000:02:11	39644	3,154.77
133	000:02:12	40105	3,191.45
134	000:02:13	40557	3,227.42
135	000:02:14	41033	3,265.30
136	000:02:15	41481	3,300.95
137	000:02:16	41941	3,337.56
138	000:02:17	42281	3,364.61
139	000:02:18	42649	3,393.90
140	000:02:19	43043	3,425.25
141	000:02:20	43455	3,458.04
142	000:02:21	43875	3,491.46
143	000:02:22	44309	3,526.00
144	000:02:23	44740	3,560.30
145	000:02:24	45186	3,595.79
146	000:02:25	45624	3,630.64
147	000:02:26	46081	3,667.01
148	000:02:27	46527	3,702.50
149	000:02:28	46931	3,734.65
150	000:02:29	47301	3,764.09
151	000:02:30	47648	3,791.71
152	000:02:31	47968	3,817.17
153	000:02:32	48310	3,844.39
154	000:02:33	48686	3,874.31

READ #	TIME	LOAD	STRESS (PSI)
155	000:02:34	49093	3,906.70
156	000:02:35	49499	3,939.01
157	000:02:36	49916	3,972.19
158	000:02:37	50316	4,004.02
159	000:02:38	50740	4,037.76
160	000:02:39	51155	4,070.79
161	000:02:40	51584	4,104.92
162	000:02:41	52002	4,138.19
163	000:02:42	52432	4,172.41
164	000:02:43	52852	4,205.83
165	000:02:44	53292	4,240.84
166	000:02:45	53722	4,275.06
167	000:02:46	54163	4,310.15
168	000:02:47	54596	4,344.61
169	000:02:48	55039	4,379.86
170	000:02:49	55472	4,414.32
171	000:02:50	55896	4,448.06
172	000:02:51	56295	4,479.81
173	000:02:52	56712	4,513.00
174	000:02:53	57137	4,546.82
175	000:02:54	57561	4,580.56
176	000:02:55	57985	4,614.30
177	000:02:56	58423	4,649.15
178	000:02:57	58851	4,683.21
179	000:02:58	59287	4,717.91
180	000:02:59	59715	4,751.97
181	000:03:00	60158	4,787.22
182	000:03:01	60587	4,821.36
183	000:03:02	61033	4,856.85
184	000:03:03	61470	4,891.63
185	000:03:04	61894	4,925.37
186	000:03:05	62251	4,953.78
187	000:03:06	62583	4,980.20
188	000:03:07	62885	5,004.23
189	000:03:08	63200	5,029.30
190	000:03:09	63550	5,057.15
191	000:03:10	63995	5,092.56
192	000:03:11	64432	5,127.34

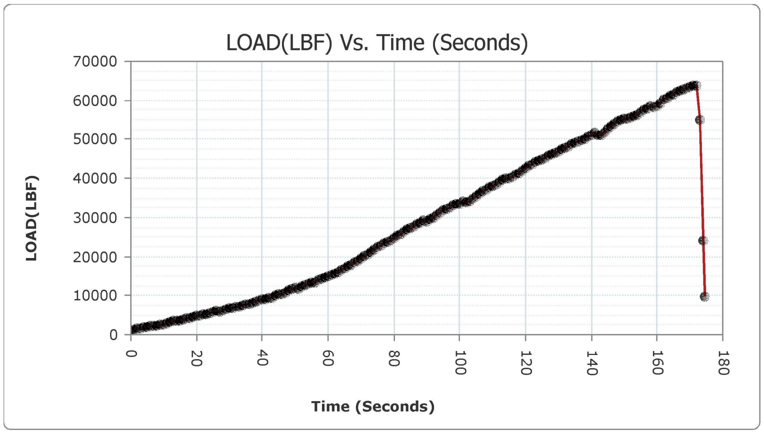
READ #	TIME	LOAD	STRESS (PSI)
193	000:03:12	64881	5,163.07
194	000:03:13	65320	5,198.00
195	000:03:14	65754	5,232.54
196	000:03:15	66177	5,266.20
197	000:03:16	66613	5,300.89
198	000:03:17	67008	5,332.33
199	000:03:18	67376	5,361.61
200	000:03:19	67750	5,391.37
201	000:03:20	68131	5,421.69
202	000:03:21	68508	5,451.69
203	000:03:22	68896	5,482.57
204	000:03:23	69277	5,512.89
205	000:03:24	69669	5,544.08
206	000:03:25	70046	5,574.08
207	000:03:26	70461	5,607.11
208	000:03:27	70885	5,640.85
209	000:03:28	71326	5,675.94
210	000:03:29	71739	5,708.81
211	000:03:30	72160	5,742.31
212	000:03:31	72578	5,775.57
213	000:03:32	72992	5,808.52
214	000:03:33	73401	5,841.07
215	000:03:34	73807	5,873.37
216	000:03:35	74205	5,905.05
217	000:03:36	74613	5,937.51
218	000:03:37	74994	5,967.83
219	000:03:38	75393	5,999.58
220	000:03:39	75761	6,028.87
221	000:03:40	76141	6,059.11
222	000:03:41	76501	6,087.76
223	000:03:42	76849	6,115.45
224	000:03:43	77198	6,143.22
225	000:03:44	77519	6,168.77
226	000:03:45	77833	6,193.75
227	000:03:46	78080	6,213.41
228	000:03:47	78025	6,209.03
229	000:03:47	19052	1,516.11

Concrete Test

Test Type: ASTM C39
9/7/2021

Sample Identification: 21-113_9-1-21_sample2
Machine ID: 6a2722

TYPE	PEAK VALUES	UNITS
LOAD	61302	LBF
Diameter	4.00	IN
Length	6.00	IN
Cross-Sectional Area	12.57	IN²
Sample Age	0.0	day(s)
Corrected Stress	4878.29	PSI
Average Pace Rate	33.55	PSI/SEC
Fracture Type	Type 3	
Correction Factor	0.960	
Temperature @ START	77.2	°F
Temperature @ FINISH	77.7	°F



READ #	TIME	LOAD	STRESS (PSI)
1	000:00:00	1020	81.17
2	000:00:01	1429	113.72

READ #	TIME	LOAD	STRESS (PSI)
3	000:00:02	1533	121.99
4	000:00:03	1658	131.94
5	000:00:04	1800	143.24
6	000:00:05	1970	156.77
7	000:00:06	2144	170.61
8	000:00:07	2146	170.77
9	000:00:08	2338	186.05
10	000:00:09	2542	202.29
11	000:00:10	2764	219.95
12	000:00:11	2987	237.70
13	000:00:12	3224	256.56
14	000:00:13	3419	272.08
15	000:00:14	3553	282.74
16	000:00:15	3661	291.33
17	000:00:16	3848	306.21
18	000:00:17	4111	327.14
19	000:00:18	4362	347.12
20	000:00:19	4636	368.92
21	000:00:20	4887	388.90
22	000:00:21	5043	401.31
23	000:00:22	5300	421.76
24	000:00:23	5185	412.61
25	000:00:24	5507	438.23
26	000:00:25	5806	462.03
27	000:00:26	6082	483.99
28	000:00:27	5850	465.53
29	000:00:28	6194	492.90
30	000:00:29	6531	519.72
31	000:00:30	6727	535.32
32	000:00:31	6838	544.15
33	000:00:32	7031	559.51
34	000:00:33	7228	575.19
35	000:00:34	7500	596.83
36	000:00:35	7730	615.13
37	000:00:36	7921	630.33
38	000:00:37	8034	639.33
39	000:00:38	8318	661.93
40	000:00:39	8664	689.46

READ #	TIME	LOAD	STRESS (PSI)
41	000:00:40	8957	712.78
42	000:00:41	9220	733.70
43	000:00:42	9457	752.56
44	000:00:43	9585	762.75
45	000:00:44	9975	793.79
46	000:00:45	10336	822.51
47	000:00:46	10566	840.82
48	000:00:47	10874	865.33
49	000:00:48	11239	894.37
50	000:00:49	11639	926.20
51	000:00:50	12040	958.11
52	000:00:51	11852	943.15
53	000:00:52	12340	981.99
54	000:00:53	12563	999.73
55	000:00:54	12978	1,032.76
56	000:00:55	13202	1,050.58
57	000:00:56	13505	1,074.69
58	000:00:57	13899	1,106.05
59	000:00:58	14291	1,137.24
60	000:00:59	14644	1,165.33
61	000:01:00	14872	1,183.48
62	000:01:01	15308	1,218.17
63	000:01:02	15763	1,254.38
64	000:01:03	16047	1,276.98
65	000:01:04	16448	1,308.89
66	000:01:05	17014	1,353.93
67	000:01:06	17534	1,395.31
68	000:01:07	18038	1,435.42
69	000:01:08	18523	1,474.01
70	000:01:09	19004	1,512.29
71	000:01:10	19472	1,549.53
72	000:01:11	20089	1,598.63
73	000:01:12	20651	1,643.35
74	000:01:13	21154	1,683.38
75	000:01:14	21763	1,731.84
76	000:01:15	22335	1,777.36
77	000:01:16	22758	1,811.02
78	000:01:17	23351	1,858.21

READ #	TIME	LOAD	STRESS (PSI)
79	000:01:18	23921	1,903.57
80	000:01:19	23937	1,904.85
81	000:01:20	24657	1,962.14
82	000:01:21	25335	2,016.10
83	000:01:22	25626	2,039.25
84	000:01:23	26341	2,096.15
85	000:01:24	26965	2,145.81
86	000:01:25	27494	2,187.90
87	000:01:26	27812	2,213.21
88	000:01:27	28315	2,253.24
89	000:01:28	28786	2,290.72
90	000:01:29	29339	2,334.72
91	000:01:30	29089	2,314.83
92	000:01:31	29530	2,349.92
93	000:01:32	29897	2,379.13
94	000:01:33	30443	2,422.58
95	000:01:34	31132	2,477.41
96	000:01:35	31769	2,528.10
97	000:01:36	32277	2,568.52
98	000:01:37	32675	2,600.19
99	000:01:38	33105	2,634.41
100	000:01:39	33424	2,659.80
101	000:01:40	33603	2,674.04
102	000:01:41	34088	2,712.64
103	000:01:42	33742	2,685.10
104	000:01:43	34295	2,729.11
105	000:01:44	34910	2,778.05
106	000:01:45	35536	2,827.86
107	000:01:46	36032	2,867.34
108	000:01:47	36659	2,917.23
109	000:01:48	37111	2,953.20
110	000:01:49	37624	2,994.02
111	000:01:50	38156	3,036.36
112	000:01:51	38571	3,069.38
113	000:01:52	39109	3,112.20
114	000:01:53	39579	3,149.60
115	000:01:54	40031	3,185.57
116	000:01:55	40175	3,197.02

READ #	TIME	LOAD	STRESS (PSI)
117	000:01:56	40529	3,225.20
118	000:01:57	40959	3,259.41
119	000:01:58	41496	3,302.15
120	000:01:59	42064	3,347.35
121	000:02:00	42647	3,393.74
122	000:02:01	43192	3,437.11
123	000:02:02	43663	3,474.59
124	000:02:03	44117	3,510.72
125	000:02:04	44573	3,547.01
126	000:02:05	45002	3,581.15
127	000:02:06	45388	3,611.86
128	000:02:07	45757	3,641.23
129	000:02:08	46181	3,674.97
130	000:02:09	46609	3,709.03
131	000:02:10	47038	3,743.17
132	000:02:11	47433	3,774.60
133	000:02:12	47883	3,810.41
134	000:02:13	48333	3,846.22
135	000:02:14	48793	3,882.82
136	000:02:15	49164	3,912.35
137	000:02:16	49611	3,947.92
138	000:02:17	49805	3,963.36
139	000:02:18	50283	4,001.39
140	000:02:19	50761	4,039.43
141	000:02:20	51240	4,077.55
142	000:02:21	51720	4,115.75
143	000:02:22	51250	4,078.35
144	000:02:23	51271	4,080.02
145	000:02:24	51887	4,129.04
146	000:02:25	52682	4,192.30
147	000:02:26	53463	4,254.45
148	000:02:27	54184	4,311.83
149	000:02:28	54838	4,363.87
150	000:02:29	55153	4,388.94
151	000:02:30	55335	4,403.42
152	000:02:31	55497	4,416.31
153	000:02:32	55702	4,432.62
154	000:02:33	55932	4,450.93

READ #	TIME	LOAD	STRESS (PSI)
155	000:02:34	56464	4,493.26
156	000:02:35	57022	4,537.67
157	000:02:36	57561	4,580.56
158	000:02:37	58042	4,618.84
159	000:02:38	58466	4,652.58
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161	000:02:40	58663	4,668.25
162	000:02:41	59373	4,724.75
163	000:02:42	60084	4,781.33
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166	000:02:45	61589	4,901.10
167	000:02:46	62030	4,936.19
168	000:02:47	62457	4,970.17
169	000:02:48	62876	5,003.51
170	000:02:49	63247	5,033.04
171	000:02:50	63575	5,059.14
172	000:02:51	63814	5,078.16
173	000:02:52	63816	5,078.32
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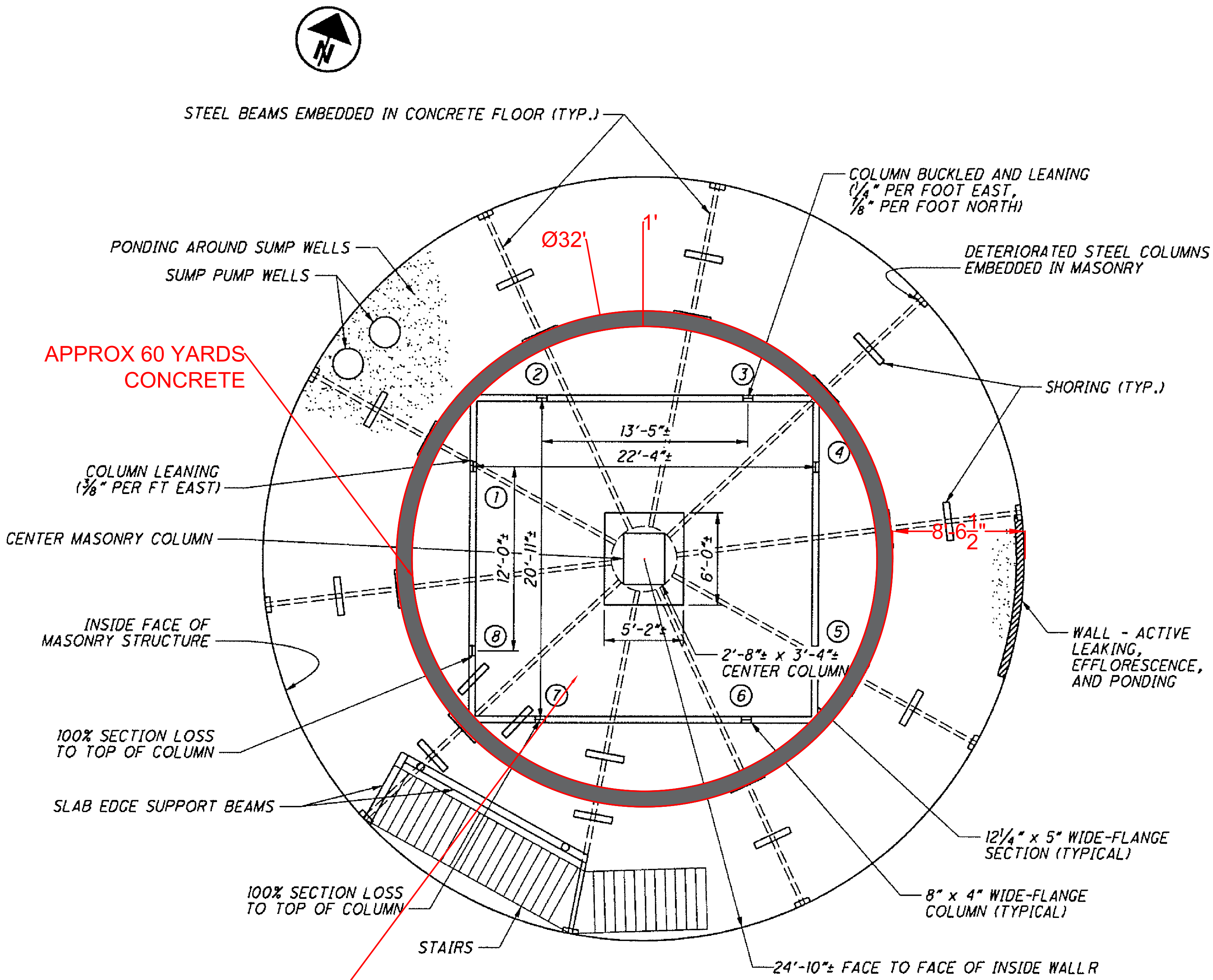
175	000:02:54	24234	1,928.48
176	000:02:54	9796	779.54

Information Provided by Contractor



BASEMENT PLAN

NOT TO SCALE

KS ASSOCIATES

Civil Engineers + Surveyors

260 Burns Road, Suite 100
Elyria, Ohio 44035
P 440 365 4730
F 440 365 4790
ksassociates.com

July 17, 2019

Mr. Chris Yates
City of Oberlin
85 S. Main Street
Oberlin, Ohio 44074

RE: Historic Gasholder Building (the Round House) Structural Inspection and Report
KS P# 19171

Dear Mr. Yates:

KS Associates, Inc. (KS) is pleased to submit the inspection finding report and conclusion of our findings for the above referenced project. We did not include recommendations in our report as we need a discussion with the City to understand the intended use for this historic building. The report includes the finding supported by photos and field notes and sketches of each floor plan.

Upon your review of the report, we would like to meet to discuss the findings and the next step toward the feasibility and rehabilitation services.

We appreciate the opportunity to provide these services to the City of Oberlin. Should you have any questions or concerns, please contact me at (440) 365-4730, ext. 340.

Sincerely,

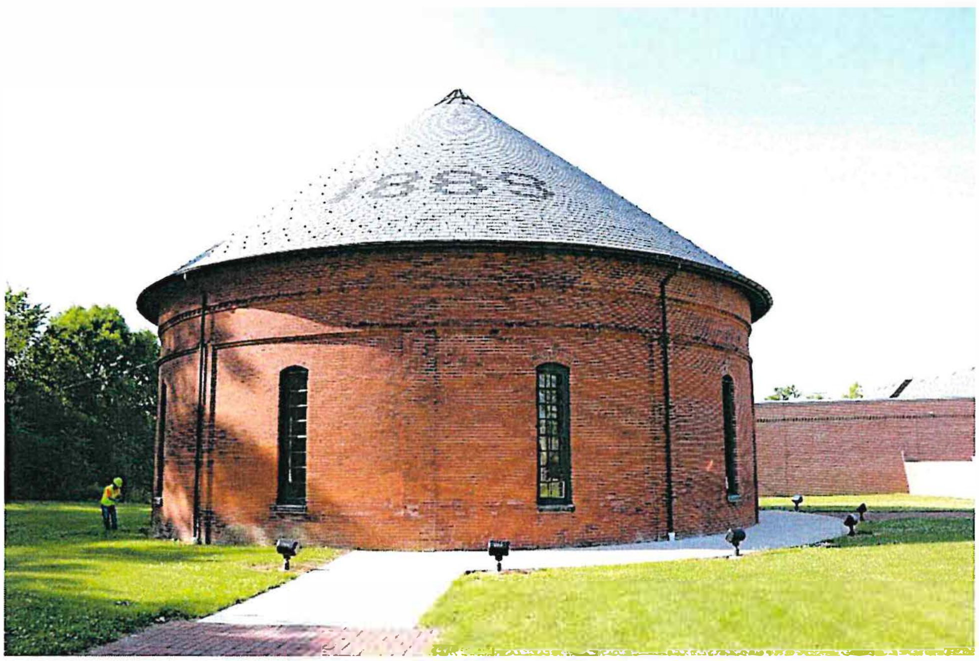
KS ASSOCIATES, INC.

Hamid V. Homaee, P.E.
Principal

Structural Field Inspection Report

Historic Gasholder Building
(The Round House)

City of Oberlin



LOCATION: 291 S Main St, Oberlin, OH 44074

PREPARED BY: KS Associates
DATE: 07-15-2019

KS ASSOCIATES

Civil Engineers + Surveyors

260 Burns Road, Suite 100
Elyria, Ohio 44035
P 440 365 4730
F 440 365 4790
www.ksassociates.com

I. FIELD INSPECTION DATA

Date of Inspection: July 2, 2019
Time of Inspection: 8:30 a.m. Eastern Time
Attendance List:

Chris Yates	City of Oberlin
Robert Yin, P.E.	KS Associates
Rob Pfingsten, P.E.	KS Associates

II. EXISTING STRUCTURE DATA

A. History

Year Built: 1889
Year(s) Reconstructed:
No major structural rehabilitation other than roof work with new shingles in 2014, added stair access to basement and temporary shoring in the basement sometime after.

B. Structure/Dimensions

The existing structure is a two story (including the basement) round masonry building with concrete floors and timber roof. See the building layout sketch in appendix for dimension details.

III. EXISTING CONDITIONS

The building is in a community park with sidewalk connected to the pavilion next to the North Coast Inland Trail. The KS team observed deterioration in the building structures as detailed in the following sections. See the sketches of the building layout and structural defect plans in the appendix for details.

A. Roof and Wall

The City of Oberlin informed KS that the structure's tile roof system was recently rehabilitated (Photo 1). Aside from isolated roof rafter members which were replaced or sistered during the rehabilitation, the timber roof structure is from the original construction. There is a staircase suspended from the roof structure to allow roof access which is deteriorated and marked as out of service (photo 3). The brick wall is in fair condition with isolated areas of bricks having uneven faces, surface coatings/patches, and evidence of previous modifications to the building (Photo 6). The old front door was removed and widened for better access to the building in 2014 (Photo 2).

B. Ground Floor Slab

The concrete floor thickness varies from 11 to 13 inches and is approximately 50′ in diameter. There are cracks in the concrete slab which radiate from the center of the floor with the areas surrounding the center being depressed several inches (Photo 5). The cracked center area sounds hollow and bouncing. Other areas are solid. There are four 18″x18″ holes on the floor along the wall (Photo 4) with an open view of the basement or temporary covers in place. A 12′x4′ portion of the existing slab has been previously removed to allow the installation of new timber stairs for basement access (Photo 7).

C. Basement

1. General: The City of Oberlin informed KS that the basement, as part of the original structure's function, was flooded with water at one point and has been flooded for periods of time since the structure was decommissioned. Sump pump was installed to drain the accumulated water. KS used a Plumb Bob to verify that the basement walls are plumb and observed no signs of uneven settlement. There are signs of active leakage on the masonry basement wall, areas of cracked and wet floor (Photo 10), and ponding around the sump wells (Photo 12). The east wall of the basement has the heaviest evidence of infiltration with active leaking, heavy efflorescence/mineral buildup on the lower half of the wall and ponding at the floor below (Photo 8). See the attached defect map for the location of the leaking wall and ponding.

2. Center Masonry Column: The center masonry column (3′-4″ X 2′-8″) was installed in 2014 and is in good condition (Photo 9). The column is supported on the 6′-0″ X 5′-2″ concrete foundation and its concrete cap provides support for the embedded fanned steel beams.

3. Main Support Frame: The main support frame (22′-4″ X 20′-11″) is consisted of 4 steel beams (12″H X 5″W X 3/8″T Section) on 8 steel

columns (8"H X 4"W X 1/8"T Section) as detailed on the attached structure sketch. All beams and columns are deteriorated with rust scales (Photos 13, 15, 16). Overall section loss is estimated to be 15% to 20%. Two of the columns (14' Height) are buckled and leaning (Photo 14). Another two columns in the southwest corner were deteriorated with 100% section loss at the top.

4. Embedded Columns and Beams: There are 10 embedded steel beams (with 3 3/8" flange width) in the main floor radially fanned from the center with the exterior ends supported by steel columns (with 6" X 3/8" flange) embedded in the basement masonry wall. All visible parts of the beams and columns are deteriorated with rust pack (Photo 11). Overall section loss is estimated to be 15% to 20%.

5. Temporary Shoring: There is temporary shoring under all 10 embedded beams in the main floor (Photo 17) and the main support frame near the two columns with 100% section loss at the top. There are also utility conduits in the basement (Photo 18).

D. Drainage

There are four downspouts along the outside of the wall for the roof drain. Two of the downspouts are connected to the drainage system and the two on the south side are draining to the ground (Photo 20). There is an apparent local low spot in the grading on the east side of the building near the wall in the basement with active leakage (Photo 19). There are sump wells and pump drainage system installed in the basement (Photo 12).

IV. CONCLUSION

Upon your review of above presented inspection findings, we would like to meet to discuss our initial structural evaluation and recommendations, develop a program to obtain material samples for testing of concrete flooring systems and supporting steel frame, if the City desires to rehabilitate this historic structure. Collected data from our field inspection and material testing will allow for a structural analysis to determine the floor system's remaining capacity regarding the design loading condition intended for this historic structure.

The program for structural rehabilitation will include drainage, utilities, masonry repairs, concrete repairs, doors and windows improvement and removal of all temporary support system without compromising the historic fabric of the building and stay within state (SHPO) and federal (Department of Interior) guidelines for this rehabilitation.

V. APPENDIX

1. Inspection Photographs
2. Sketches of the Building Layout and Structural Defects
3. Field Notes

APPENDIX 1. INSPECTION PHOTOGRAPHS

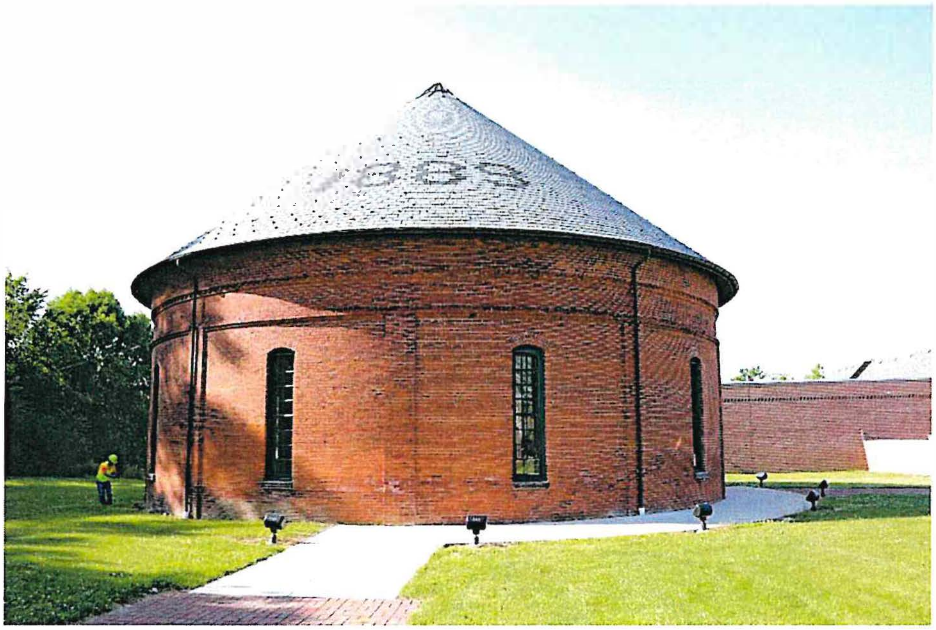


Photo 1. Exterior View of the Gasholder Building

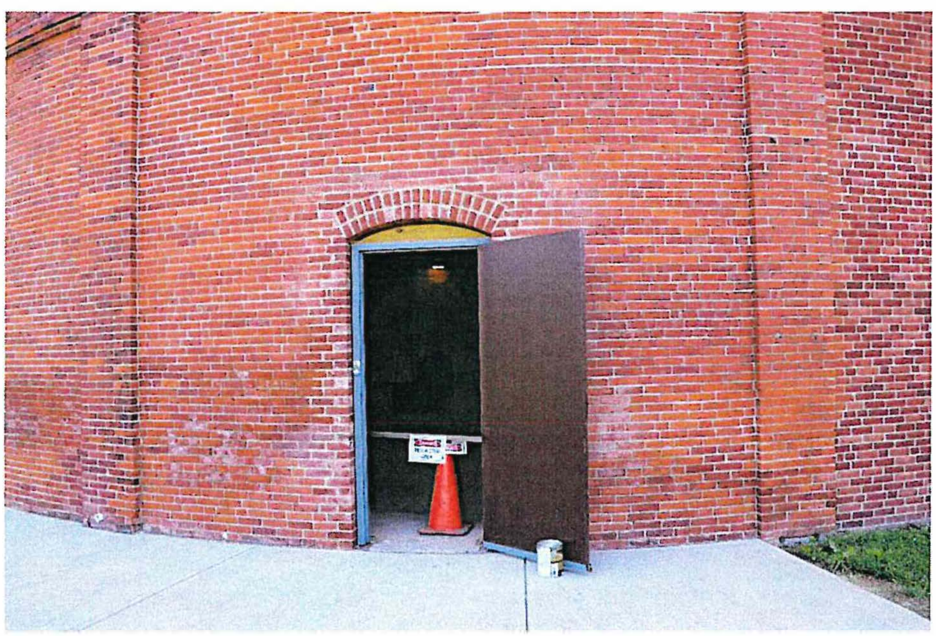


Photo 2. Front Door

Photo 3. Staircase suspended from the Roof Structure

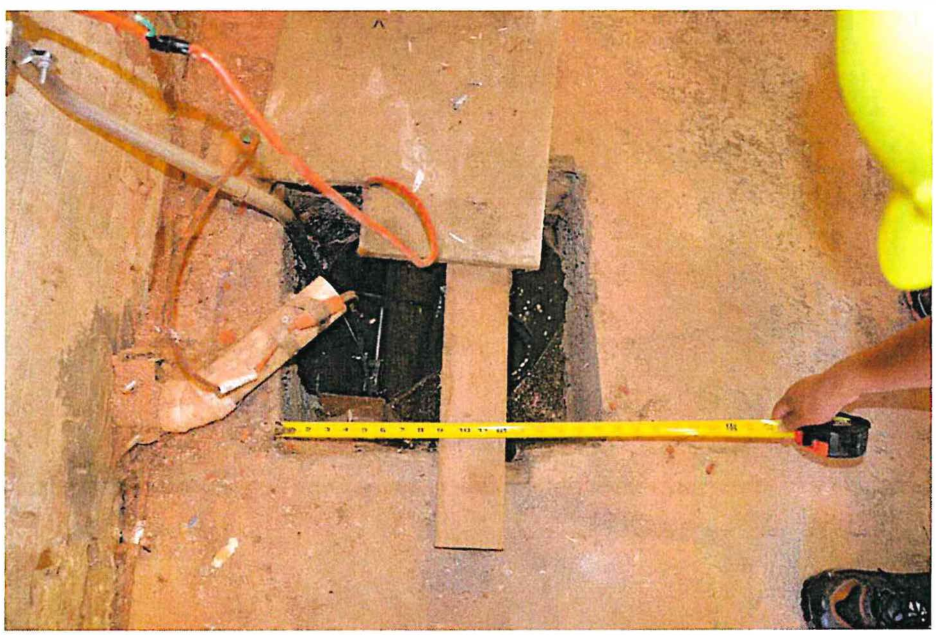


Photo 4. 18″ X 18″ Hole on the Main Floor

Photo 5. Center Area of the Round Main Floor

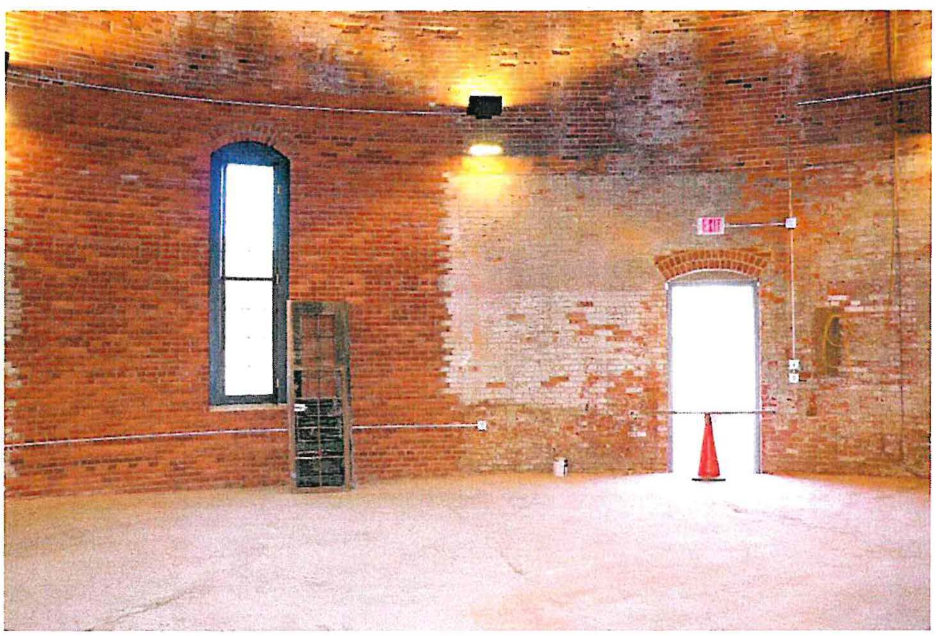


Photo 6. Main Floor Brick Wall Inside

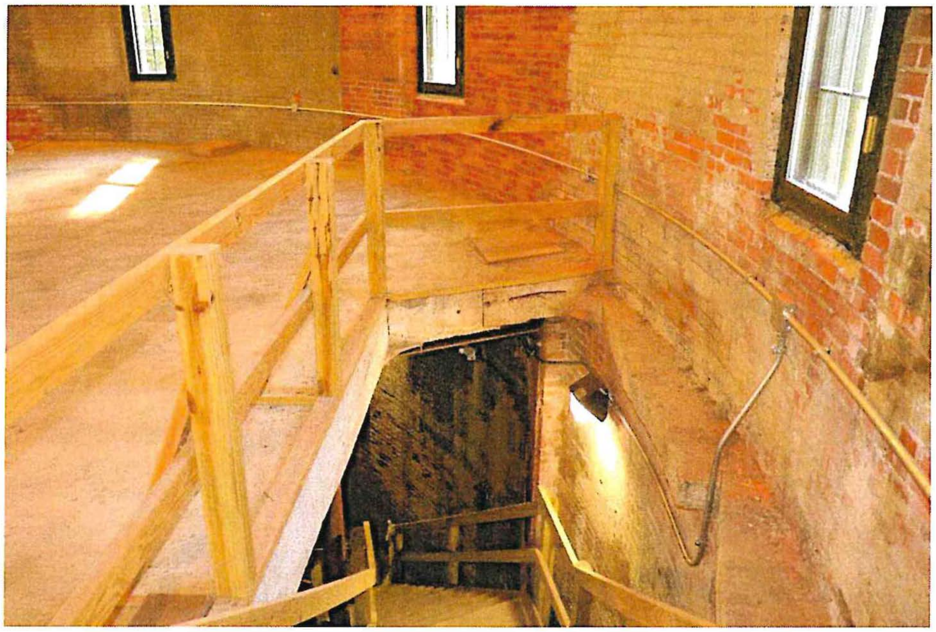


Photo 7. Opening on the Main Floor for Stairs to Basement

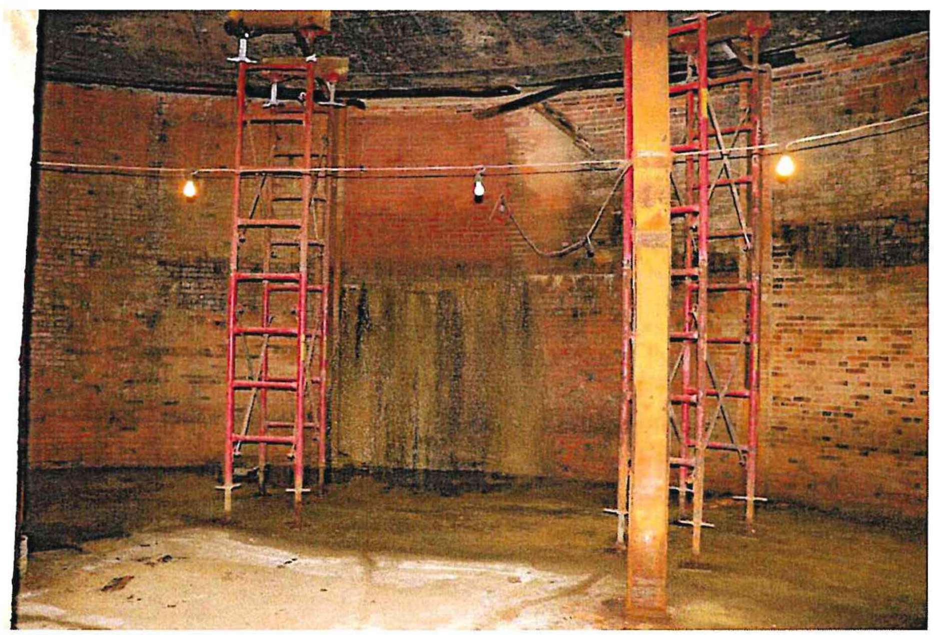


Photo 8. Active Leakage on the Basement Wall

Photo 9. Center Masonry Column under the Main Floor

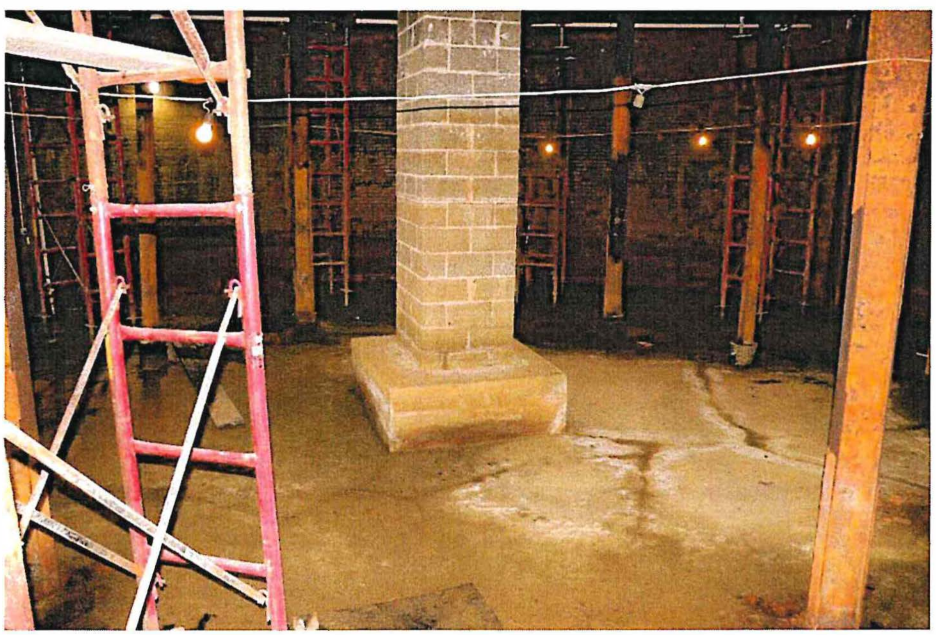


Photo 10. Basement Floor with Cracks and Wet Areas

Photo 11. Embedded Beams and Columns in Basement

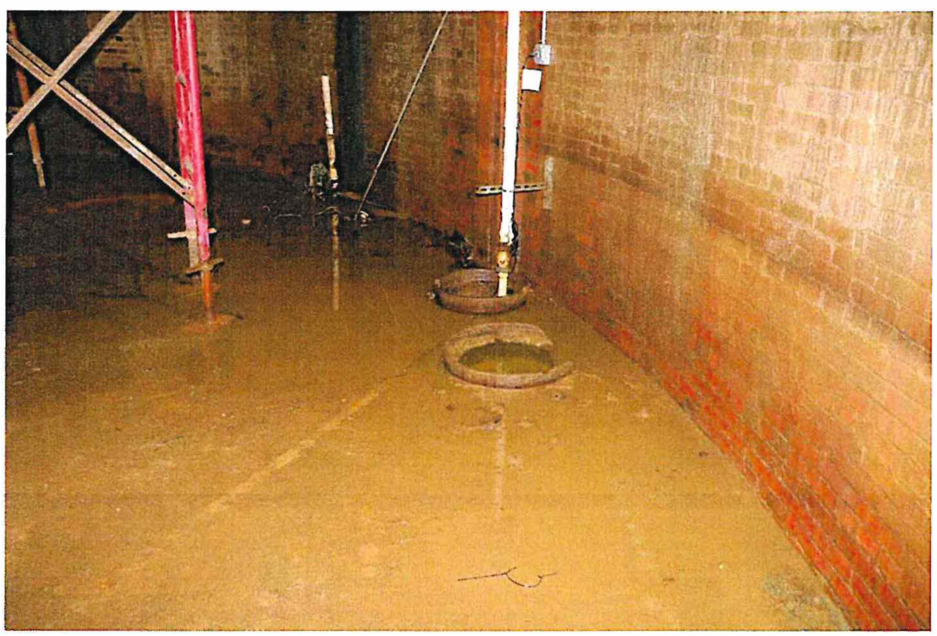


Photo 12. Ponding around Sump Crocks

Photo 13. Main Support Frame in the Basement

Photo 14. Column Buckled and Leaning

Photo 15. Main Frame Column with 100% Section Loss at Top

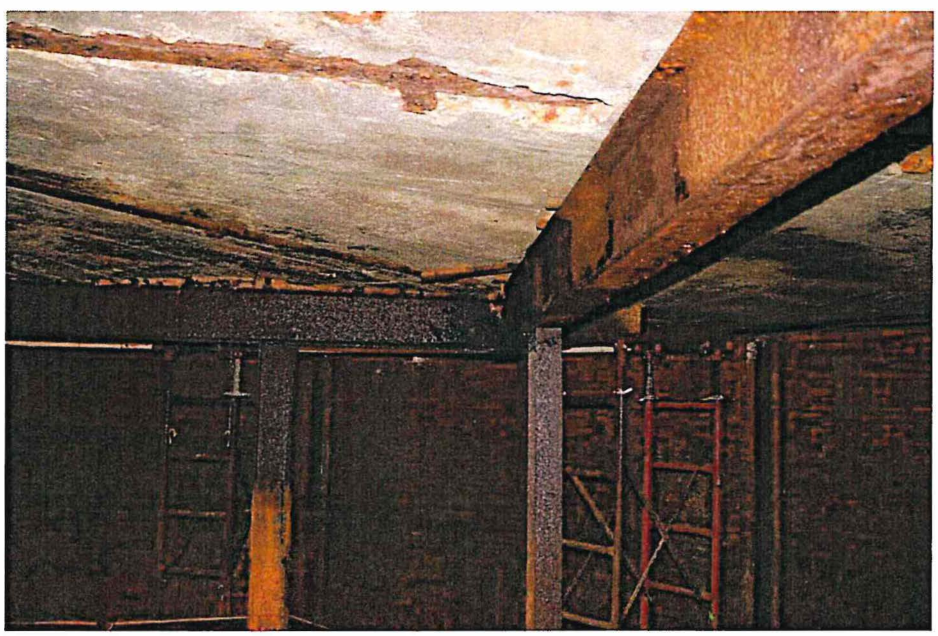


Photo 16. Main Frame Beam and Column with Rust Pack

Photo 17. Temporary Shoring under the Embedded Beam

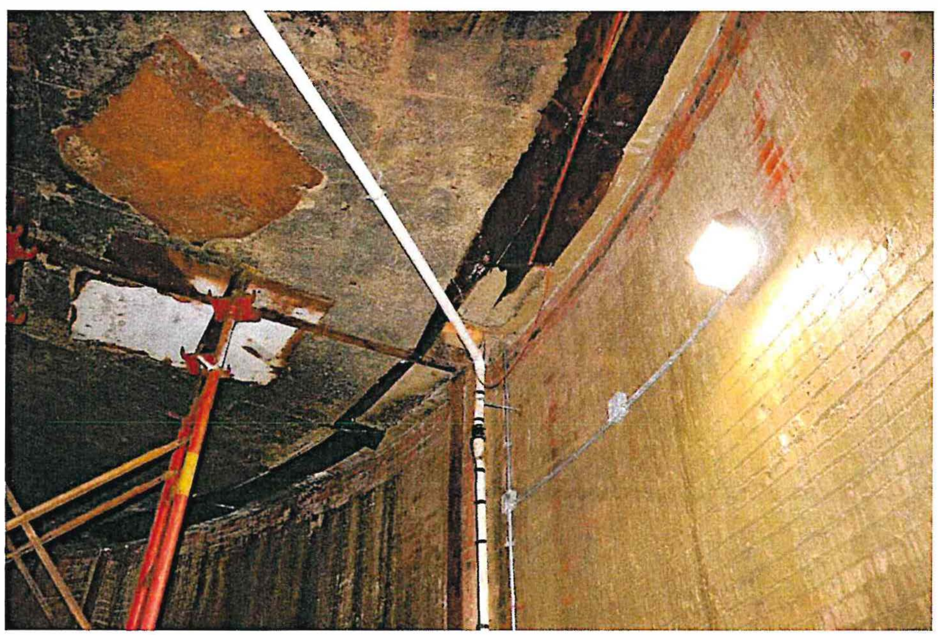
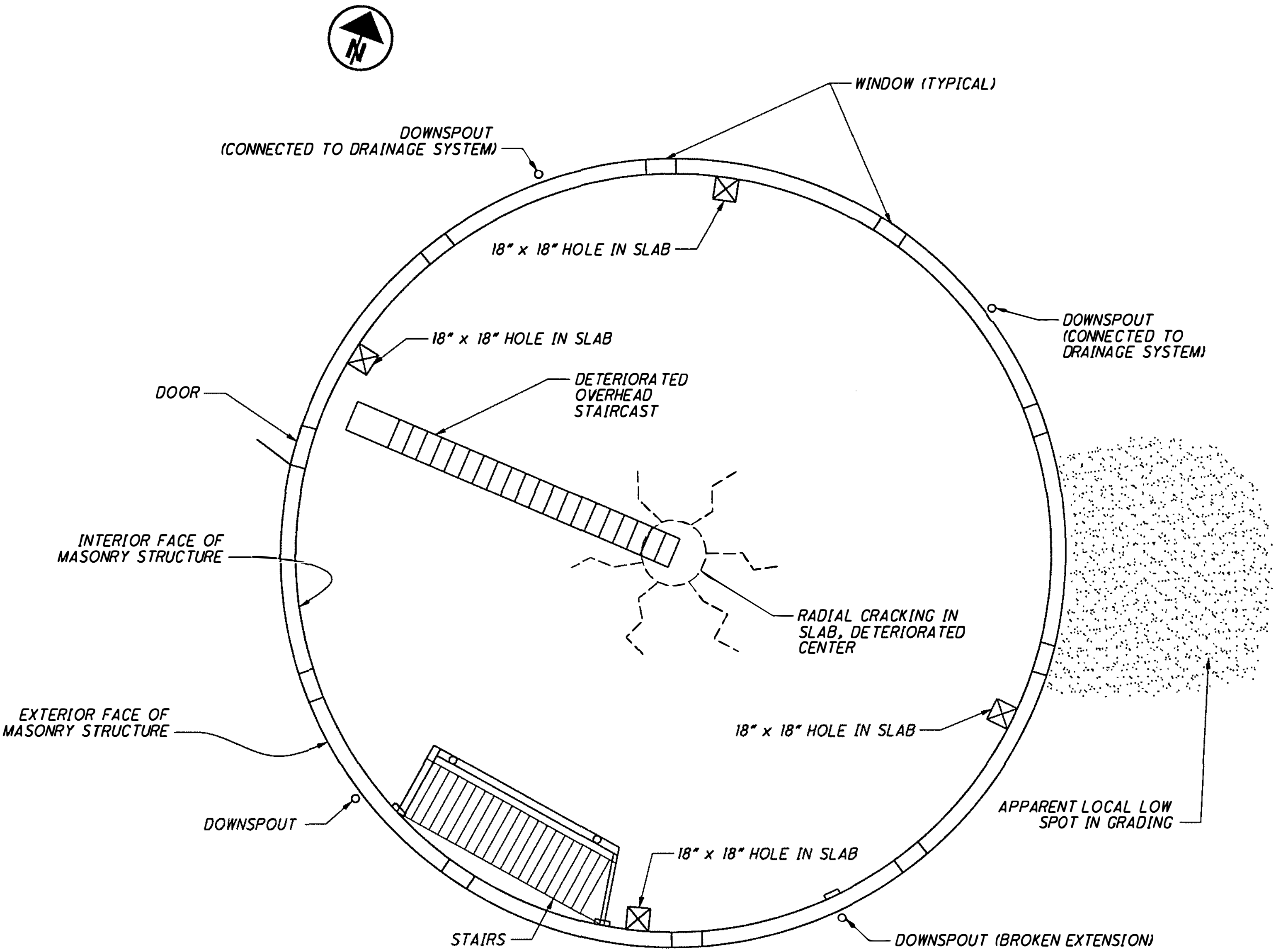


Photo 18. Utility Conduits in the Basement

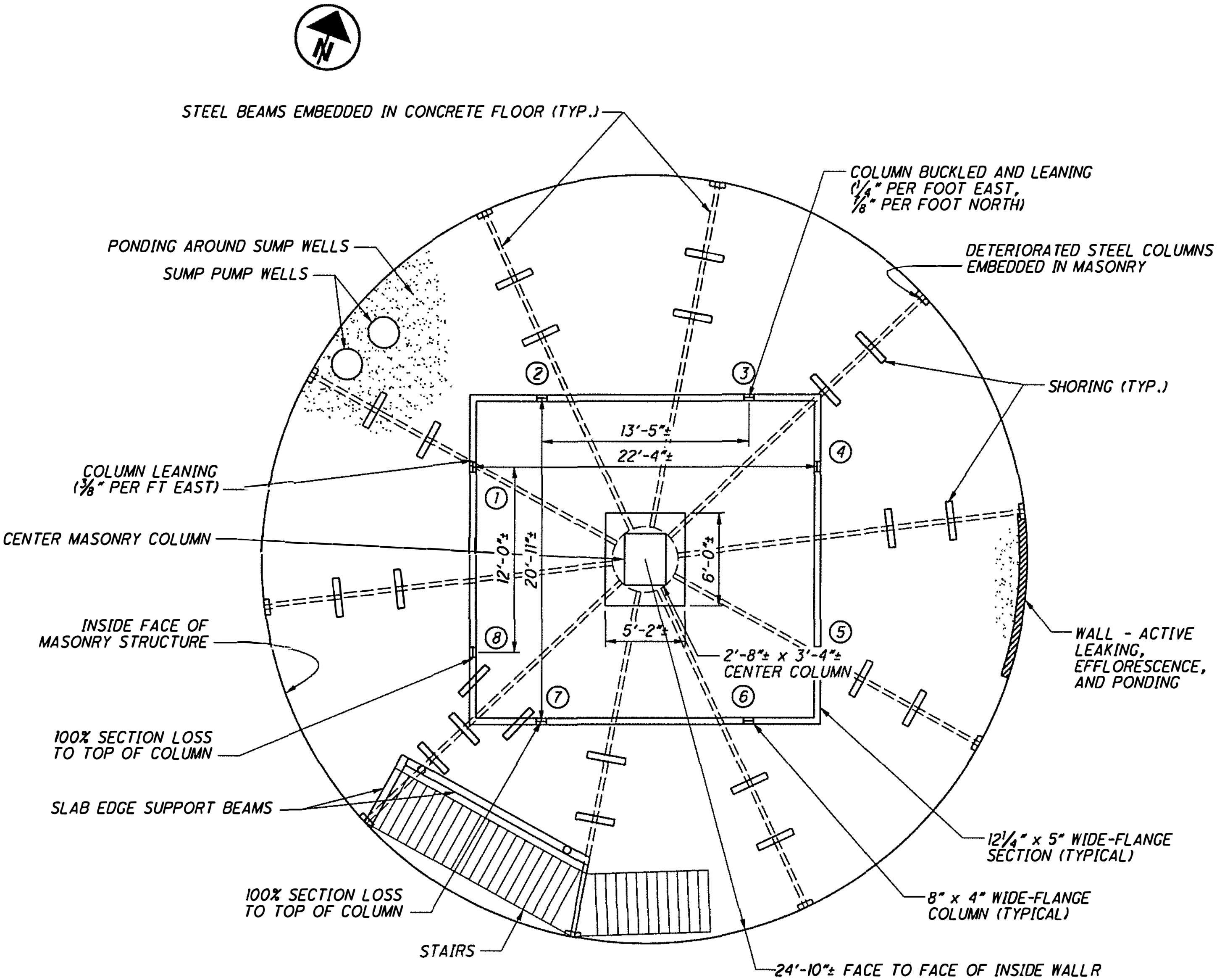
Photo 19. Low Spot behind the Building due to Grading

Photo 20. Downspout Drain to the Ground (Broken Extension)



GROUND FLOOR PLAN

NOT TO SCALE



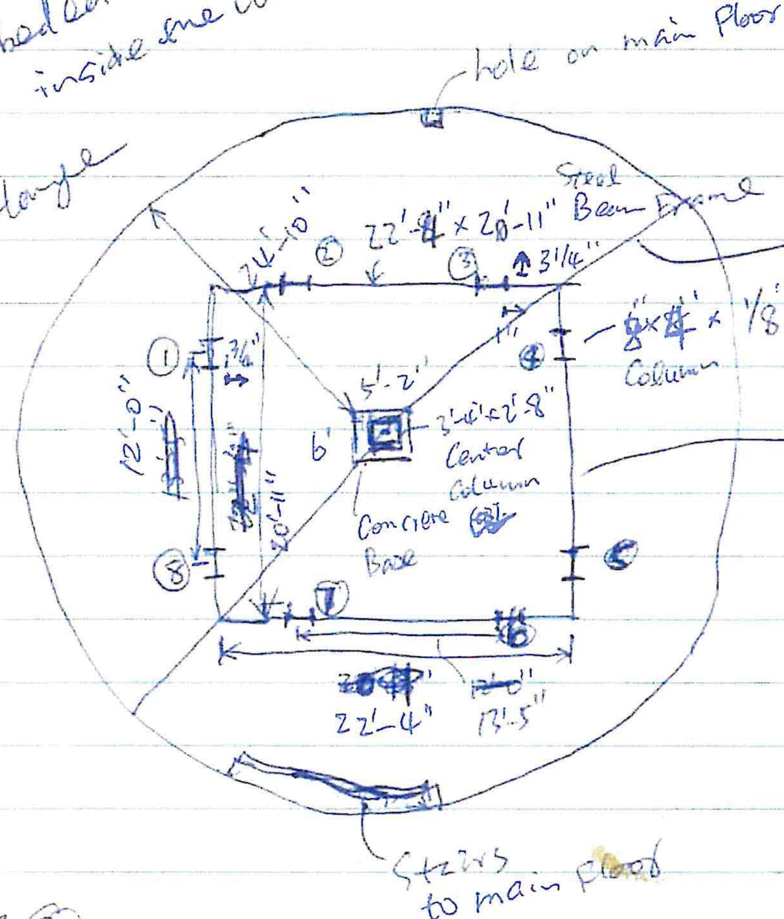
BASEMENT PLAN

NOT TO SCALE

3 3/8" (10) Embeded Beam Width in Main Floor

6" x 3/8" Embeded Steel Column inside the wall

(10) Exposed Flange



Embedded Beam (10)

8" x 4" x 1/8" Flange Column

12'4" x 5" x 3/8"

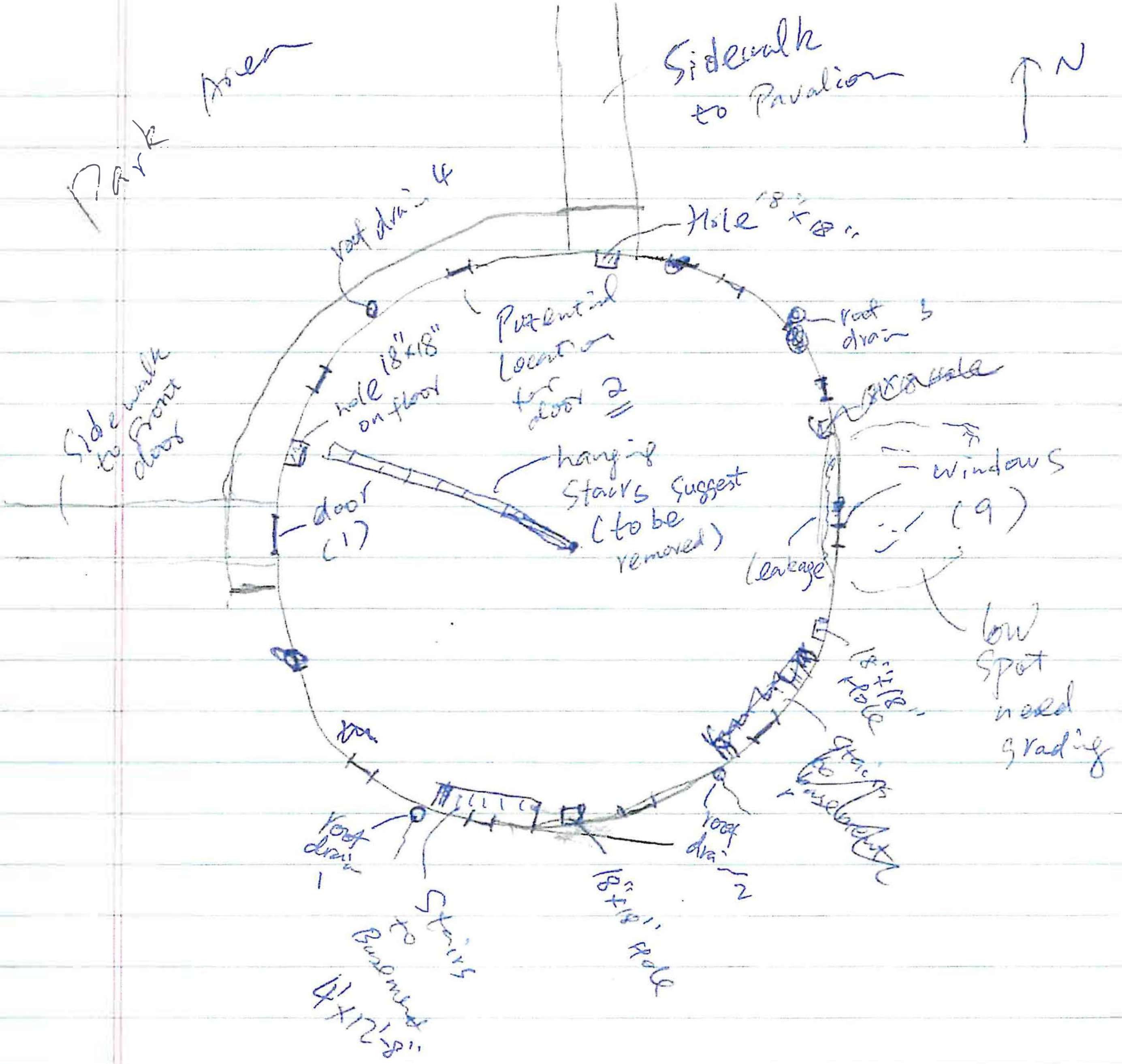
Flange Thickness Web

Columns (1) & (3) are not plumb

Basement Plan

7/2/2019

Beam & Column @ Stairs
12 1/2 x 6 1/2" x 3/8" Beam
6" ϕ Column



Roof drain 1 & 2 Drain to ground

3 & 4 Collected

2 drain pipe loose on ground.

Oberlin Building Floor plan

7/2/2019